

The Economics of the Mekong River Basin: Health, Environment and People

Hermann Waibel

School of Economics and Management, Leibniz University Hannover

With:

Shi Min,

College of Economics and Management, Huazhong Agricultural University, Wuhan,
China

Chompunuch Nantajit &

Suputra Boriwut,

Ramkhamhaeng University, Bangkok, Thailand

Seminar,

Faculty of Economics, Ramkhamhaeng University,
Bangkok

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The Mekong/Lancang River



China:

- Prof. Dr. Shi Min, College of Economics and Management, Huazhong Agricultural University

Myanmar:

- Mr. Chit Myolwin, Yangon, Consultant

Laos:

- Mr. Phouvong Phami, PhD student Wuhan University

Thailand:

- Mr. Nopporn Tantisirin, Ubon Ratchathani University
- Dr. Somkid Naprom, Udon Thani Rajabat University
- Dr. Chompunuch Nantajit, Ramkamhaeng University
- Ms Suputra Boriwut, Student of Economics, Ramkamhaeng University

Cambodia:

- Mr. Chea Chaeath, Consultant

Vietnam:

- Mrs. My Hao Van, Consultant

Germany:

- Dr. Niels Wendt, IT coordinator
- Prof. Dr. H. Waibel, Overall coordinator

- 1) My „Love“ for the Mekong River
- 2) My „Dragon dream“
- 3) Fourty Years of Development Research in Asia
- 4) Make good use of „left-over“ money

„River Love...“



The „Mekong Dragon“



„Come to my River“, said the Dragon.....

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Two major changes in the Mekong River Basin:

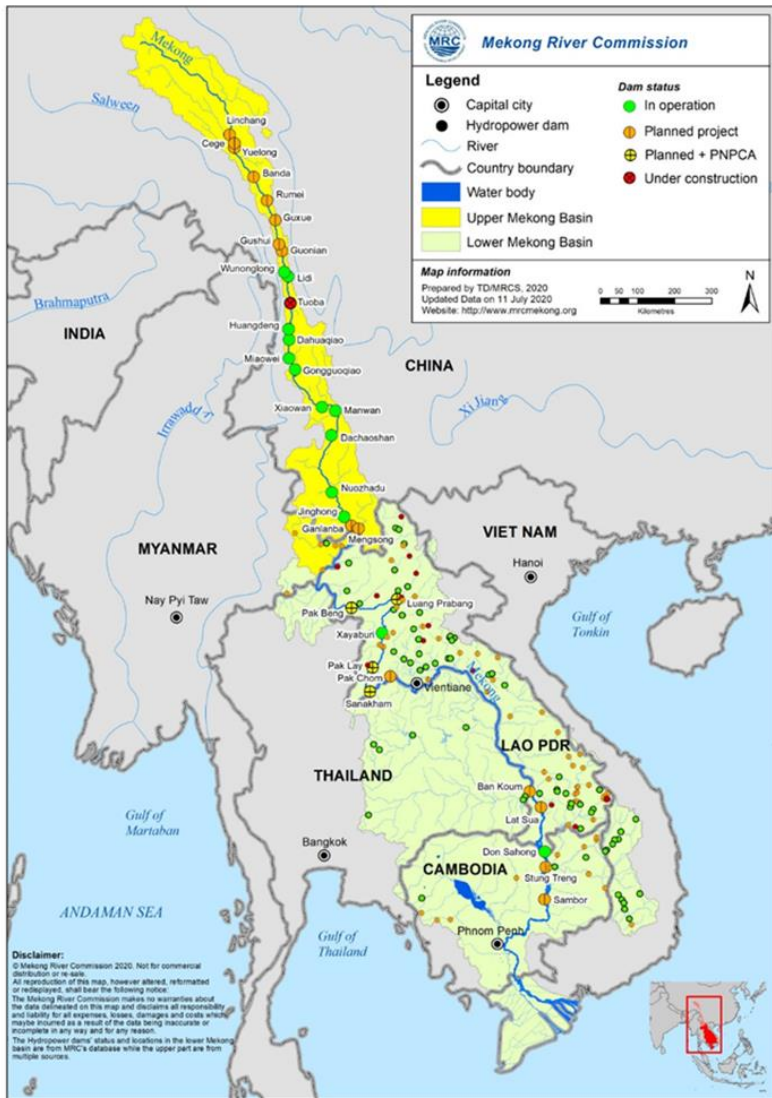
1) Establishment of Hydropower Dams:

- 167 hydropower stations in the Basin; 13 directly at the Mekong; another 20 in planning
- Current capacity: 50,000 MW
- Potential Mekong Basin capacity: 1.3 million MW (Ang, et al. 2024, in: Earth Syst. Sci. Data, 16, 1209–1228)
- 10 % of Thailand's energy from Hydropower Dams in Laos

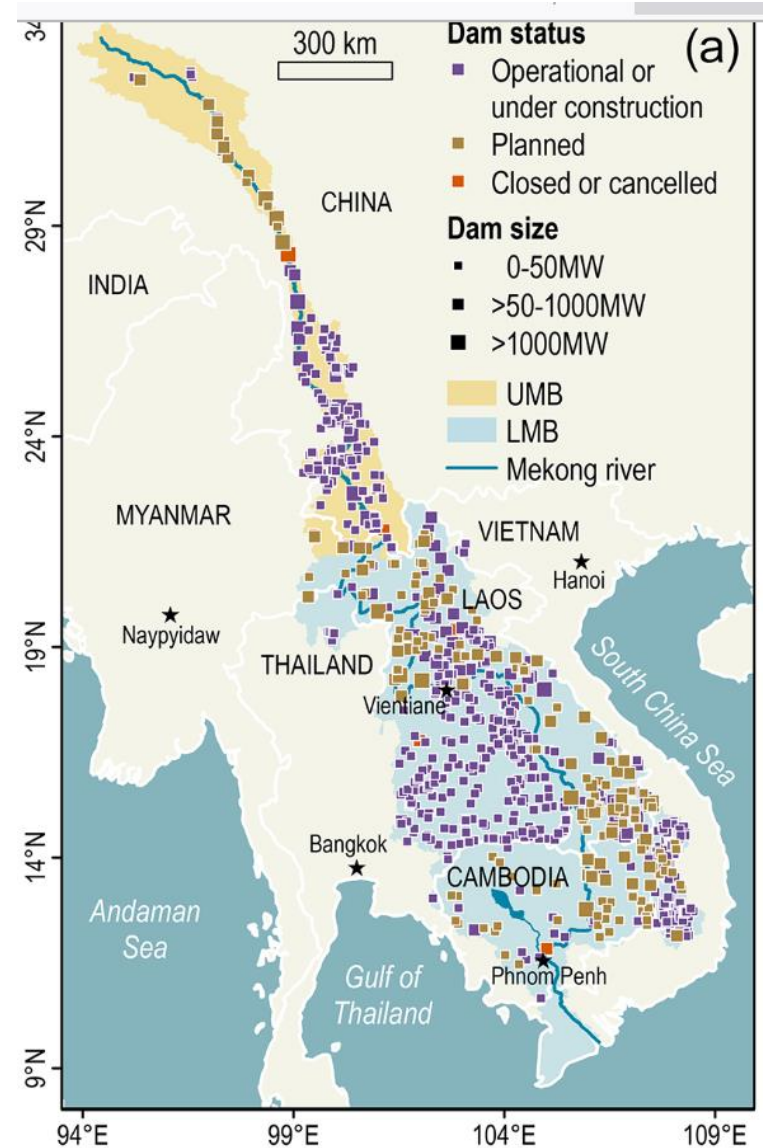
2) Extraction of Sand from Mekong River:

