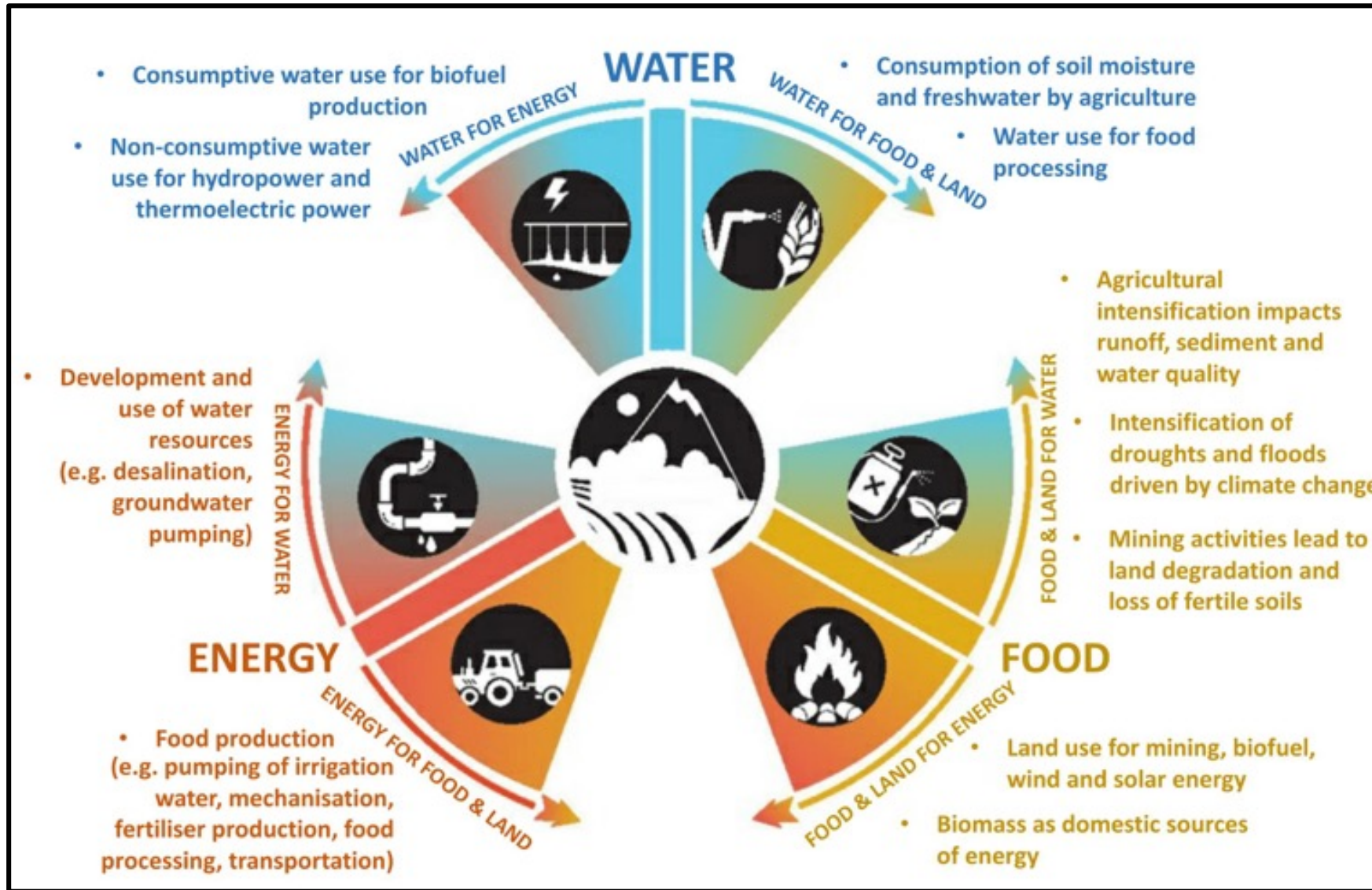


Water-Energy-Food Nexus in Mekong Countries

Jiaguo Qi

Center for Global Change, Michigan State University
Asia Hub Initiative, Nanjing Agricultural University



[GLObal geOreferenced Database of Dams \(GOOD²\)](#)
[Global Reservoir and Dam Database \(GRanD\)](#)
[Future Hydropower Reservoirs and Dams \(FHReD\)](#)



Global Dam Watch is an international collaboration between an expanding group of researchers who are passionate about understanding the costs and benefits of dams to our world

Data Layers

- On GOOD2 ●
- Off GRanD ●
- Off FHReD-Construction ●
- Off FHReD-Planned ●
- On Reservoirs ●

Base Layers

Satellite

FAQ

Open FAQ window

Reset Map



[GLObal geOreferenced Database of Dams \(GOOD²\)](#)

[Global Reservoir and Dam Database \(GRanD\)](#)

[Future Hydropower Reservoirs and Dams \(FHReD\)](#)

Data Layers

<input type="checkbox"/>	GOOD2	●
<input checked="" type="checkbox"/>	GRanD	●
<input type="checkbox"/>	FHReD- Construction	●
<input type="checkbox"/>	FHReD- Planned	●
<input checked="" type="checkbox"/>	Reservoirs	●

Base Layers

Satellite

FAQ

Open FAQ window

Reset Map








[Global geOreferenced Database of Dams \(GOOD²\)](#)

[Global Reservoir and Dam Database \(GRanD\)](#)

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Data Layers

<input type="checkbox"/>	GOOD2	
<input type="checkbox"/>	GRanD	
<input checked="" type="checkbox"/>	FHReD- Construction	
<input type="checkbox"/>	FHReD- Planned	
<input checked="" type="checkbox"/>	Reservoirs	

Base Layers

Satellite

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Data Layers

<input type="checkbox"/>	GOOD2	
<input type="checkbox"/>	GRanD	
<input type="checkbox"/>	FHReD- Construction	
<input checked="" type="checkbox"/>	FHReD- Planned	
<input checked="" type="checkbox"/>	Reservoirs	

