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## Is the Mekong at a Tipping Point?

By Ame Trandem

For thousands of years the mighty Mekong River Basin has served as a life-sustaining force, supporting the livelihoods and food security of more than 40 million people in the region.

The river's rich mosaic of ecosystems supports the world's largest inland fisheries and exceptional riverine biodiversity that is only surpassed by the Amazon River. The Mekong provides ecosystem services on a scale so vast that it's often called the mother of all rivers.

Seasonal ebbs and flows and ecosystem connectivity are the keys to the river's ecological riches. Its fisheries and other natural resources depend on a complex sediment and nutrient balance, as does the sustainable production of food crops on its fertile floodplains.

Deeply embedded in the region's economies, culture, history and livelihoods, the river originates in China and flows through Burma, Laos, Thailand, Cambodia and Vietnam before entering the South China Sea. The river's astonishing fishery, estimated at 2,500,000 tons of fish per year, is integral to the life throughout the basin.

Yet, despite the vital importance of a healthy Mekong for present and future generations, the river is potentially reaching a tipping point. A dam-building rush on the mainstem Mekong and its tributaries threatens



Fishing at Siphandone, Southern Laos. Photo: Pianporn Deetes

the ecological integrity of the entire basin. This would irreversibly change the river's hydrology and block the major fish migrations that feed and provide income to millions of people, while also disrupting other vital ecosystem services.

A 2010 Strategic Environmental Assessment commissioned by the Mekong River Commission, the intergovernmental institution charged with sustainably managing the river, warned that a proposed cascade of 11 mainstem dams planned for Laos and Cambodia would irreversibly undermine the ecology of the Mekong River and place at risk the livelihoods and food security of millions of people who depend upon the river's resources. The report stated that the river's flood pulse and

natural hydrology would no longer be maintained, and that more than half of the river would be transformed into a series of stagnant reservoirs, and its landscape changed forever. Many of the river's surrounding key biodiversity zones would be inundated. The dams would block vital fish migration routes, reduce wetland areas and change the habitat necessary for Mekong fisheries. As a result, more than 100 fish species would be at risk of extinction, including the Giant Mekong Catfish and Irrawaddy Dolphin. Fish catches would drop by as much as 42%. The livelihoods and food security of nearly 40 million people who depend on the river's rich fisheries would be undermined.

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# Commentary

## A RIVER OF MEMORIES

A group of elderly women were carefully preparing flowers to offer to the Buddha image. Outside, a dozen villagers were busy cooking a variety of dishes. A ceremony was being held in memory of a late monk who garnered respect from the villagers of Ban Na To Yai village in northern Laos. The preparations were done with utmost care for this important event. The only thing missing was the temple where villagers would normally go pay their respects.

"When we were relocated here, they did not build us a temple," said an elderly man while staring blankly at the rugged dirt road ahead, which was flanked by new homes built by the company building a huge new dam on the Mekong.

Ban Na To Yai houses villagers from a village that used to be by the Mekong River but no longer exists, as it has been turned over to the Xayaburi Dam, the first of a series of dams planned for construction on the lower stretch of the Mekong in Xayaboury Province in Laos.

Before the dam's first concrete piling was built in the Mekong three years ago, we had a chance to travel down the river. It was a very intimate experience. At nightfall, we slept on a sandy beach. One morning, while sailing through Kaeng Luang, the largest rapid on this stretch, we pulled over at Ban Huay Sui, the first village slated to be relocated, and started our documentation there.

A young couple were getting married that day. The whole village was gathered at the houses of the bride's and groom's families. A procession was made with simple songs and dances leading toward the bride's house. Everyone's faces were lit with smiles.

"We really had no idea before the dam's construction started what would happen to us. We did not know where we would be moved to," said one villager in a subdued voice. Within a year, their homes no longer existed. The joyous atmosphere at the wedding became a nostalgic memory of the village that cannot be brought back, of a community in limbo.

We had no idea what lay ahead for the newlyweds, starting their new lives together and yet with such an uncertain future. What was clear was that their families would no longer live together in the new resettlement. We were able to speak with them when we visited them again at their new settlement.

"We have no income since moving here. The land here is not good for rice farming. Fish culture was provided initially, but there is no more fish now. Water here is rusty. Women stay home with no chance to fish and pan for gold. If we were still at our old village, we would have simply walked into the river panning for gold and catching fish, just enough to live by," said one middle-aged woman. "I really, really miss the Mekong," she said with a sigh.

The Xayaburi Dam is one of the largest dam sites in the region. A gigantic section of the Mekong has been filled in, leaving just a tiny channel. Looking at the dam site now, we can no longer tell where the villages were. In the next year the whole section of the Mekong will be blocked.

This is my fourteenth year working on transboundary river issues facing the Mekong. Xayaburi Dam is definitely not the first nor the last symbol of tragedy resulting from unfair development, made at the expense of powerless people and the environment. Decisions are being made by a handful of powerful figures in government and in the construction and energy industries. Local people barely have any role in the planning and decision-making.

The Mekong, the Salween and all other major rivers in the region are the hubs of rich natural resources, a major source of natural capital. All of the flowing waters belong to our descendants for generations to come. It is our obligation to protect them from harm, so that local communities in the region will continue to benefit from them. Any large-scale development projects that will hurt our rivers must be decided collectively. The process must be transparent and the local people must be allowed to take part in the decision-making. Anything less is an unjust theft of our natural birthright.

I am proud of being a part of environmental movement in Thailand, and a part of International Rivers' stalwart campaign to protect this river, my heritage. We will continue to speak out for Mother Mekong as long as it takes

Pai Deetes



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# Devil's Bargain? Hydropower vs. Food Trade-Offs in the Mekong Basin

By Dr. Jamie Pittock

**T**he 60 million people living in the Mekong River Basin get most of their animal protein and many important nutrients from wild-caught fish from the river. The knock-on effects of hydropower dam construction on wild fish catch and food supplies in the basin is the focus of the research described here.

The governments of Cambodia, Laos, Thailand and Vietnam are contemplating the construction of more than 88 hydropower dams in the lower Mekong River basin by 2030. These governments commissioned a strategic environmental assessment in 2010 through their Mekong River Commission. The Assessment found that there would be a loss of between 550,000 to 880,000 tons of the wild fish catch due to the dams preventing the migration and breeding of a substantial minority of the fish species found in the river system. This loss would be ameliorated by only 10% in terms of the amount of sedentary fish that would find new habitat in reservoirs. The Assessment concluded that fish ladders would be largely ineffective in the case of the Mekong, based on experience of dams on other tropical rivers, the huge volume of migratory fish in the Mekong River and the problems in managing fish passages.

The Assessment's conclusion that the dams would dramatically decrease the fish populations and catch is far from new. Yet the governments concerned have continued to advance dam construction regardless of this projected loss of biodiversity and food. My colleagues at the Australian National University and WWF and I decided to see what the loss of this fishery would mean to food supplies in the countries concerned, as their governments have traditionally emphasized the importance of food security through domestic production.

We considered the value of the wild fish catch in terms of both calories and protein. I focus on protein here as calories could be replaced more readily from a number of sources. There are only five options for dealing with the loss of fish protein. First, it would be morally untenable for governments not to articulate policies for ensuring that their people have access to nutritious food, so this is not really an option. Second, the lower Mekong nations could import food to replace lost fish, but they have policies that favor self-sufficiency in supply. Third, there could be an increase in aquaculture production or diversion to local consumption of half of Vietnam's aquaculture production exports or a third of Thailand's marine fish exports. Fourth, these nations could raise more protein-rich crops like soy or peanuts. The trade-offs involved in these last two options are explored in our forthcoming research, but suffice it to say that the numbers involved make them hard choices. For example, to replace protein from fish, people would need to eat two and a half times that mass of rice; to replace the key amino acid, lysine, six times the mass of rice is required.

In our view the fifth option is most likely, namely that the loss of protein from fish would be replaced by scaling up production of the livestock that people already grow and consume in the region. We have modelled the additional pasture land and water resources required to produce this livestock using national statistics (Orr *et al.*, 2012). Our projections are based on data from the Mekong governments provided to the United Nations Food and Agriculture Organization and via the Mekong River Commission's Assessment. These are conservative projections for a number of reasons. The



Wild fish catch is the most important source of protein throughout the Mekong region. Photo: Pianporn Deetes

Assessment data only considers the barrier effect of dams on fish but not other impacts, such as changing flow patterns that are likely to further reduce fish populations. Our calculations do not consider the likely increased demand for protein-rich foods in the region due to growing populations and increasing wealth. A further assumption in our calculations is that scavenging livestock, such as pigs and poultry, need no additional dedicated land to scale up production, as opposed to grazing livestock.

