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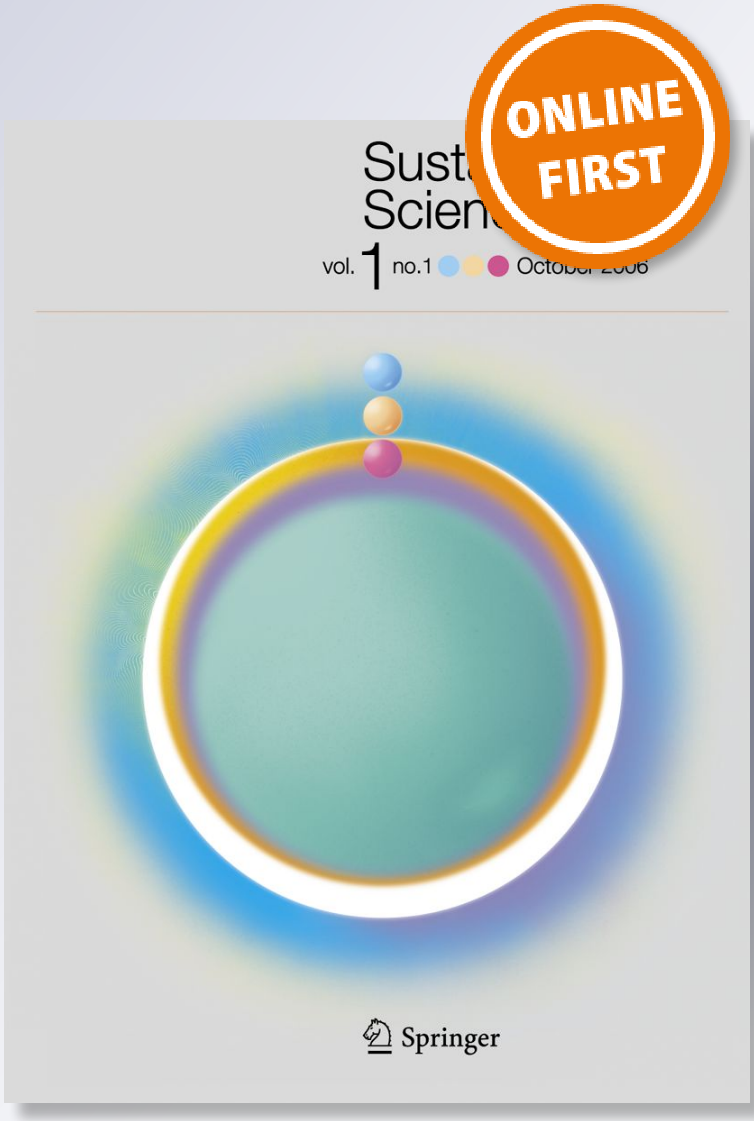
Sustainability Science

ISSN 1862-4065

Sustain Sci
DOI 10.1007/s11625-012-0195-z



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OVERVIEW ARTICLE

Understanding the impact of hydropower developments in the context of upstream–downstream relations in the Mekong river basin

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Received: 31 May 2012 / Accepted: 21 October 2012

Abstract Hydropower developments along the main stem of the Mekong River and its tributaries cause transboundary effects within the Mekong Basin Region, which comprises parts of six countries. On the one hand, the provision of hydropower triggers economic development and helps to meet the rising energy demand of the Mekong riparian countries, especially China, Thailand, and Vietnam. On the other hand, the negative impact of dam construction, mainly altered water flow and sediment load, has severe impacts on the environment and the livelihoods of the rural Mekong population. Several discrepancies exist in the needs, demands, and challenges of upstream versus downstream countries. Against the common apprehension that downstream countries are powerlessly exposed to mainly negative impacts whereas upstream countries unilaterally benefit from hydropower, the authors argue that upstream–downstream relations are not really clear-cut. This conclusion is based on a consideration of the complex power play between Mekong riparians, with a focus on recent power trade interactions. The article investigates the consequences of hydropower dams for the Mekong region as well as the role of supranational players, such as the Mekong River Commission and the Greater Mekong Subregion Initiative, on the hydropower debate. It is not nations that are the winners or losers in the hydropower schemes in the Mekong, but rather parts of the riparian population: a few influential and powerful elites versus the large mass of rural poor.

Keywords Mekong river basin · Hydropower development · Dams · River ecology · Mekong River Commission · Greater Mekong Subregion · Riparians · Electricity trade · Power grid

Handled by Soontak Lee, Yeungnam University, Korea.

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Introduction

The Mekong is the world's ninth largest river, flowing for over 4,900 km from its source on the Qinghai Tibet Plateau at 5,200 m elevation to the Mekong delta in Vietnam. On its way it passes through six countries: China, Myanmar, Laos, Thailand, Cambodia, and Vietnam. The riparian population within the basin comprises over 72 million inhabitants (Campbell 2009). Both economic wealth and population, particularly in the urban centres, have grown remarkably. This dynamic is accompanied by a growing demand for electricity, first and foremost in China, Thailand, and Vietnam. China needs power to sustain its growth in GDP, still above 6–7 %; Thailand's government estimates that the country's electricity demands will double to 58,000 megawatts (MW) by 2021 (EGAT 2008); Vietnam's government

Published online: 15 November 2012

estimates a quadrupling to 40,700 MW by 2015 (EVN 2006). Due to so far limited exploitation of the river system's hydropower potential (currently only 10 %), the Mekong countries' governments foster large-scale hydropower projects within their territories. In public media as well as in the scientific literature these developments are often analysed or discussed under the assumption that downstream countries are powerlessly exposed to the actions of unilaterally benefiting upstream nations (e.g. Garcia 2012). However, much of the information required to judge the complex situation is still missing. According to the Vietnamese Ministry of Natural Resources and the Environment, MONRE, "Viet Nam and its riparian neighbours do not have an adequate scientific understanding for informed decision making on Mekong projects; especially with respect to downstream effects of upstream dams." (MONRE 2012:1).

The goal of this paper is to provide a comprehensive overview and presentation of the upstream–downstream relations of the riparian countries in the light of past and present hydropower development and its expected future impact. The questions addressed by this paper include:

- What is the geopolitical and socio-economic setting for the hydropower debate of the Mekong riparians?
- What defining physicogeographical factors influence the hydropower potential in the Mekong Basin?
- What is the prevailing public notion concerning upstream and downstream roles in the current hydropower debate?
- What are the impacts of upstream dams on downstream localities with respect to water flow?
- What are the consequences of upstream dams in downstream localities with respect to sediment flow?
- Are upstream–downstream interests clear cut? Are downstream countries powerlessly exposed to unilaterally benefiting upstream nations?
- Which players most influence the hydropower debate?

Current geopolitical and socio-economic setting of the six Mekong riparians

Each of the six Mekong riparians has a complex history of power relations with its neighbours, which still influences their perceptions and dialogue. However, the six countries that share a common border, natural resources, and a long history of frequently alternating war and peace currently experience more peace and stability in the region than at any point in their history. Power distribution within the Mekong is defined particularly by strategic position. Upstream positions provide considerable power, and China's additional power, especially in political, military, and economic terms, complicates the situation (Ratner 2003; Backer 2006; Molle and Floch 2008).

The relationship between China and Vietnam, for instance, is strongly impacted by Vietnam's resistance to its giant northern neighbour, which shaped today's Vietnamese national identity. In 112 BC northern Vietnam was incorporated in the Chinese Han Empire, and China ruled Vietnam for over 1,000 years until AD 939 (Dosch and Vuving 2008). In the late 1970s, as a consequence of Vietnam's intrusion into Cambodia, China and western countries cut off Vietnam's development aid, and in 1979 China invaded northern Vietnam. A brief but bloody border war (Third Indochina War) was fought. China argues that the reasons for the invasion were mistreatment of ethnic Chinese in Vietnam, the Vietnamese occupation of the Spratly Islands, as well as Vietnamese intrusion into Cambodia. Even today, these countries still have disputes over the Spratly and Paracel Islands in the South China Sea (Dosch and Vuving 2008). At the same time, China has been Vietnam's top trading partner since 2005, with a trade volume exceeding 40 billion USD in 2011. Given the long history of conflict, mutual distrust characterises the bilateral relationship—and probably will continue to do so for many more decades (Will 2010). The situation is not eased by China's position as a very powerful and the most upstream Mekong country versus Vietnam's location furthest downstream, making it the most vulnerable of all Mekong nations (Ratner 2003).

Other riparian relations are similarly difficult. In the 1950s and 1960s border conflicts characterised the relationship between Thais and Cambodians, Thai and Lao, and Cambodians and Vietnamese (Makim 2002). Vietnamese–Cambodian relations remain difficult due to the Vietnamese invasion during the Pol Pot regime and to currently increasing Vietnamese economic influence. Thailand actively supported the Khmer Rouge. It thus has pre-programmed rivalries with Vietnam that broke open in the 1970s and 1980s. Thailand—the only Mekong riparian that had never been under colonial rule—now welcomes the integration of China into riparian discussions as it hopes 'to build coalitions against potential efforts to prevent large-scale development upstream' (Schmeier 2010: 36). Despite historic grudges, these current close Sino–Thai relations are also a source of anger for Vietnam. Thailand and Myanmar also had and have substantial border-related disputes relating to cross-border movement of minorities associated with forced relocation (Grundy-Warr and Wong Siew Yin 2002). Another conflict line exists between Thailand and Laos, as Thailand supported the United States while Laos followed a Communist path during the Indochina wars. Up to the present day, several border disputes remain unresolved (Schmeier 2010). Furthermore, Laos' increasing economic dependence on Thailand is observed with suspicion. Thailand purchases electricity and natural resources largely from Laos, leading to a deterioration of that country's natural resources. Cambodia goes even further, and accuses Thailand of illegally exploiting natural resources on its territory (Schmeier 2010).