Base Layers

Satellite

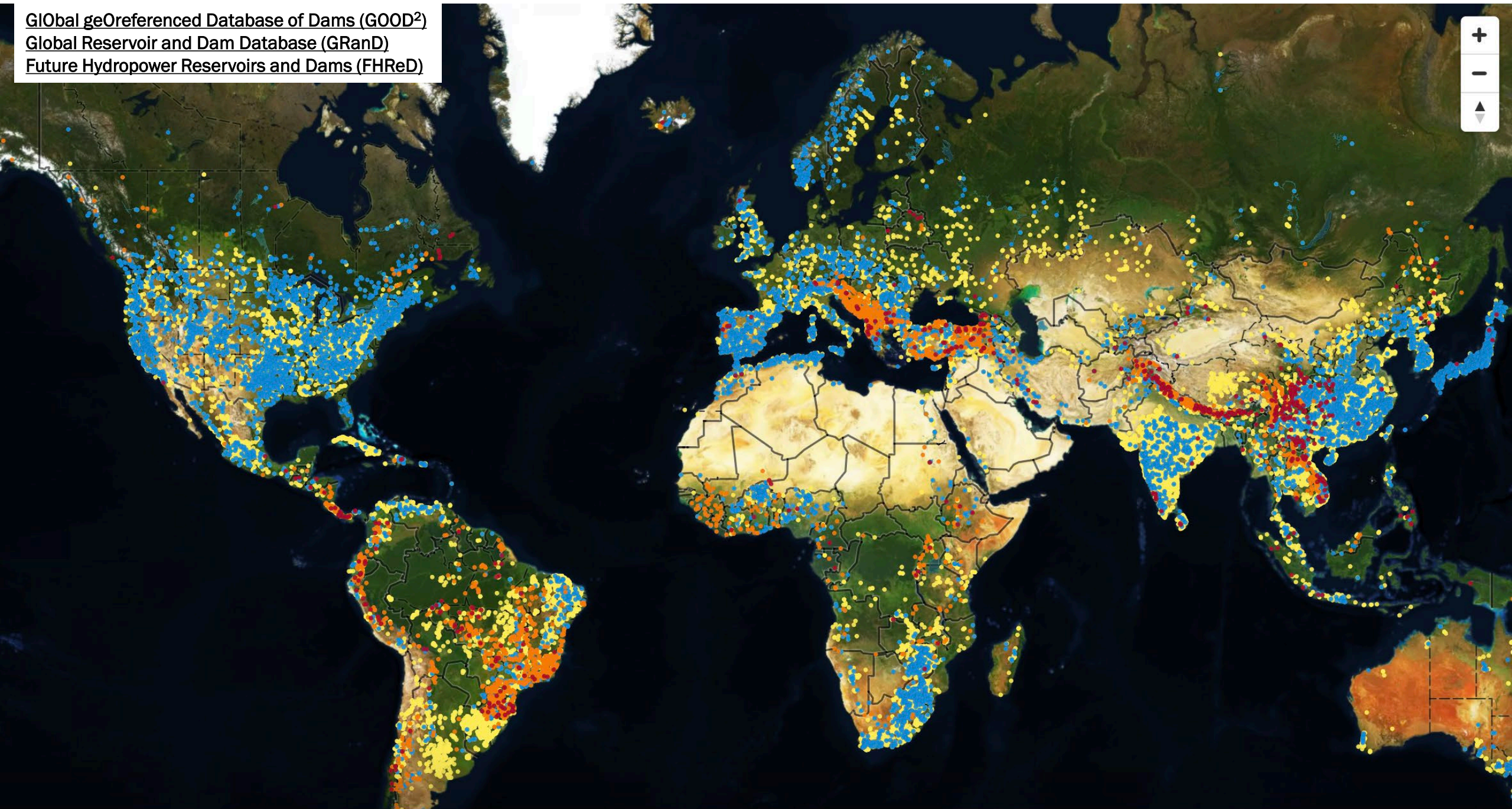
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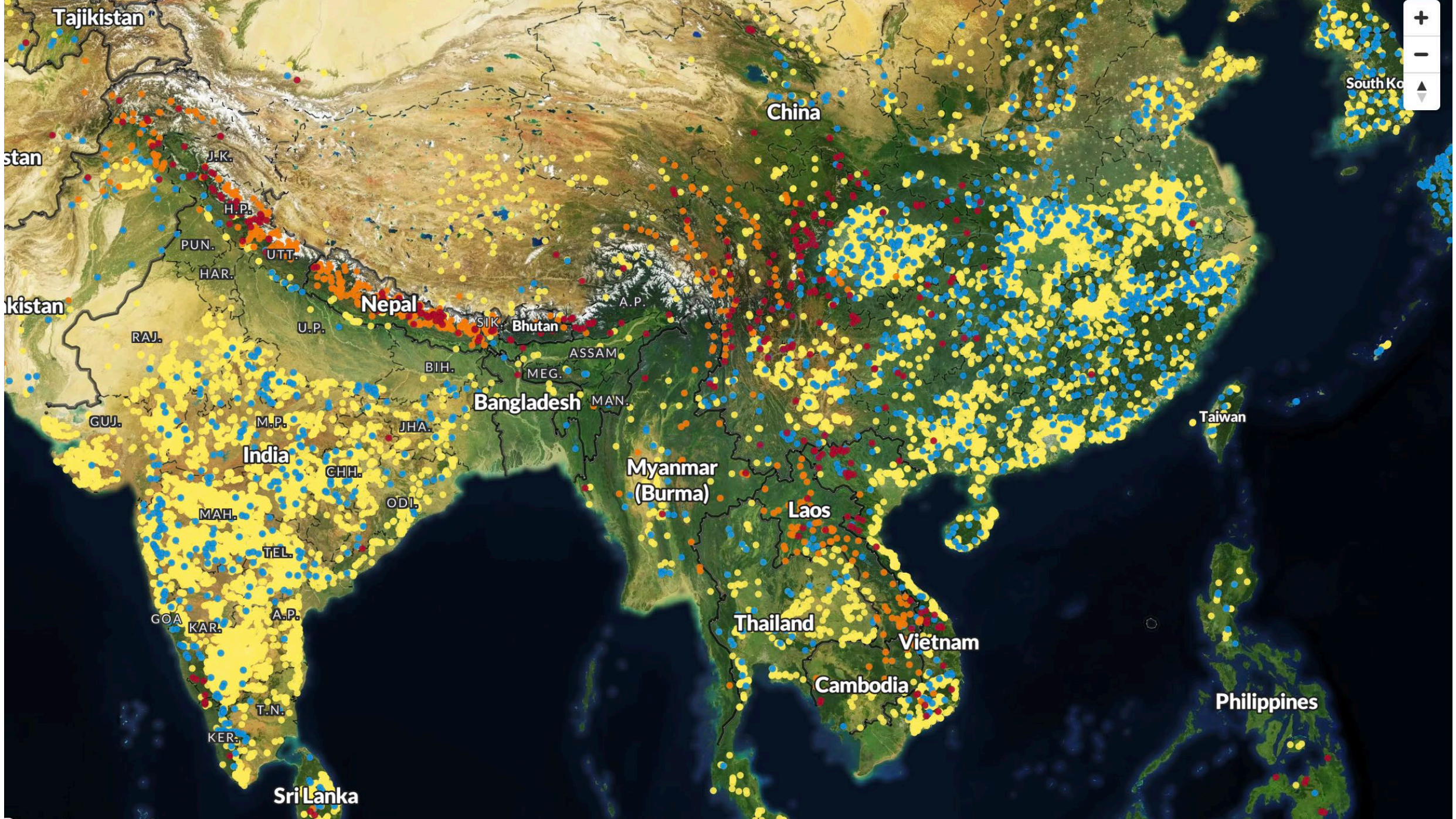
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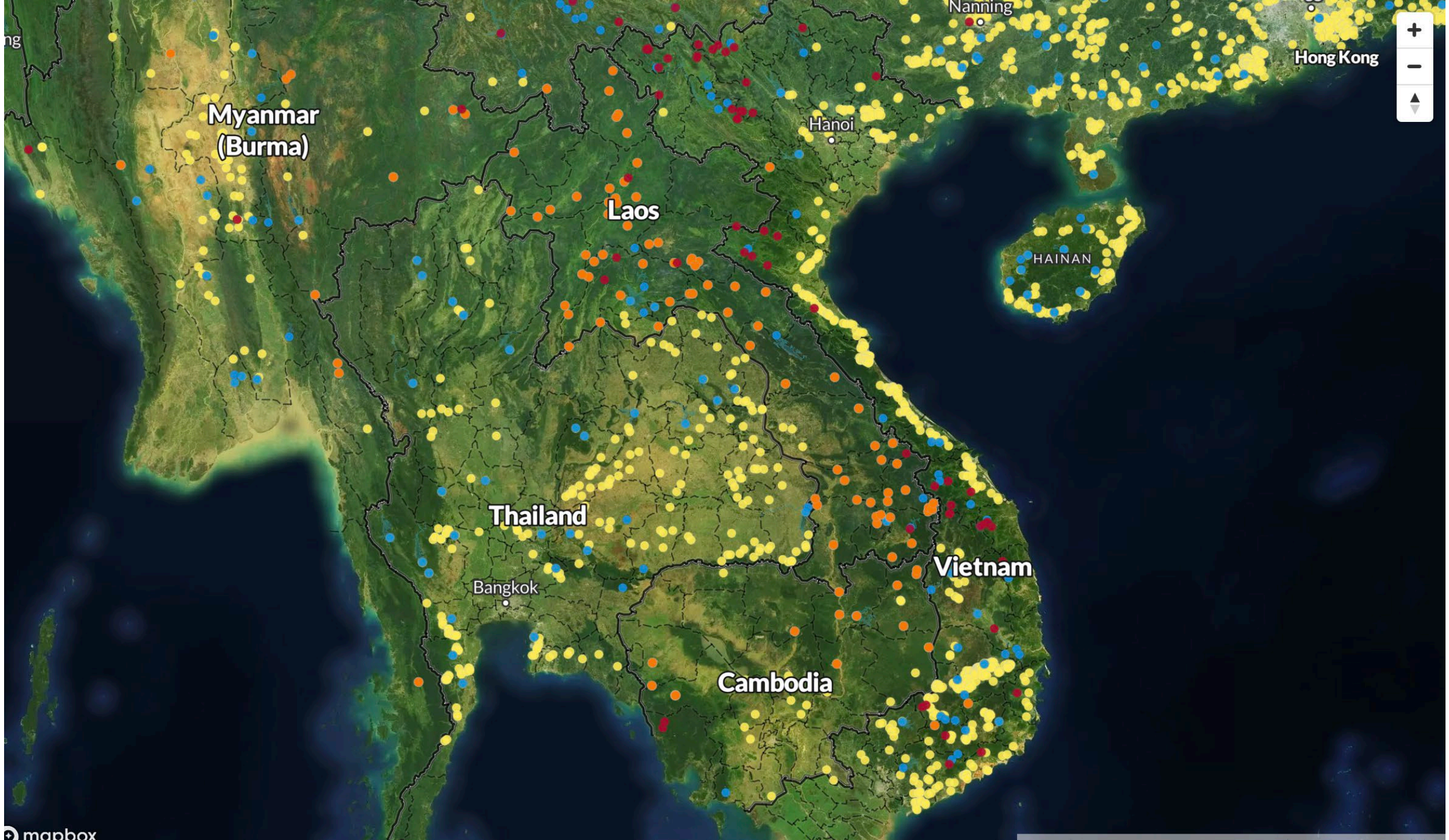
Reset Map



Global geOreferenced Database of Dams (GOOD²)
Global Reservoir and Dam Database (GRanD)
Future Hydropower Reservoirs and Dams (FHReD)







Myanmar
(Burma)

