

On the Forecast

Easing Tensions over Hydraulic Power along the Mekong

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Dam construction along the Mekong River is generating upstream-downstream tension between riparian neighbors in Southeast Asia. The viability of proposed mainstream, run-of-the-river dams in Laos, Thailand, Cambodia, and Vietnam depends on the release of water from Chinese reservoir dams. China's potential unwillingness to release sufficient water from the dams threatens the livelihoods of millions by damaging the utility of downstream dams and altering the river's ecology.

This report proposes an expansion of Forecast Mekong, a recent climate-modeling tool established by the U.S. Department of State's Lower Mekong Initiative. To date, China has been reluctant to provide information on the operation of their dams. An expanded Forecast Mekong, however, would provide estimates on the impact of Chinese dam operation and water management to downstream neighbors. Such estimates will increase the transparency of Chinese water usage and provide downstream states with a valuable tool for pressuring Beijing to cooperate.

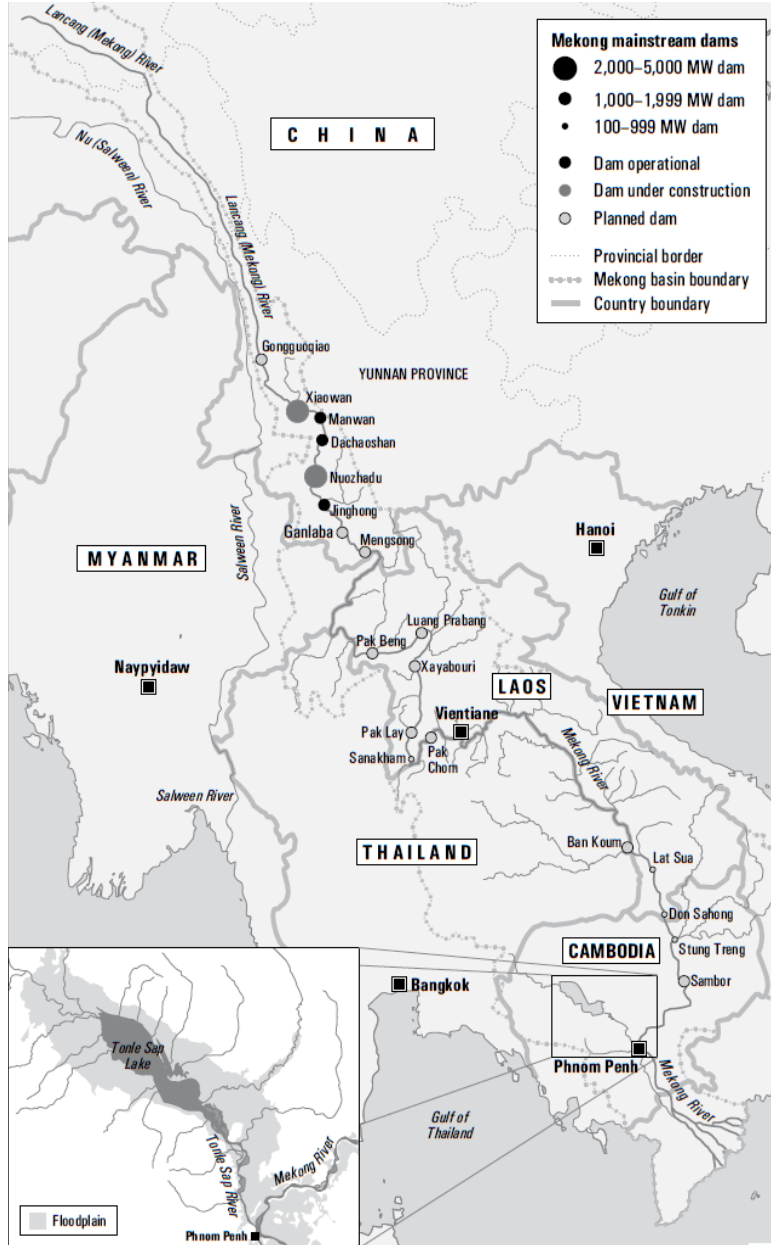
Introduction

Over the past thirty years, competition over water resources in the Asia-Pacific has escalated considerably. The Asian continent is home to over half the world's population. However, its inhabitants have access to the lowest amount of freshwater per capita other than Antarctica. Disputes over water resources are occurring between Asian neighbors from India and Pakistan to China and Southeast Asia. China has a unique vantage point in these disputes, directing the headwaters of the Tibetan Plateau, which feed the Indus, the Mekong, the Yangtze, the Yellow, the Salween, the Brahmaputra, the Karnali, and the Sutlej Rivers.