We found that under the scenario of 88 dams by 2030, water use in production of grazing livestock to replace lost fish protein would need to increase by 6–17% and the area of pasture land by 19–63%. In this water-rich region, increased use may not be a problem, although there could be opportunity costs in not using the water for other purposes, including in fisheries or agriculture. The land use change of 7,080 km<sup>2</sup> to 24,188 km<sup>2</sup> is an area equivalent to a small nation like Brunei or East Timor and would come from converting forests and woodland to pasture. More recent work suggests that this land area may be an underestimate due to the difference in nutrition between consumption of whole wild fish versus fish filets used in FAO statistics. Laos and Cambodia would be particularly impacted due to their extensive consumption of freshwater fish and limited alternative protein sources.

This scenario raises questions as to whether rural poor dependent on subsistence fishing could physically or economically access alternative protein sources. Laos, Cambodia and Vietnam

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# Don Sahong Dam Threatens Mekong Fisheries

By Kate Ross

It is early morning along the Mekong River in Siphandone, site of the remarkable Khone Falls in Southern Laos. Boats are beginning to pull up to the banks of the river, and fishers are unloading their daily catch to be sold at the nearby market. In just one season, particularly when there are heavy rains, a family in the area can earn up to 200,000 THB (roughly US\$6,000) from selling fish. This same catch will also be a staple in a family's diet. Studies have shown that wild fish make up roughly 80% of the animal protein that locals consume in this area.

Lives and livelihoods in Siphandone are intricately entwined with the Mekong River, which provides a means of transport, an economy, and most importantly, food security.

Siphandone, whose name means “4,000 islands,” is a unique and picturesque section of the Mekong River. Made up of a series of complex channels winding around small islands and inlets, it is home to extensive wetlands, and is renowned for its abundant aquatic biodiversity and rich fisheries. According to Dr. Ian Baird, a geography professor who specializes in the Mekong, approximately 205 fish species are known below the Khone Falls and just under 200 species known above the Falls, many of which are migratory.

Scientists have recognized the area as a critical bottle-neck for fish migration throughout the lower Mekong basin.

The Don Sahong Dam – the second dam proposed for construction on the lower Mekong mainstream – would block one of the main channels in the area that allows for year-round fish migration. At least 100 species migrate through the Hou Sahong Channel, which is one of the largest channels in the area. Unlike other channels, it is free of waterfalls and large enough to support the year-round migration of big groups of large and small fish. If built, the Don Sahong Dam will entirely block the Hou Sahong Channel, endangering fish migration throughout the Mekong region, jeopardizing food and livelihood security in Laos, Cambodia, Thailand and Vietnam.

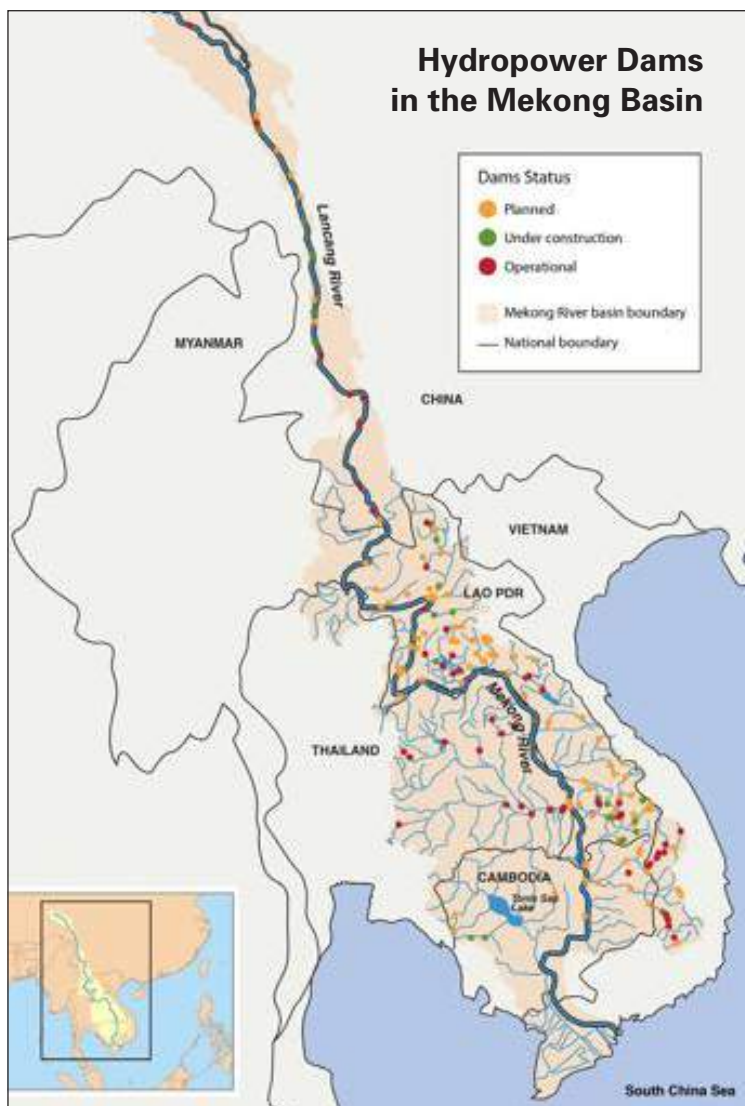
Despite being less than two kilometers upstream from the Cambodian border, no transboundary impact assessment has been carried out for the project. While the Environmental Impact Assessment (EIA) acknowledges the importance of the Hou Sahong Channel for fish migration, it does not look beyond the borders of Laos to address regional fishery implications.

The project is heavily reliant on the success of proposed mitigation measures which include re-engineering the channels on either side of Hou Sahong, and diverting more water to replicate the characteristics of the main channel, in order to attract fish to migrate up the engineered channels. However, the proposed mitigation measures have never been tested in the Mekong region. No information on which fish species the project would target for migration has been publicly shared, and the details behind the engineering design has not been explained. Experts fear these channels could fail to mitigate the loss of the Hou Sahong Channel for fish migration, not only because the design is untried but because the developer's assessments fail to take into account the diversity of fish species in the area, each with their unique characteristics and migration patterns. With insufficient baseline data about which species migrate up which channels and when, it is impossible to predict what the true impact of the Don Sahong Dam will be.

It is not clear who will be responsible if the project's proposed mitigation measures fail. What is clear is that millions of people whose lives depend on Mekong fisheries will bear the brunt of this ill-conceived project, not the Lao Government or project developers, Mega First.

An evaluation of the potential impacts of mainstream hydropower dams on Mekong fisheries published by the Mekong River Commission Secretariat in 1994 describes Siphandone as “an ecologically unique area that is essentially a microcosm of the entire lower Mekong River,” and stated that “such a site is so rare in nature that every effort should be made to preserve all of Khone Falls [Siphandone] from any development.”

The Governments of Cambodia and Vietnam have expressed strong concern over the potential impacts of the Don Sahong Dam, and have called for a moratorium on all dam building on the lower Mekong mainstream for a period of 10 years. The Don Sahong Dam is currently undergoing a regional consultation process, despite the fact that construction has already begun. Still, it is not too late to stop this disaster in the making. ●



# Downstream Communities File Groundbreaking Complaint Over Don Sahong Dam

By Ham Oudom and Maureen Harris, EarthRights International

**M**r. Thuong\*, a 55-year-old fisherman from Kratie Province in Cambodia, seemed overwhelmed at first, and then he became concerned and angry. Before attending our meeting on the impacts of the Don Sahong Dam, he had heard nothing about the huge hydropower project now being built on the Mekong River in Laos, upstream from his village. As the meeting progressed, he began to speak out:

“I really worry about the dam’s impacts on our livelihoods, as we depend on catching fish and using water from the Mekong River for our farms. We have come to know that if it is built, the dam will harm the water and the fish and then it will impact our life.”