Laos

Thailand

Cambodia

Vietnam

Hong Kong

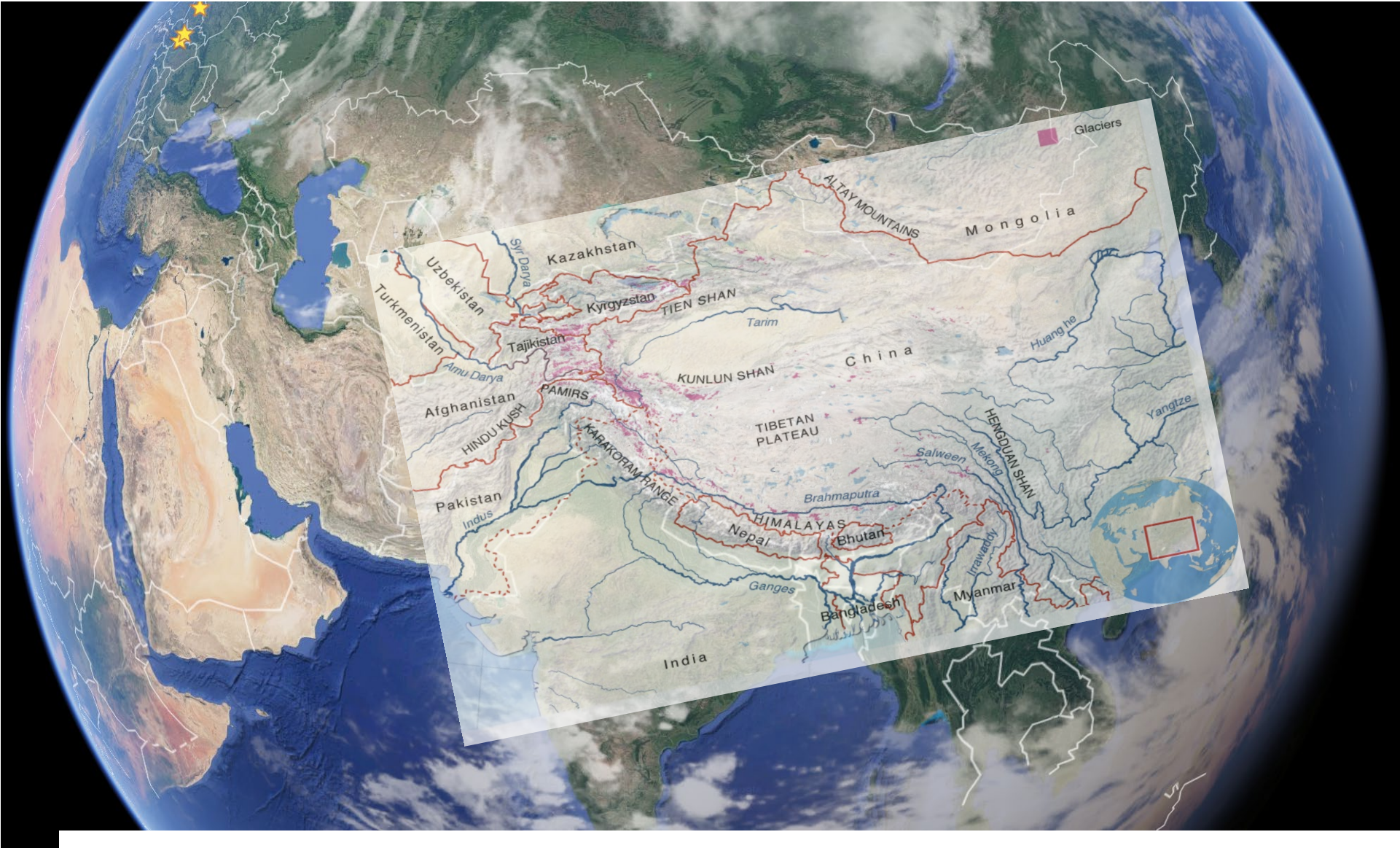
HAINAN

Hanoi

Nanning

Bangkok

The largest Macro River Basins Fed by The Third Pole (MRB-TTP) in Asia



ASSESSING THE IMPACTS OF DAMS ON THE DYNAMIC INTERACTIONS AMONG DISTANT WETLANDS, LAND USE, RURAL COMMUNITIES IN THE LOWER MEKONG RIVER BASIN

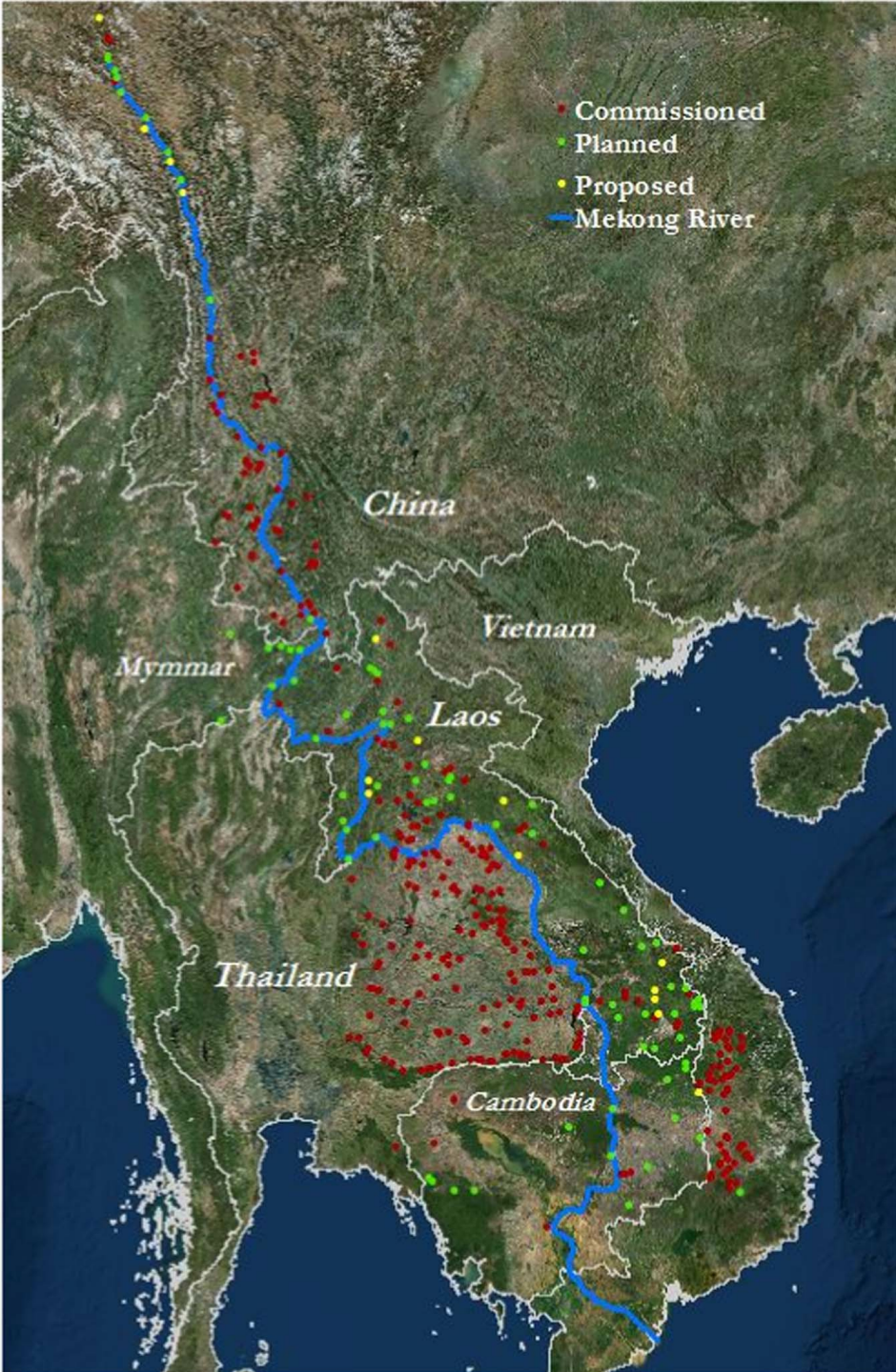
PI: Jiaguo Qi

US Co investigators:

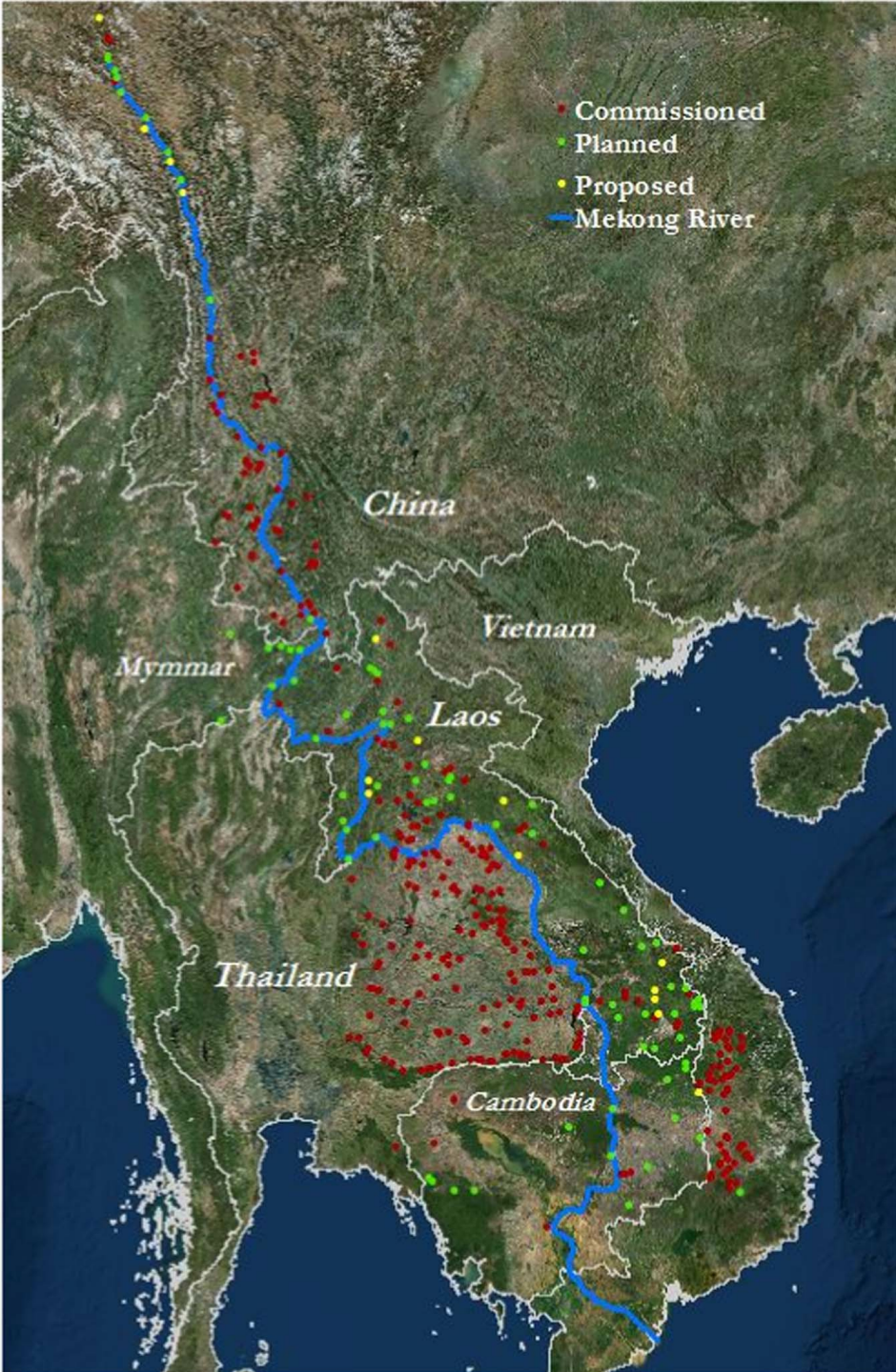
@MSU: Dan Kramer, David Hyndman, Jinhua Zhao, Joseph Messina, Peilei Fan, William McConnell and Yadu Pokhrel;
@AGS: Nathan Torbick and William Salas; **@VT:** Venkataramana Sridhar

