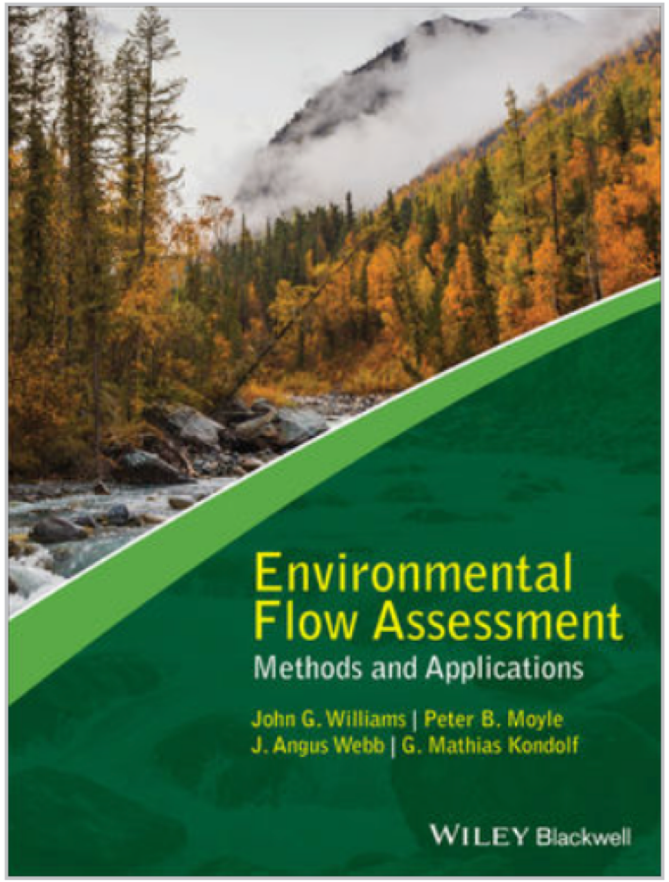
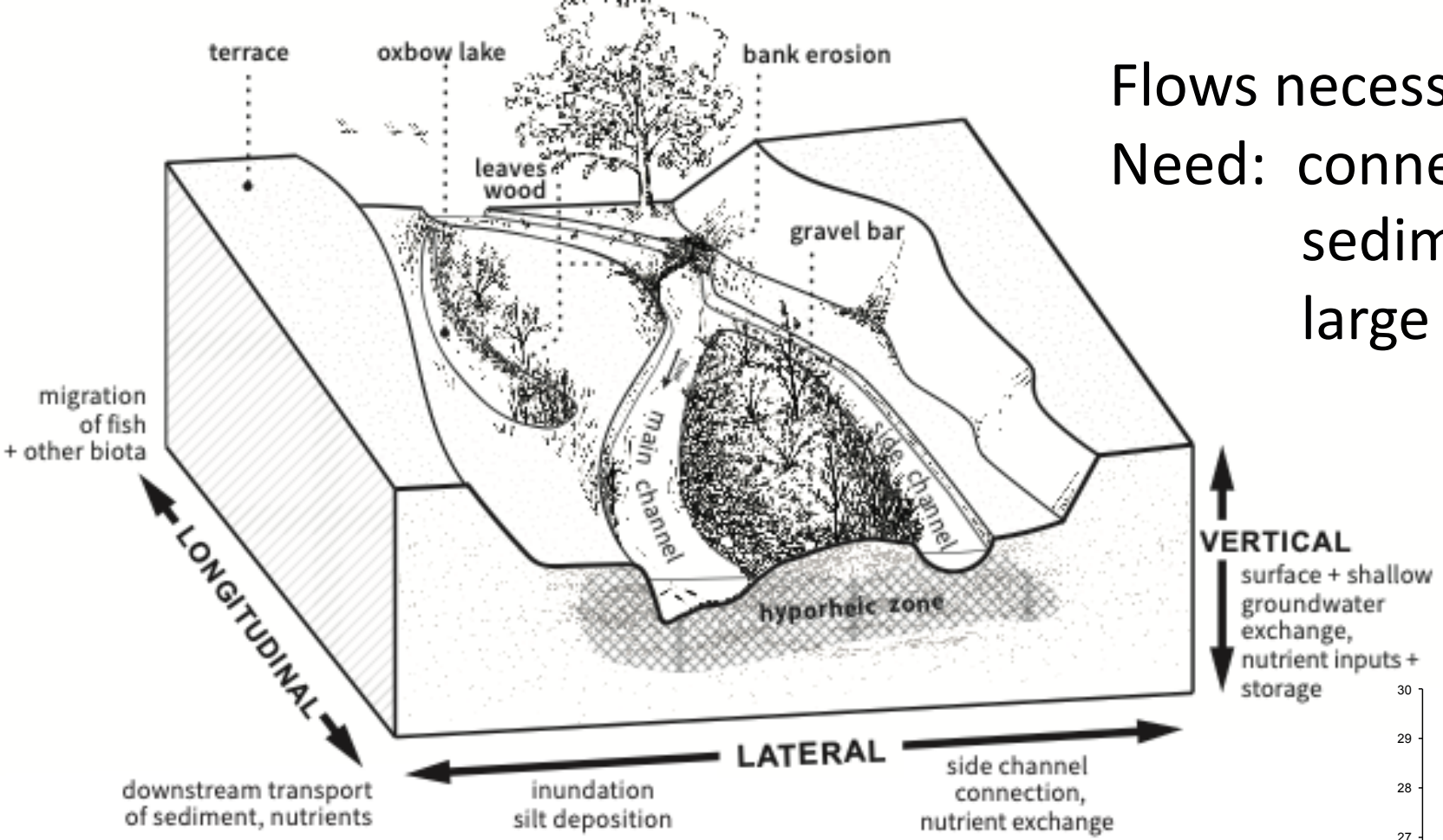
Flows and Strategic Dam Planning in Reverse for the Columbia R Basin?