Myanmar is the only country that—possibly also due to its long-term isolation—has so far played a relatively small role in the riparian power play; however, a rapidly increasing one. Still strongly dependent on China's economic cooperation and development aid (Schmeier 2010), the resource-rich country is undergoing re-definition. Many recent Lower Mekong Basin and Southeast Asia summits have taken place without inviting China, as the US and other countries seek allies in Southeast Asia to counterbalance China's dominance in the region. On 30 September 2011 the Myanmar government declared the stop of any further construction of the Chinese-funded 3.6 billion USD Myitsone hydropower dam on the Irrawaddy River due to environmental, ethnic, and cultural concerns (Qin 2012).

Numerous further examples of wars, disputes, and conflicts between the countries can be cited (Sneddon and Fox 2007; Gainsborough 2009). Before looking at Mekong riparian cooperation or confrontation with respect to hydropower development, it is important to bear in mind these 'shadows' of historic or current dissonance. Many public national-media reports on Mekong-related developments are coloured by prevailing attitudes of mistrust, fear

Table 1 Demographic, economic and energy related characteristics of the six Mekong riparians

	China	Myanmar	Thailand	Laos	Cambodia	Vietnam
Overall population, 2010[a]	1,338.3	48.0	69.1	6.2	14.1	86.9
Population Mekong Basin						
Lower MB, 2007 in Mio (total 60Mio)[b]			23.1	5.2	13.0	18.7
Share of Mekong-population in %[c]	16	1	34	7	14	28
GDP, 2010[a,f]						
In mio. current USD	5,878.6	42,953	318.9	7,5	11.3	103.6
Annual growth in %	10.3	5.3	7.8	8.4	6.7	6.8
Per capita (current USD)	4,392.6	701.9	4,612.8	1,208.3	802.3	1,191.4
Energy consumption[d]						
Average annual growth in energy consumption, 1993–2005 in %	9.2[g]	8.5	6.6	8.2	1.1	10.2
Per capita electric power consumption, 2005 kWh, (share of residential sector in total electricity consumption)	1,252 (12.9)[g]	78 (40.0)	1,950 (21.0)	187 (53.0)	56 (52.0)	573 (42.0)
Fossil fuel energy consumption (% of total)	86.9	31.0	80.6	No data	29.7	54.0
Alternative and nuclear energy (% of total energy use)	3.5	2.2	0.6	No data	0.1	3.8
Combustible renewables and waste (% of total energy)	9.6	66.8	18.7	No data	69.6	41.8
Hydro-power projects[b,e]						
Mekong main stem						
Finalised number	4[g]	–	–	–	–	–
Planned number	4[g]	–	–	9	2	–
Mekong tributaries						
Finalised number	–	4	7	16	1	14
Planned number	–	–	–	73	13	3

The weighted average annual per capita consumption in the Greater Mekong subregion (GMS) is 920 kWh (World: 2,701 kWh, OECD: 8,795 kWh, US: 14,240 kWh)

[a] World Bank (2011)

[b] MRC (2010)

[c] Will (2010)

[d] ADB (2009)

[e] MRC (2009): Lower Mekong Hydropower Database

[f] Economy Watch (2012)

[g] Yunnan Province of PRC

and envy (Gainsborough 2009, Dosch and Vuving 2008, Schmeier 2010).

Table 1 summarises the current demographic, economic and energy related characteristics of the six Mekong riparians as compiled from different sources.

The Mekong region needs—and currently is in the middle of—a regional debate on the balance between economic progress and development on the one hand, and the need for ecological protection and preservation on the other (Grumbine et al. 2012; Moder et al. 2012; Renaud and Kuenzer 2012). This debate also addresses the discrepancy between upstream and downstream needs and demands in this transboundary river basin. Upstream development influences downstream regions directly and indirectly, be it in the context of impacts on water flow and sediment availability, river-ecology and biodiversity, or in an economic context of navigability, electricity provision and monetary flow, not to mention the impact of hydropower development on the geopolitical landscape of allies.

The Lower Mekong Basin (LMB), excluding China, has an estimated hydropower potential of 30,000 MW, while that of the Upper Mekong Basin (UMB) is nearly 29,000 MW (MRC 2010; Dore et al. 2007). Nearly 20 % of this potential has been exploited so far, including current construction. Over ten additional main stem projects are planned for the LMB to exploit the river's hydropower generating capacity more effectively to meet the region's power demands, which are expected to rise 7 % over the next 20 years (MRC 2010). Hydropower is a lucrative energy market, and the governments and media of countries with a potential for dams promote hydropower as a source of green and clean energy, superior to dangerous or polluting nuclear or coal-based energy. Furthermore, the greening of so far drought-prone regions (e.g. Thailand's Isan province, with large, ongoing water diversion projects) is promoted. Technocratic visions, e.g. of Laos' becoming 'the battery of Southeast Asia' (BBC News 2012), and the implementation of a gigantic power grid and Mekong navigation schemes, dominate many public communications.

Physicogeographical factors influencing the hydropower potential: landscape units, hydrology, and river resources of the Mekong basin

The pan-shaped Mekong basin (795,000 km^2) starts as a steep narrow valley in China (where the river is called the Lancangjiang), remaining mountainous but less incised in Laos and Thailand and widening 4,000 km from its source to the alluvial lowlands of Cambodia and southern Vietnam. Here—in the Mekong delta—the river splits into individual distributary channels. The Khone waterfalls in Laos' Champasak province mark the transition between the Mekong of the hills and the Mekong of the plains. Gupta (2009) divides the basin into seven physical units, as shown in Fig. 1. These are the mountainous panhandle (river drops 4,500 m in the first 2,400 km), the mountains of northern Laos and Thailand (many tributaries join the Mekong), the Mekong Lowland (including the Tonle Sap Lake region), the Korat Upland, the Cardamom and Elephant Hills, the Annamite Mountain Range, and the Mekong delta. The delta covers an area of 70,000 km^2 at elevations mostly below 3 m above sea level and experiences regular annual flooding (Gstaiger et al. 2012). It is dominated by rice farming activities, fishery, and aquaculture as well as coastal mangrove forests (Kuenzer et al. 2011a, b, Kuenzer and Renaud 2012, Vo Quoc et al. 2012, Kuenzer 2010, Leinenkugel et al. 2011), and has a population of about 18 million.

Ideal and exclusive locations for the construction of large hydropower dams are the mountainous parts of the basin in China, Myanmar, Laos, and Thailand. Deeply incised river valleys or at least solid bedrock on both sides are needed to install dams and flood the hinterland without endangering downstream areas during the fill-up period.

As depicted in Fig. 2 most of the annual water yield of the Mekong River stems from the Laos–Vietnamese Annamite Range east of the river, as well as from the Laotian and Cambodian parts of the Mekong Lowland. It is important to note that, before any dams were built, only about 18 % of the river's overall water originated in the panhandle in China (Gupta 2009).

"The rest of Mekong's annual water discharge (82 %) comes mainly from four sources: (1) the mountains of northern Laos through a number of tributaries; (2) the Southern Mountains via the San, Kong and Srepok; (3) the Mun Chi System, draining a large part of the Korat Upland; and (4) the drainage outflow from the Tonle Sap (Gupta 2009: 47). Adamson et al. (2009) state that only 16 % of the total discharge of the Lower Mekong River comes from China and 2 % from Myanmar. Laos is the main water source for the Mekong.

Mekong River hydrology is dominated by a single wet-season flow peak, leading to a 20-fold increase in discharge in August and September. Compared to catchment size, the floods are unusually large (Adamson et al. 2009). Annual floods are natural occurrences in the lower basin floodplains. Fluctuating between terrestrial and aquatic conditions, they are characterised by predictable single-peak flood pulses of large amplitude, bringing sediment-bound nutrients and therefore supporting immense biodiversity. Some authors claim the Tonle Sap and the Mekong floodplains to be the most productive freshwater ecosystems in the world (Kummu et al. 2010), describing the fish yield in the Tonle Sap (139–230 kg ha^{-1} year^{-1}) as being up to 850 % higher than in the floodplains of, e.g. the