Beijing currently is building eight dams along the Mekong River (see Figure 1). These dams will allow China to disrupt the livelihoods of those downstream, especially during the dry season. Chinese mainstream dam construction could potentially endanger the well-being of over 60 million people in Thailand, Laos, Cambodia and Vietnam who depend on the Mekong as a vital source of income, food, and freshwater. Vietnam, situated at the mouth of the Mekong Delta, is projected to endure the brunt of the collateral damage.

To prevent the deterioration of Southeast Asian relations and to safeguard against violent conflict, the United States' Lower Mekong Initiative should expand to provide forecasting on the impact of Chinese dam operation and water management to downstream neighbors. Such forecasting will improve communication among riparian neighbors and management of water resources along the Mekong.

Figure 1: Operational and Planned Dams Along the Mekong (Langcang Jiang)



Source: Richard Cronin, *Mekong Dams and the Perils of Peace*

The Geopolitics of Dam Construction along the Mekong River

There are 50,000 dams in the world, half of which are in China. Beijing currently has eight planned or existing dams on the upper reaches of the Mekong (or Lancang) river.¹ Together these dams will alter the river's natural flow and offset existing water quality and salinity.² Chinese mega-dams also jeopardize the viability of downstream power stations during droughts. Additionally, China could hoard water from Lower Mekong Basin (LMB) countries to mitigate growing food and water insecurity.

Chinese Mega-Dams

Among China's eight Yunnan hydropower stations, the Nuozhadu and Xiaowan projects have the largest capacities. Both dams will generate electricity for the power deficient Yunnan province and for cities over 1000 miles from the source, such as Shanghai.³

The energy potential of Nuozhadu alone is greater than the hydro-electric generating capacity of all Lower Mekong countries combined.⁴ On September 7, 2012, the Nuozhadu station turned on the first of its nine generating units. Together these units will produce 5,500 MW of energy by 2015—over 1000 MW greater than the total capacity of the Palo Verde Generating Station, the largest U.S. nuclear power plant.⁵ The electricity generated by the Nuozhadu dam annually could power New York City for seven months.⁶

The Xiaowan dam is the tallest arch dam in the world. At 958 feet, the dam rivals the stature of Paris's Eiffel Tower. The Nuozhadu and Xiaowan dam reservoirs are over 100 miles wide and have the capacity to hold 22 and 15 million cubic kilometers respectively.⁷

Figure 2: Planned and Operational Dams in Yunnan Province, China

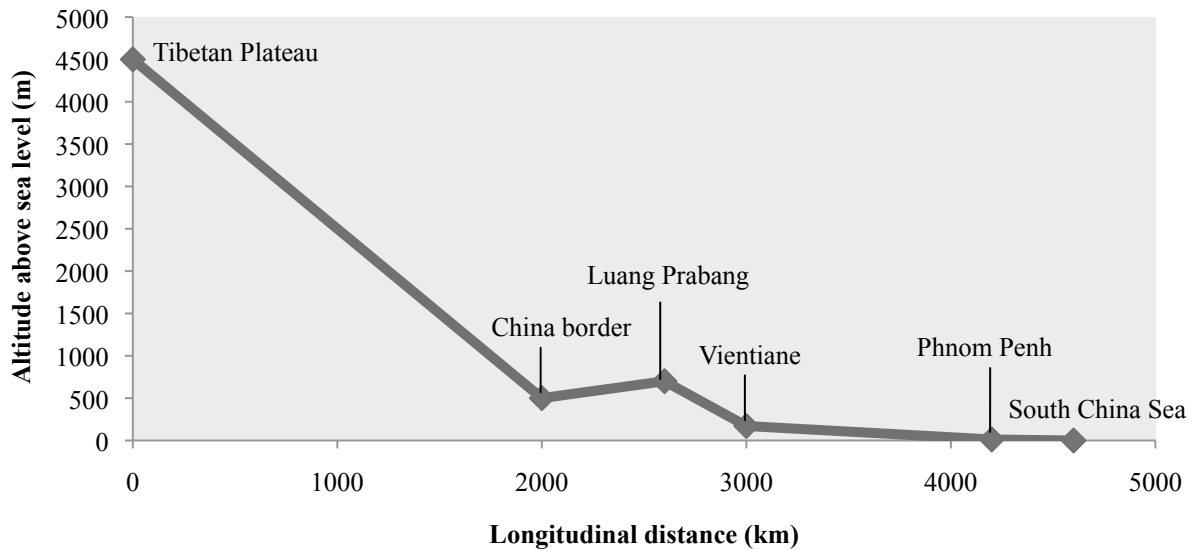
	Nuozhadu	Xiaowan	Jinghong	Manwan	Dachaoshan	Gongguoqiao	Mensong	Ganlaba
Storage (MCM)	22,400	14,560	1,233	920	890	510	N/A	N/A
Height (M)	254	292	118	126	118	130	65	60.5
Power Capacity (MW)	5,500	4,200	1,500	1,500	1,350	750	600	155
Operation Date	2015	2012	2010	2005	2003	N/A	N/A	N/A
Displaced People	23,826	23,826	2,264	3,513	6,100	4,596	230	58
Watershed (KM²)	114,700	113,300	149,100	114,500	121,000	97,200	160,000	151,800
Cost (Millions)	\$ 3,600	\$ 3,000	\$ 1,000	\$ 32.25	\$ 800	\$612.75	\$ 354.75	\$ 96.75