Int'l Partners:

Sura Pattanakiat, Mahidol University, Thailand. Apisom Intralawan, Mae Fah Laung University, Thailand. Charlie Navanugraha, Nakhon Phanom University, Thailand. Le Duc Trung, Vietnam National Mekong Committee, Vietnam, Pham Tuan Phan, Mekong River Commission, Laos. Vu Ngoc Ut, Can Tho University, Vietnam. Siam Lawawirojwong, Geoinformatics and Space Technology Development Agency, Thailand. Tep Makathy, Cambodian Institute for Urban Studies, Cambodia. Zaw Naing, Mandalay Technologies, Myanmar. Aiko Endo, Research Institute for Humanity and Nature, Japan. Anik Bhaduri, Sustainable Water Future Programme, Australia. Thongchai Suwonsichon, Kasetsart University, Thailand.



- Challenges and Opportunities
 - Hydropower dams –
 - Huge impacts on water resources;
 - Significant implications to water-energy-food nexus;
 - Important socioeconomic consequences;
 - Very controversial in biological and ecological impacts;
 - Number of dams are increasing!



MEKONG RIVER BASIN FACTS:

- **LENGTH: 2,700 miles; LONGEST RIVER IN SOUTHEAST ASIA, THE 7TH LONGEST IN ASIA, AND THE 12TH LONGEST IN THE WORLD**
- **HYDROPOWER DAMS:**

Country	No. Planned dams	No. Proposed dams
Cambodia	12	0
China	11	2
Laos	43	20
Myanmar	7	0
Thailand	7	0
Vietnam	1	1
Totals	74	23

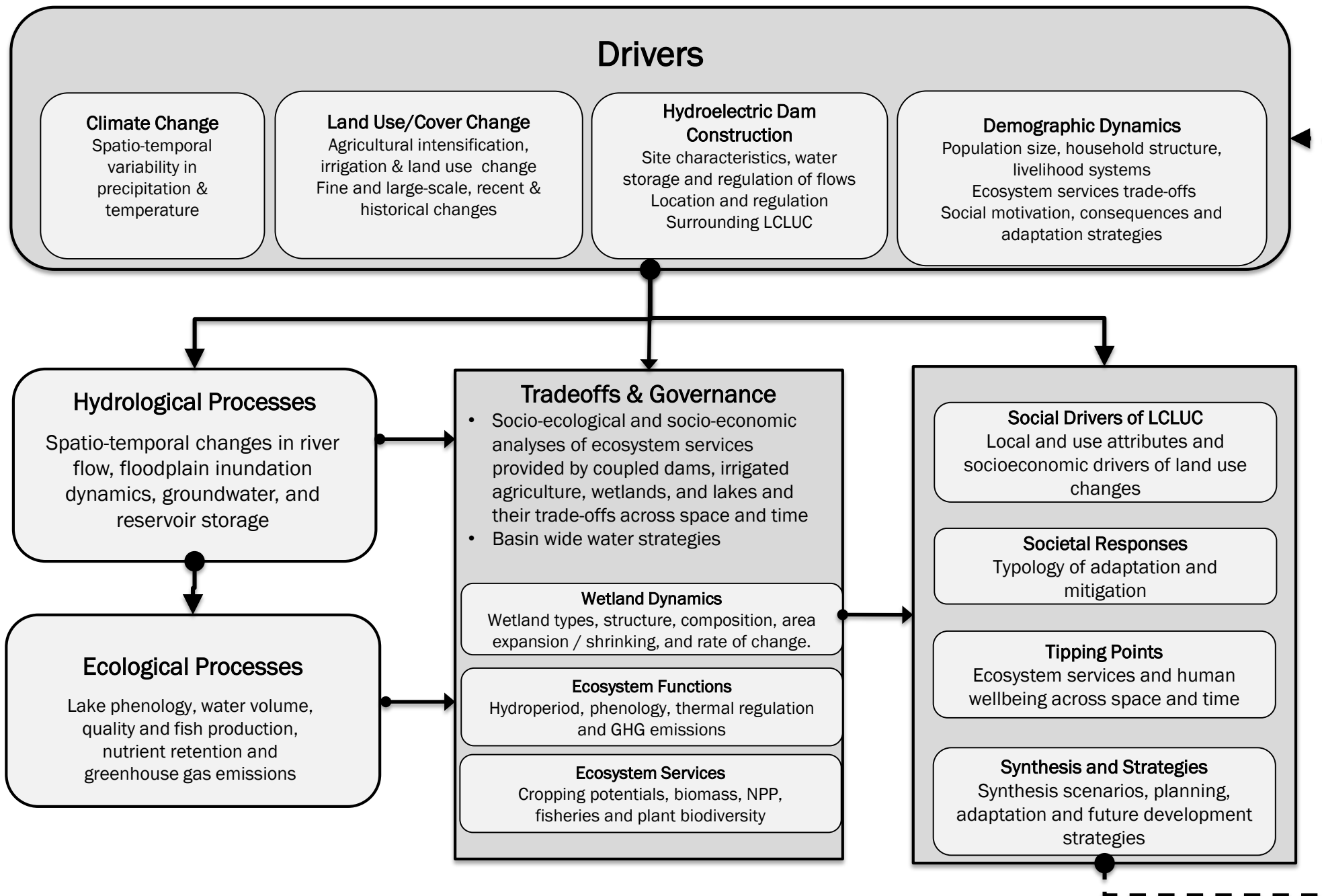
■ Selected field study sites: Mae Chan; Pak Munn and Tonle Sap