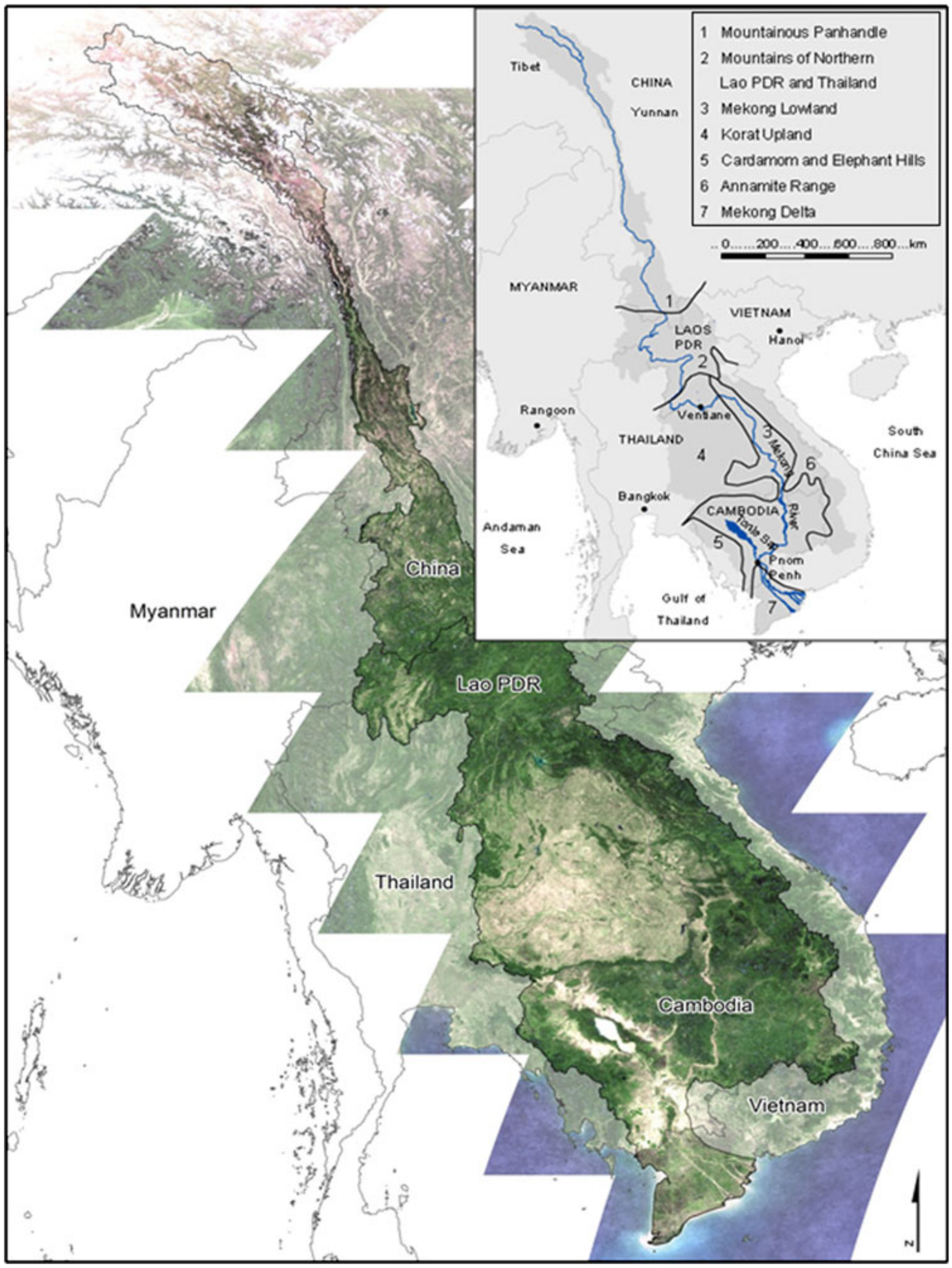

Fig. 1 *Right* The Mekong Basin: physical units (own map based on MODIS 2010 rainy season data between April and October, processed by P. Leinenkugel, and Gupta 2009, modified)

Amazon or the Brahmaputra (van Zalinge 2002). At least 781 species of freshwater fish are known for the Mekong (Vaidyanathan 2011); Ziv et al. (2012) even identified 877 freshwater species. Regional species richness is highest in the Mekong delta with 484 species, and lowest in Chinese headwaters with only 24 species (Ziv et al. 2012). The diet of the Mekong Basin population depends strongly on the area's natural resources. In Cambodia, 80 % of people's protein intake stems from fish caught in the Mekong and its tributaries (Will 2010). The MRC (2010) reports that LMB fisheries alone yield over 2.6 metric tons/year with a total value exceeding 7 billion USD/year.

Floods bringing sediment and enabling irrigation and fishing are considered to have a net benefit for the local population. It is only anomalous events that lead to human suffering (Nikula 2008). The year-2000 flood led to over 800 casualties, and economic damage exceeded 400 million USD. Even if such flooding does not occur every year, they are still devastating for the people affected. However, changes in pulse variability usually have a much stronger impact on the natural resources and rural population than do extreme events. The most vulnerable parts of the population are usually rural farmers and fishermen in the lower lying parts of Laos, Cambodia, and Vietnam, where

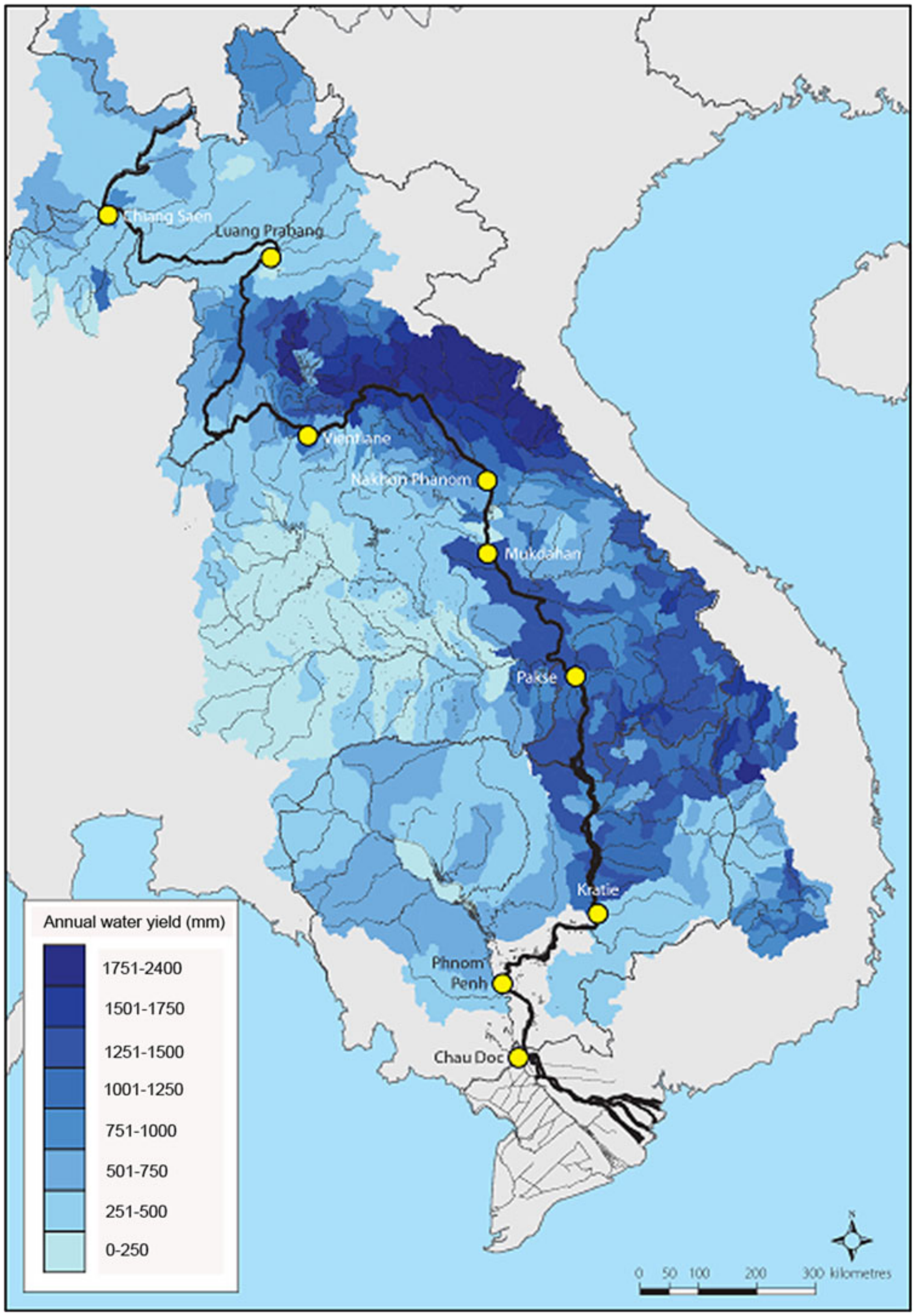

Fig. 2 Annual water yield of the Lower Mekong Basin (MRC 2010)

25–40 % live below the poverty line (Nikula 2008; Grumbine and Xu 2011).

Mekong hydropower dams in the current debate

Bakker (1999) assessed the politics of hydropower in the Mekong. Since that time a lot has happened. In recent years, China alone has proposed a cascade of eight Mekong mainstream dams inside China, aiming to take advantage of an 810 m drop over a 750 km river section, envisaging the supply of 15.6 GW per year. The cascade is often termed the 'Chinese cascade', 'Yunnan cascade', or 'Lancangjiang cascade'. Construction started in the 1980s, and four of these dams—namely the Manwan, the Dachaoshan, the Xiaowan, and the Jinghong—were completed in 1986, 2003, 2009, and 2011, respectively. In the tallest one—Xiaowan (292 m high)—the first generator went into operation in 2009; the third and last one will be installed in 2013. Six of the eight planned dams will be

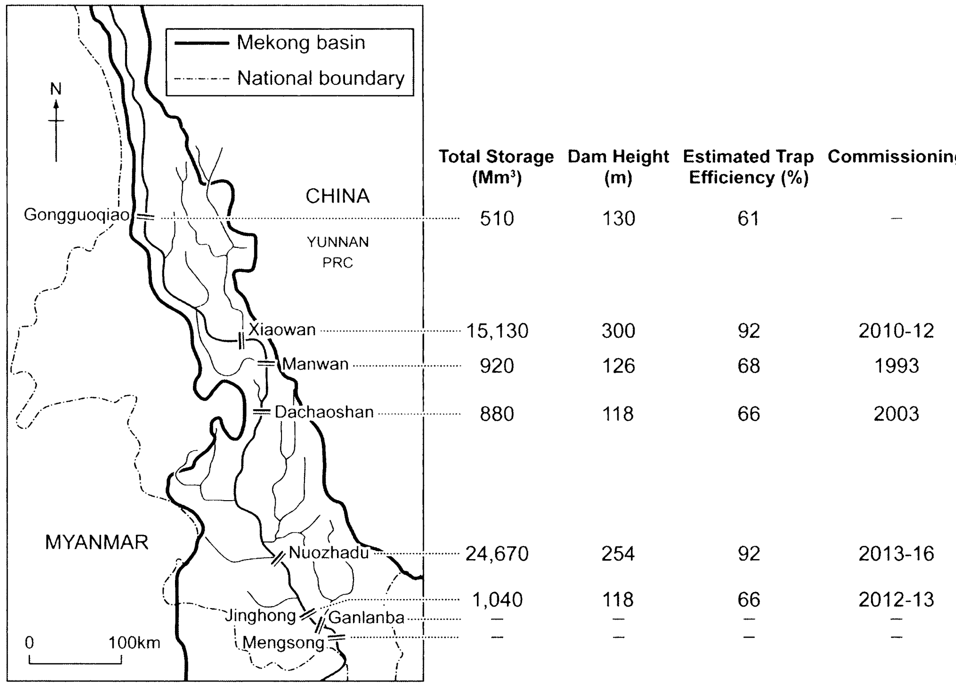

Fig. 3 The cascade of dams in the Upper Mekong Basin (UMB) including (from upstream to downstream) the Gonguoqiao, Xiaowan, Manwan, Dachaoshan, Nuozhadu, Jinghong, Ganlamba, and Mengsong dams. Source: Walling (2009)

operational by 2012 (Räsänen et al. 2012). Once the cascade is in full operation, over 23 km^3 of reservoir storage will have been established (MRC 2010). Additionally, a further 20+ tributary dams are planned in the Upper Mekong Basin (UMB, Fig. 3).