- Started: since late 90ties
- Estimated extraction/year: ~50 million tons (*Bravard et al. 2021*)

Hydropower stations in the Mekong Basin/Countries



Source: MRC, 2021



Source: Ang, W.J. et al. 2024

Example: The Xayaburi Dam in Laos



Source: <https://phys.org/news/2019-10-laos-hydro-dried-out-mekong.html>

- 1) River water flow less predictable (*e.g. Hecht et al, 2019*)
- 2) Risk of droughts and flash floods increases, exacerbated by climate change (*Schmitt et al, 2021*)
- 3) Change in sediment flows and in river bed (*Hackney et al.,2021*)
- 4) Destruction of river banks, loss of farm land (*e.g. Hughes, 2024;*)
- 5) Loss of natural resources, mainly fish&other aquatic resources (*WWF, 2023*)
- 6) Navigation more restricted
- 7) Upstream-Downstream conflicts intensify (*e.g. Oishia&Tajikab, 2024; Singh& Ramachandran, 2019; Kuenzer et al. 2012*)
- 8) Highly diverse research results about economic benefits of Hydropower Dams and their external costs (*e.g. Constanza et al, 2018; MRC, 2011;*)
- 9) Not much is known about the economics of sand extraction

Some „Food for thought“: What are the benefits of a river?

Table 1: The Benefits of a River

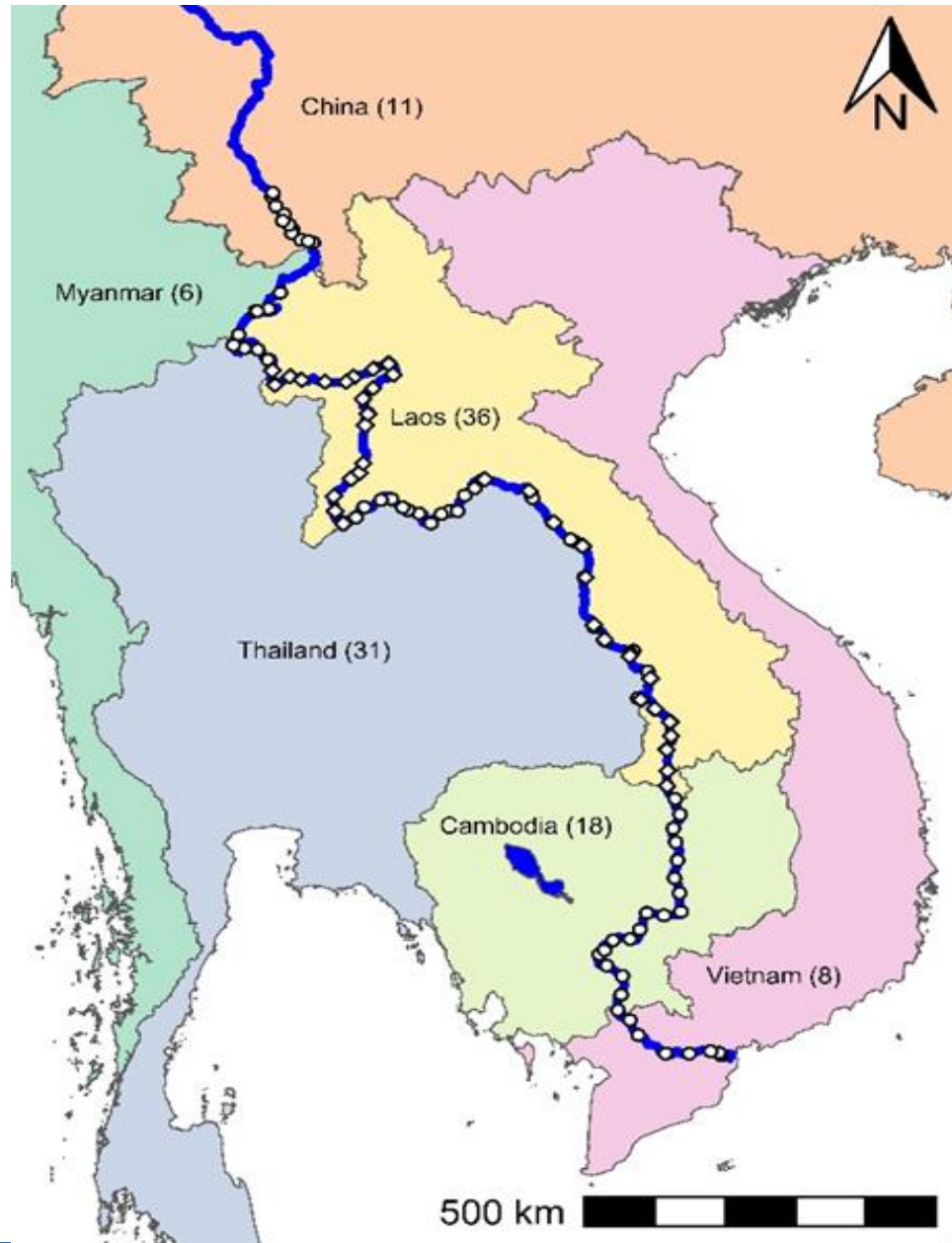
Benefit Category	Component	Outputs	Relative Importance	Basis for economic valuation	
Economic	Water Quantity	Hydropower	High	Market value of electricity	
		Capture Fisheries	High	Market Value of Fish	
		Cage Culture	Low	Market Value of Fish	
		Irrigation	Medium	Added value in Agriculture	
		Shipping	Low	Opportunity Costs of Transportation	
		Domestic Water Supply	Low	Opportunity Costs of Water	
	General Viability of River	Fish Species Diversity	Medium	Stated Preferences	
		Domestic Waste disposal	Low	Opportunity Costs of Waste Disposal	
		Sand Extraction	High	Market Value	
		River Width	Bridges	High	Opportunity Costs of Transportation
Environment	Water Quality	Fish Health	Medium	Revealed/Stated Preferences	
		Plant Health	Low	Revealed/Stated Preferences	
		Human Health	Medium	Revealed/Stated Preferences	
	River Floodplain	Plants & Crops	Medium	Market Value	
		Biodiversity (animals and plants)	Low	Stated Preferences	
		Flood water retention	Medium	Loss of Earnings	
	Social	General River Viability	Local Food Security	Medium	Revealed Preferences
			Tourism	Medium	Market value of recreation
River Atmosphere			Low	Stated Preferences	
Sports			Low	Revealed Preferences	
		Mythology, Traditions & Religion	Low	Revealed Preferences	
	River Institutions	Participation of river communities in decision making	High	Revealed Preferences	