Our organization, EarthRights International (ERI), works to raise awareness about the impacts of large-scale dams and other developments in the Mekong region, and to support local people to voice concerns and protect their rights. We work with people who will be harmed by such projects, because the dam-building government agencies and private companies often do not inform people or enable their participation in decision-making.

One such project is the Don Sahong Dam, now being built in Laos. This project will completely block the main channel of the Mekong River for year-round fish migration, threatening the river’s diverse fish populations. Fish are an essential source of food for local people and fundamental to their lives, traditions and identities. The threat to fisheries is likely to have disastrous consequences. Affected villages in Cambodia – many already impoverished – rely on fish for up to 70% of their daily protein needs. Moreover, the project is poised to destroy the iconic Irrawaddy dolphins living in the area and disrupt water and sediment flows, which are critical for supporting downstream farming communities and the river’s delta.

When ERI began meeting with Cambodian villagers to conduct community consultations around the Don Sahong project, most knew very little about the project. None of the participants in ERI’s consultations had received any information from the project developers.

The dam is being built by Mega First Corporation Berhad, a Malaysian company, and the Lao Government. Flouting requirements under national and international laws, the developers failed to conduct an adequate assessment of project impacts up and downstream, including transboundary impacts that will affect Cambodia, Thailand and Vietnam. They ignored obligations to provide information to affected communities and respect their rights to consultation and participation in decision-making. No adequate proposals for mitigation or compensation for the dire impacts are included in the project plans.

Affected communities in Cambodia and their counterparts in Thailand had nowhere to turn for redress. The Mekong River Commission (MRC), the regional body for resolving disputes over transboundary uses of the Mekong River, does not have any mechanism to consider and address community concerns.

Pheau Moeung Khun, Commune Chief of Preah Romkel in Stung Treng Province, just 1.5km from the dam site in downstream Cambodia, described his community’s frustration with the lack of a complaint mechanism for communities affected by the dam: “I used to think that MRC should be the one who can help resolve



Community Consultation on Don Sahong. Photo: ERI

transboundary problems happening on the Mekong River, but they communicate only through the country level, so is there any way that the community can raise our concerns? Who will listen to us?”

In collaboration with local NGO partners affiliated with the Rivers Coalition in Cambodia, ERI conducted consultations with over 200 community leaders and representatives from 33 villages, including indigenous and ethnic minority communities in Stung Treng and Kratie provinces. The consultations provided a forum for local people to express concerns and support the development of a complaint against Mega First to SUHAKAM, the Malaysian National Human Rights Commission. Following the consultations, participants returned to their villages to circulate petitions in support of the complaint, garnering more than 2,000 signatures. Villagers gave personal testimonies and video statements. Additional consultations were conducted by ERI and local partners in Thailand. Thai communities living along the Mekong River joined the complaint.

The groundbreaking complaint was filed on 20 October 2014 and is now pending: the first ever received by SUHAKAM concerning human rights violations committed by a Malaysian company abroad. At the consultations, villagers had asked, “Who will speak for the communities? And who will listen to us?” In a powerful reply to their own questions, community representatives who had never left Cambodia, together with Thai community representatives, travelled to Kuala Lumpur to file the complaint and deliver their testimonies in person, appealing to SUHAKAM to investigate and to intervene with Mega First and the Malaysian government to halt the project and resolve concerns.

SUHAKAM will now consider whether they have jurisdiction to investigate the complaint, including the transboundary issues it raises. We hope that they will decide to follow the example of the Thai Human Rights Commission, which has already accepted jurisdiction in numerous transboundary cases, including that of the Xayaburi Dam, currently being built further upstream. Doing so would represent a critical step forward in helping address the lack of remedial mechanisms and access to justice for communities affected by such projects in the Mekong. ●

\* His name has been changed to protect him.

# Dams and the Politicization of Science

## A PRECAUTIONARY TALE OF XAYABURI DAM'S FISH PASSAGE

By Kirk Herbertson

For almost two years, the sensational water conflict brewing in Southeast Asia was a hot topic, drawing the attention of global leaders and major newspapers. Laos was planning to build the enormous Xayaburi Dam across the Mekong River, angering downstream countries that depend on the river for food security. Prominent global politicians, including Hillary Clinton, urged Laos to act in an environmentally responsible manner. Regional leaders, especially from Vietnam and Cambodia, called for a delay in the project. I was working for International Rivers at the time, and we were constantly responding to requests from journalists who wanted to gauge how far the conflict would go.

In December 2012, Laos suddenly announced that it had re-designed Xayaburi Dam to be environmentally safe and that it would proceed with construction. The government spokesman downplayed the project's potential impacts on Mekong fisheries, claiming that a new "state-of-the-art" fish passage would allow migrating fish to travel safely past the dam. Laos promised to share its new fish passage design with governments and the Mekong River Commission. Many felt that the concerns with the dam had been resolved. Media attention began to fade away. The international community stopped monitoring the project, and Laos was able to proceed without scrutiny.

Now, Xayaburi Dam construction is 40% completed, and the potential for conflict remains unabated. Laos' central promise to neighboring countries – to design a safe fish passage – remains unfulfilled. To date, neither the regional governments nor the Mekong River Commission have been given the opportunity to review the design of the new fish passage. The continued secrecy suggests that Xayaburi's developers might not be able to deliver on their promise after all.

It is essential that the fish passage works. With 781 known fish species, the Mekong is the world's second most biodiverse river. With 2.1 million tonnes of fish yielded each year, the Lower Mekong is also home to the world's largest inland fishery, and migratory fish comprise at least 39% of that yield. The four countries of the Lower Mekong Basin have the four highest rates of fish con-

sumption in the world. In Cambodia, for example, people consume 40.3 kg of river fish per person per year, making fish the second most consumed food item after rice. At least 229 fish species have been recorded near the Xayaburi Dam site, including 70 long-distance migratory species.

**The Xayaburi developers are attempting to build this fish passage facility at a scale and complexity that are unprecedented. There is a lot that could go wrong.**

The Lao government is working with Thai company Ch. Karnchang to develop the Xayaburi Dam. They are relying on European and US engineering companies to design the fish passage facility. The Pöyry Group (Finnish, Swiss) is leading the effort, along with Terraplant and AF Consult (Swiss), KGAL (British), Xylem Inc. (US), and Andritz (Austria). Together, these companies have taken an unconventional approach that contradicts the basic principles of fish passage science. There is a lot that could go wrong.

For years, the Xayaburi developers have claimed that their new fish passage facility will allow fish to swim safely past the dam. This is a challenge, because there are so many different types of fish – each with different sizes and behaviors – that would need to pass the dam. According to early reports, the Xayaburi developers will provide several options for fish to pass the dam: an 800-2,000 meter long ladder, a fish lift and a navigation lock operated to facilitate fish passage upstream; a bypass fish collector; and

*Continued opposite*



Fishing near the Mekong. Photo: ERI

“fish friendly” turbines for downstream migrations. All of these components have been used in some shape or form in other fish passages around the world. However, the Xayaburi developers are attempting to build this fish passage facility at a scale and complexity that are unprecedented. Here are the main challenges.

### Step 1: Selecting target species to be conserved

In fish passage design, the first step consists of selecting target species so that the facility can be designed to accommodate the specific behavior or constraints inherent to these species. Thus, the size, location, and design of the facility depend on whether the target species are large or small, are strong swimmers or not, swim in the middle of the river or along banks, etc. The Xayaburi Dam developers have indicated that they will attempt a one-size-fits-all approach to fish passages, rather than tailor the design to specific species. However, no fish passage in the world has ever used a generic design to accommodate such a wide variety of fish species at once – in this case, ranging from the 3-meter-long critically endangered giant catfish to the 12-centimeter-long very abundant Siamese mud carp, also essential to food security.

Selecting target species for the passage’s design implies ignoring other migratory species. The choice is not difficult in temperate rivers where the number of migratory species is very limited (mainly salmon, eels, and shads), but is a heavy responsibility in tropical countries characterized by a very high biodiversity. In the case of Xayaburi, the choice must be among 70 migratory species. So on what basis is the selection made (biodiversity conservation, food security), and by whom (who selects, how consultative is the process)? What will become of the other migratory species for which the fish passage is not specifically designed? There is no indication that the developer has tackled these questions. External stakeholders have not been consulted.