At the same time, the LMB alone already hosts 36 dams and a further 60–100 are in the planning here as well (Räsänen et al. 2012). Such large-scale projects always also mean drastic fragmentation of river systems and interventions in the ecosystem and livelihood of the rural population. These inevitably lead to environmental and social costs, making these ambitious hydropower plans highly controversial and politically charged (Fu et al. 2010; Räsänen et al. 2012).

The dams will provide renewable energy and jobs, and can maybe contribute to better flood control in the wet season and a greater water supply in the dry season. Increased navigation options (Methonen et al. 2008b), extra irrigation opportunities, and lower salt water intrusion into the Mekong delta might be other assets. The electricity produced will be able to enter the Mekong 13-Region electricity grid (He et al. 2009). The World Bank (WB) and the Asian Development Bank (ADB) strongly support schemes and projects of cross-border electricity trade, especially fostering UMB supply to LMB nations. Broad opposition, however, comes from INGOS, NGOs, scientists, the public media, and some political sources. Many proposed dams pose direct risks to the livelihood of rural communities, not only in the vicinity of the projects. In Thailand, opposition to large-scale power stations was so strong that the government increasingly favours importing hydropower from its neighbours Laos and Myanmar, thereby outsourcing the social and environmental impact. The negative impacts are clearly evident and can be seen in many completed projects where local communities have been affected directly by a loss of land or access to fisheries and other natural resources due to filling of the reservoir and construction of transmission lines, roads, and project facilities. Middleton et al. (2009) report numerous cases where dam construction led to the impoverishment of local communities. For the Hoa Binh Dam project in Vietnam, for instance, which was initiated in 1979 but only finalised 15 years later, between 50,000 and 60,000 people (mainly ethnic minorities) had to be resettled with hardly any compensation. The planned Son La Dam will require the resettlement of up to 100,000 people, again mainly of ethnic minority. In Laos, the Nam Song Diversion Dam affected 13 villages through deterioration of vitally important natural resources and assets, including severe declines in fisheries, and erosion and flooding of agricultural land (Middleton et al. 2009). In Cambodia, the Kamchay Dam, currently under construction, will flood approximately 2,000 ha protected forest in the Bokor National Park, which is the habitat of 31 mammals and 10 endangered species (Middleton et al. 2009).

In the foreground of the current debate is—next to the ever dominant topic of Chinese dams—the proposed (and officially stopped) large-scale project of the 3.8 billion USD Xayaburi dam in Laos. This project would create a 49 km^2 reservoir of 60 km length (Vaidyanathan 2011) at the Mekong main stem. The 1,260 MW dam would lead to forced migration of 18 villages, block migratory fish, interfere with navigation, and impede nutrient-rich sediment from settling in the Mekong delta and the Tonle Sap floodplain. At the same time the dam would earn 3–4 billion USD per year for the developer, CH. Karnchang Public Company of Thailand, with about 30 % of the revenue flowing to the Laotian government (Vaidyanathan 2011). The MRC Strategic Environmental Assessment (SEA) report (2010) estimates the environmental costs of fisheries and agricultural losses at 500 million USD a year, with a domino effect on nutrition and food security. Even though many dams have built-in fish ladders, those planned for Xayaburi are not considered sufficient. Several important species require a free flow of the river, among them the tropical Asian catfish, *Pangasius krempfi.* The Mekong region's annual catch of 2.1 million tons could drop to 1.4 million tons if all proposed main stem dams are built (Vaidyanathan 2011). This impact on food security would lead to a loss of livelihood not only for over 1 million Cambodians (Mather and Brunner 2010). However, Xayaburi is not the only Laos project that will probably be finalised within the next decade. In September 2010, the Laos government requested the Mekong River Commission to approve additional main stem dams in the LMB. If finalised, they would generate 15,000 MW power, and income generation might reach 3.7 billion USD/year (Grumbine and Xu 2011).

Another prominent—probably the most prominent—topic in public media concerns the large-scale transboundary impact of the main stem cascade in China. The dams are held responsible for the alteration of the overall Mekong river flow. Optimistic expectations were that the dams would lead to positive inter-annual flow regulation or attenuation (releasing water in the dry season, storing water in the wet seasons). Against this perception stands the downstream countries' apprehension of an exacerbation of inter-annual flow differences, which in the long-term may imply high environmental and social costs due to bank erosion, water shortage, increased irrigation challenges, and shifts in biodiversity. However, despite the tense geopolitical perceptions of China's neighbours, it is important to separate polemics from facts. "There are a lot of accusations that the dams in China are exacerbating the current low water levels, but the Chinese have informed downstream nations that they will not fill any reservoir during the dry season" says Roger Mollot, a fisheries expert with the World Wildlife Fund, WWF, in Vientiane, Laos. However, much suspicion is based on China's refusal to disclose the operating rules of their dams. Even though the 2004 downstream droughts were clearly not induced by the dams (Campbell and Manusthiparom 2004), and the August 2008 floods were also not triggered or aggravated by the dams (MRC 2008), people and local media in downstream countries were quick to blame China when they saw their livelihoods affected. TV and print media incorrectly spurred widespread anger against the powerful giant (e.g. Garcia 2012; Campbell 2009). Table 2 gives an overview of current and planned hydropower projects in the Mekong Basin.

At the same time, it is often overlooked that the numerous main stem dams also planned in Laos, Cambodia and Vietnam would certainly have similar regional (albeit different local) effects, and would aggravate the challenges presented below. Common to all dam cascades is that they turn the river into a fragmented chain of slow moving water and reservoirs, changing the flow regime of a catchment. Of severe concern is that they hinder migratory fish in their upstream/downstream movement. Of the 11 planned Laos main stem dams, only 3 incorporate fish ladders and even these have inadequate designs (Grumbine and Xu 2011; Grumbine et al. 2012). Migratory fish lucky enough to pass a ladder find themselves in a slow- to non-flowing reservoir, lose their orientation, and spawn in the wrong place. Their fry are then easy prey for larger reservoir species. Loss of migratory fish would lead to decreasing protein availability for the local population. The WWF (2012) postulates that this loss would be compensated by livestock, leading to land cover and land use changes and endangering natural forests and shrublands, which would be turned into fodder crop cultivation areas and pastures.

In addition to the main stem dams, hundreds of Mekong tributary dams exist or are in planning. These tributary dams are especially located in Laos, Thailand, and Vietnam. While main stem dams require international consultation before construction, tributary dams are under only national jurisdiction. Their construction necessitates merely 'notification' to the Mekong River Commission (Ziv et al. 2012). The largest 27 planned tributary dams in (mainly) Laos and (partially) Vietnam alone may have an extreme impact on fish biomass and species composition. According to Ziv et al. (2012), the Lower Se San 2 dam could lead to a 9.3 % drop in fish biomass basin-wide. The authors modelled a clear non-linear trade-off between hydropower and fish biomass, stating that fish biomass decreases by 0.3 % or 1,700 tons/year for each terawatt hour generated per year (up to 14 TWh/a). They conclude that "construction of all planned tributary dams, nearly all within Laos national borders, would have graver impacts on fish biodiversity basin-wide and on the Cambodian and Vietnamese floodplain's fish productivity, than the combined impact of the six upper main stem dams on the lower Mekong River, including Xayaburi" (Ziv et al. 2012: p. 2).

It is largely Chinese companies such as Sinohydro Corporation or Dongfeng Electric Corporation that are to finance many of the planned LMB dams (Grumbine and Xu 2011; Matthews 2012). However, Thailand also has a large stake, especially in Lao developments. The government of

Table 2 Overview of complete (C), ongoing (O), and planned (P) hydropower projects in the Mekong Basin as compiled from different sources. Projects >10 MV, Mekong Mainstream (M)