- Document Changes in the Mekong River Basin
- Assess impact of changes on the livelihoods of rural villages along the Mekong River
- Provide scientific evidence about sustainable development in the Mekong River Basin
- Costs and Benefits of Sand Extraction from the Mekong River in Thailand

- H1 : Development of villages along the Mekong River is impaired by changes in the River
- H2: Villages that suffer from Mekong-related shocks develop less than those who are exposed exclusively to non-Mekong shocks.
- H3: Pressure to adapt is aggravated by changes in the Mekong
- H4: Safety net function of the Mekong River is gone.

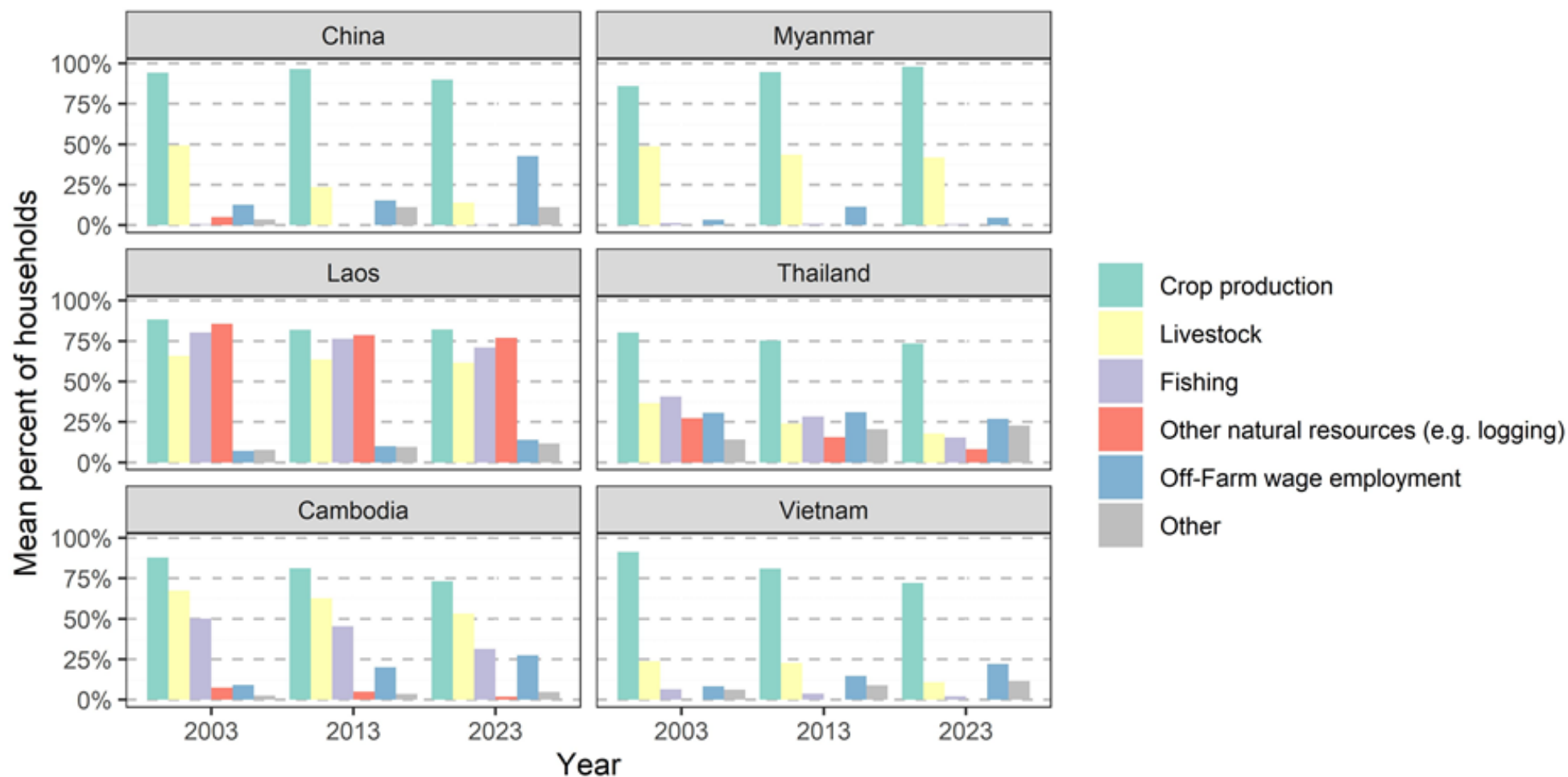
- 1) Georeferencing the Mekong River
- 2) Establish equal-distance reference points
- 3) Identify Villages along the River in proximity to the river point
- 4) Three time points: 2003, 2013 and 2023
- 5) Personal Interviews with Village Representatives
- 6) Survey Instrument includes quantitative and open-ended questions
- 7) Conduct survey (PAPI&CAPI)
- 8) Translate and Code open-ended questions
- 9) Data overview and descriptive statistics
- 10) Verify and complement survey data with satellite data
- 11) Formulate models
- 12) Conduct Cost Benefit Analysis of Sand Extraction

