Finding Balance Between Energy and Conservation During Hydropower Development

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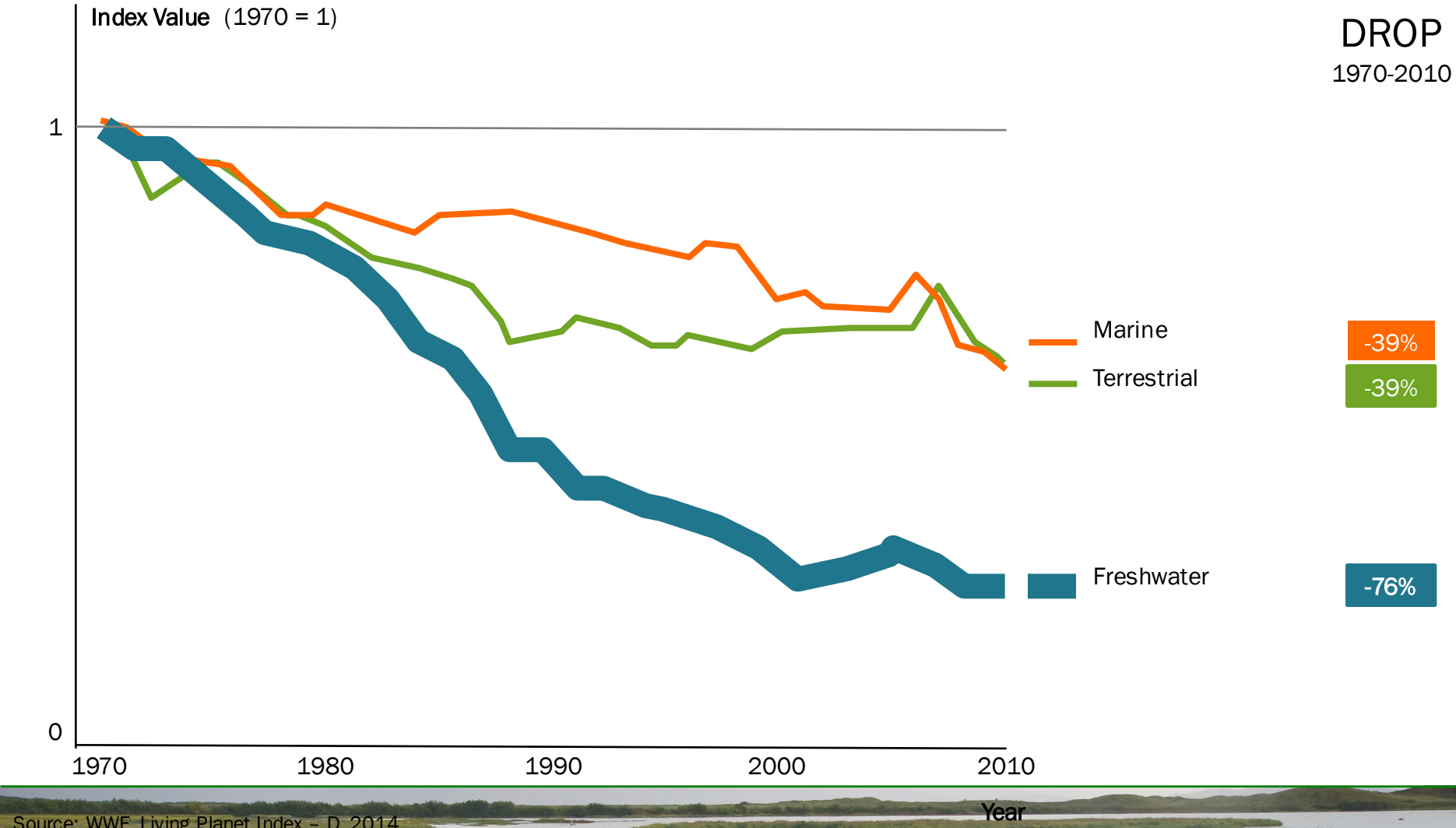