	Project status/commission year		Expected installed capacity (MW)		Project status[a]/ commission year		Expected installed capacity (MW)
Laos				**Cambodia**			
Nam Ngum 1	C	1971	149	O Chum	O	1992	1
Theun Hinboun	C	1998	210	LowerSeSan2/SrePok 2	P	2016	480
Nam Theun 2	C	2009	1,075	Battambang 1	P		24
Nam Ngum 2	O	2010	615	Battambang 2	P		22
Xekaman 1	C	2011	290	Sambor (M)	P	2020	3,300
Don Sahong (M)	P	2013	360	Stung Treng (M)	P		980
Pak Chom (M)	P	2017	1,079	Pursat 1	P		100
Pak Beng (M)	P	2016	1,230	Pursat 2	P		10
Luangprabang (M)	P	2016	1,410	Lower Se San 3	P		243
Sanakham (M)	P	2018	1,200	Prek Liang 1	P		35
Xayaburi (M)	O	2019	1,285	Prek Liang 2	P		25
Ban Kum (M)	P	2017	1,872	Lower Sre Pok 3	P		204
Pak Lay (M)	P	2016	1,320	Lower Sre Pok 4	P		143
Lat Sua (M)	P	2018	686	Stung Sen	P		23
Existing projects 2009 (M)	16 (0)		3,220	Existing projects 2009 (M)	1 (0)		1
Planned projects until 2020 (M)	84 (9)		17,572	Planned projects until 2020 (M)	13 (2)		5,589
All projects until 2020 (M)	100 (9)		20,793	All projects until 2020 (M)	14 (2)		5,590
China				**Myanmar**			
Manwan (M)	C	1986	1,500	Kyaington 1	O	1994	3
Dachaoshan (M)	C	2003	1,350	Hkun	O		6
Xiaowan (M)	C	2009	4,200	Mae Sai	O		12.5
Jinghong (M)	C	2011	1,750	Mae Kok	O		294
Gonguoqiao (M)	P/O	2012	750				
Nuozhadu (M)	P/O	2014	5,500				
Mengsong (M)	P/O						
Ganlanba (M)	P/O		150				
Existing projects 2009 (M)	4 (4)		8,800	Existing projects 2009 (M)	4 (0)		315.5
Planned projects until 2020 M)	4 (4)		6,400	Planned projects until 2020 (M)	–		–
All projects until 2020 (M)	8 (8)		15,200	All projects until 2020 (M)	4 (0)		315.5
Thailand				**Vietnam**			
Chulabhorn	O	1972	40	Dray Hlinh 1	O	1990	12
Huai Kum	O	1982	1.2	Hoa Binh	O	1994	1,920
Nam Pung	O	1965	6.3	Yali Falls	O	2001	720
Pak Mun	O	1994	136	Se San 3 + 3A	O	2006/2007	356
Sirindhorn	O	1971	36	Plei Krong	O	2008	100
Ubol Ratana	O	1966	25.2	Se San 4	C	2009	360
Lam Ta Khong P.S.	O	2001	500	Buon Kuop	C	2009	280
				Sre Pok 3	C	2009	220
				Upper Kontum	P	2011	250
				Duc Xuyen	P		49
				Son La	P	2012	2400
Existing projects 2009 (M)	7 (0)		744.7	Existing projects 2009 (M)	14 (0)		4,204
Planned projects until 2020 (M)	–		–	Planned projects until 2020 (M)	3 (0)		2,699
All projects until 2020 (M)	7 (0)		744.7	All projects until 2020 (M)	17 (0)		6,903

Sources: Ringler (2001), MRC (2009): Lower Mekong Hydropower Database, MRC (2010), Wikipedia, 2012

Laos has committed itself to supply 7,000 MW to Thailand by 2015. Matthews (2012) explains that different drivers and factors have "created opportunities for powerful state and private actors from Thailand and Laos to mobilise political, institutional and economic power to control the benefits of hydropower while the social and environmental impacts are ignored, thereby constituting a form of water grabbing" (p. 393).

Since so far no main stem dams outside of China have been completed, only the impact of the Chinese cascade is depicted and reviewed here. Addressing further impacts of tributary dams (other than those presented above) would exceed the scope of this paper.

Assessing the impact of upstream Chinese dams on downstream water levels

Several authors have attempted to assess the impact of the finalised upstream Chinese dams. The Singaporean authors Lu et al. (2008) investigated the impact of the Manwan dam on downstream water levels at the Chiang Saen and Chiang Khong stations (time series from the 1960s up to 2006), the gauge stations nearest to the Chinese dams. They concluded that both hydrological regimes were influenced by the operation of the Manwan dam, with impacts being more evident in the dry season than in the wet season. It was found that the dam led to a reduction in low water levels and discharge, while high water level alterations were insignificant. This result contradicts the hopes of downstream nations with regard to inter-annual flow regulation (but one has to consider that part of the time span investigated by Lu et al. 2008 included the filling-up period) as well as the findings of Chapman and He (1996). They suspected (much earlier, and without scientific evidence) that the impact of the smaller Manwan and Dachaoshan dams would be insignificant and that changes would be noted only after the completion of the much larger Xiaowan dam. They expected the changes to be positive—dry season flows could increase about 70 % as far as 1,000 km downstream in Vientiane, and would thus be beneficial for irrigation, navigation, and flood control (Lu et al. 2008). Numerous other authors have also published their findings on the Manwan dam's impact. Kummu and Varis (2007) found that mean flow increased at Luang Prabang and Pakse compared to the pre-dam period, and they expect increasing dry season flows and decreasing wet season flows. Lu and Siew (2006) found no significant change in mean discharge after the construction of Manwan, except during the 'infilling' period, but they underlined a change in amplitude: annual minimum discharge decreased at Chiang Saen and Luang Prabang. Furthermore, dry season fluctuations increased considerably, while variability within the wet season remained unchanged. Osborne (2004) expected excessive flooding from the sudden water release from one or both dams if their holding capacity was reached—such as occurred 2003 at Jinghong station. Quang and Nguyen (2003) found that mean flow changes could still be noted at Chiang Saen, but were negligible further downstream in the Mekong delta at Chau Doc and Tan Chau stations. Dry season flow increased by over 60 % at Chiang Saen, according to their analyses, which contradicts the findings of Lu and Siew (2006). According to Quang and Nguyen (2003), wet season flow increased by nearly 30 %, which they attribute to an increase in rainfall. He and Chen (2002), as well as Plinston and He (1999) and Chapman and He (1996), expect a mean increase in discharge of 17 % after the completion of Xiawan and Nuozhadu, as well as substantial increases in dry season flow and reduced wet season discharges of nearly 25 %, which—they state—might not be felt downstream significantly, as flow discharges from Laos tributaries are high (Lu et al. 2008). However, it should not be ignored that the infilling periods of the reservoirs have an immense—albeit temporary—impact. The infilling of the relatively small Manwan reservoir (920 million m^3) led to dramatic water level decreases in the middle reaches in 1993 (Will 2010). The most recent study on the topic published by Räsänen et al. (2012) models dam impacts of the Yunnan cascade in three scenarios (no dams, the first three dams completed, six dams completed). Their modelling results and predictions are well in line with several previous studies and suggest a 20–22 % decrease in June–November flows and a 90 % increase in December–May flows (for Chiang Saen station, the closest gauging station downstream of the cascade). Very different in magnitude but similar in pattern, the MRC (2010) concludes a significant increase in average discharge of 20–40 % in the dry season and a decrease in flood season flow of about 5–15 %. Independent of source, all authors underline the occurrence of a shift in flood pulse and a decrease in its duration and amplitude, while dry season variability is likely to increase.

There is great concern about these flood pulse changes, especially for the highly productive Tonle Sap Lake ecosystem. The Tonle Sap is connected with the Mekong via the 100 km long Tonle Sap River, which—during the drier months—drains the lake into the river. During the rainy season, the flow direction of the Tonle Sap River is reversed and Mekong River water is pushed into Tonle Sap Lake (Lamberts 2008). The lake therefore undergoes extensive drying and flooding regimes, established as diurnal and seasonal limnological changes, leading to a fluctuation in water level from 0.5 up to 9 m. During specific flood stages certain groups of the thousands of species of plants and animals are favoured, and thus complex ecologic niches and habitats have developed. Only slight changes in flood pulse characteristics may alter the associated processes that determine the Tonle Sap's ecosystem productivity.

The above shows that numerous authors have come to contrary conclusions—even if they worked with the same numerical data. It cannot be ruled out that riparian publications are biassed indirectly by the geopolitical background of the respective society.

Currently, predominantly Vietnam raises a voice of concern with respect to the Chinese hydropower plans (Vaidyanathan 2011). At the same time, the former country might feel pressured to maintain friendly relations with its neighbour as their bilateral trade already exceeds 40 billion USD annually. Nevertheless, during the 2nd Greater Mekong Subregion (GMS) summit in Kunming in 2005, the then Vietnamese Prime Minister Phan Van Khai underlined the need to consider the legitimate interests of Vietnam as a downstream country needing water for irrigation and stable flows to prevent saltwater intrusion into the Mekong delta (Sokhem and Sunada 2008). Additionally, the emerging industrial sector and the growing urban population in the delta generate an increasing demand for water (Will 2010; Kuenzer et al. 2011a). Despite ongoing dam construction, Vietnam's concern about water shortage also has to be illuminated in the context of flow alteration as an impact of climate change. After examining weather and tree ring data, scientists concluded that, in the past 40 years, Yunnan has become warmer and drier—a trend that started long before the dams were built (Stone 2010). Adamson et al. (2009) also find a climate-change-induced decrease in dry season discharge from the Tibetan plateau. Spring and summer meltwater decreased and the glacial extent on the plateau has shrunk by 6,600 km^2 from of a total 110,000 km^2. Even though the Yunnan component contributes only between 16 and 18 % of the overall flow, during the low flow months it contributes about 70 % of the low flow component at Vientiane and 30–40 % at Kratie. This shows that it is the dry season flows that are the most vulnerable to artificial flow regulation or climate change impacts (Adamson et al. 2009, Zhao et al. 2008). While there might be a reason why China presently shares the high-flow data with the downstream countries but not the low-flow data (Campbell 2009), the country unexpectedly released dry-season flow data for the first time in 2010 during the "MRC International Conference on Transboundary Resources Management in a Changing World" to counteract suspicion that the extreme droughts in southwest China, Laos, and northern Thailand were dam-induced. It became obvious that there was a balance of inflow and outflow at Manwan, Dachaoshan, and Jinghong dams, and that outflow from Xiaowan even exceeded inflow. Also, the MRC released information on water levels at Chiang Khong station in Thailand that were even higher than expected (Mather and Brunner 2010).

Next to climate change, outlier years (Kuenzer et al. 2009) and dam-related impacts on flow, increasing water extraction for irrigation in mid-stream areas such as the lower Cambodian plains or the semi-arid Khorat plateau of Thailand, aggravates flow alteration. Although the volume of water diverted for irrigation is modest, it is important to note that the diversion occurs in the dry season when the relative effect is the greatest. Extreme irrigation and diking, as introduced in the Mekong delta to ensure a third rice crop, also lead to reduced groundwater recharge. The sponge-like buffering capacity for water release in the dry season decreases. Brunner (2011) asks and answers: "If rice intensification is not necessary for domestic food security and has serious environmental impacts, why is the government so keen to grow even more rice? As with infrastructure projects anywhere in the world, dyke construction involves lucrative contracts and thousands of well-paid jobs. The dyke companies and their friends in local governments are vocal advocates for dyke construction." (Brunner 2011: 1). One can imagine the parallels with dam construction.