(A topic for the mock report)





Flows necessary but not sufficient

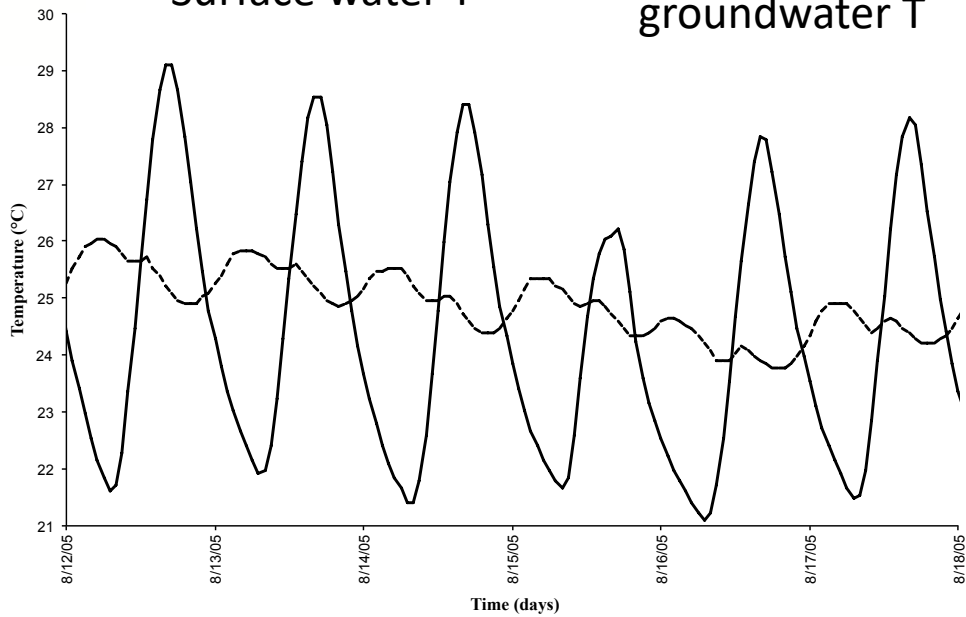
Need: connectivity

sediment & nutrient flux

large wood

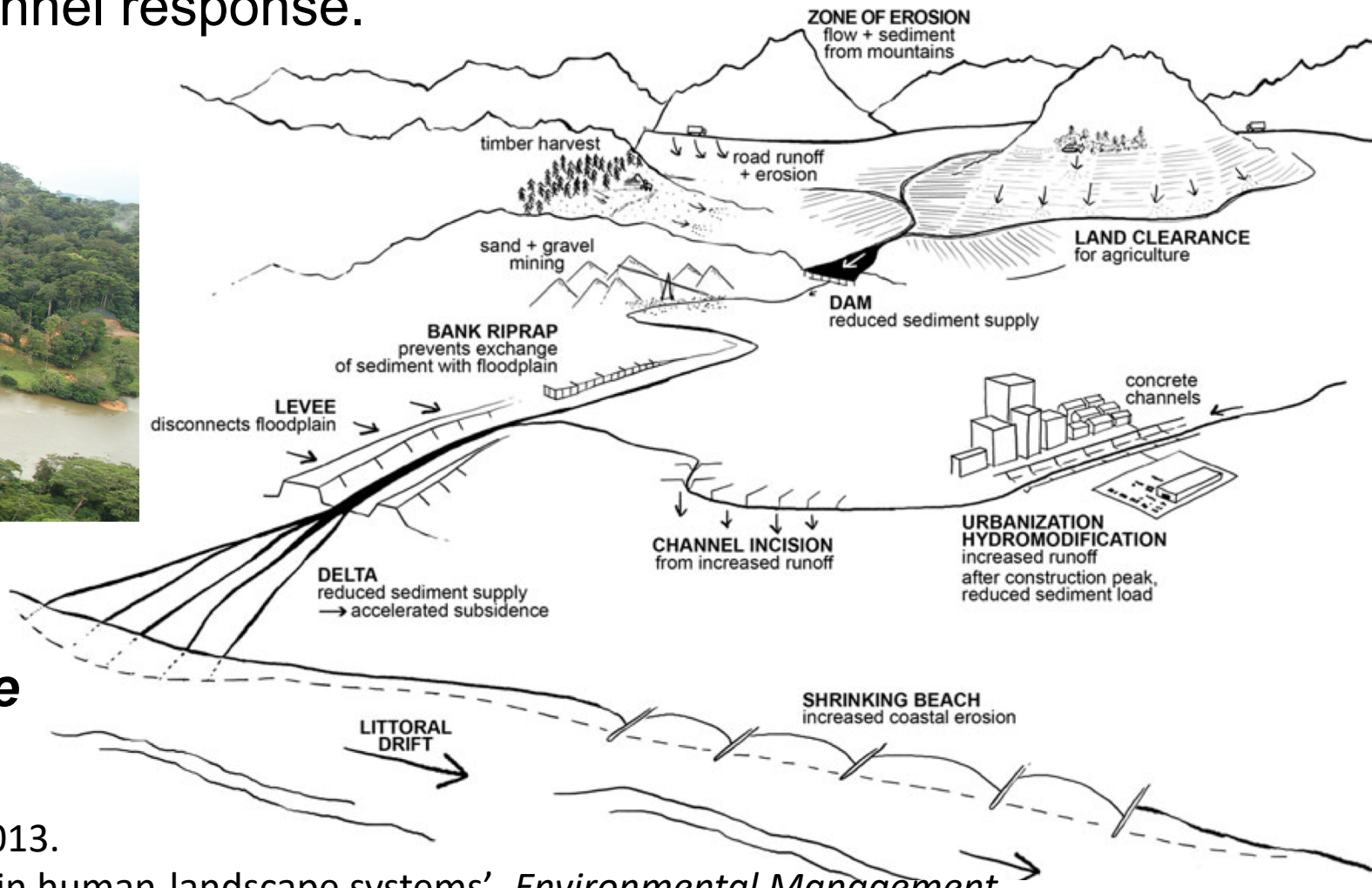
Deer Creek,
Surface water T

Upwelling
groundwater T



“Even if a post-dam flow regime were to mimic precisely the pre-dam flow regime, the river system would be severely altered by the loss of its sediment load.” (Williams et al 2019)

Many ways in which human activities alter the balance of flow (energy) and sediment load in river basins, inducing channel response.



Globally most rivers show decreasing sediment loads due to sediment trapping by dams

Kondolf and Podolak 2013.
‘Space and time scales in human-landscape systems’. *Environmental Management*

Basin-scale effects

- What effects cumulative sediment trapping downstream (coasts, deltas)?
- Problem technical, institutional & political - lack of interdisciplinary study

The Social Life of the Sediment Balance: Combining Social and Geomorphic Approaches to River Systems & Deltas (w/Giacomo Parinnello, Sciences Po)

- First conference in Lyon (Oct 2018): Rhone, Ebro & Po
- Second workshop in Berkeley (May 2019): Global, transboundary basins

Potential for strategic hydropower dam planning to optimize power production, minimize environmental impacts