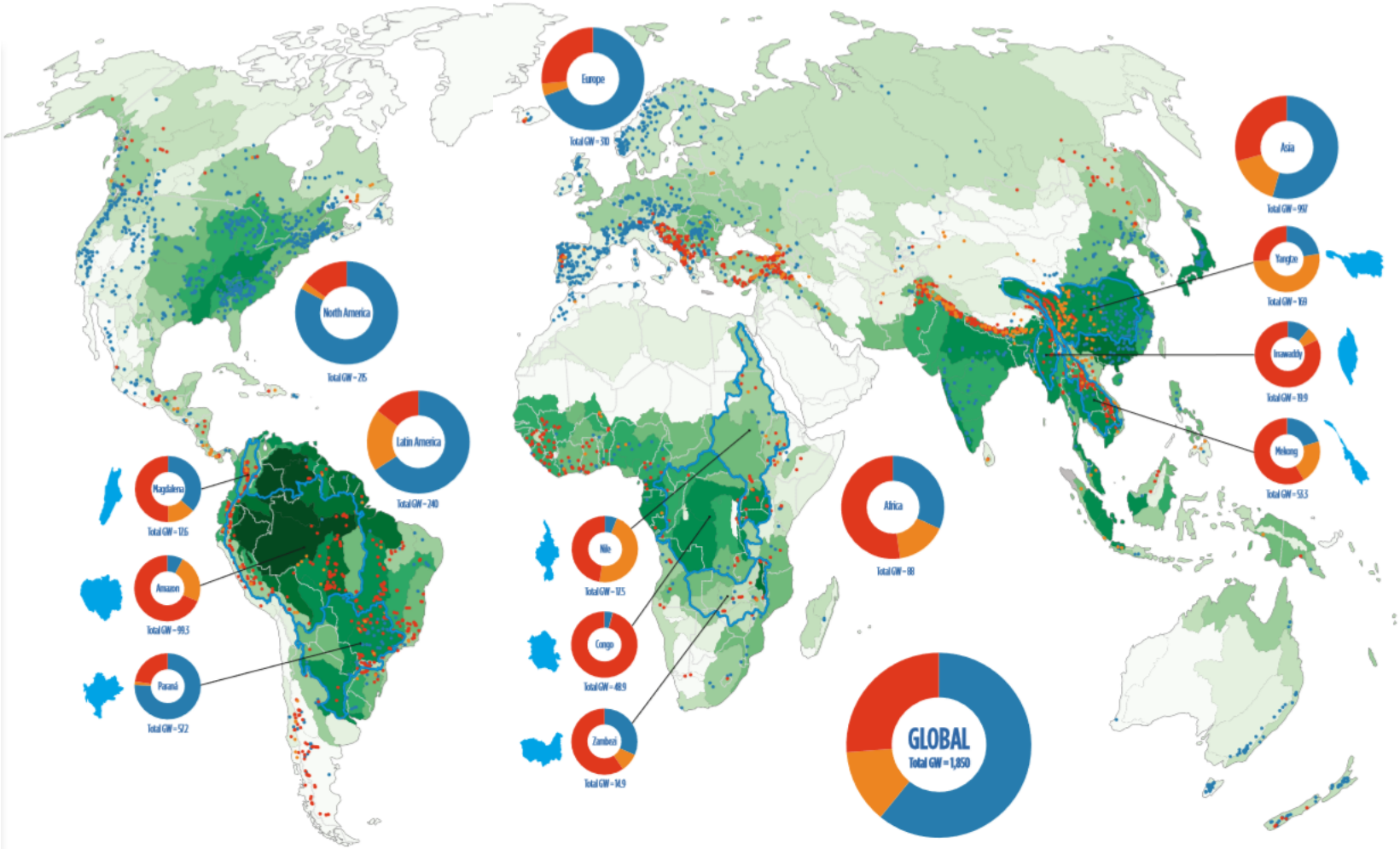
IAIA Sustainable Mega-Infrastructure and Impact Assessment
Panama City, December 2, 2015