Assessing the impact of upstream Chinese dams on downstream sedimentation

Another transboundary effect of dams is reduction in the river's suspended sediment load. With estimates that as much as 40–50 % of the Mekong River's sediment originates in China (MRC 2010), the reduction in sediment concentration will likely have significant implications for the ecosystem of downstream countries—both positive and negative. According to a survey undertaken by Chinese authorities, the combined trapping load of China's Manwan and Dachaoshan dams is ca. 70–80 million tons per year (Walling 2009). Fu et al. (2006) analysed the sediment concentration in the Lancang Jiang at Jinghong (about 400 km/314 km downstream of Manwan/Dachaoshan) and concluded that completion of the two dams has caused a significant and continuous reduction in annual sediment concentration by 50 % since the late 1980s. This decrease is particularly evident when comparing the results in sediment load measured at Jinghong for the time prior to the dam constructions (Walling 2009). The author showed that between the mid-1960s and the end of the 1980s the annual sediment load of the Mekong River increased steadily by about 50 %, which could be attributed to the intensification of land use in the upper Mekong Basin. For the future, it can be expected that the completion of the much larger Xiaowan dam, with a predicted trap efficiency of 90 % (Guo et al. 2007) and location upstream of the Manwan dam, will reduce the sediment concentration to <10 % of its natural value after passing the Dachaoshan dam (Walling 2009). This sediment load will be reduced even further after construction of the remaining dams of the cascade (MRC 2010). This is also postulated by Wang et al. (2011), who found that, usually, sediment load increases due to soil disturbance occur only during the construction period of dams, as observed from 1986 to 1992 during Manwan construction.

At the same time, the availability of sediment data remains relatively sparse, and gap-free time series do not exist. Furthermore, impacts of dams on sediment load must be disentangled from impacts caused by land use change as well as by hydrological regime and climate change. This is a difficult endeavour (Wang et al. 2011), although Lauri et al. (2012) assure that the impacts of reservoir operations on hydrology are definitely larger than the effects of climate change.

In view of the observed and projected reduction of sediment flux, the question of the environmental and social implications for the Mekong downstream countries arises. For Laos and Cambodia, the decreasing sediment loads will have significant advantages for their own hydropower mainstream projects, since a reduced sediment load means a decelerated loss of reservoir storage capacity and an extended economic life expectancy for their hydropower dams.

For the floodplains around Cambodia's Tonle Sap and the delta in Vietnam where the river deposits much of its sediments, the pending reduction in sediment flux will have largely negative implications for the ecosystem's productivity, ecological biodiversity, and coastal stability—especially in the face of sea level rise (Biggs et al. 2009). In all stretches of the river a reduced sediment load will lead to impacts such as channel bed erosion, lateral channel expansion, river incision, and a harmful reduction in the over bank flooding that usually supplies nutritious sediments to the ecosystem (MRC 2010).

Are upstream–downstream interests really so clear-cut?

A paper by Methonen (2008a) is titled: 'Do the Downstream Countries oppose the Upstream Dams?' The author comes to the conclusion that—despite all the public media fuelling the local opposition of the downstream countries—it is the national governments who agree to the plans. All Mekong countries are involved in the regional power trade, which will settle some region's destiny as a net exporter or importer of electricity (Methonen 2008a).

Thailand is an especially large energy market in the Mekong region, with annual energy consumption expected to triple by 2020. Currently, 9 % of the country's electricity is based on hydropower, which will be increased considerably via national funds flowing into hydropower projects in neighbouring Myanmar and Laos (Matthews 2012). From the very beginning of China's hydropower project planning, Thailand has signalled interest in electricity imports from the upstream dams. A memorandum of understanding (MoU) signed by Thailand and China specifies Thailand's purchase of up to 3,000 MW generated by Chinese dams. Furthermore, Thailand funds hydropower projects not only in China (the Thai company MDX Power is developing the Jinghong project in Yunnan), but also in Myanmar (Salween River) and Laos, where the Thai power company EGAT is involved in the Nam Theun 2 project financed by the Agence Française de Développement, the Nordic Investment Bank, the ADB, and the WB's International Development Agency. In return, Laos earns a lot of foreign exchange selling the electricity back to Thailand, and 2,000 MW are also sold to the Vietnamese government (Backer 2006; Schmeier 2010).

Also Vietnam—relying up to 40 % on hydropower—imports electricity largely from China, and increased these imports significantly in 2006 to avoid shortages during the dry season (Methonen 2008a). Vietnam's purchase of Chinese electricity is possible only through the GMS power grid. "However, in doing so, Vietnam indirectly supports projects it suffers from the most." (Schmeier 2010: 38). Already in October 2004, Vietnam's prime minister presented a national strategy (Decision 677/2004/QD-TTG) to develop the electric energy sector, putting major emphasis on hydropower (increasing hydropower capacity from 39 % in 2006 to 62 % in 2020). The focus was especially on Vietnam's central highlands (at that time 17 planned projects), where numerous Mekong tributaries originate. However, just recently the National Assembly has imposed a moratorium on all dam building after recent floods exposed design flaws in the first completed dams. On 21 July 2012, current Vietnamese Prime Minister Nguyen Tan Duy signed a decision on power development by 2020, seeking to boost alternative energy development but reducing hydropower dependence (23 % envisaged).

Laos has a hydropower potential exceeding 23,000 MW and 49 dams are currently already installed (690 MW). Hydropower projects are developed speedily and Laos is—just like Yunnan province in China—a net exporter of electricity. The country has exported electricity to Thailand since the 1970s, and in the year 2000 80 % of its electricity was generated by hydropower. Cambodia also has a substantial hydropower potential of 8,000 MW, which remains untapped so far as the country is one of the lesser developed in the GMS. Myanmar's large potential exceeding 100,000 MW also remains largely untapped. However, in 2002 a Department of Hydroelectric Power was established within the Ministry of Energy and 268 potential dam sites have been identified (Schmeier 2010).

Table 3 Electricity supply requirements in the GMS countries in 2000 and 2020

	Supply requirements in 2000 (GWh)	Supply requirements in 2020 (GWh)	Annual growth (%)	Per capita requirements in 2000 (kWh)	Per capita requirements in 2020 (kWh)
Thailand	96,781	328,429	6.3	1,576	5,349
Laos	865	4,438	8.5	160	822
Cambodia	586	5,720	12.1	52	511
Vietnam	26,722	169,428	9.7	335	2,123
Myanmar	4,400	16,400	6.8	96	360
Yunnan	31,635	91,689	5.5	755	2,188

Source: ADB (2003)

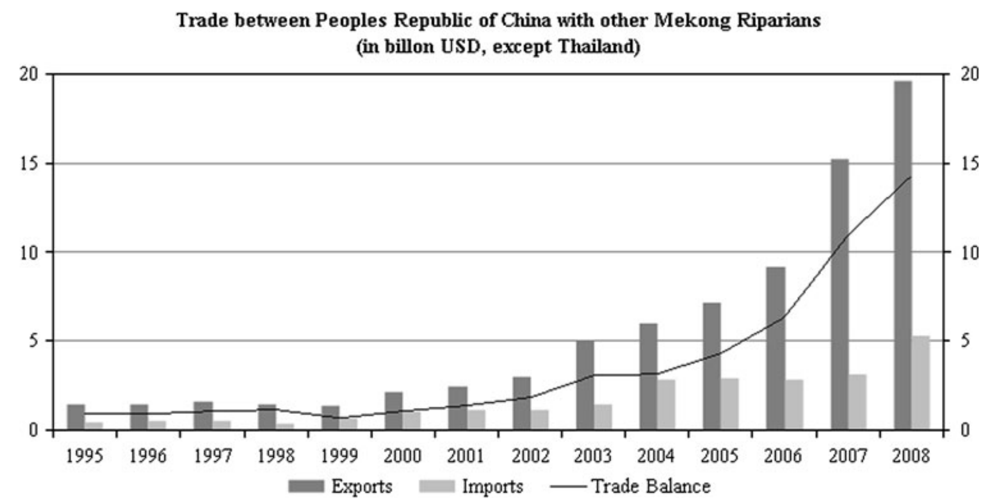

Fig. 4 People's Republic of China (PRC) trade with Mekong riparians (except Thailand), in billion USD. Source: Will (2010)

Partially realised cross border trade (see Fig. 5) already shows the contradictory nature of upstream–downstream interests. While numerous NGOs, national newspapers and new media condemn upstream activities as the source of downstream problems (see Bangkok Post, Vietnam Today, etc.), large power trade deals have been signed in the background. They enable Vietnam to import electricity from Yunnan province, China, Laos, and Cambodia; enable Thailand to import electricity from Yunnan province, China, Myanmar, Laos, and Cambodia; enable Laos to import electricity from China; and enable Cambodia to import from Laos and Thailand. Vietnam and Thailand are the two largest importers, profiting strongly from the upstream countries' exports. At the same time, especially Vietnam exploits its own hydropower potential to the fullest, independent of downstream (e.g. Mekong delta) concerns. According to International Union for Conservation of Nature's (IUCN) programme coordinator Jake Brunner: "It's too late. The binge is over. Private sector participation in dam construction far outstripped the government's capacity to plan or regulate it. Vietnam is now one of the world's most 'dammed' countries in terms of the proportion of its hydropower potential that has been exploited" (Minh 2011).