Source: Evelyn Goh, *Developing the Mekong: Regionalism and Regional Security in China-Southeast Asian Relations*

The Interdependence of Mekong Dams

The Yunnan province dams are both the justification for and the Achilles heel of planned downstream dams. China's dams, such as the Nuozhadu and Xiaowan, promise to generate significant energy. Their water storage capacity, however, threatens the commercial viability of downstream dams. China's stretch of the Mekong contributes 100 percent of the flow at the Yunnan-Laos border, 60 percent at the Laotian capital Vientiane, 16 percent at the Cambodian capital Phnom Penh, and 15 to 20 percent in Vietnam (see Figure 3).⁸

Figure 3: Altitude profile of the Mekong River



Source: Mekong River Commission

None of the smaller mainstream dams in Laos or Cambodia will hold enough water to run for more than a few days without replenishment. The operation of these mainstream dams will be contingent upon whether China releases the necessary amounts of water at appropriate times.⁹ This potential water shortage is of greater concern during periods of extreme drought, which are becoming more frequent. Upon completion, the combined capacity of Chinese dams will store half of the Mekong's flow before it passes downstream.¹⁰ However, without regular data sharing, downstream countries must rely on their limited knowledge of the physical characteristics of upstream Chinese dams when making decisions about water storage and distribution. The governments of Cambodia and Vietnam already have expressed frustration with Beijing's denial of transboundary impacts. The Chinese government insists that the Yunnan dams will not have any detrimental ripple effects because only 13.5 percent of the Mekong discharge leaves China's borders.

Reservoir Water: the Answer to Chinese Water Insecurity?

Although Beijing insists that it intends to use the Yunnan dams solely for hydroelectric purposes, severe food and water insecurity could drive China to divert reservoir water for irrigation or for conversion to drinking water. Water security will come to the forefront of Chinese policy as the population continues to grow. Today over 300 million rural Chinese do not have access to safe drinking water.¹¹ This figure will likely rise before the population peaks at 1.5 billion in 2030.¹² The Water Resources and Hydropower Planning and Design General Institute in Beijing defends reservoir water as the best source of alternative drinking water: "In terms of water quantity dependability, water quality security and anti-risk capability, reservoir projects have played an irreplaceable role in ensuring the safety of drinking water sources in China."¹³ Although total water resources have diminished by 13 percent throughout China from 2000 to 2009, the South and Southwest regions endured the largest drops in rainfall and snowmelt.¹⁴

Water Threats: A Case Study on the Abuse of Upstream Water Management

Instances in which upstream riparian countries withhold water from their downstream neighbors are often sources of conflict. Turkey and Syria's claims to the Euphrates River mirror those of China and its neighbors along the Mekong. Turkey considers the Euphrates a national resource and the unilateral construction of dams as an inherent right. Syria, like countries of the Lower Mekong Basin, has raised concerns over human-induced water shortages downstream. When Syrian officials encouraged Kurdish separatist activity within Turkey in the late 1980s, Turkish President Turgut Ozal responded by threatening to restrict water flow to Syria.¹⁵ Ozal manipulated his water regime to force the Syrian government to withdraw support for Kurdish rebels operating in southern Turkey.¹⁶ Thereafter, Turkey prepared for war, and amassed 10,000 troops near the Syrian border. The Adana agreement prevented further violence. However, Turkish-Syrian water disputes are a prime example of how water flow disruption can produce instability. Ongoing tensions along the Mekong, specifically between China and Vietnam, may escalate similarly if a solution is not reached.

Potential Conflict between China and Vietnam

In the Mekong region, Sino-Vietnamese relations are the most vulnerable to conflict. Vietnamese President Truong Tang Sang recently remarked that: "We cannot deny the fact that tensions over water resources are threatening economic growth in many countries and representing a source of conflict. Dam construction and stream adjustments by some countries in upstream rivers constitute a growing concern for many countries and implicitly impinge on relations between relevant countries."¹⁷ Unequal distribution of costs and benefits from dam projects, a long history of violence with China, and a growing Vietnamese military point towards mounting Sino-Vietnamese tensions. Chinese hydropower transparency will be key to averting conflict.