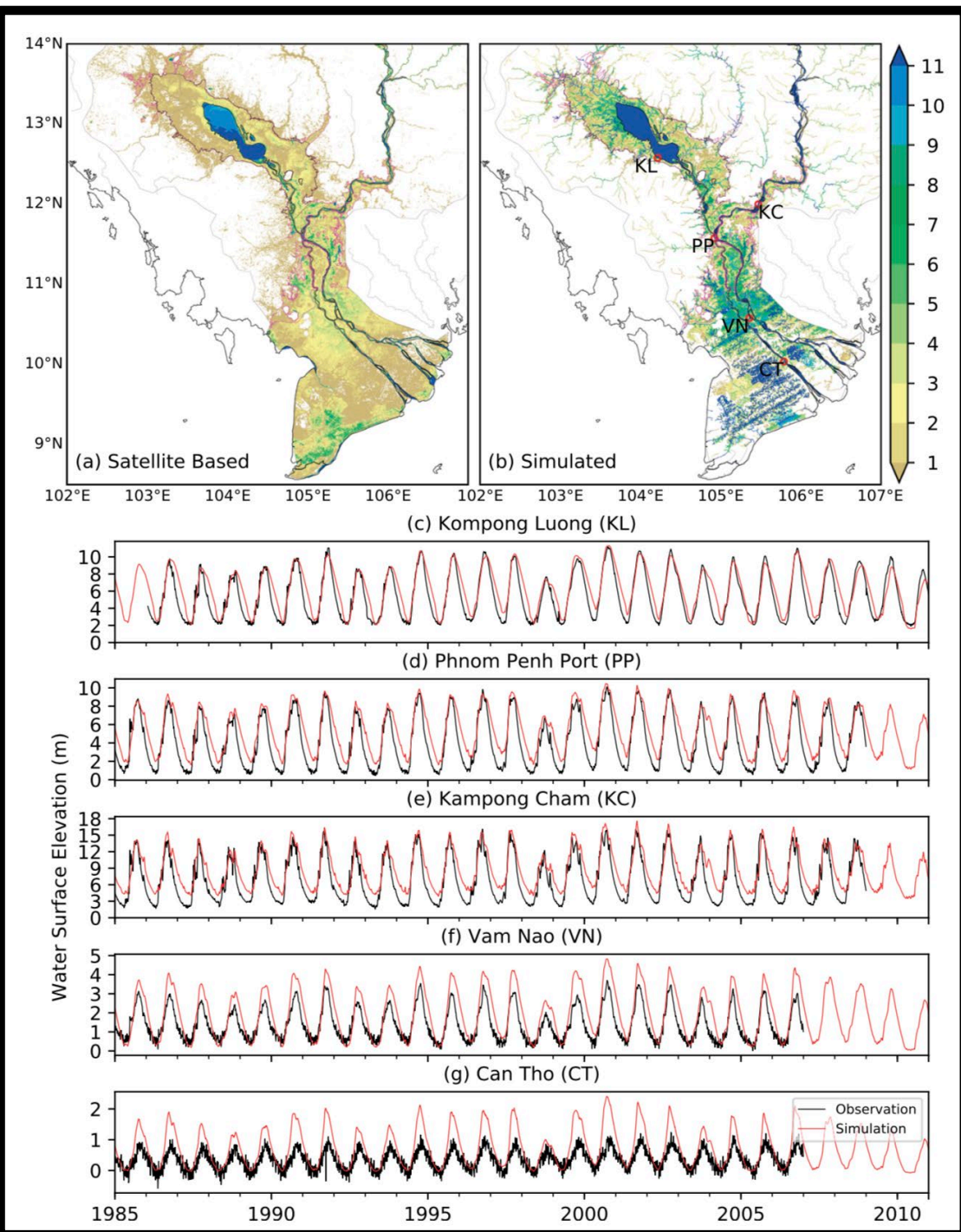
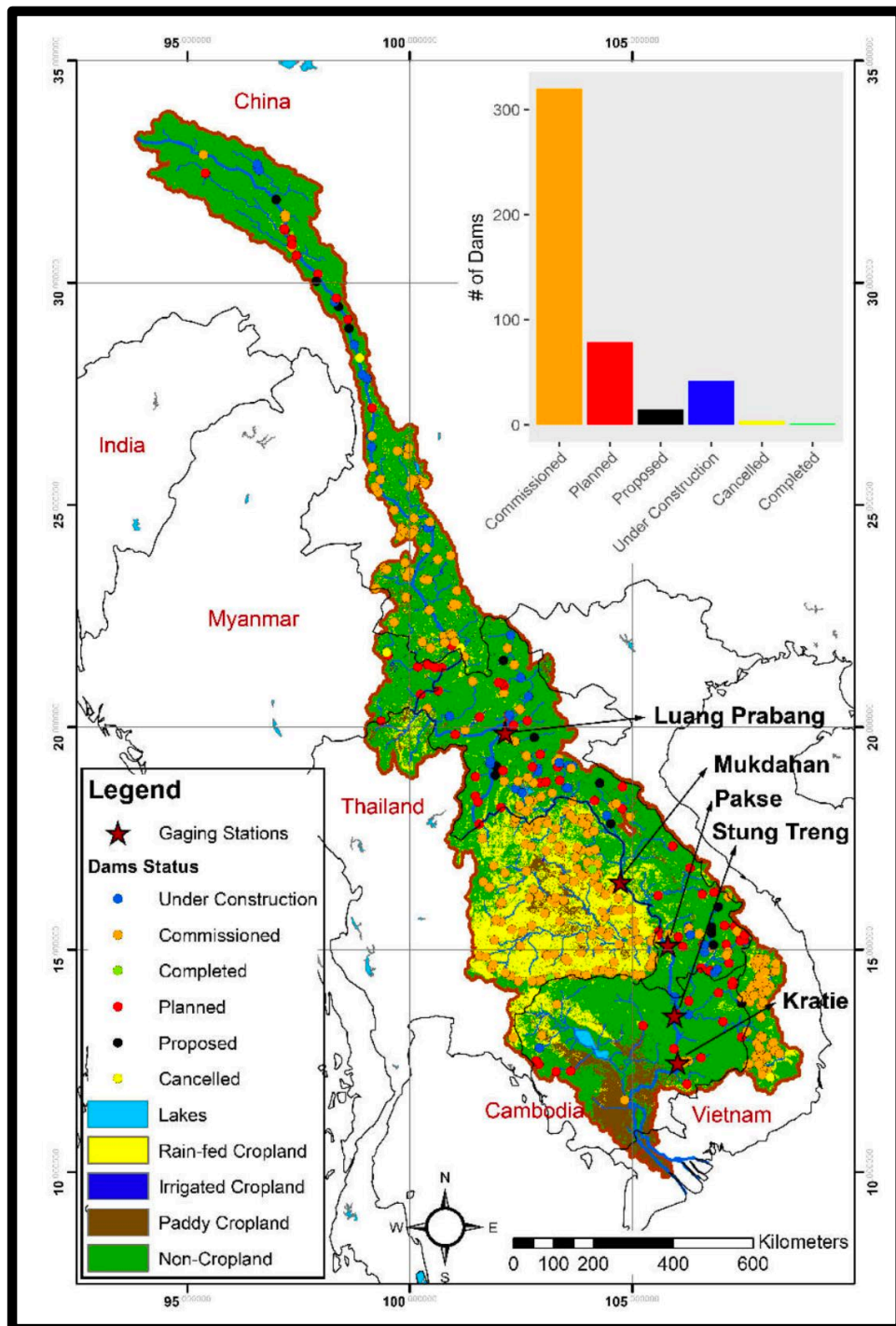
Pak Mun Dam



failed fish ladder

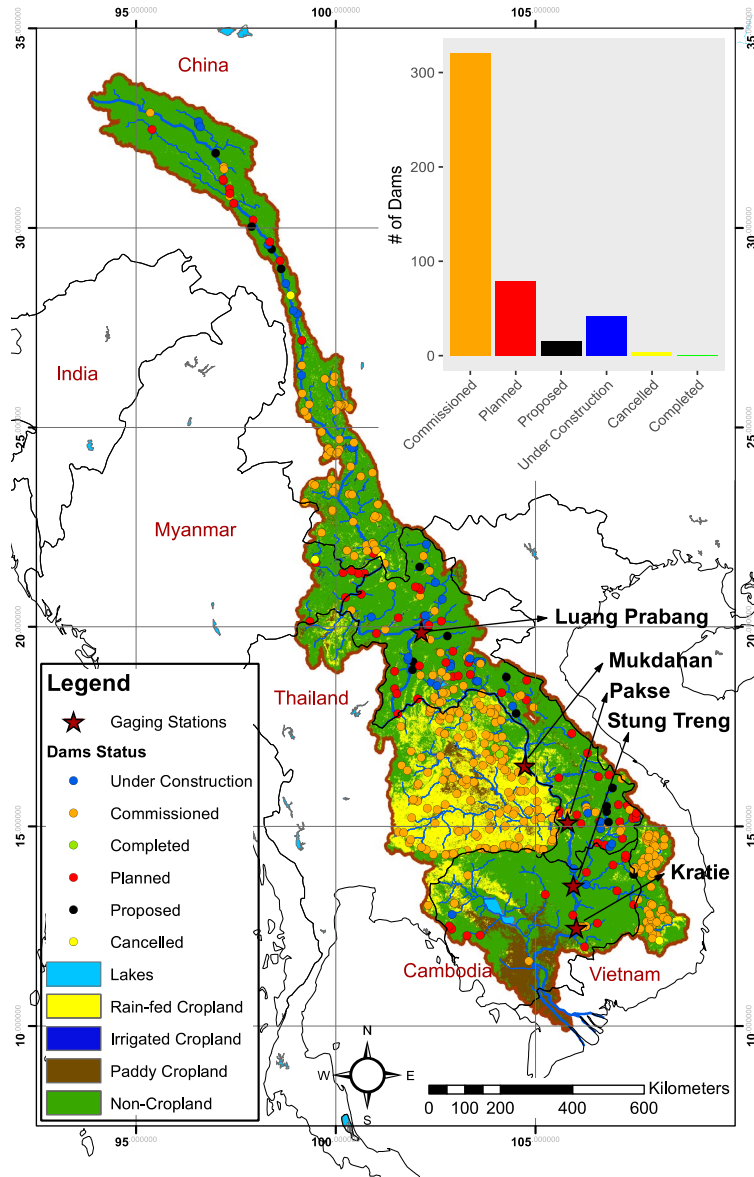




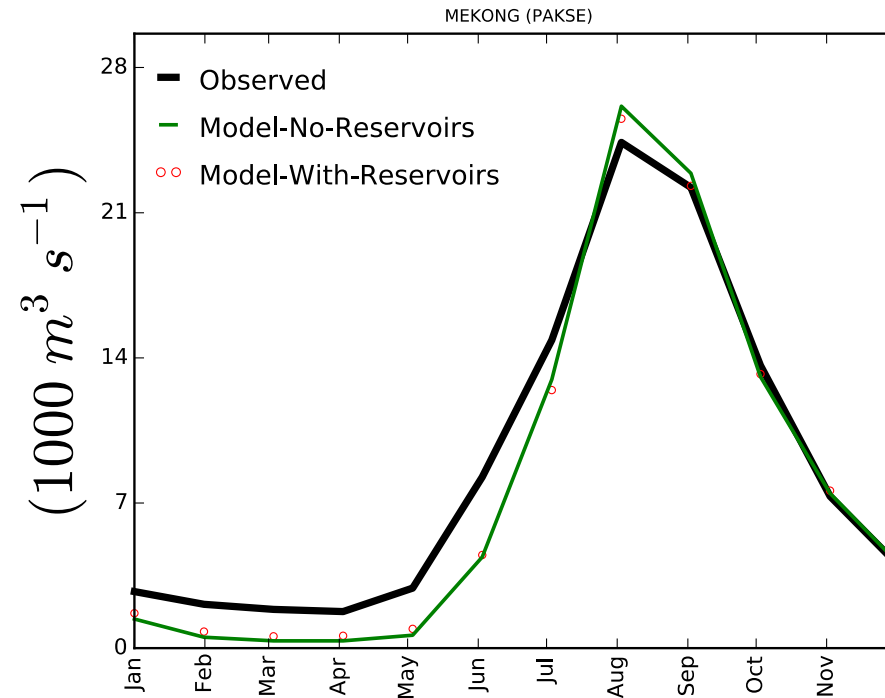


DAMS IN THE MEKONG

Pokhrel et al. (2018)