Vietnam and Laos, for example, build dams jointly in Laos under the 'Viet-Lao Electricity Development and Investment Joint Stock Company'. "China alone is not the only one to blame for the Upper Mekong (and Salween) developments." The countries "construction plans are clearly influenced by the involvement of other Mekong nations" and Thailand particularly plays a significant role in increasing the profitability of the upper Mekong schemes because of large scale demands for electricity (Methonen 2008a: 169). The fact that China is the biggest trade partner, often the largest investor, and partially also donor of loans to the downstream countries might mute some of the downstream government officials. The riparians engage in difficult dependencies. Already Sovacool (2009) stated that large-scale energy infrastructure networks can degrade rather than enhance energy security—especially when international conflict arises. However, this staying quiet for its own projects shows that even for the downstream countries economic development and projects increasing GDP are currently more important than environmental protection or the vulnerability of the rural poor. "There are many parties opposing the dam projects and these parties even include individual government officials. However, all the arrangements made for the regional energy trade show that the myth of the downstream countries' opposition towards China's upper Mekong dams is not true when talking about the national governments. Nevertheless, a reader not familiar with all these aspects gets a very different picture when trying to follow the situation through media and other sources." (Methonen 2008a: 170) Table 3; Fig. 4.

Overall, the Mekong acts as a "battery", generating electricity to be exported to wealthier users in places like Thailand, exacerbating wealth asymmetries and often hurting marginalised communities (Greacen and Greacen 2004). Each country (Fig. 5) tries to capitalise on its river location by exploiting the river's resources as much as possible for its own interests and needs, regardless of the consequences pending further downstream or the overall health of the hydraulic system. Mather and Brunner (2010) very correctly note: "So while the benefits of power sales would accrue primarily to governments, state owned enterprises, investors, construction companies, and hydropower operators, with some presumed trickle-down effects, the costs would be overwhelmingly borne by millions of rural poor" (Mather and Brunner 2010: 3). Simpson (2007) expresses what can be read between the lines of many articles: that the social and environmental costs of Mekong hydro development will outweigh its benefits by far.

Players fostering the hydropower debate: assessment of mandates and achievements

Numerous players shape and influence the hydropower debate, such as large international and national banks (e.g. WB, ADB, China Exim Bank, Japan Bank for International Cooperation), political networks (e.g. ASEAN), foreign aid organisations (e.g. USAID, AusAID, GIZ, DANIDA), large private hydropower companies (e.g. Sinohydro Corporation, Dongfeng Electric Corporation, Karnchang), national governments via state agencies (the six riparian governments, plus substantial influence by donor countries), global (UN) and supra-regional bodies (e.g. MRC, GMS), INGOS (e.g. WWF, IUCN, Oxfam, International Rivers), national NGOs (e.g. Green Watershed, 3S River Protection Network, Assembly for the Poor), foundations (e.g. Ford, Rockefeller), individual consultants, universities and research institutes (located mainly in the riparian and donor countries), and last but not least, local communities, all of which cannot be elaborated on.

An extensive categorisation and overview of players in the Mekong can be found in Dore et al. (2012). The latter authors present a framework for the analysis of transboundary water governance complexes, based on the pillars of context, drivers, arenas, tools, decisions, and impacts.

At this point we focus on and compare two supraregional bodies impacting the hydropower debate: the Mekong River Commission and the GMS Initiative.

The Mekong River Commission

The first Mekong Committee was established in 1957 to attempt to solve Mekong regional water controversies. Already at that time a hydropower capacity of 23,300 MW and seven huge dams had been planned (Varis et al. 2008). However, the work of this Committee was strongly hindered by national and international wars from the 1960s until the mid-1990s. Cambodia was absent from the committee from 1974 until 1995. Furthermore, China was not part of the committee. Indeed, only from 1995 onwards did the regional political situation allow political and economic integration in Southeast Asia (Varis et al. 2008). Vietnam, Laos, Cambodia, and Thailand signed the Mekong agreement on new cooperation modalities in the LMB, which re-established the Mekong Committee, now newly named Mekong River Commission (MRC). The MRC aims at sustainable management and development of the basin's water resources for the countries' mutual benefit. The main task of the MRC is the development of Mekong Basin Development Plans. The MRC member countries are Vietnam, Laos, Cambodia, and Thailand, while China and Myanmar are considered dialogue partners. It is problematic that the MRC is not fully funded by the member countries, but that donor funding remains dominant (Backer 2006). The fact that basin country ministries are unwilling to share their power (and resources) with the MRC poses challenges for the achievement of measurable impacts and the organisation's general acceptance.

According to Ha (2011), who has investigated the role of the MRC since its re-founding in 1995, the MRC "has done a poor job in its fundamental tasks of water management and sustainable development and has struggled to maintain dialogue with all parties." (Ha 2011: 126). The MRC's effectiveness was hampered "because the 1995 agreement set out procedures that were not rules-based and lacked real enforcement mechanisms. In essence, the MRC was unable to influence the national policies of its member countries" (Ha 2011: 130). Although the MRC has set up a large knowledge base including micro- and macro-level data, the commission could not utilise this knowledge base successfully to foster good water governance and sustainable development (Backer 2006; Sneddon and Fox 2007). According to Ha (2011) it was mainly the MRC leadership personalities who impacted the understanding of sustainable development and the valuation and attention given to environmental concerns. Under the 1st year's leadership of Japanese former engineer Yanasabu Matoba, the MRC focussed mainly on centralised infrastructure support. From 2000 until 2004 under the lead of Joern Christensen, the MRC steered towards more extensive basin-wide consideration emphasising ecological conservation. During the implementation of the basin development plan of 1999

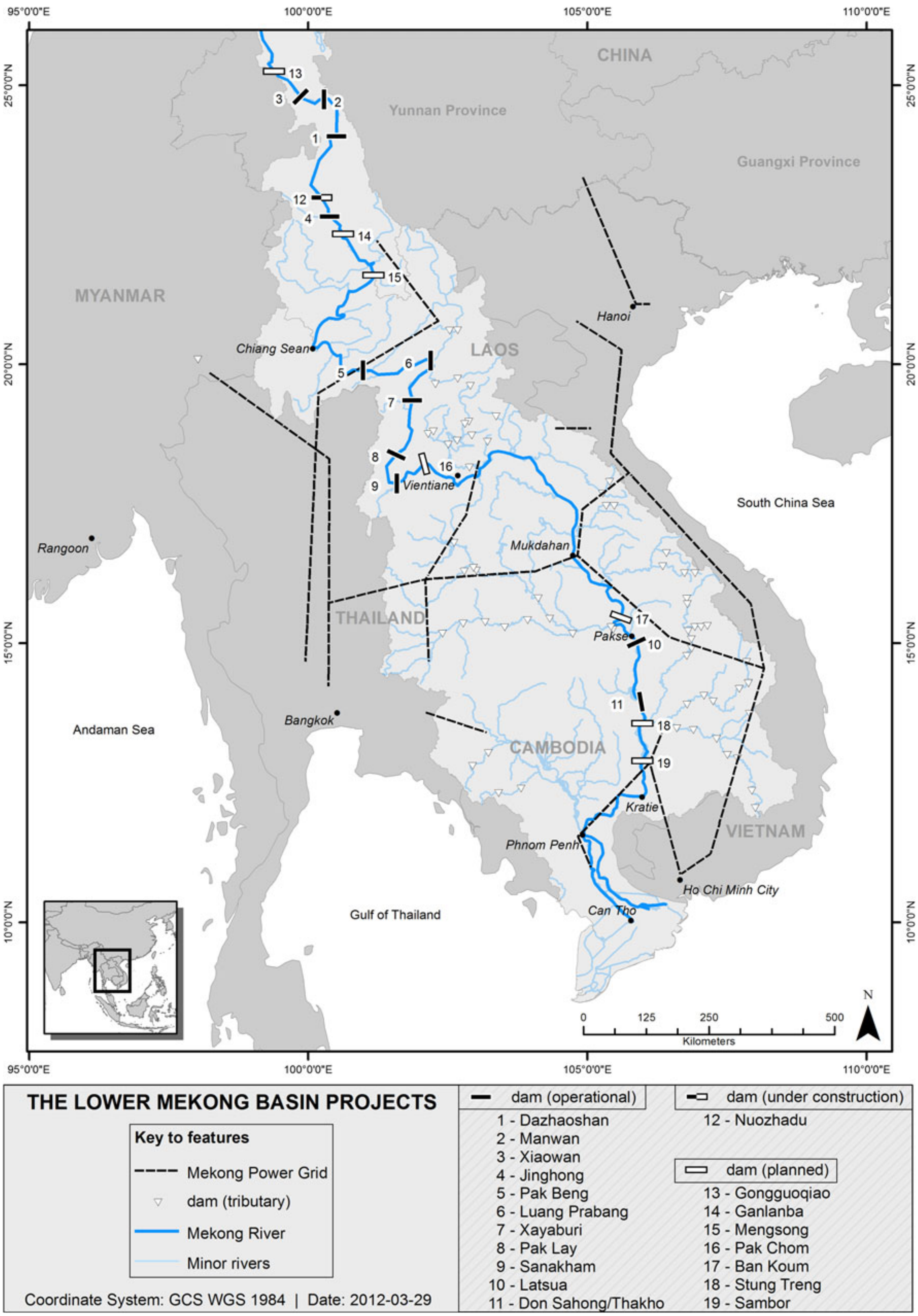

Fig. 5 Sketch of the Mekong subregional power grid (adapted and extended based on IRN 2006 and MRC 2010)

(already generated under the influence of Christensen) great attention was paid to the ecological ramifications of the projects (Ha 2011). A shift occurred again under the following leadership of Oliver Cogels—MRC's third CEO—who focussed on intensive cooperation with the WB and the ADB, understanding sustainable development as 'concrete projects in hydropower, navigation, fisheries, irrigated agriculture, environmental management, watershed management, etc.' (Ha 2011: 129). Technologic (and technocratic) project implementation was the characteristic of this period. From 2008 on, the fourth CEO, Jeremy Bird (former head of the World Commission on Dams), shifted the position of the MRC towards a social and environmentally sound impact assessment of project implementation. Special attention was given to the definition of acceptable practices for mainstream hydropower development. Bird's term ended early 2011 and the MRC has been under new Swedish leadership by Hans Guttman since November 2011, even though it was originally planned for a riparian national to become CEO.