### Step 2: Attracting target species to the fish passage

Once target species are identified, it is essential that the water currents through the fish passage mimic the water currents that would attract these species in natural conditions. At Xayaburi, migratory fish are scattered across an 800m-wide river, while the fish pass entrance will be 10m wide at best. Fish have no reason to find and enter the ladder or lift, unless they are attracted by a specific discharge or water current that mimicks the streams and habitats they ultimately seek. Without proper attraction flows, migratory fish simply will not find the fish passage entrance. At Xayaburi, there is no indication that the developer has identified research on attraction flows as a priority.

### Step 3: Ensuring that target species have the ability to swim the passage

Once the target species and the attraction flows are identified, fish passage science requires an understanding of the swimming capabilities of each species. In particular, what maximum flow velocity can target species swim against, and how long can they keep swimming against such current? If the water flow in a fish ladder is too strong, fish will not be strong enough to swim up the pass. Swimming ability depends on the species and its size, hence the importance of clearly identifying the target species.

Designing an effective fish pass also requires knowledge of the maximum height a fish can jump. In the Xayaburi developers’ initial fish passage design, the height of each of the 106 steps of the fish ladder was almost three times the size of the dominant fish species. The developers later recognized that the length of the fish pass would have to be significantly extended to reduce the slope and height of the steps, but this acknowledgement itself reflects

how uninformed and inadequate the dam’s fish passage design has been.

Fish cannot swim several hours without interruption, which implies that they must rest in some places during their daily journey (if not, they would drift back). In temperate countries, long fish passage facilities include cross-walls behind which fish can rest, or resting pools. At Xayaburi, the developer has not indicated how resting areas will fit into the design.

### Build now, adapt later?

The Xayaburi developers began construction before finishing the fish passage design. It is likely that this decision was motivated at least in part by the dam’s investors. A review of the Xayaburi Dam’s power purchase agreement by International Rivers, for example, revealed that the developers were required to pay up to \$210,000 for each day that construction was delayed. This created a strong incentive to proceed without a proven fish passage facility in place.

Yet it was a risky decision to proceed without confirmation that the fish passage facility will work. In a November 2011 review of the project, the Mekong River Commission Secretariat concluded that “conducting specific investigations before (rather than in parallel with) dam construction will reduce risks, including those of transboundary and cumulative impacts, and avoid ‘regret measures’, actions that may ultimately be inappropriate and lead to expensive and/or irreversible unintended negative impacts.” The Secretariat recommended taking two years to collect more information for the fish passage before beginning construction, but this recommendation was not taken. Even basic data collection did not begin until construction was already underway. Two years later, it appears that key data is still missing. In the absence of this crucial data, the fish passage design is based largely on guesswork.

### Missed opportunities for collaboration

Despite the risks, the Xayaburi fish passage design is proceeding behind closed doors, and current dam designs have not been shared with other regional governments, as promised two years ago. No independent monitoring is allowed at the dam site, and there has been no collaboration or information sharing with regional scientists. As a result, the dam developers have not benefited from the expertise, data, and constructive criticism of regional and international experts.

A failed Xayaburi Dam fish passage design will bring high costs. These costs will be borne by citizens living along the Mekong River, not by the Lao Government officials and Thai businessmen who have already profited from the construction of the dam. A lack of monitoring by the international community compounds a dangerous situation in which the Xayaburi developers have no incentives to act responsibly.

Laos is now using similar strategies to push forward a second dam, Don Sahong, on the Mekong near the Cambodian border. At least nine others are planned. If these projects move forward, it will be crucial that the region’s governments create space for real dialogue based on scientific evidence. This means transparency in the details of dam designs, adequate time set aside for debate before construction begins, and outreach to independent experts who are not on the payroll of the developer. Without these processes in place, decisions on whether to dam the Mekong will continue to be based on power and corruption, which is a recipe for conflict. ●

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*The author is an environmental and human rights lawyer who previously worked for International Rivers’ Southeast Asia Program.*

# The Mekong Feeds Millions

## Dams Threaten Southeast Asia's Vital Lifeline

The Mekong is the longest river in Southeast Asia, and the twelfth longest river in the world. **The Mekong supports the livelihoods and food security of 7 in 10 of its basin's inhabitants** through agriculture and one of the most productive and diverse freshwater fisheries in the world. Their livelihoods are threatened by 82 existing dams in the watershed and a further 153 under construction or planned, including 11 dams that would block the lower mainstem Mekong.

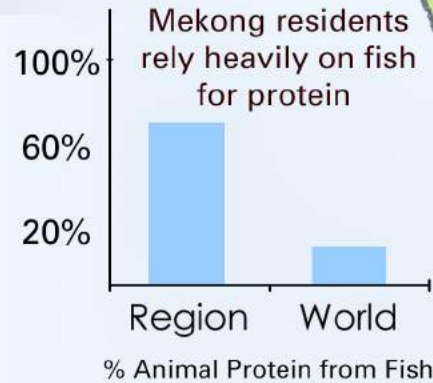
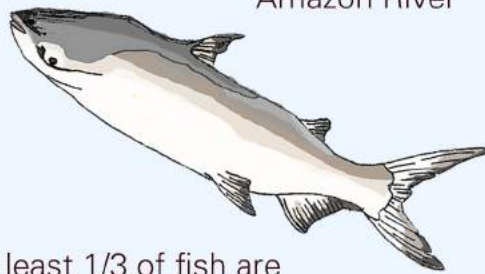


### THE WORLD'S LARGEST INLAND FISHERY AT RISK

Inland fisheries in the lower Mekong Basin produce up to **2.5 million tonnes** of fish per year



The river's biological diversity is second only to the Amazon River



This is **7-22%** of global freshwater production

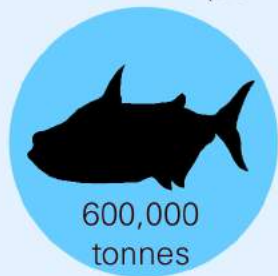
... and worth ~ **\$4.2-7.6 billion**

At least 1/3 of fish are migratory, like the Mekong Giant Catfish

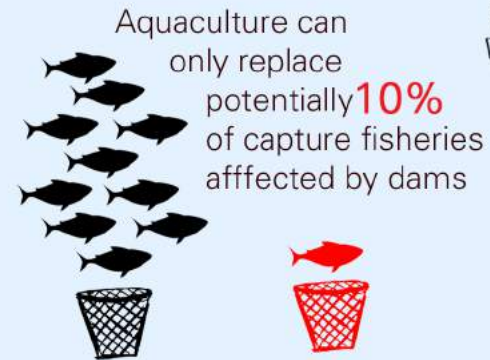
MYANMA

### Mainstream dams would devastate fisheries . . .

If planned mainstream dams are built, the likely loss in fish capture could be over 600,000 tonnes fish/yr



**2X** the annual livestock production of **CAMBODIA & LAOS**



Huge amounts of land and water resources would be needed to replace lost fish protein and calories with livestock products

**+19-63%** increase in land used



**+6-17%** increase in water used



**-\$274 billion**

Losses to ecosystem services from dam development have been estimated as high as \$274 billion, indicating the danger that **huge and unanticipated losses** could occur





More than 60 million people live in the Lower Mekong Basin, and half of them live within 15km of the river. The Mekong is a lifeline for over 70 ethnic groups. It is known by many names: near its headwaters it is called the **Turbulent River**. Downstream it is the **Mother of Waters**. And near its delta, it is called the **Nine-tailed Dragon**.