Unequal Benefit and Cost Distribution

While China and Laos reap the majority of hydroelectric energy potential, Vietnam will likely suffer the greatest environmental costs. The Mekong River Delta provides water and nutrients for 20 million tons of rice—about 50 to 60 percent of Vietnam’s rice crop—and accounts for 25 percent of the country’s GDP.¹⁸ Climate change already is degrading the productivity of over 100,000 hectares (247,105 acres) of Mekong farmland. The delta, lying a mere 6.6 feet (2 meters) above sea level, may experience substantial sea level rise of 3.3 feet (1 meter) annually. Analysts predict that “such flooding today would cause approximately \$17 billion in economic losses—a substantial percentage of Vietnam’s gross domestic product.”¹⁹ The dams will worsen conditions in Vietnam by causing more erosion and altering water salinity.²⁰ Additionally, dams may exacerbate water shortages and amplify the negative impact of droughts. According to 2010 World Wildlife Fund estimates, 90 percent of Vietnam’s rice exports originate from the Mekong Delta and are valued at \$2.8 billion. Provided existing Sino-Vietnamese tensions, Vietnam may revert to force to protect its rice industry from Chinese dam construction.

Historical Conflicts

Given shared history, China and Vietnam are predisposed to violent conflict. During the 1979 Sino-Vietnamese War, China invaded Vietnam in response to Vietnam’s pro-Soviet stance in Cambodia. According to varying estimates, 40,000 to 100,000 casualties occurred within two weeks.²¹ Although relations between the two states have improved considerably, tensions over the Spratly and Paracel islands in the South China Sea (SCS) remain. Both China and Vietnam claim sovereignty over the islands. Beijing argues that almost 80 percent of SCS area belongs to China due to a territorial claim, dating back over 2000 years. Vietnam, on the other hand, contends that it has actively ruled over the islands since the 17th century and can document its occupancy. In late 2012, Vietnam held large anti-China protests in Hanoi and Ho Chi Minh City over the alleged Chinese sabotage of Vietnamese exploration operations in SCS.²² To date, the disputes over the Spratly and Paracel islands are unresolved.

Vietnamese Army on the Rise

Although Vietnam scaled back its military spending after Moscow reduced aid in 1980, rapid economic growth over the last decade has led to a renewed defense spending. Today, the Vietnam People’s Army (VPA), with 482,000 members, is larger and enjoys more operational experience than any other country in Southeast Asia.²³ Vietnam significantly improved its naval capability through modern military upgrades, including Kilo-class submarines, Sigma class corvettes, naval strike fighters, and naval surveillance. Even though Vietnam will never be able to match China’s power single-handedly, these renovations present new challenges to the Chinese.²⁴

Vietnam may respond with force if it perceives environmental degradation of the Mekong Delta and surrounding rice fields as a bi-product of Chinese negligence or abuse of upstream responsibility. Vietnam has the most to lose from China’s construction of hydroelectric projects.

Water disputes could turn violent if Vietnam deems the cost of conflict to be less than that of losses resulting from water flow interruption. Furthermore, Vietnam's rising military capabilities could increase its confidence of a battlefield success against the Chinese, and therefore increase the probability of violence, especially if Vietnam sees gains in the SCS as a means of compensating for economic losses related to China's dams.

Chinese dams pose a threat to stability in Southeast Asia. However, potential violence is not the only security issue at play. Hydropower projects will devastate the well-being of millions of LMB inhabitants.

Human Security Concerns

Electricity revenue from hydroelectric projects along the Mekong could reduce poverty and promote growth for Southeast Asian countries like Laos. The Laotian government expects to generate up to \$2.5 billion a year from exports of hydroelectric power once all six of its planned dams become operational.²⁵ Likewise, Burma will earn approximately \$500 million annually from electricity generated by its Myitsone dam, 90 percent of which will be sold to China.²⁶

That said, environmental degradation leading to economic losses will likely outweigh potential economic benefits. While dam-building countries along the Mekong hope to use the revenue to increase economic development, the persons most in need of poverty reduction measures—tens of millions of subsistence farmers and small-scale fishermen—will suffer the highest costs.²⁷ Three quarters of the LMB population earn their living from a combination of agriculture and fishing.²⁸ The Mekong's fisheries support the diets and incomes of the 60 million people who live in the region, and its fertile soils sustain agriculture in the delta.²⁹