Map of interviewed Mekong villages, by country



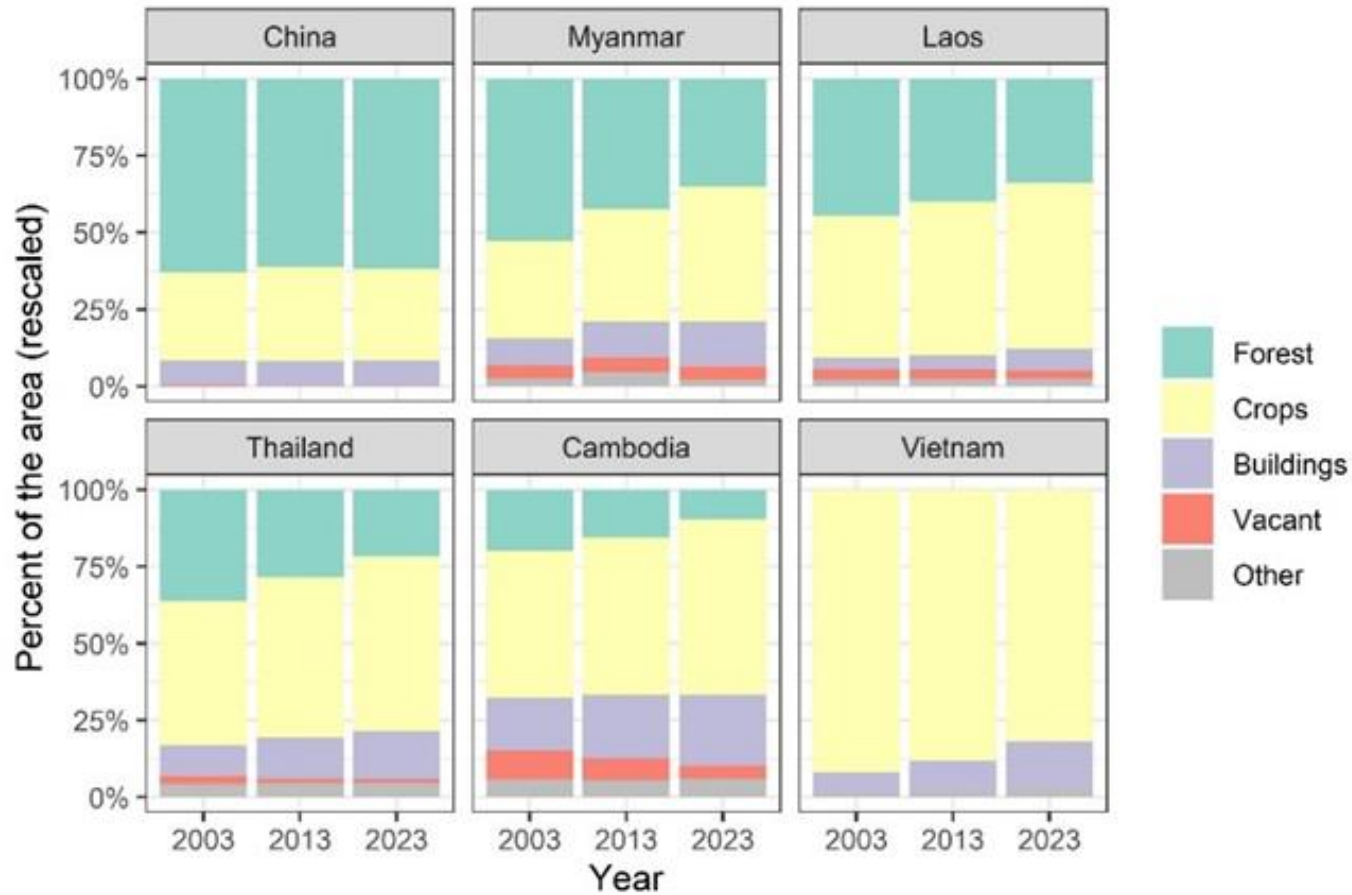
- Village populations/households per village, ranges from 500/110 in China to 2900/730 in Vietnam
- Village populations and number of households per village have increased between 2003 and 2023
- Share of Households with migrants range from 7 % (China) to 27 % (Laos)
- Distance of village to town ranges from 9.5 km (Vietnam) to 23.1 km (Laos)
- Awareness of nearest hydropower dams is zero in Myanmar, low (25%) in Vietnam, medium in Thailand (56%) and high (> 80%) in all the other countries
- Major Source of Income in all countries, in all three time periods, is agriculture (cropping); only in Laos, fishing is 2nd priority income.

Income Sources in % of households reporting by country, between 2003 and 2023



Source: Waibel, H and N. Wendt, Intermediate Report MRVP, Hannover 2024

Changes in Land Use in Mekong Villages



Source: Waibel, H and N. Wendt, Intermediate Report MRVP, Hannover 2024

Quotes from open-ended questions (China Example)

V21024: Did the village benefit from development of the River?

- “*Construction of cement roads, installation of solar street lights, fitness equipment and sports fields have enhanced the village infrastructure...*”

V 21025: Did the village suffer disadvantages from development of the River?

- “*Construction of the hydroelectric station resulted in the flooding of over a thousand acres of land in the village; government compensation was insufficient...*”

Variables for Modelling

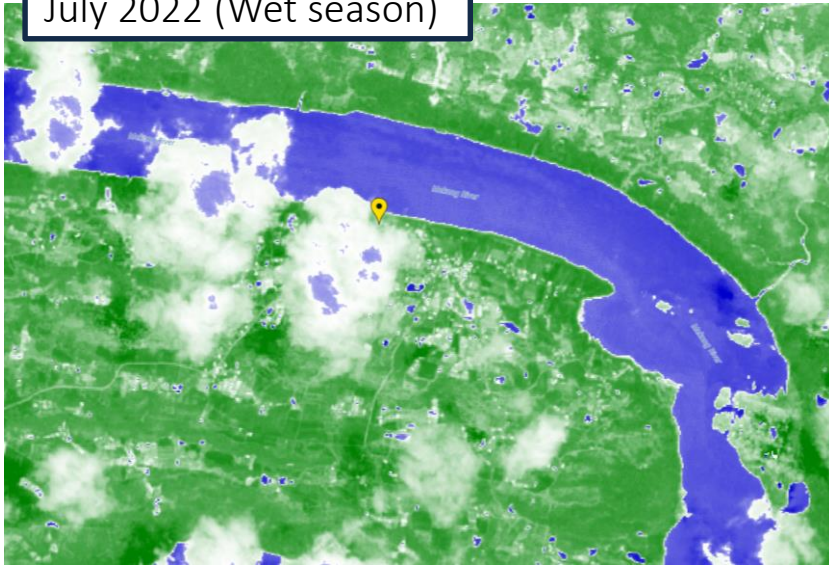
Description	Unit	Source	Survey-Question
Village Area	ha	Survey/Satellite	Quantitative
Residential share/growth	%	Survey/ Satellite	Quantitative
Residential share growth	%	Survey/ Satellite	Quantitative
Village Population Status/Growth	number	Survey	Quantitative
Migrant Households Share/Change	%	Survey	Quantitative
Change in Migrant Share	%	Derived f. Survey	Quantitative
Distance to River	km	Survey	Quantitative
Distance to Town	km	Survey	Quantitative
Awareness of Hydropower Dam	0/1	Survey	Qualitative
Economic Growth	0/1	Survey	Qualitative
Poverty Status/Change	%	Survey	Quantitative
Indebtedness Status/Change	%	Survey	Quantitative
Economic Diversity/Index	0/1/scale	Derived f. Survey	Qualitative
Infrastructure Improvement	0/1	Survey	Qualitative
Benefitted from country development	0/1	Survey	Qualitative
Benefitted from Mekong Changes	0/1	Survey	Qualitative
Suffered from Mekong Changes	0/1	Survey	Qualitative
Fishing Share/Change	0/1	Survey	Quantitative
Village Safety Net Index	scale	Derived f. Survey	Quant-/Qualitative
Mekong-related shocks	0/1	Survey	Qualitative
Non-Mekong shocks	0/1	Survey	Qualitative
Water Level in Village before Dam	NDWI	Satellite	Quantitative
Water Level in Village after Dam	NDWI	Satellite	Quantitative
Water Level in Dam	NDWI	Satellite	Quantitative
Expectations: Pessimistic/Optimistic	0/1	Survey	Qualitative

Mekong River Village Models?