Fish Migration, Sediment Flux in the Mekong

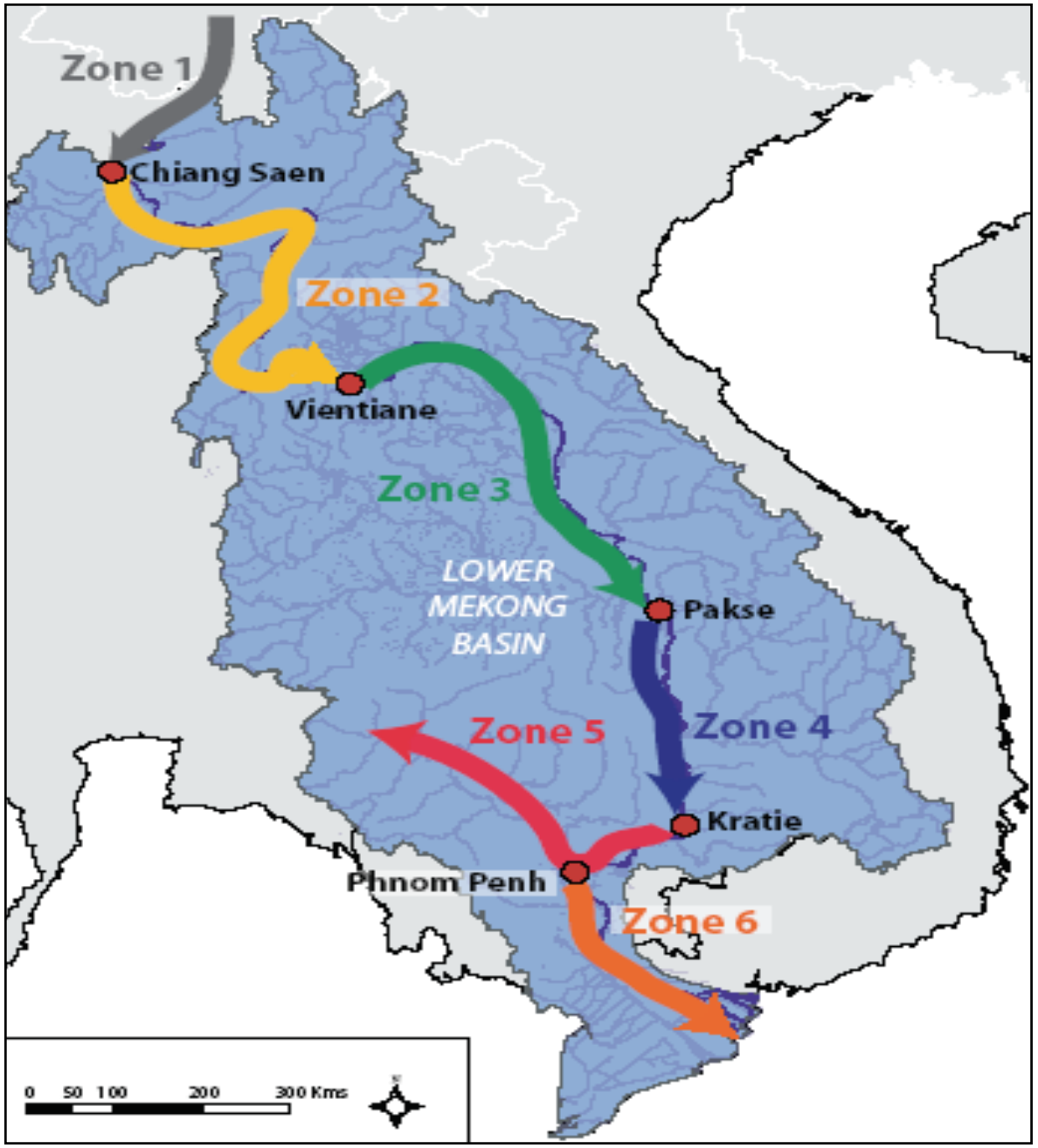
More than 850 fish species

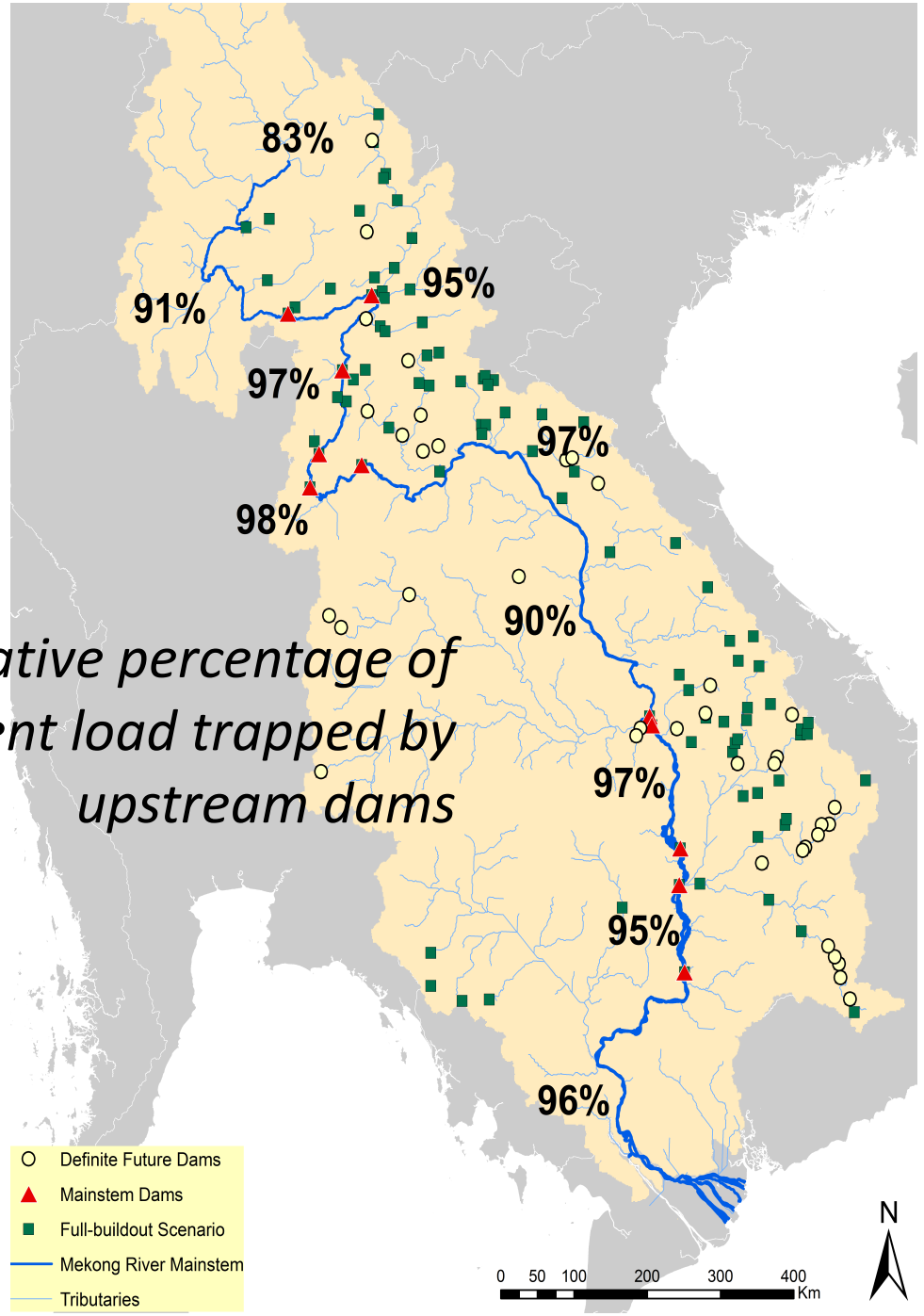
Many fish migrate long distances

Migratory fish very important for riparian populations

> 140 dams built, under construction, or planned. These will block migration, fish ladders insufficient to compensate

Cumulative impacts on sediment supply to Delta? (17M population)