Over-building of dams threatens the health and productivity of the Mekong River system. Experts predict that if mainstream dam construction proceeds as planned up to 80 percent of Mekong giant fish will face extinction, including the 600lb Giant Mekong Catfish.³⁰ The controversial construction of the Xayaburi Dam in particular will interrupt the migration of up to 100 fish species. The retail value of affected fisheries is priced at roughly \$4.2 to 7.6 billion annually.³¹ Cambodia's Tonle Sap Lake also is at risk from upstream damming. The largest freshwater lake in Southeast Asia accounts for approximately 60 percent of the country's total fish production and 70 percent of the Cambodian population's protein intake.³²

China's dams will jeopardize the livelihoods of approximately 1 million people.³³ Long-term damming also could force tens of thousands of people to relocate because their homes and land will be flooded.³⁴ Those displaced by dam construction were guaranteed monetary compensation and job training to compensate their losses. Promised payments to-date, however, remain to be seen. It also remains unclear whether less affected neighboring countries will have the capacity to support the likely refugee influx.³⁵

Organizations such as the Mekong River Commission and the Lower Mekong Initiative address growing human security concerns along the Mekong.

Current Cooperation Among Riparian States

There are several institutions created to encourage dialogue and cooperation between Southeast Asian states.³⁶ However, the Mekong River Commission (MRC) is the only transboundary organization that focuses primarily on the multilateral management of the river and the well-being of coastal inhabitants. The Lower Mekong Initiative (LMI) is the U.S. Department of State's program to support sustainable development and growth along the Mekong. These organizations both suffer from structural weaknesses and limited interaction with Beijing.

The Mekong River Commission

The MRC is the most important inter-governmental instrument for regulating river activity. It was founded in 1995 to design initiatives that reinforce sustainable management and the development of water and other resources.³⁷ While the MRC creates an avenue for cooperation, it still faces a plethora of challenges.

- *Strengths.* The four Lower Mekong countries signed a treaty establishing a set of "Procedures for Notification, Prior Consultation, and Agreement (PNPCA)." PNPCA allows a six-month public review period for neighboring countries to give their approval of projects, or raise ongoing concerns.

The MRC has succeeded in obtaining Chinese cooperation, albeit limited in scope. In 2002, China promised to provide the MRC with hydrologic data, including water levels and rainfalls recorded at two stations in the Yunnan Province. China renewed its agreement to share data with the MRC in 2008, which thereafter improved flood forecasting in the Mekong's wet season and reduced casualties, damages, and economic losses due to flooding in LMB countries. China last reaffirmed its commitment to supply information to the MRC in 2010, and consented to providing additional data during the dry season. Although China has resisted data sharing in the past, its recent agreements with the MRC suggest that it is more willing to cooperate with LMB countries.

- *Existing Challenges.* Only Laos, Thailand, Cambodia, and Vietnam participate as full members of the MRC, while Burma and China insist on maintaining "dialogue partner" status. Consequently, coordination of policies and actions by all stakeholders of the Mekong is difficult to achieve. China is unlikely to become a full-fledged member of the MRC given the Commission's stringent restrictions and regulations.

The internal structure of the MRC also poses problems. Policies are not prioritized at the regional level because the MRC Council is comprised of members with ministerial-level appointments. The inclusion of prime ministers or deputy prime ministers could improve political commitment among functionaries.³⁸ However, higher leadership may mean little cooperation without a binding enforcement mechanism. The MRC was unable to prevent Laos from constructing the Xayaburi dam, even after Cambodia and Vietnam voiced continued concerns.

The Lower Mekong Initiative

In 2009, the United States established the Lower Mekong Initiative Forum (LMI) to promote collaboration in the areas of environment, health, education, and infrastructure development. At the Fifth Lower Mekong Initiative Ministerial Meeting in July 2012, the United States rebranded its mission as “LMI 2020” to indicate long-term engagement in the region. The United States pledged \$50 million in grants for projects within the framework of LMI until 2015, and total assistance will surpass \$220 million by FY10.³⁹

- *Strengths.* The United States funds initiatives to promote health in the LMB, including HIV/AIDS treatment services for over 2 million people. The U.S. Department of State also seeks to promote education by supporting academic exchanges and local education reform. Former Secretary of State Hillary Clinton emphasized the health and education of girls and women especially as a LMI priority.⁴⁰ In addition, the United States recently launched Forecast Mekong, a climate-modeling tool and a “sister-river” agreement with the Mississippi River Commission, to bolster water management.