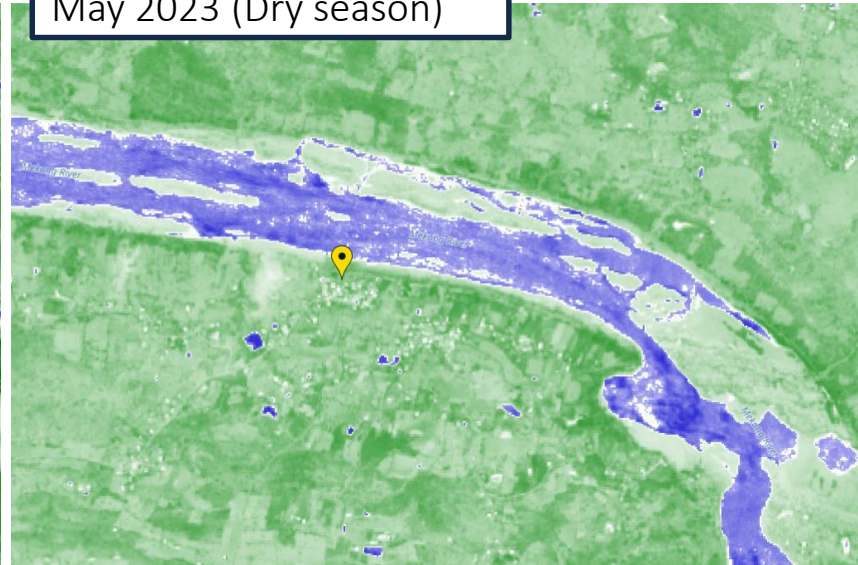
Variable Description	Unit	Source	Survey-Question	Model Type
Village is developing	0/1	Village Survey	Qualitative	Logit/Probit
Village Development Index	Scale/ catego- ries	Constructed from Village survey	Quantitative/ Qualitative	OLS/FE/IV/Mutin omial Logit
Village Safety Net Index	scale	Constructed from Village survey	Quantitative/ Qualitative	OLS/FE/IV/Multin omial Logit
Mekong vs non- Mekong Villages	0/1 or scale	Village Survey+other panels (TVSEP+China)	Quantitative/ Qualitative	Difference in Difference (DD mode)
Others??				

Compare Village Report with Satellite Data

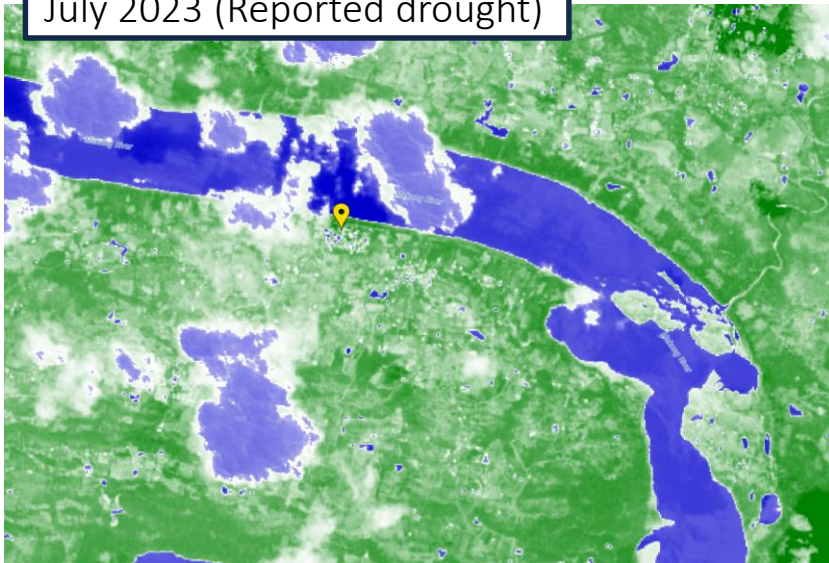
July 2022 (Wet season)



May 2023 (Dry season)



July 2023 (Reported drought)



Note:

- Village reported drought, wet season July 2023 (survey)
- NDWI Copernicus Browser: (<https://browser.dataspace.copernicus.eu/>) & "Sentinel-2 L2A" and "Sentinel-2 L1C"

Water Level in the Xayaburi Dam (NDWI)