## DAMMING THE FLOW THREATENS FOOD SECURITY

Seasonal flooding is key to productive farms and fisheries health



Floodwaters inundate land and carry valuable nutrients and sediment



Nutrients stimulate the food web and enrich soil



Crops are grown to be eaten or sold and fish stocks are renewed



### The sediment load of the Mekong could be drastically reduced

However, hydropower projects in China and the 3S rivers will cut the sediment load (~160-165 million tonnes/yr) by **50%**

With the addition of planned mainstream dams the load would be **halved again**

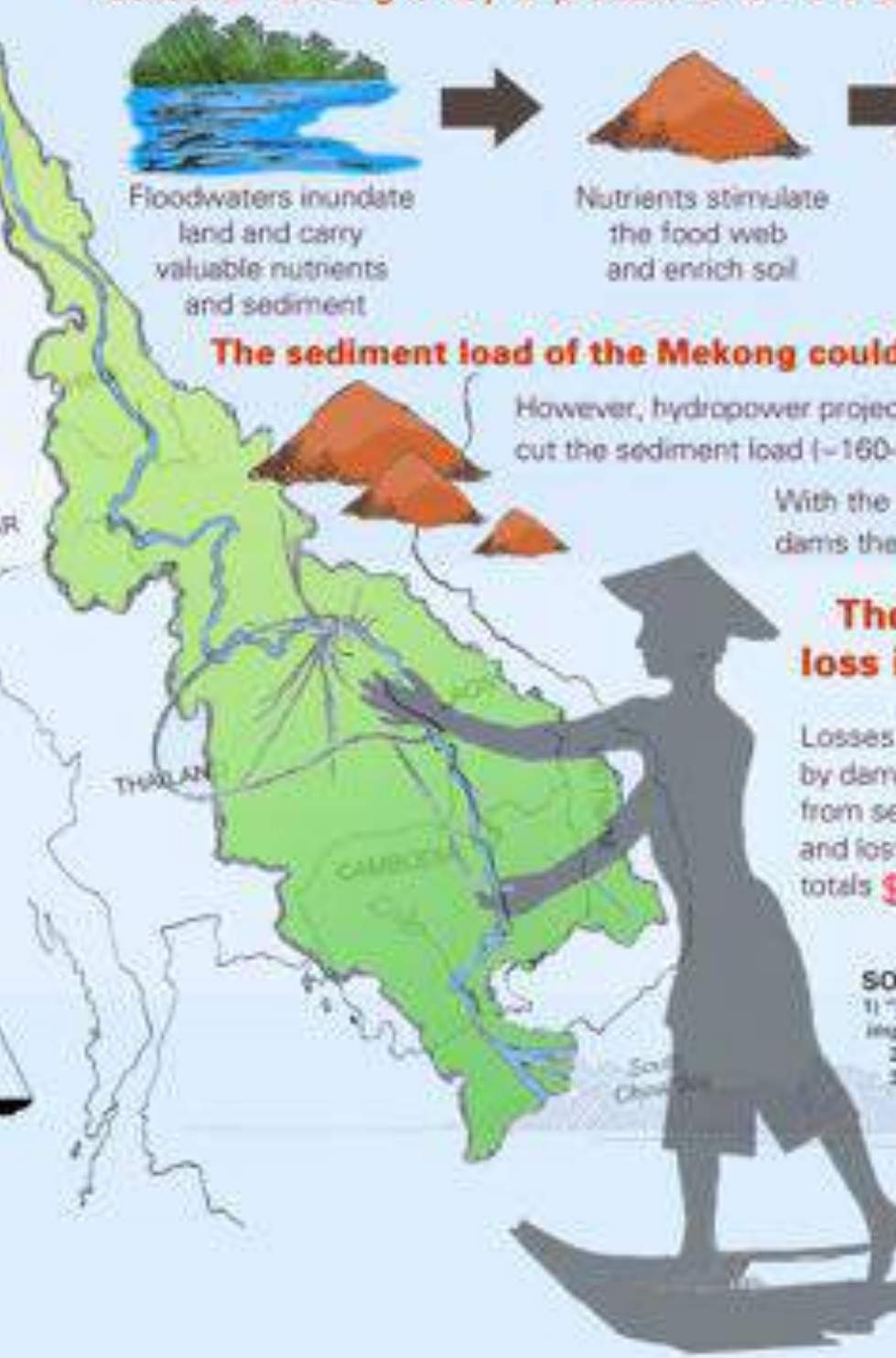
### The dams will cause a net loss in agricultural production

Losses due to inundation by dams, lost nutrients from sediment trapping, and lost riverbank gardens totals **\$50 million/yr**



#### SOURCES

- 1) "Dams on the Mekong River: Lost fish protein and the implications for land and water resources," Orr et al. (2012)
- 2) "Fisheries of the Mekong River Basin," Norde (2009)
- 3) "Mekong Fisheries and the current situation on Mekong mainstream dams," Chheng Phin (2014)
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# Nam Theun 2: The World Bank's Narrative of Success Falls Apart

By Bruce Shoemaker, Ian G. Baird and Kanokwan Manorom

*“Nam Theun 2 confirmed my longstanding suspicion that the task of building a large dam is just too complex and too damaging.”*

— Dr. Thayer Scudder, *New York Times*, 24 August 2014

This past August, Dr. Thayer Scudder, a renowned expert on the social and environmental impacts of dams and a prominent member of the Panel of Experts that monitored the Nam Theun 2 hydropower project, openly critiqued this World Bank showcase project. He described Nam Theun 2 as having failed to meet its social and environmental goals, and called it his “final disappointment” in a long career of trying to make large dam projects work better. His words resonated with environmental, social rights and indigenous peoples’ rights groups that have been monitoring the dam’s development in Laos for nearly two decades.

The World Bank approved support for the dam in 2005, which made it possible for other agencies, including the Asian Development Bank, to come forward with financial backing for the dam. Completed in 2010, the US\$1.45 billion project is owned by the Nam Theun Power Company (NTPC), which is a consortium jointly owned by French and Thai companies and the Lao government. Almost all of the electricity generated is exported to Thailand.

## World Bank's model project

The World Bank has tirelessly promoted Nam Theun 2 as its flagship large-scale hydropower project. The Bank’s strategy features an attempt to re-package lending for controversial hydropower dams by labeling them “poverty alleviation” and “green energy” projects. The Lao government’s portion of revenues from the sale of hydropower is supposed to be used for nationwide poverty alleviation programs. In addition, one million dollars annually is specifically allocated for conservation programs. However, the concerns raised by social justice and environmental advocates – including the involuntary resettlement of more than 6,300 mainly indigenous peoples to make way for the dam reservoir, biodiversity conservation in the an adjacent National Protected Area, and downstream



Families living downstream of NT2 have experienced a severe decline in food security. Photo: Tanya Lee

impacts in the Xe Bang Fai River basin, where more than 150,000 people have livelihood links to the river – are compounded by the fact that Laos is one of the most politically intolerant and corrupt countries in the world.

In early 2011 the World Bank published a book titled *Doing a Dam Better*, about its involvement in the development of Nam Theun 2. Written shortly after commercial operations had commenced, the book’s publication was connected to an extensive public relations campaign. This included blogs and websites, promotional films, press releases, and the employment of full-time public information officers. Critical inquiries were dismissed as misinformed. Meanwhile, the lack of independent media and strict limits on civil society in Laos have made it challenging to refute these arguments, conduct detailed independent research, or begin community organizing efforts. Thus, Nam Theun 2 proceeded without the type of close in-country public scrutiny – or open opposition – that may have accompanied the development of such a large-scale project in neighboring Thailand. This has worked in the World Bank’s favor, allowing the storyline that the dam represents a new model capable of overcoming the social and environmental challenges, while helping to bring in essential revenues to alleviate poverty.

Nearly ten years later, the World Bank has continued to showcase the project. In 2013, the dam’s purported success was referenced as justifying the Bank’s further re-engagement in large-scale hydropower projects in Africa and Asia.

In justifying its support for NT2, the World Bank claimed its involvement would lead to improvements in local livelihoods and biodiversity conservation in the area. It lauded what it claimed was an unprecedented participatory and transparent consultation and monitoring process. Key to project monitoring was the International Social and Environmental Panel of Experts (POE). The POE’s monitoring role, and issuing of annual public reports, was considered by many to be an important and innovative aspect of the project and particularly important in Laos, which lacks independent local civil society, media or other monitoring mechanisms.

## Narrative of success collapses

Four years after NT2 commenced operation, an increasing body of evidence has developed that directly challenges the purported successes of this project. The POE’s most recent report, published in May 2014, reveals that it is not just Dr. Scudder but the entire POE (other members include Dr. David McDowell and Dr. Lee Talbot) have developed substantial criticisms of multiple aspects of the project.

In regards to indigenous communities resettled from the reservoir area, their status falls far short of minimum expectations outlined by the World Bank. According to the most recent POE report, while much infrastructure (roads, schools, clinics, etc.) has been built in association with NT2, “important problems remain” with each of the five “livelihood pillars” that were to be the basis of improved sustainable livelihoods for resettlers. The village forestry component, originally expected to generate a third of villager income, is particularly problematic and “the sustainability sought in the Concession Agreement is a remote prospect.” While the POE makes a number of recommendations in regards to improving

these livelihoods programs, it also notes that these programs are to be handed over to the Lao government in early 2015. Without further support from NTPC, it is very likely many of these programs will not be continued, much less be improved upon.