Environmental experts praise the LMI for its first-rate technological and scientific contributions. U.S. aid and expertise promote honest environmental assessments. Chheang Vannarith, executive director at the Cambodian institute for Cooperation and Peace, calls for greater transparency and identifies American assistance as key to environmental preservation.⁴¹

- *Existing Challenges.* Analysts criticize the LMI as a thinly veiled U.S. scheme to insert itself in the region and counter Chinese influence. While the proposals are extensive, academics like Gregory Polling of the Southeast Asia Program of the Center for Strategic and International Studies worry that there is no clear ground plan for the dispersal of funds. Critics cite the \$50 million in financial aid as inadequate.⁴²

Additionally, China does not collaborate or share data with the LMI. Therefore, LMI programs are hindered by hydraulic information gaps and inadequately address security issues along the Mekong. Specifically, the LMI’s climate-modeling tool, Forecast Mekong could benefit from Chinese data sharing.

Organizations such as the Mekong River Commission and Lower Mekong Initiative would be more effective with increased Chinese cooperation. Without assistance or investment from Beijing, it will be impossible to develop the Mekong to ensure equitable distribution of costs and benefits among LMB countries. Therefore, Chinese commitment is imperative to the success of the MRC and LMI.

Policy Recommendations

Existing institutions and policies will be unable to mediate future water tensions successfully if China remains on the periphery of hydroelectric infrastructure talks. Current cooperation with Beijing is far from robust. Although the Chinese have provided additional water level data since 2002, this data is insufficient to address LMB concerns fully. With the Nuozhadu dam near completion and the construction of several other dams scheduled over upcoming years, it is imperative that the Chinese honor their agreements and continue to make necessary data available to the Mekong River Commission. This report argues that an expanded Forecast Mekong will pressure greater Chinese transparency and multilateral cooperation through the release of sensitive hydraulic information.

An Expanded Forecast Mekong

This paper recommends that the United States work with Mekong countries to enhance water cooperation by expanding the role of LMI's Forecast Mekong. USGS aims to provide an accurate visualization of the Mekong Delta ecosystem through data integration and modeling. Forecast Mekong's core components include a sister river agreement with the Mississippi River Commission and the use of graphic visualization tools (GVTs). By depicting climate change scenarios and consequences for human security, Forecast Mekong helps inform management decisions related to the river basin.⁴³

This report proposes to improve Forecast Mekong with the inclusion of a transboundary river model and Chinese hydraulic data. Chinese cooperation is not guaranteed and therefore this paper outlines two plausible scenarios for Beijing's behavior and appropriate U.S. responses.

- *Current Mississippi River Model.* Under the existing sister river partnership, USGS will use data on water flow, sediment transfer, and ecology in the Mississippi River basin to write a hydrological lessons learned manual. The project will summarize the effects of dams, levees, and other river engineering structures on water quality and ecology indicators in the Mississippi River. Additionally, the study will highlight U.S. restoration, conservation, and management efforts as a guideline for future Mekong riparian cooperation.⁴⁴ The Mekong River Commission intends to use this manual to make informed river management decisions.
- *Recommendation.* USGS should revise its hydrological lessons learned manual to include an evaluation of hydraulic projects that require transboundary management. Data from the Mississippi River do not offer an intergovernmental solution to a border-defying problem. Moreover, it will be difficult to draw parallel development strategies because the banks of the Mississippi are relatively uninhabited. For these reasons, the Mekong River and the Mississippi River are not the ideal comparative case study. To overcome these shortcomings, Forecast Mekong could examine water flow and sediment transfer data from the Jordan River and its tributaries to determine the cross-boundary effects of existing and planned dams.

- *Current Graphic Visualization Tools.* USGS is building a graphic visualization tool (GVT) that can help Lower Mekong states assess the expected advantages and consequences of hydropower projects. The GVT will use an existing Mekong tributary dam as a model to evaluate the potential effects of main stem dams on the hydrology and ecology of the Mekong Delta. The model will predict several scenarios for river flow, water quality, and salinity conditions. The project outlines three tasks: (1) create a computer animation for a tributary of the Mekong river using USGS data sets; (2) generate a temporal simulation to demonstrate altered hydrology, disrupted fish migration, and reduced biodiversity and productivity of rice cultivation land after dam construction; and (3) provide annotations to legitimize data simulation and idea exchange.⁴⁵
- *Recommendation.* This report proposes that USGS build on the current GVT model to evaluate the effects of upstream hydropower on mainstream dam projects and the hydrology of the Mekong Delta. More specifically, Forecast Mekong should use existing Chinese data and support MRC attempts to acquire additional information.

The data China has already shared with the MRC is available to Forecast Mekong and has the potential to improve data modeling and flood prediction significantly. However, Forecast Mekong has yet to incorporate these data into its evaluations of the Mekong Delta.