July 2022

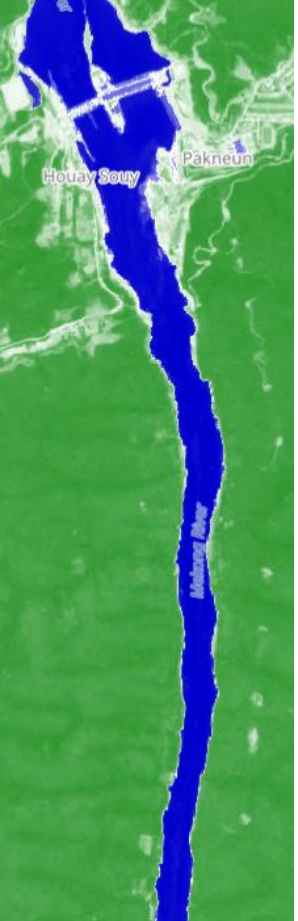
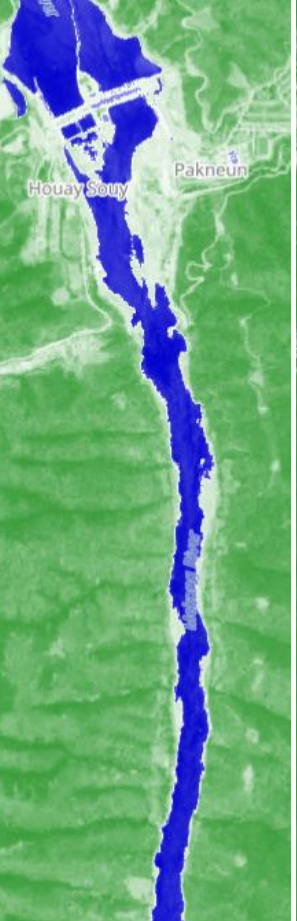
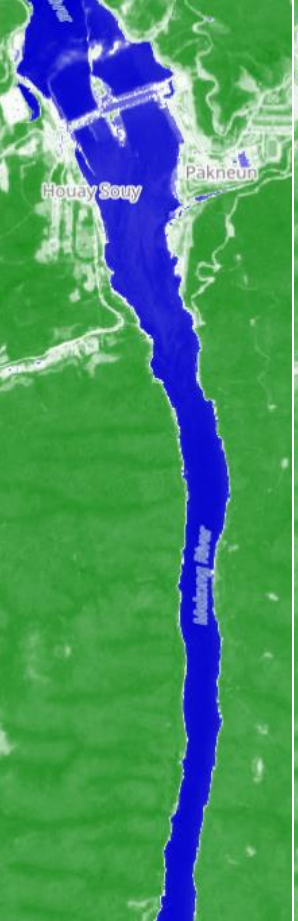
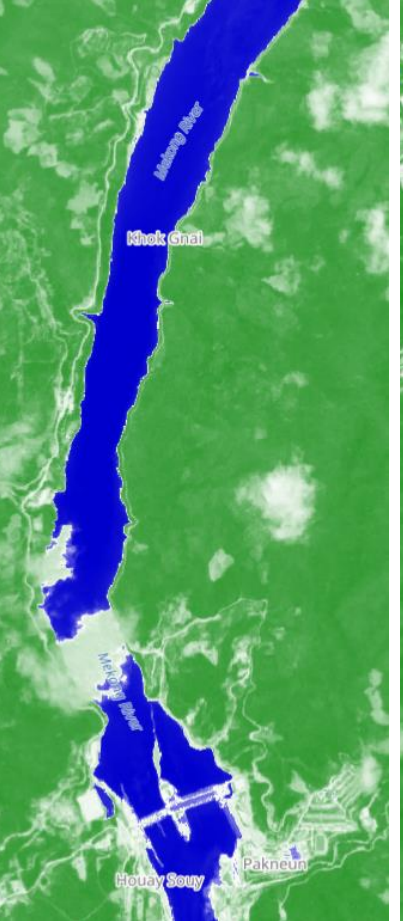
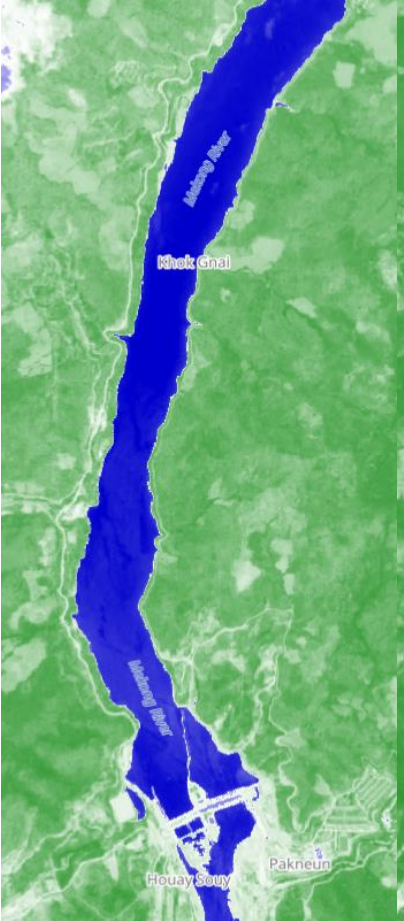
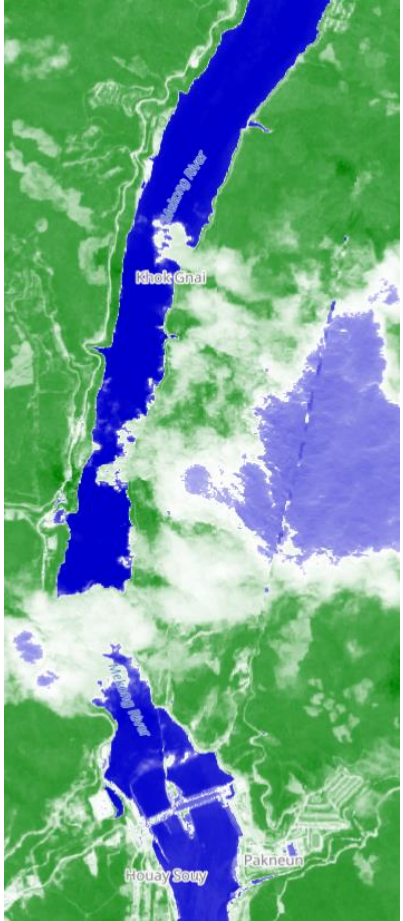
May 2023

July 2023

July 2022

May 2023

July 2023



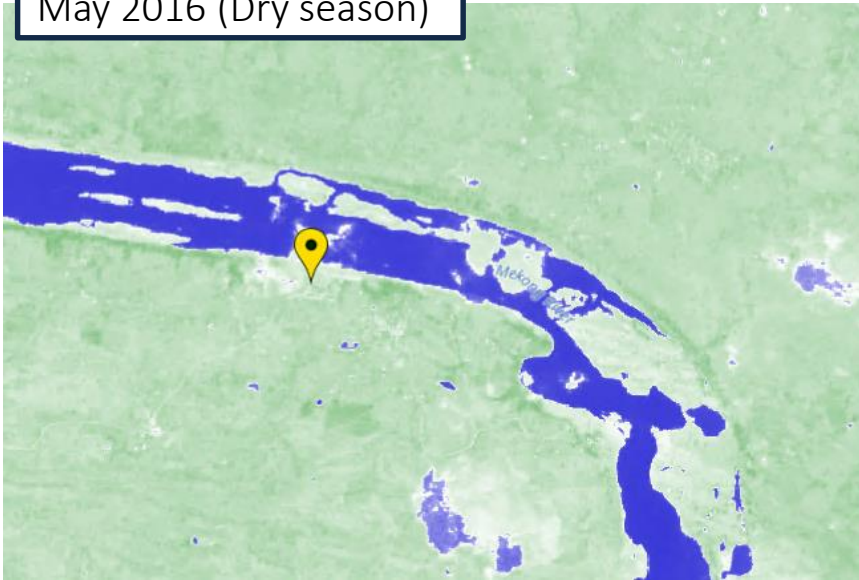
River above the Dam

..below the Dam

Note: Water Level in the Xayaburi Dam (NDWI); NDWI Copernicus Browser: (<https://browser.dataspace.copernicus.eu/>) & "Sentinel-2 L2A" and "Sentinel-2 L1C"

Compare Water Condition (NDWI) in Village before and after Dam

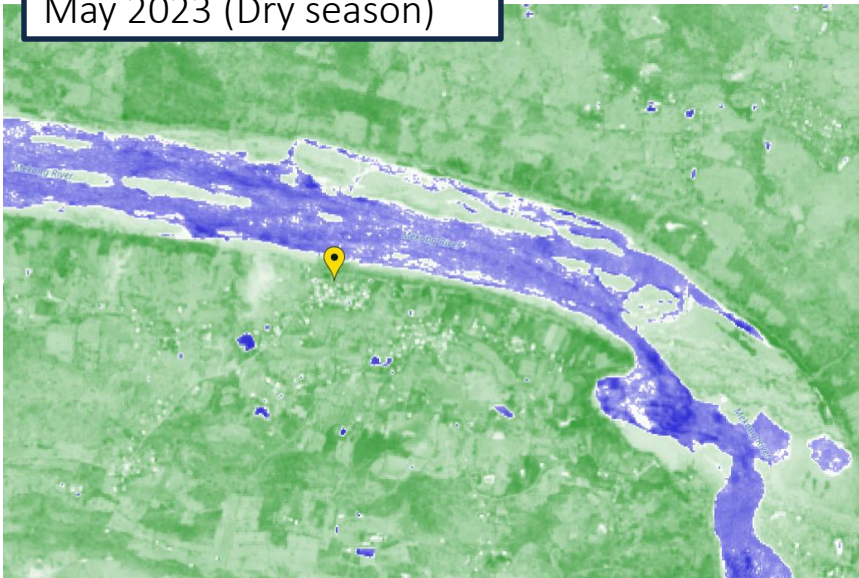
May 2016 (Dry season)