Pokhrel et al. 2012, 2015

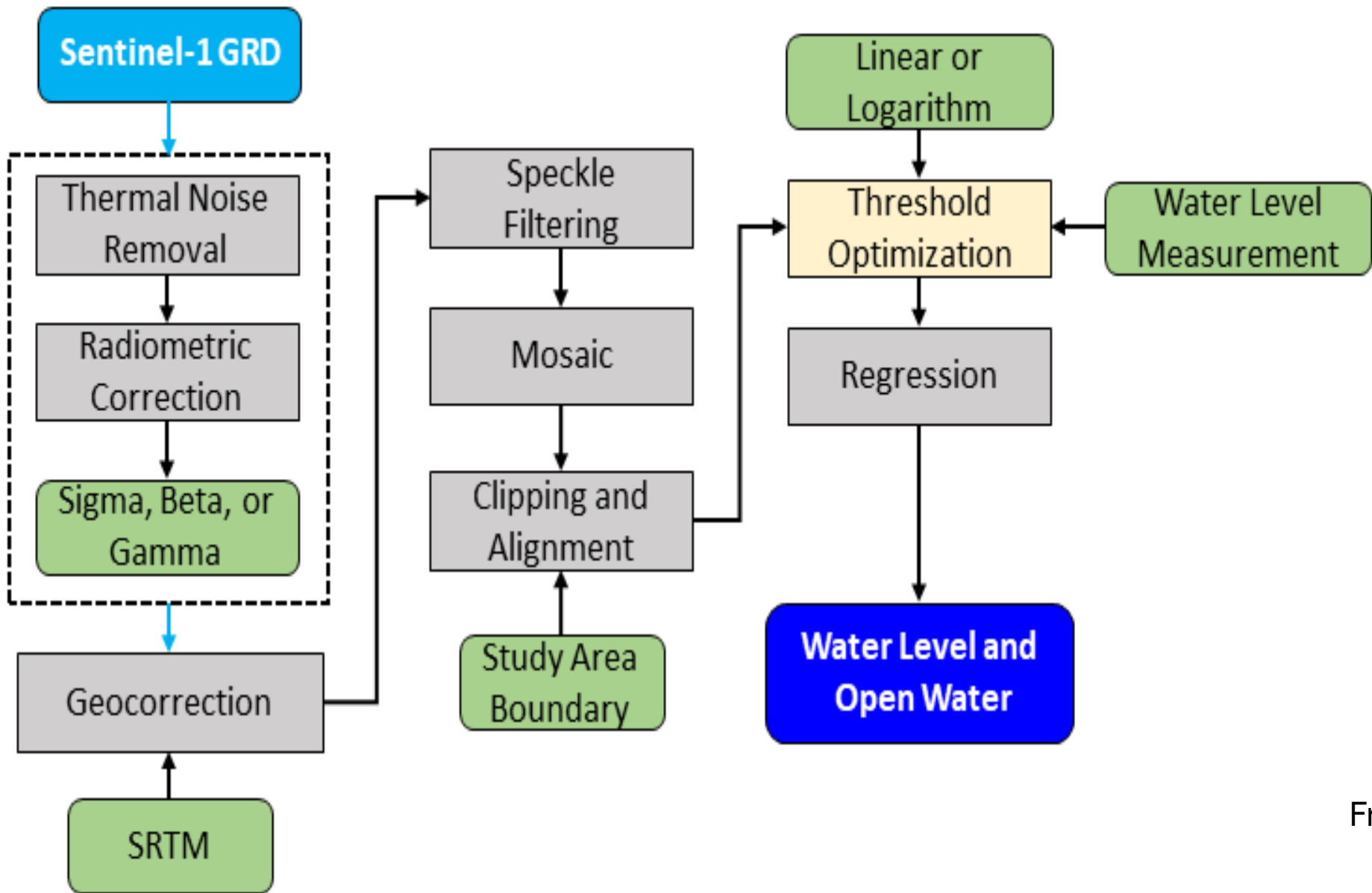


- ❖ Existing dams do not have significant impact on the flow in the mainstream
- ❖ Impacts on tributaries could be significant
- ❖ Future dams are likely to largely affect the mainstream flow

BUT.... What about lakes and wetlands?

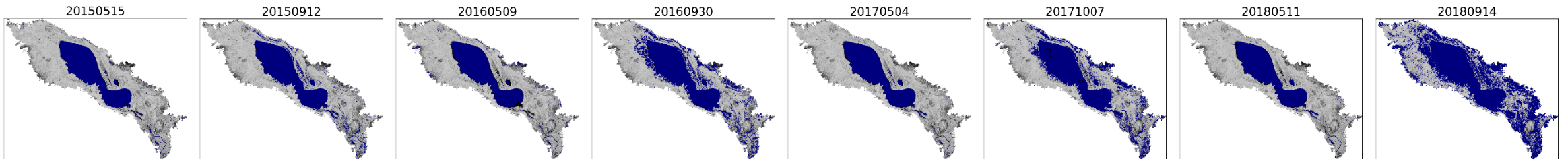
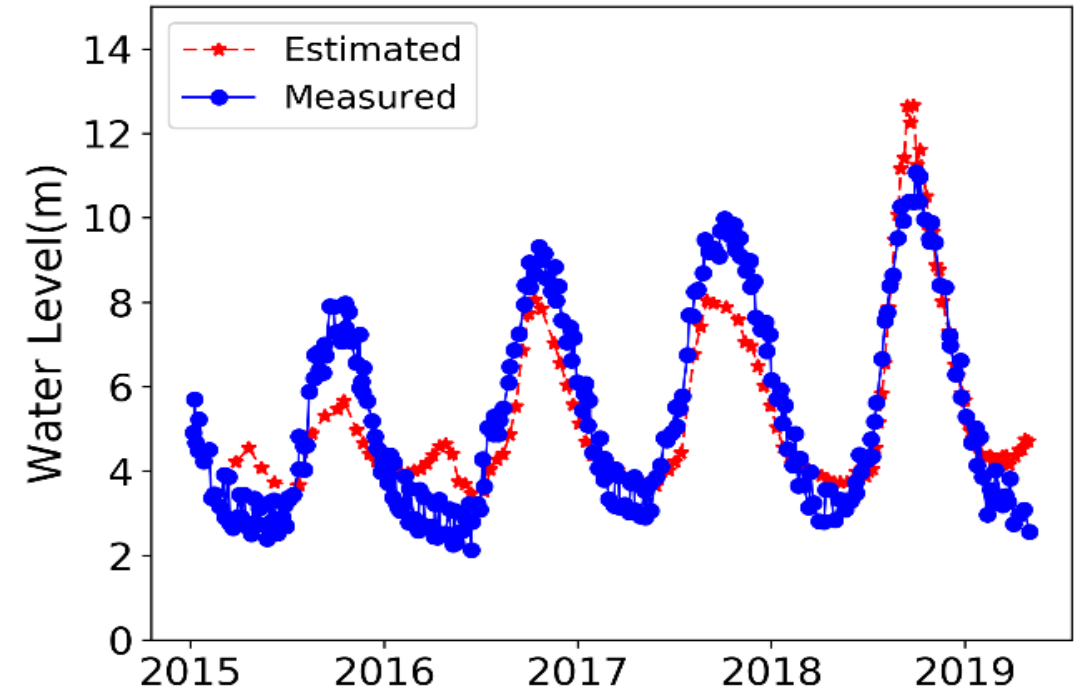
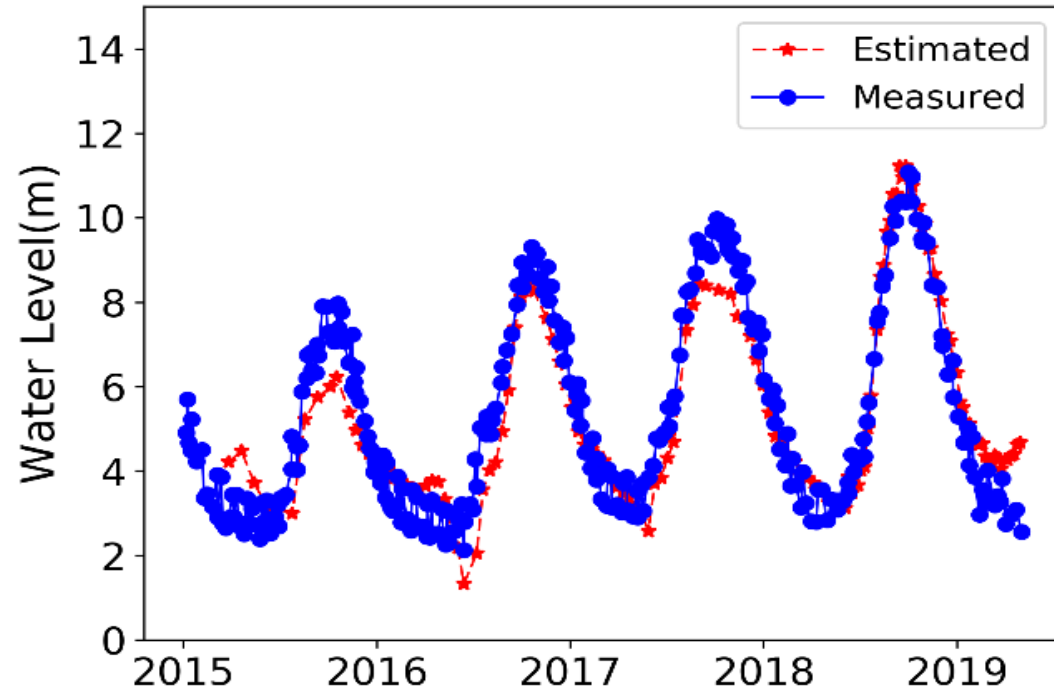
Sentinel-1 GRD Pre-processing