A synthesis of data from Chinese engineers and officials can produce sea-level rise and decline scenarios due to upstream infrastructure and climate change. This model would be both hydrologic (rain fall patterns) and hydraulic (dam design and hydropower). By layering different flooding and sea level recession predictions over demographic and resource maps, policy makers may better identify at-risk populations and industries. In addition, the GVT may be referenced to make recommendations to Chinese officials on water flow regime adjustments to ensure the viability of planned mainstream projects and alleviate future flooding and droughts. LMB state officials will also have the information they need to release or withhold the appropriate amounts of water at upstream locations.

Therefore, the United States should broaden the aims of Forecast Mekong to include the synthesis of Chinese dam information, including dam size, capacity, surrounding topography, etc. Forecast Mekong should also integrate mainstream dam estimates and environmental change predictions.

For the most accurate scientific modeling, Chinese engineers and hydrologists should release the following technical information to Forecast Mekong specialists:

1. Continuous flow data coming out of the upper basins of dams.
2. Stage river level on both lake side and tail-way side.
3. Size of catchment areas contributing water to reservoirs.

4. Flood storage capacity including number of gates, minimum flow and overflow structures.
5. Amount of water stored in reservoirs.
6. Times and frequency of water release.
7. Quantity of water discharged.
8. Frequency of electricity generation.⁴⁶

The question is then whether China will be willing to be more transparent with its current construction plans and to provide more data on its operational dams. The following section discusses two scenarios: (1) China agrees to be more transparent, and (2) China refuses to cooperate. In either scenario, LMB states can hold China accountable for potential water flow manipulation with Forecast Mekong models. If Beijing does not willingly release necessary hydraulic data to USGS scientists, Forecast Mekong's models will compel the Chinese to disclose sensitive information.

Scenario A: Chinese Cooperation

China's greater transparency will provide LMB countries with the opportunity to both maximize their hydroelectric potential while minimizing their environmental risks. However, there are several reasons why it is in China's interest to be more transparent with its dam building and operations.

Economic Incentives

The Chinese were the largest importers of Vietnamese rice in 2012. Of the 7.65 million tons of rice Vietnam exported, 1.43 million tons were shipped to China in the first ten months of 2012. The U.S. Department of Agriculture estimates that China will continue as a net importer in 2013.⁴⁷ Since 90 percent of Vietnam's rice exports are cultivated in the Mekong Delta, China would benefit from a water flow regime that maximizes the productivity of the Vietnamese rice industry.⁴⁸

The Chinese also depend on the Mekong for the free navigation of large vessels. The water supports the year-round navigation of large cargo ships from Chinese ports in Yunnan to Luang Prabang, Laos. Increased water flow transparency could inform navigation decisions especially during the dry season.

Chinese electric companies are currently funding three projects along the mainstream, one of which is destined to supply energy to Vietnam. China Southern Power Grid Company currently finances the Sambor dam project, which will likely be built in Kratie, Cambodia. The planned

operation date is 2020.⁴⁹ Although the dam is significantly smaller than its Chinese brothers, its viability may impact Chinese policy considerations.

Maintaining a Positive International Image

At a 2010 MRC meeting in Thailand, ministers from Laos, Thailand, Vietnam, and Cambodia accused China of exacerbating droughts and floods with its upstream infrastructure.⁵⁰ Sharing information would allow China to legitimize its claims that climate change is responsible for low water levels. By doing so, Beijing could restore its positive public image. Additionally, as an emerging regional leader, it will be in China's interest to address concerns among LMB countries.

If the Chinese released the construction plans of the remaining Yunnan dams, they may safeguard themselves against future attacks from the international community should a natural disaster lead to dam failure. The failure of a single Chinese dam would inundate surrounding riverbank areas and likely cause catastrophic flooding downstream. The Yunnan province is one of the most seismically active regions in China, and Beijing cannot protect its dams against inevitable natural processes.⁵¹ However, in the event of a dam disaster, greater transparency will help the Chinese government demonstrate that neither careless engineering nor Chinese construction errors are to blame.

Scenario B: Chinese are Uncooperative

While there are clear incentives for the Chinese to cooperate with the Mekong River Commission, there is a possibility that the Chinese will either delay or refuse to release sensitive hydrologic and hydraulic engineering information. There are several reasons why Beijing officials may withhold information from the Mekong River Commission.