May 2017 (Dry season)



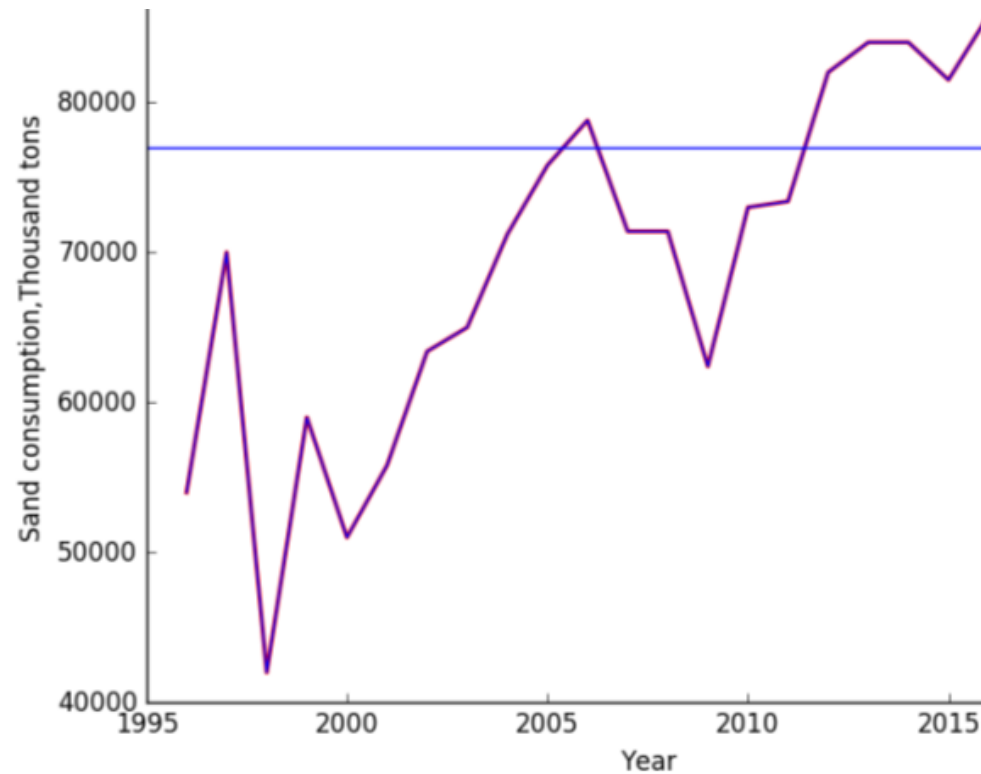
May 2023 (Dry season)



Note:

- Village conditions during end of dry season (May) 2023 (with Dam); 2016 and 2017 (without Dam)
- NDWI Copernicus Browser: (<https://browser.dataspace.copernicus.eu/>) & "Sentinel-2 L2A" and "Sentinel-2 L1C"

- Sand is one of the Earth's six most important materials (Ed Conway, 2022)
- Sand is a natural resource used for construction, landfills and other purposes.
- Globally, over 50.000 million tons are mined every year (Bravard, Goichot, and Gaillot, 2013).
- Frequently, sand is extracted from rivers because it has better quality than when taken from land.
- There are over 1000 authorized river sand extraction sites in Thailand; 140 of them in provinces bordered by the Mekong River (Mekong Eye, 2023).
- Annual net revenues from sand extraction per extraction site and season at Mekong River in Thailand around 100.000 USD (3.5 million THB) per season (Waibel and Wendt, 2024).
- Sand extraction can cause negative environmental externalities resulting in costs to the society (Lamb, et al., 2019).