The POE is scathing in its description of the failure of the agency meant to implement the conservation work in the national protected area adjacent to NT2, the Watershed Management and Protection Agency (WMPA), noting its “*manifest failure in its present form to carry out the fundamental task of protecting the watershed’s biodiversity.*” Planned foot or motorcycle paths in the protected area, meant to facilitate patrols, instead turned into wide roads that allow trucks to pass and facilitate illegal logging and wildlife poaching. Recent audits of the WMPA found extensive financial and operational irregularities. The POE notes that

a main exchange point for illegally cut lumber is located only 200 meters from an NTPC guard post at the main gate to the dam. The level of corruption and poor governance is so high that the POE is calling for the WMPA’s complete dismantling and restructuring.

Significant negative impacts to local livelihoods have also occurred in downstream areas. A downstream program for 150 impacted communities in the Xe Bang Fai basin was quickly terminated and handed over to the Lao government at the beginning of 2013 when the allocated funds ran out prematurely. While the World Bank was supportive of this early handover, the POE was not and subsequently criticized the move.

In January 2014, we conducted an independent study of communities in the Xe Bang Fai River Basin, mainly downstream of where water is diverted from the Nam Theun River via a 27 km long canal from NT2’s reservoir into the Xe Bang Fai River. Our objective was to revisit the areas where, before NT2 was built, two of us had helped conduct an in-depth rivers-based livelihoods study that documented the essential livelihood links local people had to their river. We visited many of the same communities and met some of the same people we had first interviewed 13 years earlier, allowing us to assess how the project has changed the lives of the people and the environment in the area.

Our extensive interviews with villagers and observations of the river confirmed many of the POE’s concerns, and also revealed some additional problems. Many of those impacted by the dam reported that they have been left worse off by the project. Villagers have suffered a dramatic drop in wild fish catches, excessive flooding of low lying rice fields during the rainy season, a loss of riverbank gardens, and other impacts associated with major hydrological and water quality changes. Compensation programs were rushed, and many initiatives were either inadequate or inappropriate. In the view of most villagers, the compensation provided by the dam developers has not come close to making up for the livelihood losses they have suffered. Women, indigenous and poor communities have been particularly impacted, as they often lack the resources to shift to other livelihoods. Key aspects of the now-terminated compensation program, such as dry-season irrigated rice cultivation, have fundamental environmental and economic problems, and have certainly not made up for the livelihood losses of impacted communities. Many villagers express a fear of openly criticizing the project or the compensation program. Almost nobody we spoke to was aware of a functioning grievance process, even though the World Bank and the project developers have boasted about such a system being in place.

The POE notes that the Lao government has been very reluctant to allocate revenues to assist those who have been negatively impacted by NT2. Evidently, the World Bank’s idea that there would be genuine benefit-sharing has not become a reality.

## Conclusions

As evidence mounts of the failure of Nam Theun 2 to achieve its social and environmental objectives, it is increasingly clear that the self-congratulatory tone of the World Bank’s public relations campaign was overly optimistic. It is time for the World Bank to examine how to best address the serious problems caused by the project, including restoring the negatively impacted livelihoods of well over 100,000 people, rather than blindly persisting in promoting NT2 as a positive model of success. ●

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*Bruce Shoemaker is an independent researcher focused on natural resource conflict issues in the Mekong region. Ian G. Baird is a professor of geography at the University of Wisconsin-Madison. Kanokwan Manorom is a professor of sociology at Ubon Ratchathani University, Thailand.*



**Tree roots and limbs left to rot in NT2’s reservoir are a significant contributor of methane emissions**

## High Greenhouse Gas Emissions Found at Nam Theun 2

A new study reveals high greenhouse gas emissions at the huge Nam Theun 2 reservoir in Laos. The study, by a group of French scientists from Toulouse University, Electricité De France and Nam Theun 2 Power Company, was published in *Biogeosciences* in August 2014, and marks the first public release of information about the dam’s environmental impacts.

The recent scientific findings focus on the measurements of “ebullition” (methane gases bubbling to the surface of the water and being released suddenly into the air) over a four-year period. Despite seasonal and daily variations in the releases of gases detected, the study found that overall, ebullition contributed between 60-80% of total emissions at the surface of the reservoir. The authors concluded that “ebullition is a major and overlooked pathway in young tropical or subtropical hydroelectric reservoirs” for greenhouse gas emissions. This study confirms the need for there to be greater understanding and acknowledgement of the significant volumes of methane released from hydroelectric dam reservoirs over the course of a project cycle.

# Toward More Democratic Power Planning in the Mekong Region

We talked to **Witoon Permpongsacharoen**, Director of the Mekong Energy and Ecology Network (MEE Net), about power planning in the Mekong region, and better alternatives to large hydropower dams. MEE Net works to address the social and environmental problems arising from the rapid growth of the electricity sector in the region.

## What is the current context for energy planning in the Mekong region?

In the current system, they start by looking at energy demand forecasts and from this, create a Power Development Plan. Energy forecasting is based on GDP growth forecasting. However while energy projections are made for a period of 20 years, GDP projections can only be made for a maximum of three years. No one can predict GDP growth for 10 years, which makes the forecasting system problematic as you are betting on continued exponential growth. In reality we are facing more uncertainty in terms of economic growth, which will not rise exponentially, but rather fluctuate up and down over the next 20 years.

However, forecasting and power development planning are used to promote growth and investment, and a higher forecast means greater investment. This is the attitude that we are facing, and a common problem with a centralized planning system. What it means is that there is a growing gap between demand projections and reality.

Growth is based on peak demand, meaning the highest demand that occurs in a year. In the case of monsoon countries such as those in the Mekong region, the hot season creates peak demand when people are using air conditioning. Peak demand can last for just two weeks. In Thailand, within 60 hours the demand can increase by 2,000 MW. The rationale behind taking the peak as your demand figure is to ensure there is coverage during these times. But that high level of demand is needed for a very limited period.

Added to that is a “preserve margin,” a percentage to create a cushion. In the past, Thailand had a 25% preserve margin, now it is 15%, however there are always those trying to push it back up to 20%. On the surface 15% may not look like a lot, and when your total capacity is still low, i.e. 10,000 MW, then 15% is only 1,500 MW extra. However when you are dealing with a total capacity of 30,000 MW, the preserve margin becomes 4,500 MW. The biggest power plant in Thailand is 2,000 MW, so even if the whole plant were cut from the system, you will not need a 15% preserve margin.

What these examples demonstrate are the problems with the statistics of energy planning, which leads to inflated demand and over-projections.

## Is there an alternative approach to consider?

If you can make energy consumption more efficient, it is better for the economy. Using an energy efficiency approach, there are many ways to respond to peak demand periods – for example, by asking the end-use consumer to manage the demand. If there are 10 factories which together need 2,000 MW and if you know that during a certain week, this peak will occur, then you approach them to discuss ways to manage their consumption during this period: for example, limit operations or use standby power. You could offer financial incentives. So rather than building new capacity to manage two weeks of peak demand, you improve management of the current installed capacity.

This seems like the logical solution in Thailand where the majority of consumption comes from industry that is owned by less than 20 families. If you can take representatives for these companies, sit them in a room, it should be straightforward to communicate and deal with the peak demand in a different way. But that is only if you want to. This initiative would need to come from the energy industry.

However, the energy industry is a business. EGAT – the Electricity Generating Authority of Thailand, is a business and they are still looking at how they can best increase their investments and increase their income.

## How do politics figure into energy planning?

While forecasting is one aspect of energy planning, there are many interests that become a driving factor in energy development and demand. In the Mekong, the energy industry is a centralized monopoly, in which a small number of experts are responsible for decision-making in a system which lacks transparency and accountability. In order for energy planning to improve, the process and energy sector need to become more democratic, and more transparent.

We cannot necessarily change from a centralized to a decentralized system, but we should be working toward an open system. For example, giving people the freedom to be producers as well as consumers, through initiatives such as rooftop solar. These decentralized systems can be backed up by the centralized grid. But what is happening at the moment is more “top-up” rather than full reform of the system. Small-scale initiatives are not reducing the capacity requirement. We need all of this to be under the same system and plan.