National Security Concerns

The Chinese consider the Mekong River an untapped national resource for exploitation and electricity generation. Richard Cronin, director of the Southeast Asia Program at the Stimson Center, believes that China is reluctant to share data because Beijing regards water flow within Chinese territory as private. Therefore, China keeps the details of its hydropower projects confidential. The Chinese government considers this issue as a national security concern because hydroelectric energy has the potential to provide China with prolonged economic development, growth, and prosperity.⁵²

Avoiding a Binding Precedent

The Mekong is not the only transboundary river granting the Chinese an upstream advantage. China has also recently revealed plans to construct dams along the Brahmaputra River, which

originates in China's southwest region of Tibet. Infrastructure development on the upper reaches of the Brahmaputra has alarmed officials in India, who, like their counterparts in Southeast Asia, are concerned about changes in water flow and nutrient-rich silt. Many have called for an increase in transparency: "They should give us all the information, the height of the dam, how much water it will hold and how much it is going to divert...and then decide how to proceed."⁵³ Similarly, China's quest for energy along the Indus, Salween, Karnali, and Sutlej Rivers has led downstream countries to recognize the need for comprehensive water and information sharing agreements. Many of these countries acknowledge their weak position relative to China. However, should the Chinese share information with LMB countries, riparian neighbors in other regions may expect equal treatment from China.

History of Hydropower Secrecy

The Chinese have a long-standing reputation for concealing hydropower planning and operation specifics. Cronin argues that Chinese reticence is not new: "China long withheld information on its plans for the massive Lancang and individual dam projects."⁵⁴ Both the Manwan and Dachaoshan dams were under construction for years before the Chinese agreed to provide limited water level data from two upstream locations in 2002. This data, Cronin points out, is insufficient to determine with certainty the amount of water the Chinese have withheld or released. Details of dam operation are not even widely circulated within China. The Chinese State Council's new Energy Development plan resumed several suspended dam projects in January 2013, igniting public opposition by LI Bo, China's oldest environmental group, and the Indian media.⁵⁵

If Beijing refuses to acquiesce, LMB countries can compel Chinese data sharing with remote sensing models that expose the effects of Chinese water management.

Compelling Chinese Cooperation: Publish Models Using Existing Data and Remote Sensing Technology

China may decide to withhold hydrologic and hydraulic information from Forecast Mekong. In that event, Forecast Mekong's estimations will compel Chinese transparency.

Despite wider margins of error, remote sensing satellite imagery can approximate topographical features, rainfall data, and watershed area surrounding dam projects. While it is more difficult to measure the depth of reservoirs at a high temporal frequency, scientists can still generate rough estimates.

There is a precedent. In response to accusations of Chinese water hoarding in 2010, the MRC released a report using rainfall statistics to account for the historically low water levels in Laos and Thailand. While the MRC lacked Chinese hydraulic data on which to base their findings, they were successful in achieving academic and political clout.

Thus, regardless of whether the Chinese release additional information, Forecast Mekong's models will hold China accountable for its water management. Should Beijing withhold water from its riparian neighbors, models may serve as a tool for LMB countries to publicly denounce the Chinese for their behavior. Public pressure will convince the Chinese to either release data to counter Forecast Mekong models, or alter their water regime.

Shaming tactics were successful in the past. On April 16, 2003, World Health Organization representatives publicly accused the Chinese Government of misreporting the number of Severe Acute Respiratory Syndrome (SARS) cases among the Chinese population. Within days, the former leader of the Chinese Communist Party, Hu Jintao, declared war on the airborne virus and called for a national recount of SARS cases.⁵⁶ With the scientific might of Forecast Mekong GVTs backing LMB countries, Chinese officials will be unable misuse the Mekong without stirring the waters.

Conclusion

In the upcoming decades Chinese hydraulic engineering will prompt the construction of a series of hydroelectric dams in Laos, Burma, Thailand, Vietnam and Cambodia, transforming the once largely untapped Mekong River into a cascade of still-water lakes. As more contenders vie for access to this valuable transboundary resource, close collaboration over river management will become essential to long-term productivity.

Conflict could quickly escalate should China take advantage of its upstream position by hoarding water and failing to cooperate with its riparian neighbors. To avert water disputes, the United States should support all mechanisms that enhance inter-state dialogue and cooperation. Specifically, the United States should expand Forecast Mekong under the Lower Mekong Initiative to include Chinese dam infrastructure and operational data in climate change models.

Hydraulic and hydrologic data integration will provide a low-cost solution to this geopolitical challenge by increasing transparency and allowing LMB countries to hold the Chinese accountable for upstream water management. If the Chinese refuse to disclose sensitive hydraulic and hydrological data, Forecast Mekong should generate models using data available and otherwise attainable through satellites. If data from every Mekong hydroelectric project is incorporated into one comprehensive database and visualization tool, scientists will be able to more accurately forecast infrastructure and climate change effects on the Mekong Basin. This information will enable them to pressure Beijing for water regime modifications to mitigate undesirable environmental and socioeconomic consequences.

China's new government led by Xi Jinping has been praised for its open outlook and willingness to be transparent. Whether or not dam infrastructure aligns with this promise remains to be seen. The proposal made in this report ensures Chinese transparency regardless of Beijing's intentions, and thereby increases the likelihood of a cooperative future.

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