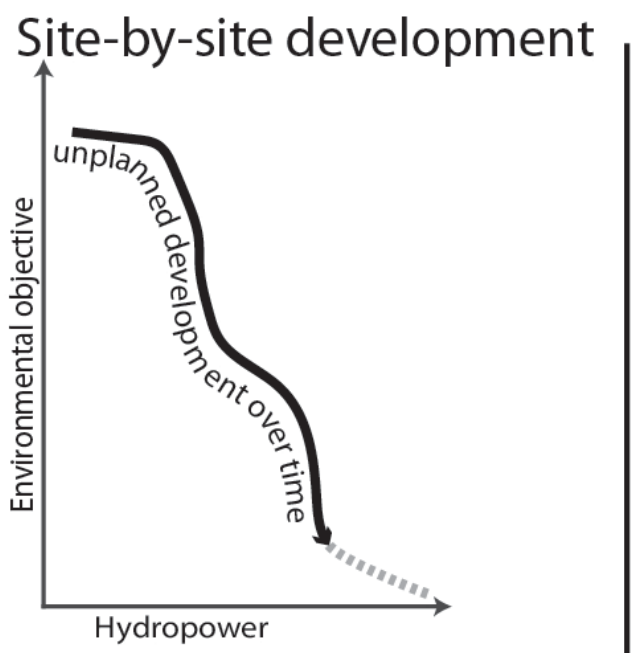
Cumulative percentage of sediment load trapped by upstream dams

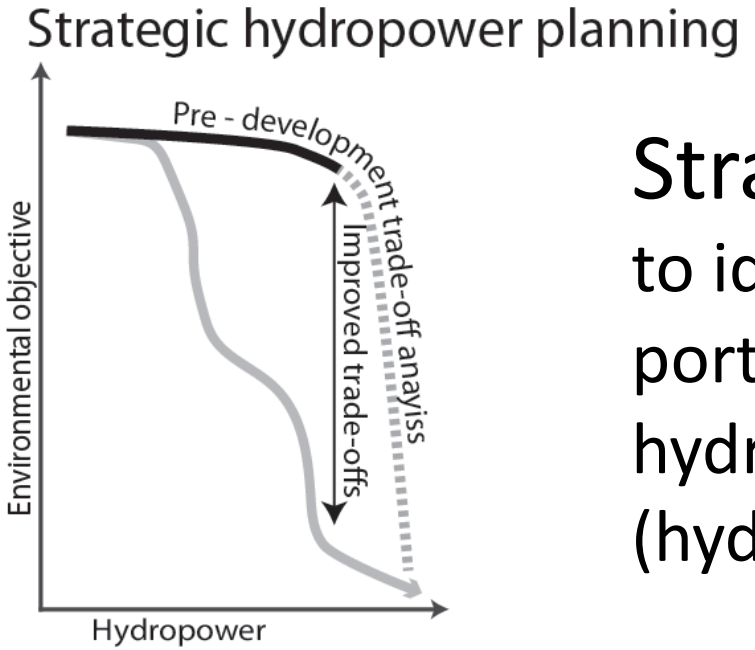
Cumulative effects of ~140 planned (or built) dams: >90% of natural sediment load trapped along entire mainstem. Only 4% of the natural sediment load will reach the Delta.

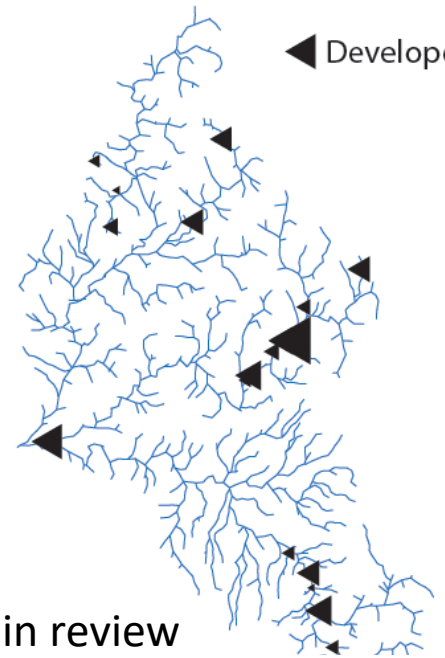
Kondolf et al 2014 'Dams on the Mekong: Cumulative Sediment Starvation' *Water Resources Research*

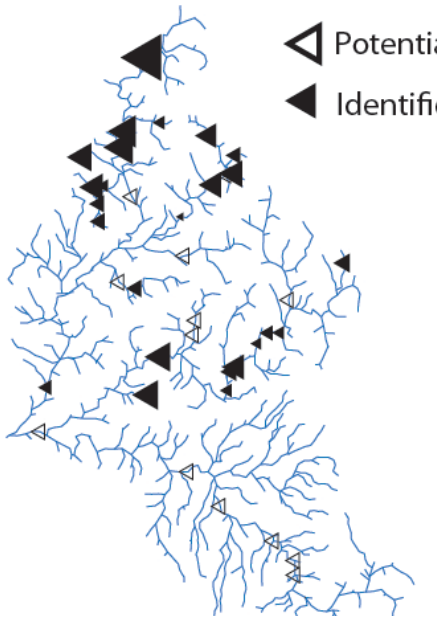
Sediment starvation, groundwater pumping, and sea level rise will put half of the Delta under water by 2100

Kondolf et al 2018 Changing sediment budget of the Mekong: Cumulative threats & management strategies for a large river basin. *Science of the Total Environment*









Strategic dam planning

to identify optimal dam portfolios and sustainable hydropower.
(hydropower only)