Campbell (2009), who has worked for the MRC for several years, also stresses that the current attempts of the MRC to be both a development agency and a basin management agency are incompatible. "A consequence has been that the MRC has swung from one role to the other, identifying itself as a basin management organisation or as a development agency" depending on the chief executive officers (Campbell 2009: 413). Until this ambiguity in mandate is resolved the MRC will not be able to succeed. At the same time it is widely accepted that the MRC is the only organisation that can fulfil the river basin management role. However, it cannot fulfil the role of a river basin management organisation and a development agency at the same time and needs to clarify its role (Sneddon and Fox 2007; Keskinen et al. 2008). Also according to Mather and Brunner (2010), the MRC has currently reached a crucial moment. With respect to an official agreement on a 10-year Xayaburi dam delay, partially opposed by the Laotian government, and via ongoing construction activities at the dam site, the question is now whether the MRC can really facilitate the process of finding a pathway of action conflicting with national short-term interests. "If not, then the hundreds of millions of dollars of donor funding since 1995 will arguably have been in vain" (Mather and Brunner 2010: 3).

The greater Mekong subregion initiative

Other supranational players in the region exist next to the MRC: namely the WB and the ADB. The ADB fosters a programme called the 'Greater Mekong Subregion Initiative' (GMS), which includes the four member countries of the MRC as well as China and Myanmar. The GMS, which was initiated jointly with UN-ESCAP in 1992, aims at the livelihood improvement of over 250 million Mekong Basin inhabitants and the strengthening of regional and subregional economic cooperation, mainly via investment in the development of infrastructure (Lang 2005; Nikula 2008). The programme is backed up by the Association of Southeast Asian Nations, ASEAN, which in 2002 agreed jointly with China to create the world's biggest free trade zone. Investment and development of the Mekong river basin are key priorities for cooperation in the region. The GMS unifies multiple subregional priority projects from the field of transport, energy, environment, human resource development, trade and investment, tourism, and telecommunication under its framework (Krongkaew 2004). The Mekong Power Grid is one of the flagships of this programme (IRN 2006). The very strong engagement of China with the GMS and ASEAN is spurred by huge financial incentives. However, it is currently limited to "socio-economic development rather than setting strict institutions to serve a broader goal of international cooperation for the sustainable development of the Mekong Basin" (Sokhem and Sunada 2008: 144). Within ASEAN, the ASEAN Mekong Basin Development Cooperation Initiative was established in 1996 with the goal of economically sound sustainable development of the region. In the year 2011 alone, several hundred ASEAN workshops and events took place (see http://www.aseansec.org), among them technical and subregional working group meetings on transboundary pollution in the Mekong Basin.

While ASEAN and the GMS are perceived as options for business and trade expansion and resulting economic gains, the MRC is perceived as an organisation developing guidelines for sustainable development. These include water quality and quantity guidelines without the backup of national government's acceptance and thus without the backup of new laws and law enforcement (Sokhem and Sunada 2008). Lang (2005) even states: "While the MRC has been seen as having a formal and clumsy bureaucratic style, the GMS operates as an informal sub-regional cooperative framework" (Lang 2005:6). The differences between MRC and GMS are also obvious when taking a closer look at the level of their investments. Between 2003 and 2008, the MRC spent 90.3 million USD (15 million USD per year) on their work. During the same 6 years the GMS spent half a billion USD. While national governments contributed only 7.5 % of the funds of the MRC, they contributed 33 % to GMS investments (Will 2010).

However, many authors, such as Gainsborough (2009), also argue that GMS-based "so called 'cooperation' has led to new forms of regulation and restriction, particularly, it would appear, targeted at the poor and marginal" (Gainsborough 2009: 6). Matthews (2012) impressively depicted the political ecology of winners and losers in Laos hydropower development. Profits from Mekong hydropower materialise via construction contracts, electricity sales, timber profits, and the export of expertise and technology, to name only a few of the many sources. Factors enabling unbalanced profiting, such as tight state control of media, INGOS and NGOs, the lack of regulating or law enforcement capacity in the riparian countries, the easy availability of capital, a focus on short-term gains, and the praise of hydropower as green and clean energy all lead to water grabbing opportunities in the Mekong riparian countries. Powerful actors, from national government agencies to private companies to powerful influential elites, are usually the winners of hydropower development, while the environment and especially rural people, depending on their natural livelihoods, are the vulnerable losers. This is the case independent of riparian nation. So, in contrast to common public perception, there is no such thing as upstream winner countries and downstream loser countries, as numerous downstream institutions profit from the expansion of the sector. It boils down to a question of rich and poor, of influential, and not influential.

To counterbalance these prevailing inequalities, major efforts must be undertaken to increase transparency and participation. The involvement of local communities in impact assessment studies, development of mechanisms to foster cross-sector, trans-disciplinary dialogue throughout the different decision-making levels, harmonisation of assessment methods, and improved communication of Mekong-related information in all riparian languages are only some of the urgently needed steps that could focus the hydropower debate on sustainability and on the interests of the majority of the Mekong riparian population.

Conclusion

Examining hydropower development within the Mekong Basin reveals an obvious conflict interest between the needs of upstream and downstream countries, and especially between the priorities of Mekong upper class decision makers directly or indirectly profiting from the dams and the majority of the rural poor, whose livelihood they put at risk.

Main stem and tributary hydropower dams impact flood pulse timing variability, which can have grave effects on ecologic niches, ecosystems and biodiversity. They lead to a long-term decrease in downstream sediment load, which reduces the nutritious load to plains, wetlands and agricultural areas. Sediment loss is expected to aggravate coastal erosion and saltwater intrusion in the Mekong delta—a region already threatened by sea level rise. Endangered natural environments are, however, not only the Mekong delta, but also the Tonle Sap and southern Cambodian floodplains. These regions host over one-third of the Mekong Basin population, which depends heavily on fish catch as a source of daily protein. Migrating fish will, however, be hindered on their pathway by hundreds of metres of high concrete walls. Fish ladders on such constructions have proven to be mostly inadequate in design, and also cannot prevent migratory fish from losing their sense of orientation when they end up in a slow flowing large reservoir instead of a stream. At the dam sites themselves, forced relocation of rural populations often leads to a decrease in resilience and impoverishment. All the above underline the complexities of the water-food-energy nexus in the Mekong region. Many authors argue that the environmental and social costs of cascading the Mekong and its tributaries probably outweigh the benefits of energy generation, improved navigability, and associated economic development.

In public media and the public debate, the large-scale transboundary impact of hydropower development is a politically charged topic. First and foremost, the main stem cascade of China is brought up when explanations are needed for any abnormal downstream situations. However, many authors addressing the topic of dam impact in the Mekong have come to contradictory results and conclusions. Many studies and assessment reports are biased and guided by the complex interests of their respective institutions. Flow and sediment related data often lack temporal or spatial coherence, and it is difficult to derive clear quantitative statements, although the general trends seem clear. Additional impacts on the variability of Mekong water flows, such as increasing water consumption for urban and rural areas, land use change, and the influence of climate variations, must be considered. At the same time, planned mainstream dams as well as operational and planned tributary dams in the lower Mekong Basin need to move more to centre stage. The Xayaburi case is a first good example, and more should follow. Despite the strong opposition of local populations to the dams of upstream riparian neighbours it is often forgotten that their own country's government, companies and other interest groups are closely engaged in building and operating dams on their own territory—or are at least involved in electricity transfer schemes.

Therefore, the common apprehension that downstream countries suffer unilaterally from the negative impacts of hydropower development in upstream countries seems only partly justified. The interests of upstream and downstream countries are not clear-cut because of the economic interaction of all Mekong riparians. All Mekong countries are involved in the regional power trade triggered by the GMS initiative. Thailand and Vietnam are the main net importers of electricity from upstream countries; Yunnan Province and Laos are the main net-exporters of electricity.

Cambodia and Myanmar have large potential hydropower energy use, and especially Cambodia plans to increase hydropower development to benefit from electricity exports. Thailand and Vietnam support hydropower development in their neighbouring countries by providing national funds for investment in hydropower projects. In addition, especially Vietnam exploits its own hydropower potential without considering the impact on the Mekong delta further downstream. Many media, NGOs and INGOS emphasise the negative impacts of upstream dams, while at the same time national governments are signing large power trade deals in the background. Currently, each country tries to capitalise on its river location, regardless of the pending consequences for the overall health of the hydraulic system.

The arena of players influencing the hydropower debate in the Mekong is extensive. It ranges from large international and national banks to riparian and non-riparian governments, private corporations, companies, supraregional bodies and networks to INGOs, NGOs, foundations, scientific institutions, media and even to individual power-elite decision makers and lobbyists, all with their own interests. Whereas the future of Mekong hydropower seems to be shaped mainly by economic cooperation under the Greater Mekong Subregion Initiative, the role of the Mekong River Commission remains unclarified. If its members do not commit themselves to empowering this organisation to plan and implement river basin management, its influence via the development of recommendations, norms, and standards will be meagre. Much stronger involvement of local communities and local studies in impact assessments, the development of mechanisms to foster true cross-sector, trans-disciplinary dialogue that can percolate through different hierarchical levels of decision making, the harmonisation of assessment methods and data analyses, and an improved communication of Mekong related information in all riparian languages are only some of the challenges urgently needing attention.

Acknowledgments The authors would like to thank Jake Brunner, Ed Grumbine, Fabrice Renaud, and Heiko Apel for their valuable comments on the manuscript. Further thanks go to two anonymous reviewers. The research undertaken for this paper was funded by the German Ministry of Education and Research, BMBF. However, the funding source had no impact on the content of this study. This paper does not express the view of any government or organisation.

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