Water Level and Area Retrieval

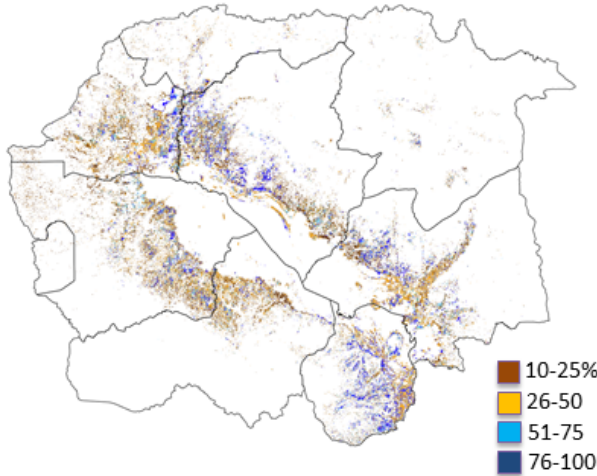


From Co-I Nate Torbick

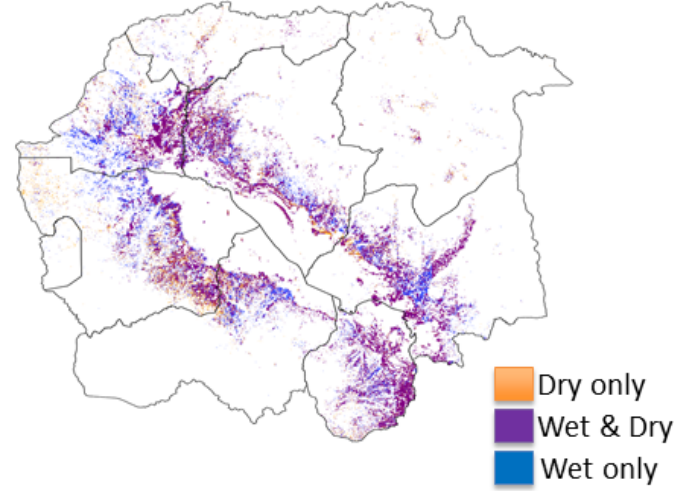
Water Level estimates from remote sensing



Time cropland inundated

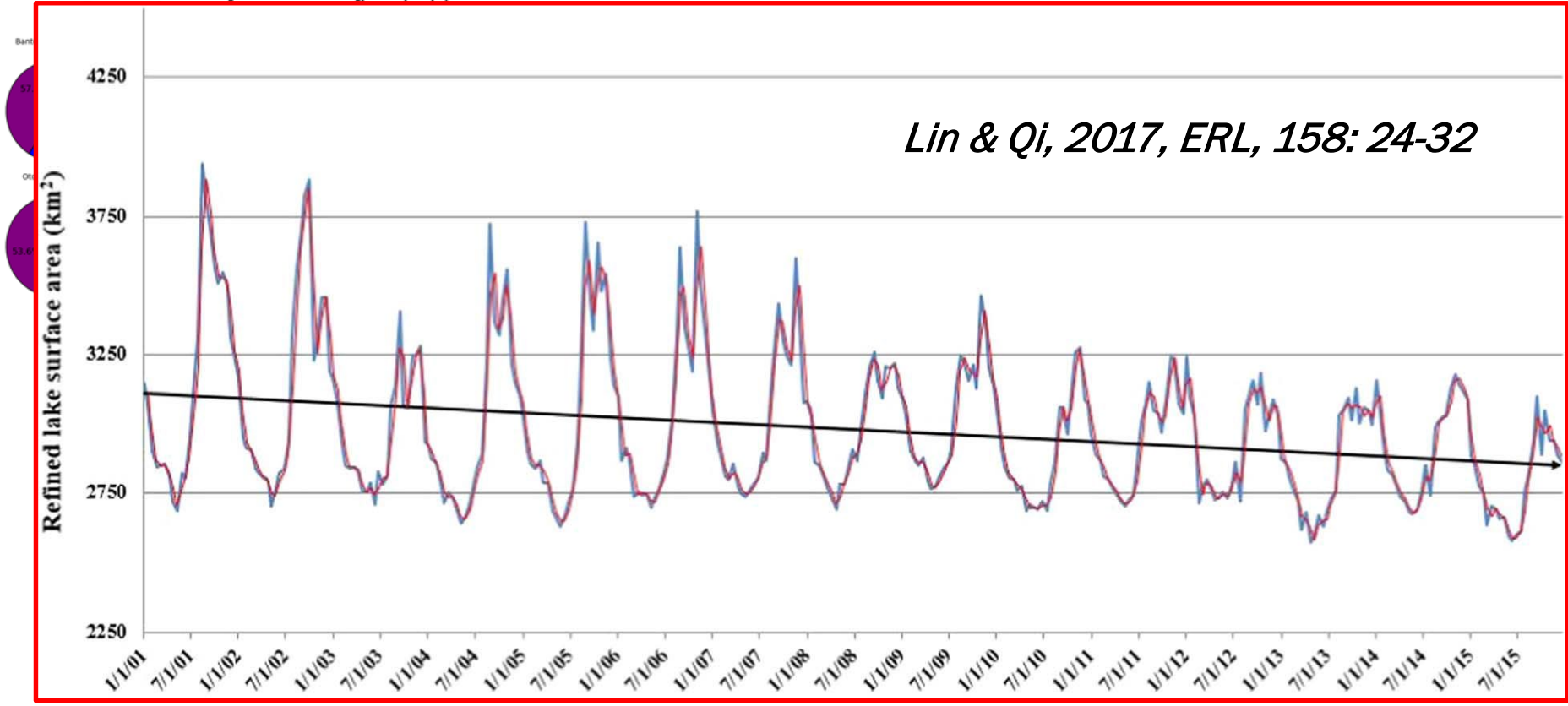
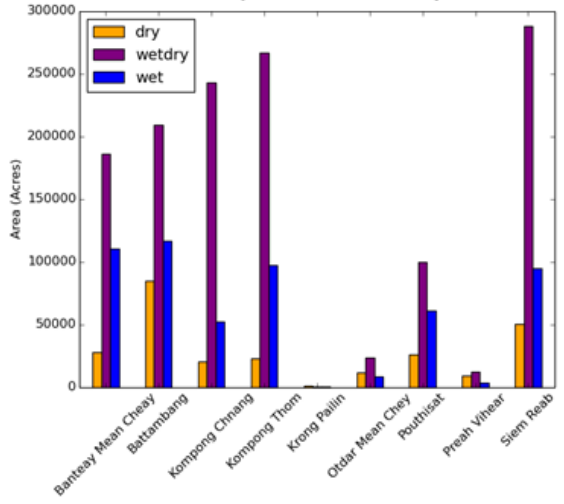