## How can the system be made more democratic?

This question of the democratization of the energy sector is complex, and related to other political problems. When we talk about political democracy, it is often focused on elections and voting. But in Thailand the energy sector accounts for one-third of the economy, so if we can make the electricity sector democratic, then maybe we can make other sectors democratic and finally have a political democracy.

The challenge is how to get the public to participate in these issues. For example, when we campaign against destructive dam projects, if only dam-affected people are fighting the dams, we may stop the project, but this will not necessarily create societal change. So how can we get consumers to care? This is why MEE Net has been working to introduce the concept of “know your power,” which aims to create a more participatory process within power policy planning. Ultimately the question is how can we make people see what they can do to be a part of the solution and how we can work together to create a democratic and transparent energy sector. ●

Learn more about MEE Net's work: <http://www.meenet.org/>

# Mekong School's Lessons for Change: One Activist's Story

By Hoang Duong

One day late in November, after a long period of preparation, public meetings on Don Sahong Dam finally started to move forward. I was travelling in the Mekong Delta. It is the time of year local people in the Delta start to collect and sell *Ca Linh* (a traditional fish), lotus trunk, and flowers only found in the rainy season. Livelihoods in the Mekong Delta are becoming harder since there's more consumption and fewer natural resources than before.

This year, construction on the second dam of 11 proposed hydropower projects on the lower Mekong mainstream starts in Laos. Despite all debates so far about the loss and gain of this development project, the river will be stopped in order to produce electricity, and its rhythm will definitely change.

Local people are the last ones to know about the dam, but they will be the first to suffer from decline of fish, the changing of river flows and also the impacts of climate change. Recently, people are experiencing abnormal tides and flooding. Some say the flooding comes earlier and stays longer than before. Some common dishes that are found in the rainy season now become rare and very expensive. This year, in An Giang province, the flooding didn't come; the water level is lower than usual. It means there are no traditional fish usually found in flooding season. There's no abundant sediment so that farmers have to use more chemical fertilizer for their crops.

I had never thought how human livelihoods and sustainable development can be connected until I attended the Mekong School in 2011. The Mekong School was founded in 2006 by EarthRights International to create change. It gathers students from six countries in the Mekong Region with different backgrounds and diverse cultures; they can be recently graduated students, researchers, freelance journalists, lawyers, or community leaders. The common point among us is our commitment toward local communities, the desire to build



Pak Mun Dam. Photo: Assembly of the Poor

community capacity, or plan advocacy strategies. During seven months of training, students learn about human rights, the environment, international standards, and the relationship between human beings and nature – particularly in relation to development projects. The students not only learn from teachers but also from one another.

During my time at the Mekong School, we met with affected communities in Thailand who for generations

have been committed to protecting their motherland from the impacts of development projects. During a visit to the site of the Pak Mun Dam, students witnessed a healthy river now changed into a big polluted reservoir full of water hyacinth. Local people desperately try to fish in it, with little luck. I saw people gathered around a van buying fish from another town. Such projects, when built without accountability and transparency of implementation, cause disaster for local communities. The campaign is never easy and it will take a very long time before people really can stand up and fight for their rights or the government to listen and respect their opinions.

I could say I'm a lucky person because I have seen first-hand what will happen when a dam stops a flowing river. Now, all of that will surely come true in my country – Vietnam. The Laos government has plans to build the Don Sahong Dam along with 10 other dams on the mainstem of the Mekong, a Mother river that is the main source of food and livelihood for millions of people in the Mekong Delta. For the Mekong people, the river is too precious to gamble with.

With the ability to share my experience and raise awareness among local people about these impacts and the threats posed by dams, I cannot keep silent. Now working as part of the Vietnam Rivers Network, I am engaged in building capacity and knowledge within communities in Vietnam about the impacts of the Don Sahong Dam. Vietnam Rivers Network is an open platform to dialogue among experts, environmental non-government organizations and other stakeholders who care about the river systems in Vietnam. One of our missions is monitoring, and doing campaign and advocacy on water resources management. In November, we're aiming to conduct six public meetings with local farmers, fisherman and with women in the Mekong Delta.

I know this kind of work is not easy, but it's not impossible. Talking about my commitment and where my motivation comes from, as my colleague said "If I don't try anything to make change, I will regret it later." Indeed, this is not only for my generation, but also for many future generations of the Mekong Delta. I cannot say if just six public hearings will make changes we need to protect the Mekong, but at least local people will be aware and informed about these dams that will affect their lives and their rights to be consulted. ●



Hoang Duong

Many of the risks associated with the dams cannot be mitigated and would result in massive losses of economic, social and environmental assets. Given the severity of these risks, the report's main recommendation was to defer all decisions over whether or not to build the mainstem dams for ten years, to allow for more informed decision-making based on a comprehensive understanding of the risks involved.

### Laos dives into dam-building

Despite these significant warnings, the first dam in the cascade of mainstem projects, the Xayaburi Dam, is recklessly moving ahead in Northern Laos. With no transboundary environmental impact assessment, no cumulative impact assessment and no public disclosure of the dam's final design, the extent of the impacts on neighboring countries remains unclear, while the proposed mitigation measures, such as fish ladders, remain unproven and unlikely to work in the Mekong River.

The Cambodian and Vietnamese governments have repeatedly demanded further study and consultation on Xayaburi. Civil society groups and international governments have echoed their call for construction to stop and respect for international laws, such as the 1995 Mekong Agreement. These calls have led to numerous construction delays, achieved broad international awareness and opposition to the project, and forced the Lao government to commit more than \$100 million to improved mitigation measures. A lawsuit against five Thailand government agencies for agreeing to purchase the dam's electricity is also under review by the country's Administrative Court.

The Lao government is now pushing forward with its second mainstem dam, Don Sahong, less than 2km from the Lao/Cambodian border. Although preparatory work is already underway and Laos has expressed its plans to build the dam no matter what, the project is still being discussed regionally within the Mekong River Commission. Public consultations are now underway in Cambodia, Thailand and Vietnam. The regional governments are expected to meet in January 2015 to put forward their positions on the project.

### Sad legacy of dams

While scientific reports have already warned that the consequences of proceeding with these dams are likely to be catastrophic, the dark side of hydropower development in the Mekong River Basin is nothing new. The past two decades have demonstrated the social and environmental woes of dam building with more than 80 projects commissioned to date in the region. Since the 1980s, dams have been built on the Upper Mekong River mainstem in China without notification or consultation with downstream countries. The transboundary impacts of these dams are now being experienced throughout the region, and their regulated flows have helped make the lower Mekong mainstem dams more feasible. Dam



Mekong fishing boat. Photo: Pianporn Deetes

projects completed in the basin – such as the Pak Mun Dam in Thailand, the Nam Theun 2 Dam in Laos, and the Yali Falls Dam in Vietnam – exemplify some of the serious social and environmental costs of dam building in the region, and illustrate why the concept of sustainable hydropower remains a dangerous myth when transparent, participatory, and accountable energy planning processes are not first put in place.

Yet there are signs of hope for the mighty Mekong. In the past few years, the Government of Vietnam has cancelled more than 400 hydropower dams due to concerns over their environmental impacts and poor economic feasibility. Vietnam has also maintained a position of opposition to the Mekong mainstem dams. In April, the Prime Ministers of Vietnam and Cambodia called for a ten-year moratorium on all Mekong mainstem dam building.

There are better options that would keep the Mekong River healthy for future generations. Improved energy planning and the use of more sustainable energy options must be at the forefront of the debate. Convincing research already exists disputing future energy demands within the region, which have historically been over-forecasted in the main importing countries of Thailand and Vietnam, while also demonstrating that more sustainable energy options exist.

It remains to be seen if regional leaders will come together in defending this most productive of rivers, and cancel destructive dam projects that would tamper with the ecosystem services that a healthy Mekong River Basin provides. If they don't, they will be gambling with the futures of millions of people in the Mekong River Basin, a dangerous game that will bring serious consequences for present and future generations. ●

### Food Security *continued from page 3*

have 2.9 million people who are regarded as vulnerable to a 10% increase in food prices. Diet and health could undergo a forced change with the loss of fish as a fundamental source of nutrition.