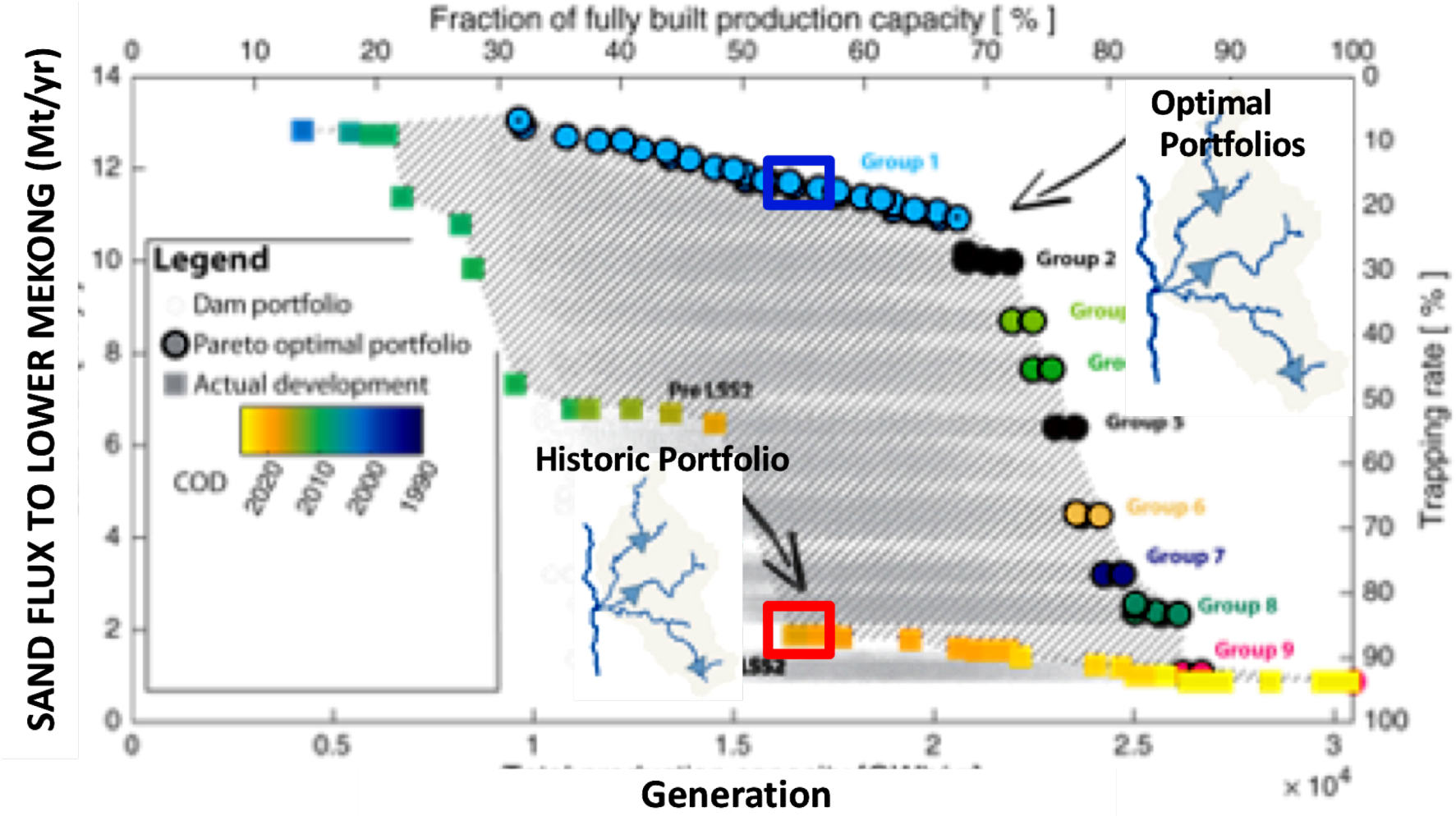
Role for hydropower in facilitating transition to other renewables like solar

Source:
Schmitt et al in review

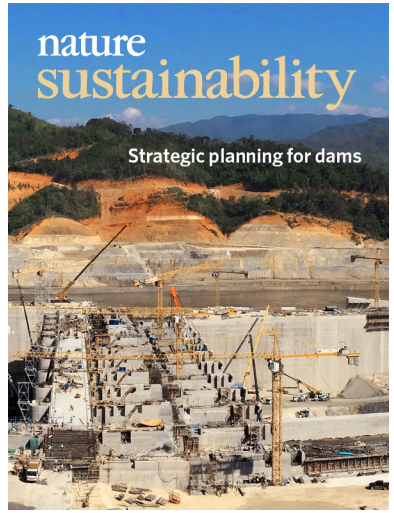
Strategic dam planning for Mekong tributaries SrePok, SeSan, & SeSan:

Actual built portfolio:
15,000 GWh generation, trapping 90 % of basin's sediment

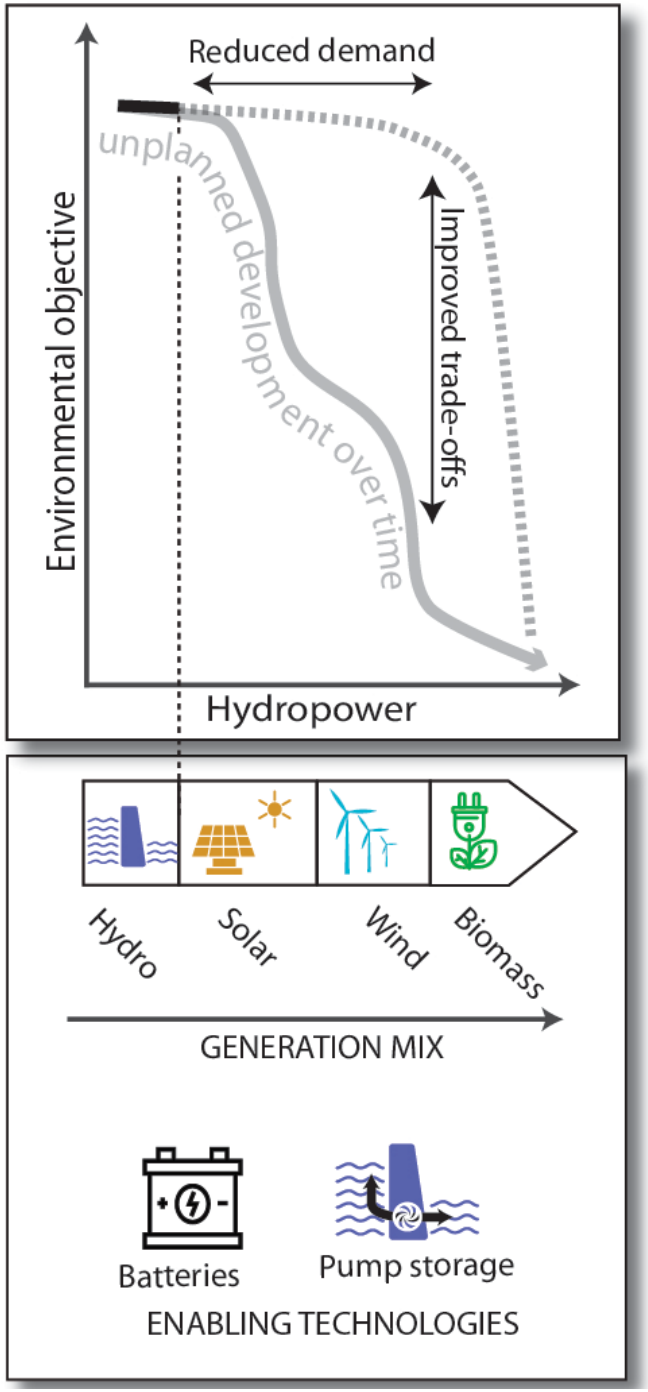
Optimal portfolio:
More generation with < 20 % trapping
Also more economically efficient