Flood seasons

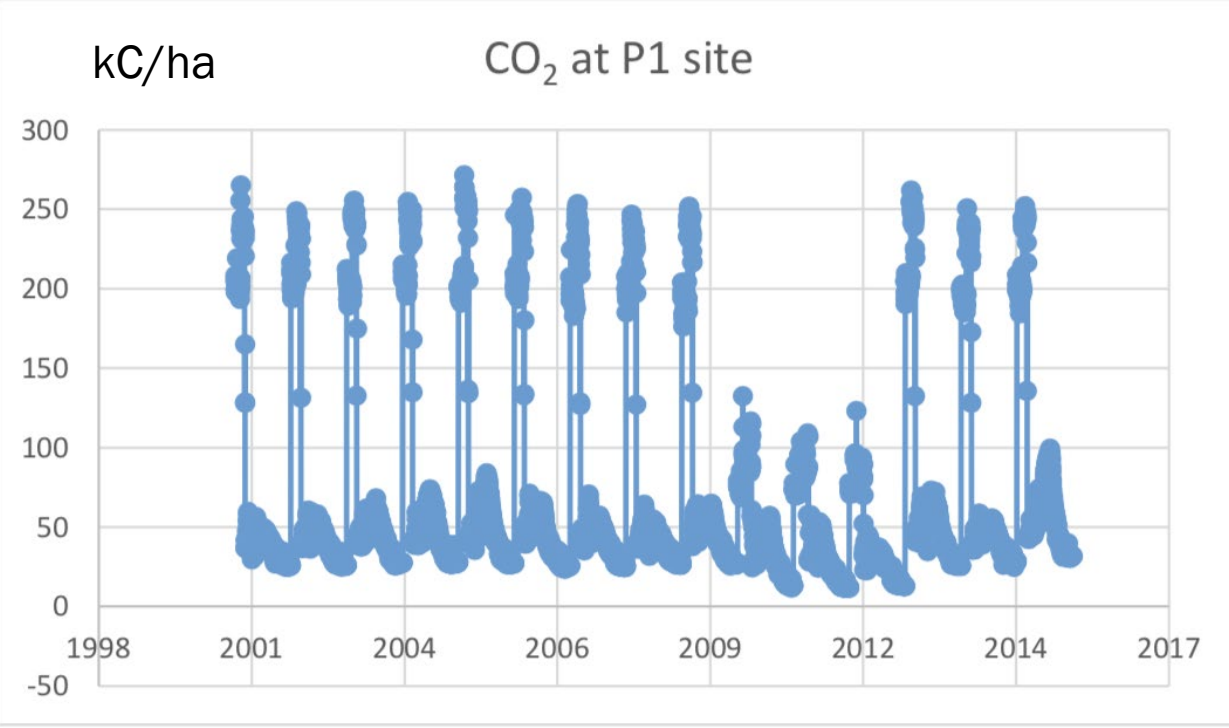
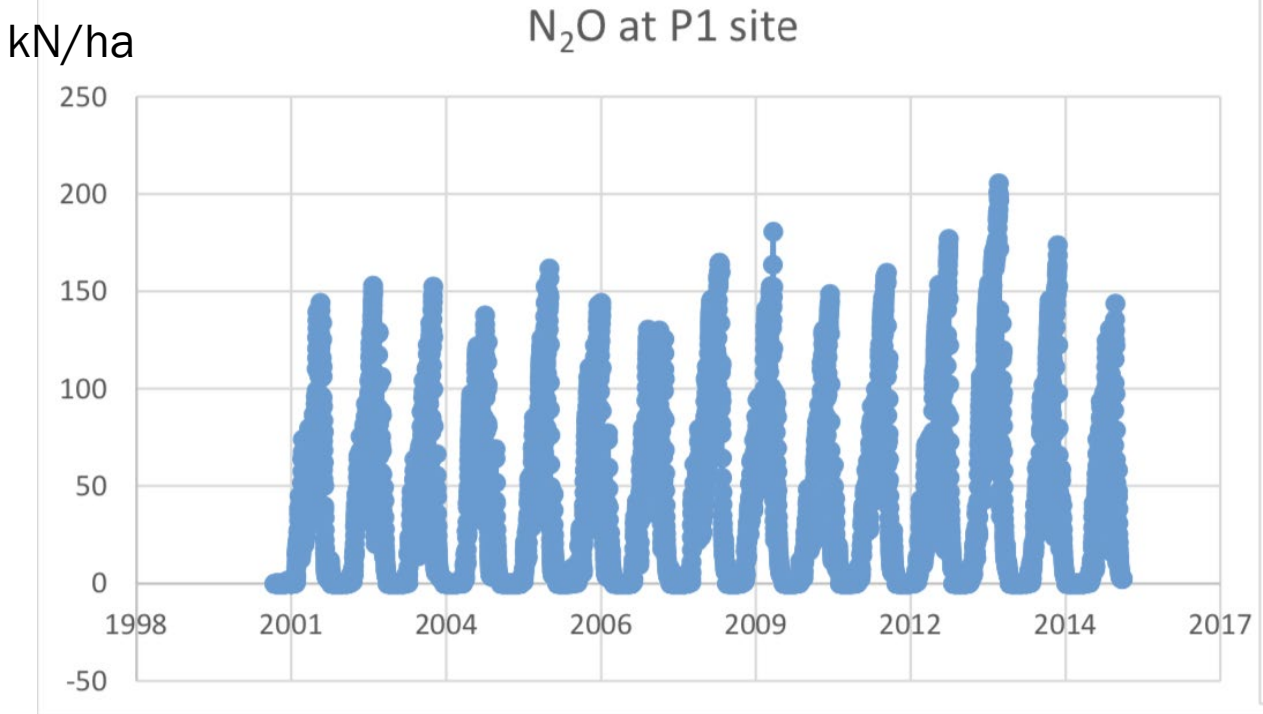


Tonle Sap Lake

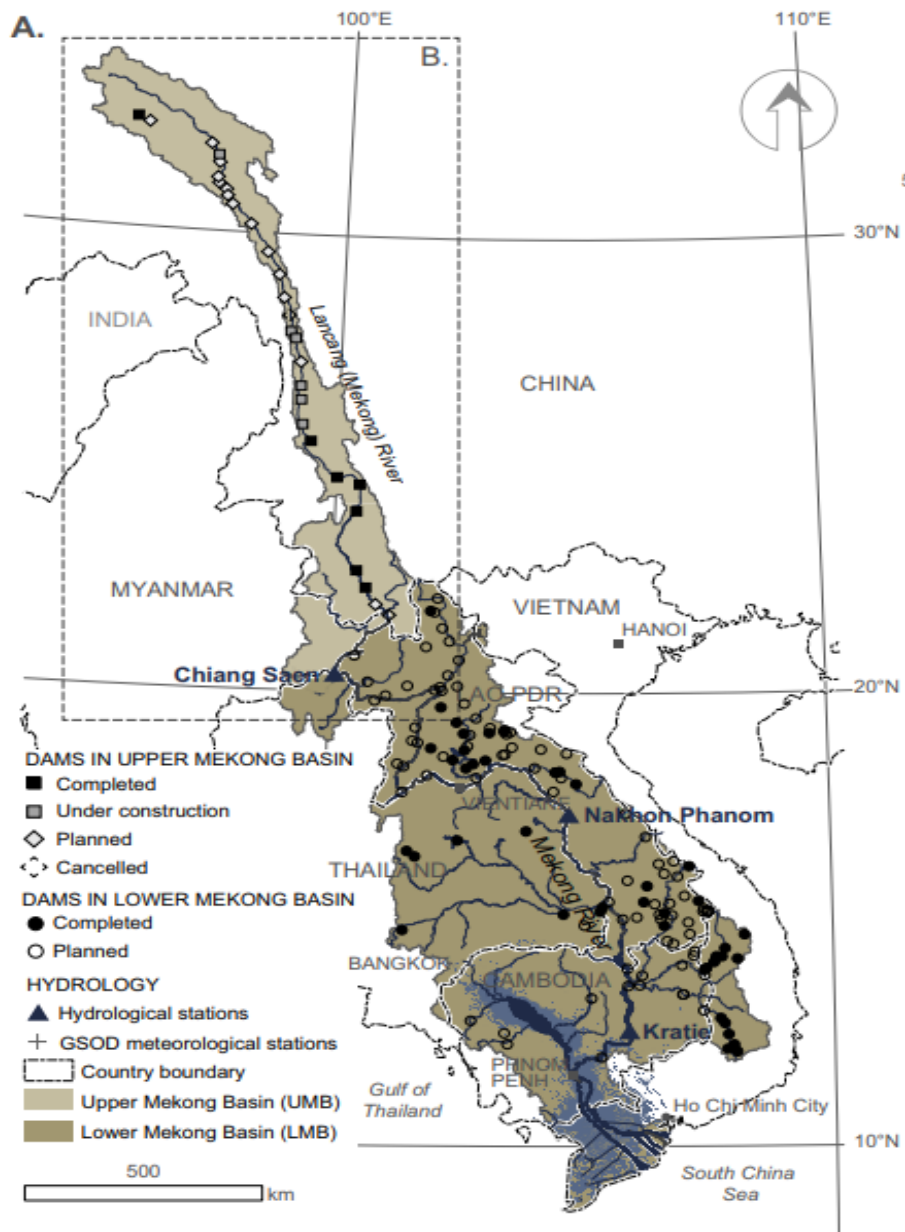
Area of crop inundation by season



ECOLOGICAL IMPLICATIONS



TRADEOFFS AND SYNERGIES



TRADEOFFS AND SYNERGIES

Field survey to understand the impacts and responses



Table 1 Annual Benefit and Cost (Millions of US\$/year)

Theme	CS (M3CC-M1 the effect of development scenario)	MDS (Scenario 2)	MRC - BDP2 (20 year plan incl. all dams + climate change)	SEA (Scenario 3)
1.Hydropower, Water Flows & Water Levels	\$ 9,396.1	Dry year: -54.44% in water volume; - 1.12 meter in water level for 10 day interval at <u>Kratie</u> , Cambodia. Dry year: -36.07% in water volume and -0.12 m in water level for 10 day interval at <u>Tan Chua</u> , Vietnam.	\$ 5,344.05	\$ 3-4,000

Keys:

CS: MRC Council Studies; MDS: Mainstream Hydropower Studies

SEA: Strategic Environmental Assessment;

Phase 2 (BDP2) – Basin Development Plan Phase 2

	CS	MDS	SEA	BDP2
2. Irrigated agriculture	Total agriculture: \$ 6,410.8 Irrigation: \$ 1,228.3	Rice production: -552,500 tons (Vietnam) and -203,300 tons (Cambodia) per year for 10 years Maize production: -21,700 tons (Vietnam) and 41,000 tons (Cambodia) per year for 10 years. No effect estimated on crop area and crop calendar -\$ 426 (Cambodia) -\$ 250 million (Vietnam) in fisheries and farming sectors	\$ 270.30	Riverbank production: -\$ 21 Paddy production: -\$ 4 Nutrient replacement: \$ 24 New irrigated production: \$ 15.54
3. Reservoir fisheries	Included in 5	NA	\$ 32.59	\$ 14
4. Aquaculture	NA	Little to no impact	\$ 211.81	NA
5. Capture Fisheries	-\$ 658.2	Whitefish: -80-100% Capture fisheries: -50% Total fish production: -614,000 tons OAA: -45,000 tons (of total) Economically valuable: -315,000 tons (of total) Inland fisheries: -\$ 580 (Vietnam) Coastal fisheries: -50,000 tons or -\$ 150	-\$ 1,220.0	-\$ 476
6. Wetlands (Natural Capital)	-\$ 7,314.1 (uncertainty range: min: -4,761.8; max: -9,865.9); includes 6, 7 & 9	Little to no change in extent	\$ 16.29	-\$ 4 to 13.8

CONCLUSIONS

- So far, we have seen a significant impacts of hydro dams on hydrological and ecological processes and ecosystem services
- Tradeoffs are obvious but we need to look at all possible tradeoffs across space and time as well.
- The WEF system in Mekong is complex but the Nexus approach seems to help address these pressing issues,

Thank You!