This research suggests that basic food security could be disrupted by hydropower dam development. Basin stakeholders should be engaged in strategies to manage these impacts. While national governments may have rights to decide to build dams, that right comes with the moral obligation to consider all

reasonable alternatives and an obligation to consider all reasonable means to mitigate the impacts of such developments. Articulating credible policies for food security is a fundamental obligation of governments. ●

*The author is a senior lecturer at the Fenner School of Environment and Society, The Australian National University.*

# Understanding the Impacts of China's Upper Mekong Dams

China has built seven hydropower dams on the upper Mekong River (known as the Lancang in China), and plans to build 21 more. The Lancang crosses through Qinghai, Tibet and Yunnan before flowing into Myanmar, Laos, Thailand, Cambodia and Vietnam. There have been many concerns from the Lower Mekong communities on how these dams will impact their lives and livelihoods. People have questioned whether recent sudden changes of water levels and droughts in the Lower Mekong were caused by these Lancang dams. International Rivers prepared a research brief based on a literature review and monitoring data to help understanding the downstream impacts on hydrology, fisheries and sedimentation caused by the Lower Lancang cascade in China.

Because the Lancang River contributes 45% of water to the Mekong basin in the dry season, the flow at Chiang Saen in Thailand, which is located hundreds of kilometers downstream from the Lower Lancang cascade, can be increased by over 100% in the dry season. An increase in water levels in the dry season will reduce the exposed riverbank areas that are now used for seasonal agriculture. Millions of villagers who live along the Mekong River grow vegetables in riverbank gardens and their livelihoods will be significantly impacted if they lose the gardens. In the wet season, the decrease in flow at Chiang Saen caused by the seven Lancang dams will be about 30%. This will shrink the floodplain area and reduce the flow of nutrients deposited on floodplains.

The Lancang dams have also altered water temperatures. The daily average water temperature at Chiang Saen decreased after Dachaoshan Dam started operation. The annual water temperature range has also increased. Once the Lancang cascade in the middle reaches is completed, the temperature impacts are certain to accumulate and will extend at minimum hundreds of kilometers downstream. The decrease in water temperature and the increase in temperature fluctuation will change the behaviors of fish species, impacting their reproduction and migration activities.

The dams not only change the river's flow and temperature, but also block fish migration channels, which are critical for reproduction. The extent of fish migration from the Lower Mekong into the Upper Mekong is unknown. However, the endangered Mekong Giant Catfish has been found to forage and spawn in the Buyuan River (a tributary of Lancang) between the Jinghong and Mengsong dam sites. Other fish species such as *Tor sinensis*, *Wallago attu*, *Hemibagrus wychioides* may also migrate between the Lower and Upper Mekong.

Several scientific reports have found that half of the sedimentation in the Lower Mekong originates from the Lancang basin. Because of the different measuring methodologies used between Yunnan and downstream Mekong countries, as well as different analysis methodologies, the sedimentation capture rate by the Manwan Dam (completed in 1995) has been estimated to range from 53% to 94%. Some researchers have reported that the sedimentation impact from Manwan Dam extends as far as Vientiane, Laos. The whole cascade of dams will theoretically trap 94% of the suspended sediment load coming from China. The reduction of sedimentation downstream will not only result in riverbank erosion, but will also reduce the nutrients carried in the flow and deposited in floodplain areas, thus undermining the chemical base of the ecosystem. It is also likely to trigger the acceleration of seawater intrusion in the delta. These impacts aren't easily observed in the short term, but build over decades.

## Dams in the Lancang Hydroelectric Cascade within Yunnan

Dam Name	Installed Capacity (MW)	Dam Height (meters)	Status
Gushui	2,600	220	Under site preparation
Wunonglong	990	136.5	Under construction
Lidi	420	74	Under construction
Tuoba	1,400	158	Under site preparation
Huangdeng	1,900	202	Under construction
Dahuaqiao	900	106	Under site preparation
Miaowei	1,400	139.8	Under construction
Gongguoqiao	900	130	Completed (2012)
Xiaowan	4,200	292	Completed (2010)
Manwan	1,550	126	Completed (2007)
Dachaoshan	1,350	118	Completed (2003)
Nuozhadu	5,850	261.5	Completed (2012)
Jinghong	1,750	118	Completed (2009)
Ganlanba	155	60.5	Planned

With the two biggest dams of the cascade, Xiaowan and Nuozhadu, put into operation in 2010 and 2012, and the middle Lancang cascade expected to be completed in the next few years, bigger downstream impacts are expected. The changes in hydrology, fisheries and sedimentation brought by the Lancang dams will have extensive and very significant impacts on millions of people who rely directly on the river for their food and livelihoods. Altering the hydrological and sedimentation regimes and blocking fish migration will potentially reduce the quantity and diversity of fish in the downstream Mekong River, and lead to food insecurity and lost livelihoods. Furthermore, the reduction of sedimentation deposit and the seawater intrusion will affect the highly productive agricultural and rice fields in the region, which depend on nutrients transported by the river in its sediment, and therefore create even bigger challenges in food and livelihoods.

It has been demonstrated that China and Chinese dam builders can be more responsive and responsible when planning and operating dams. China has agreed to share more hydrological data with the Mekong River Commission by extending the hydrological data provision by 30 days, every year, as well as increasing the frequency of the data sharing to twice a day. The developer of the Lancang dams, Hydrolancang, has taken environmental and social concerns into consideration in several cases. Gushui Dam's height was reduced due to concerns over inundating a protected area in Tibet. Guonian Dam – originally planned between the Gushui and Wunonglong dams – was canceled because of its potential impacts on the Mingyong Glacier. The water level of Wunonglong Dam was reduced to avoid some impacts, which therefore led to the reduction of installed capacity. Mengsong Dam, originally planned as the last dam on the Lancang, was canceled due to concerns over its negative impact on fish migration. However, the large impacts from the Lancang dams are not avoidable and the effectiveness of mitigation measures remains to be seen. ●

## Climate Change's Impacts on Mekong Need Study

**C**limate change will result in many hydrological changes of relevance to hydropower generation in the Mekong Basin, says Dr. Richard Beilfuss of the International Crane Foundation, a hydrologist and expert on the climate risks of large hydropower dams who has been studying Mekong climate risks for the German aid agency GIZ.

The Mekong is facing huge growth in large hydropower projects, yet planning and design of dam projects in the basin are not taking into account climate risks. Most hydropower projects are designed on the basis of recent climate history and the assumption that future hydrological patterns will follow historic patterns. Under future climate scenarios, a hydropower station designed and operated based on the past century's record of flows is unlikely to deliver the expected services over its lifetime. It may be over-designed relative to droughts, and under-designed relative to extreme inflow events in the future.

"Uncertainty about future hydrology presents a great challenge for infrastructure planning and engineering," says Beilfuss. "Water resource developers and managers depend on accurate hydrological models. Yet the Mekong's future hydrologic regime is unclear – some studies project increases in Mekong runoff, while others project decreases. Any infrastructure will have to contend with the impact of more frequent extreme floods and droughts."

In addition to risks to hydropower projects, projected impacts of climate change on human livelihoods and biodiversity in the densely-populated Mekong Delta are expected to include

decreasing food production capacity (especially rice and aquaculture production), increased incidence of flood and drought damage, and loss of productive wetlands due to sea-level rise and land submersion, according to the co-author of the new research, Dr. Tran Triet, of the International Crane Foundation and University of Science, Ho Chi Minh City. This could exacerbate the negative impacts associated with a Mekong dam boom on the basin's fishing and farming communities. The basin will be further affected by large-scale irrigation development, land use change, industrialization and urbanization. "There is an urgent need for comprehensive studies that assess cumulative impacts of river basin development and climate change in the Mekong Basin," says Beilfuss. "Such studies would ensure sound decision-making about the future of hydropower development in the basin."

The analysis also notes that various development alternatives have been suggested that are more robust to climate risks and impacts than large dams. Suggestions include innovative systems for tapping the power of the mainstream in ways which do not require dams across the full breadth of the river channel; upgrading existing infrastructure; investing in infrastructure that is reversible or can be used under a range of conditions as climate changes; building larger safety margins in infrastructure to cope with extreme events; promoting non-infrastructure adaptation strategies, such as investing in floodplain restoration, and reducing decision-time horizons for more rapid responses, such as the addition of smaller and decentralized infrastructure. ●