Source: Chilamkurthy et al 2016

Sand Extraction Site in Ubon



Loading Sand on Trucks



Dredging Sand from the Mekong River



Environmental Changes on the Mekong

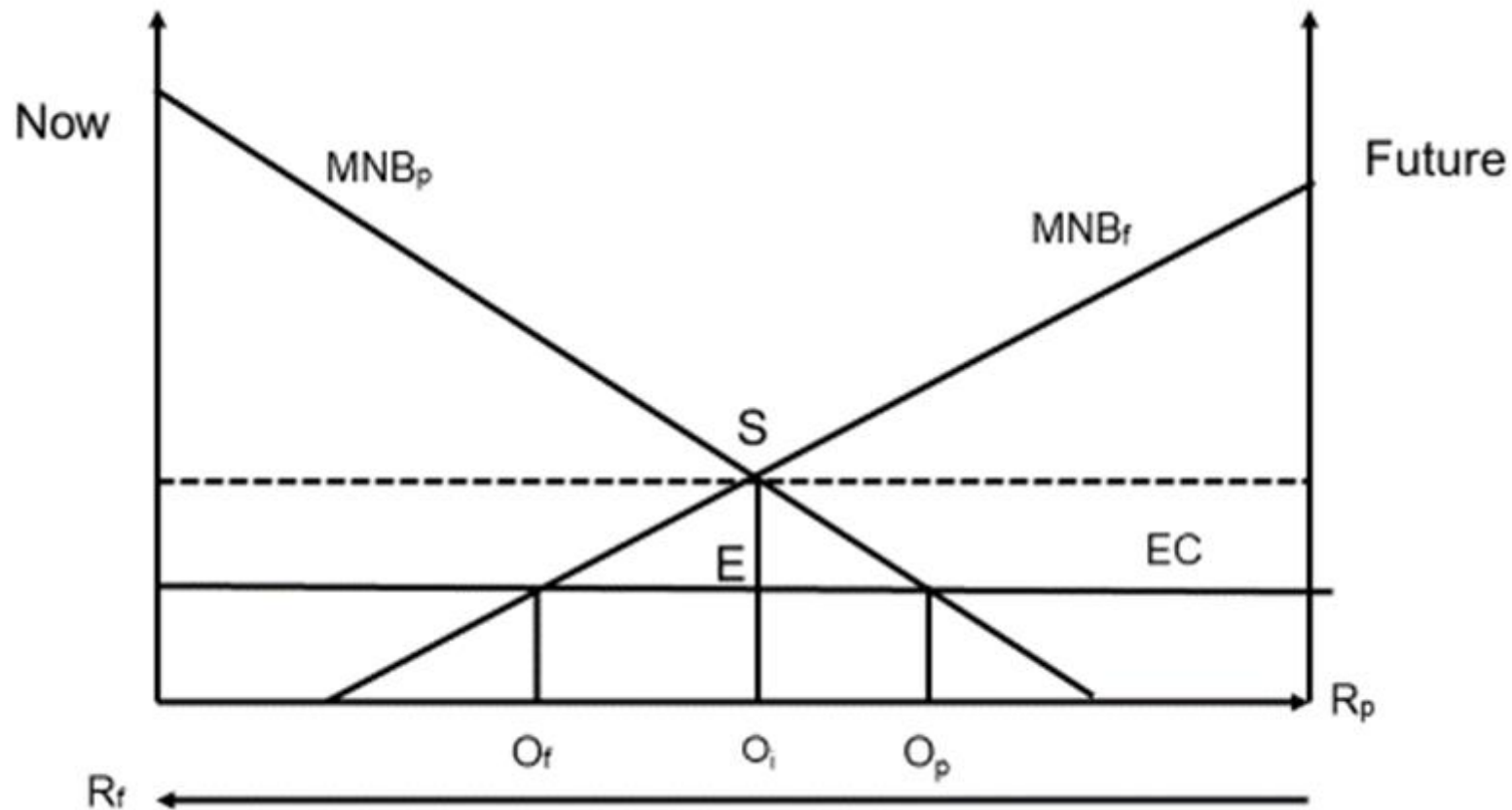


Erosion

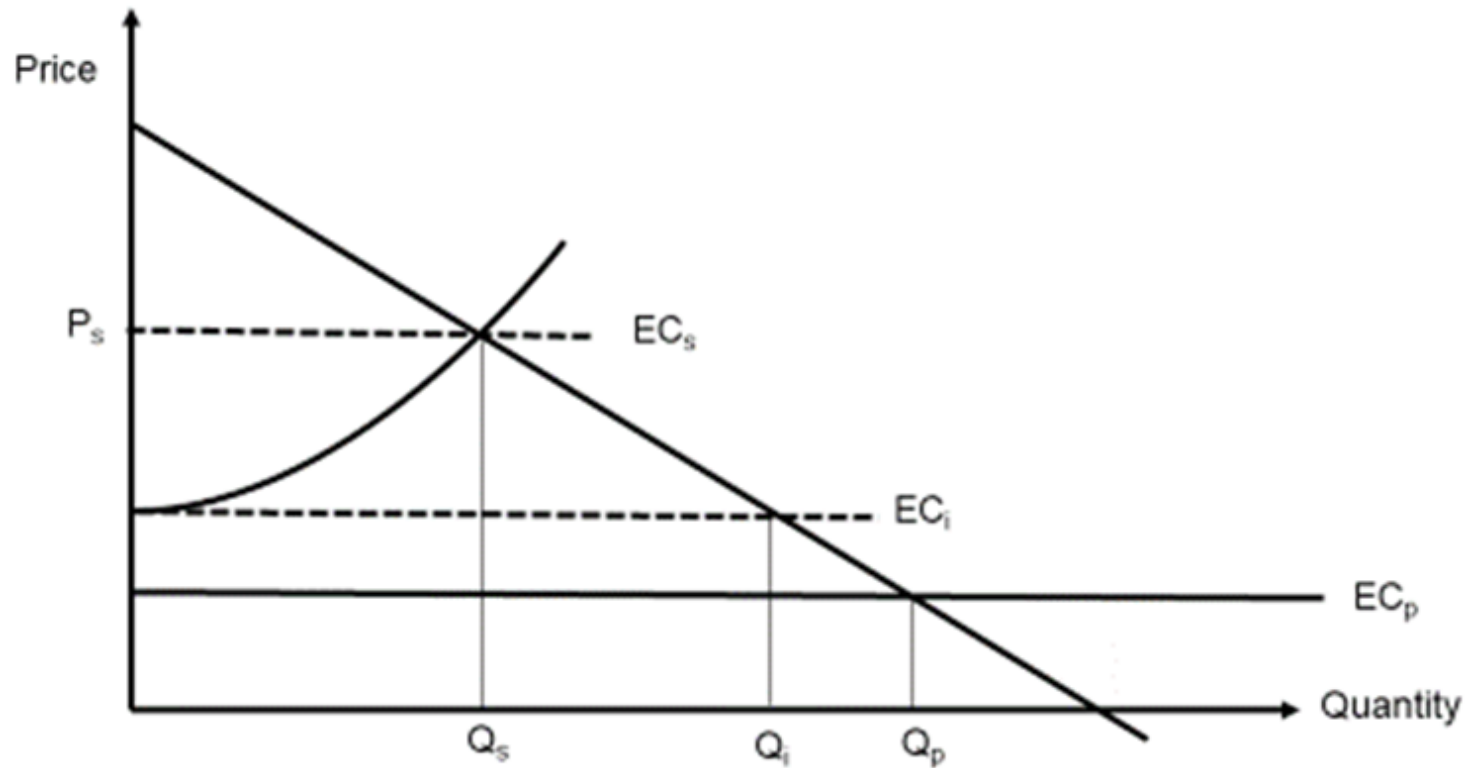
Loss of Agricultural Land



Intergenerational Optimum of Sand Extraction (hypothetical scenario)



The Economic Price of Sand



- Total annual capital investment of equipments:
 - Extraction (Boats, Pumps, Pipes)
 - Transportation (Boat, Trucks)
 - Buildings
 - Storage
- Total annual operational costs:
 - Labor
 - Management
 - Energy
- Steps in Valuation:
 - Estimate extraction quantities
 - Use market price of Sand (ex sand site)
 - Eliminate transfer payments
 - Add externalities (literature-based)

- 1) A Research Conference in 2025
- 2) A Book publication with all research partners as co-authors
- 3) An illustrated village story Book (English & Asian languages)
- 4) Cost-Benefit-Analysis of Sand Extraction in the Mekong River in Thailand
- 5) Paper publications
- 6) A documentary Film: “A hundred Mekong Villages”
- 7) A Data base for follow-up projects by other researchers

Let's try to avoid the „Mekong River Horror Movie“....

The future of the Mekong River is unfolding like a movie we have seen many times:

The opening scene is this idyllic river with traditional fishing and farming villages clustered along the shore. Hydroelectric dams first start appearing on the tributaries, and then on the main stem of the river. We can expect the movie to end with the river transformed into a series of reservoirs backing up to the dams that provide electricity for the region's economy. The traditional villages, farms, and forests, are replaced by shopping malls, factories, and monoculture plantations”.

In: D. Groenfelt, 2019. “*Imagining an Ethical Future for the Mekong River*”.

Thank you for your Participation!