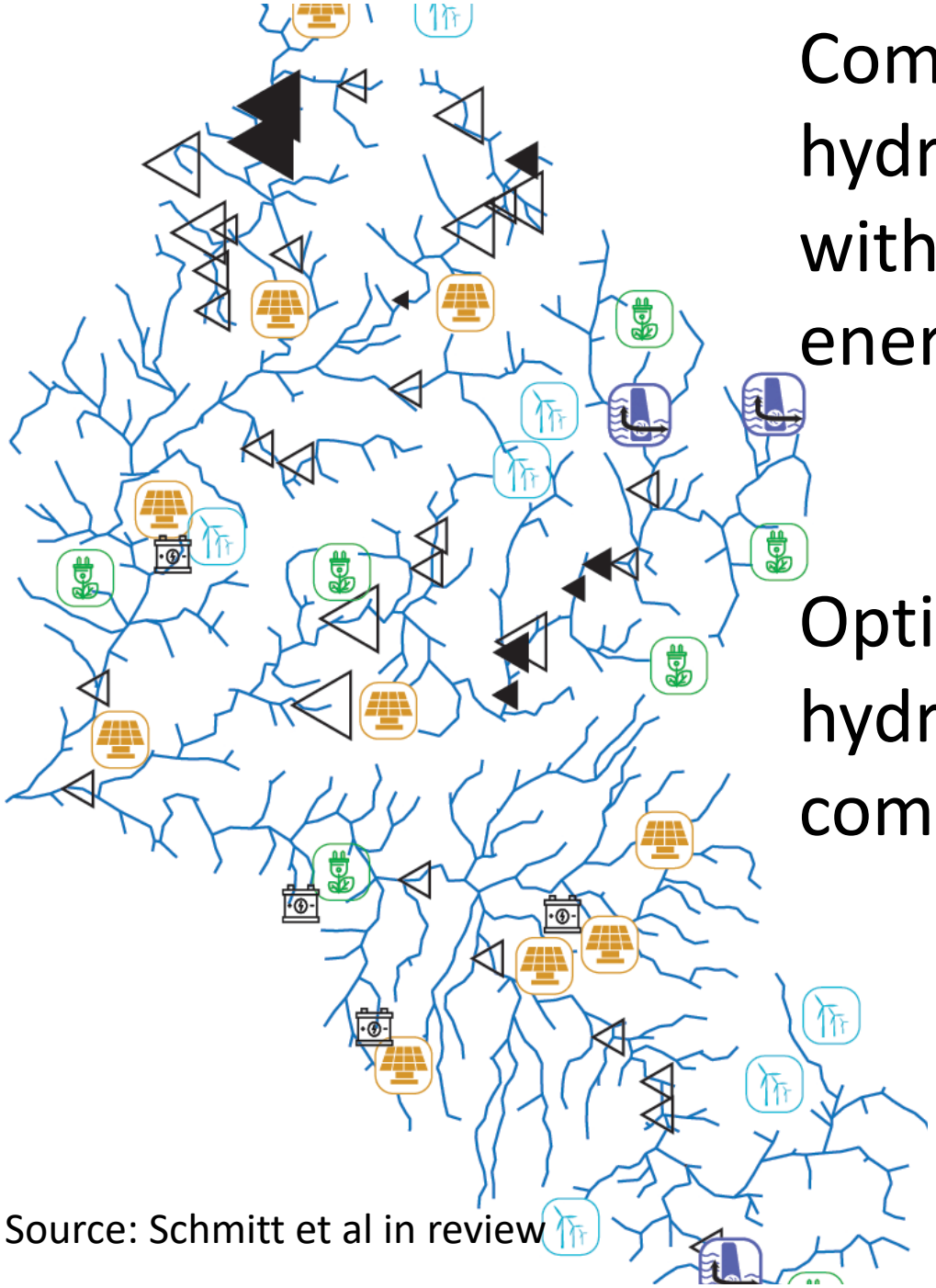


Transboundary issues! *Costs & benefits not equitably distributed among countires*



Schmitt et al 2018. Improved trade-offs of hydropower & sand connectivity by strategic dam plannir in the Mekong.
Nature Sustainability





Source: Schmitt et al in review

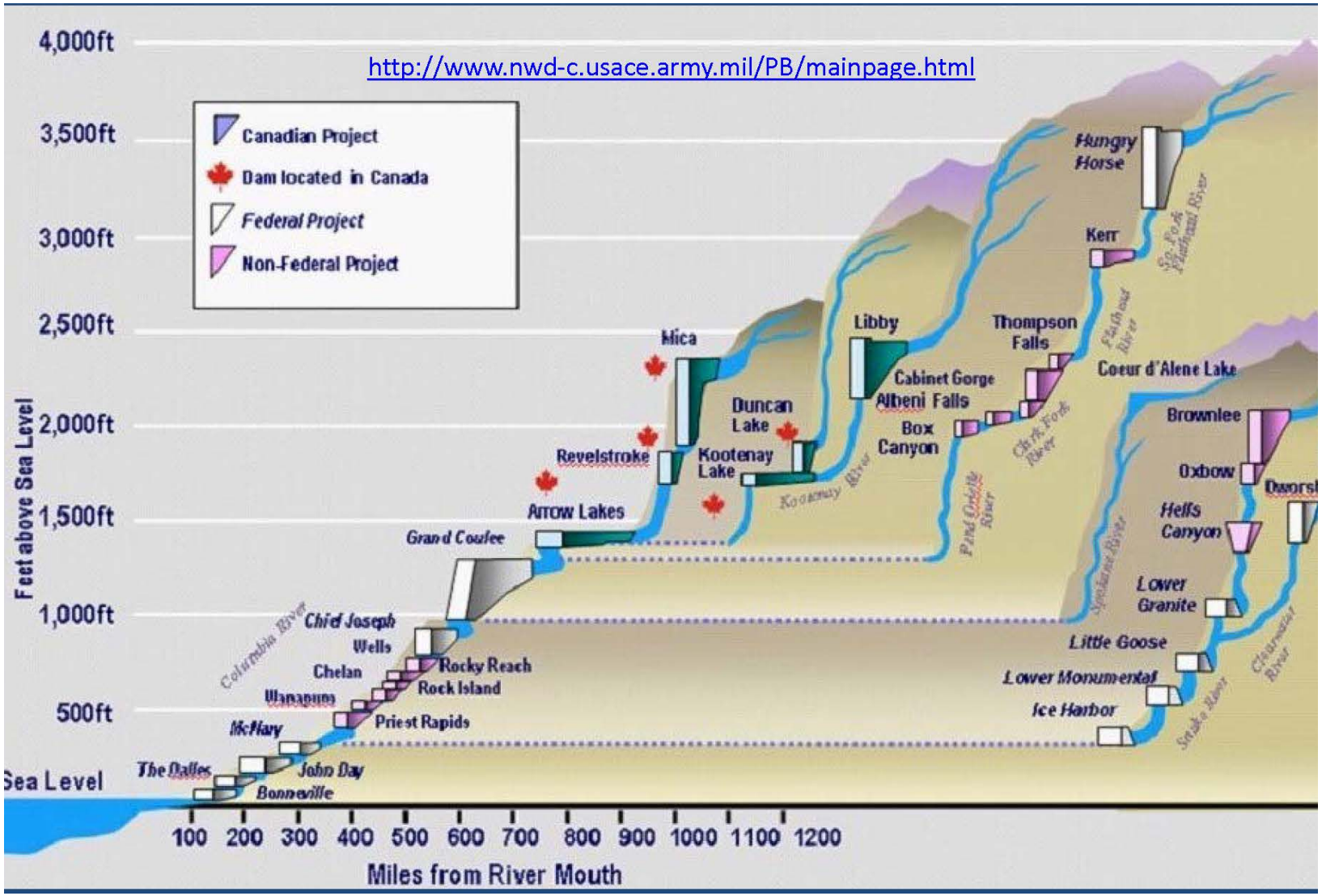
Combine strategic hydropower planning with national/regional energy planning

Optimize benefits of hydropower as complement to solar, etc

Can we apply these concepts to assess dams in the Columbia R Basin?

(A topic for the mock report)

Objectively assess benefits and impacts of all dams, explore new configurations, put removals on the table.



Consider flows, sediment, and passage in each reach: free-flowing vs impounded reaches

Can we take a basin-scale perspective, without closing off range of options including removing or building passage around some dams