DRAMATIC DECLINES IN FRESHWATER ECOSYSTEMS



Source: WWF, Living Planet Index – D, 2014

Global database of existing, under construction, and planned dams



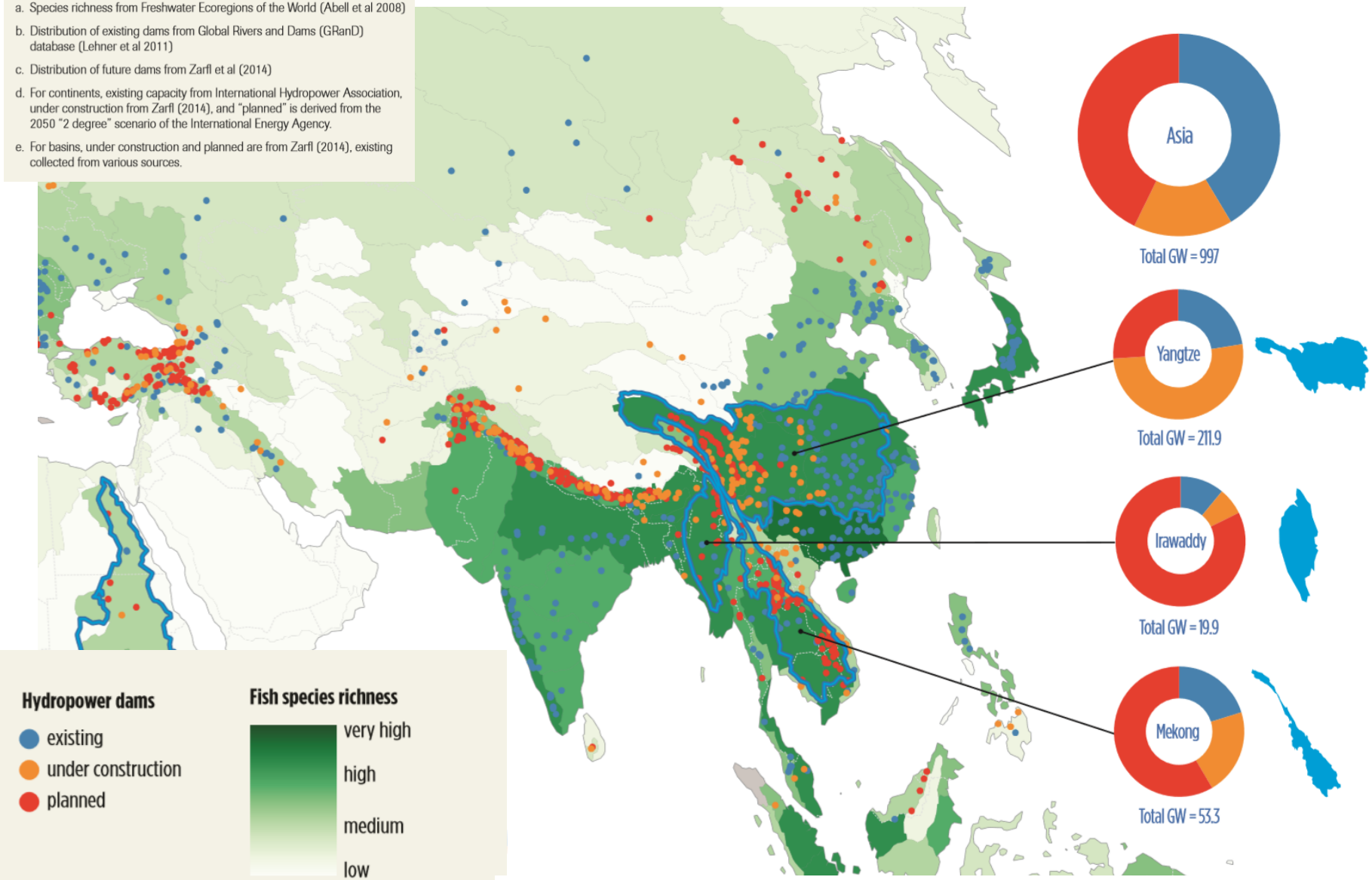
a. Species richness from Freshwater Ecoregions of the World (Abell et al 2008)

b. Distribution of existing dams from Global Rivers and Dams (GRanD) database (Lehner et al 2011)

c. Distribution of future dams from Zarfl et al (2014)

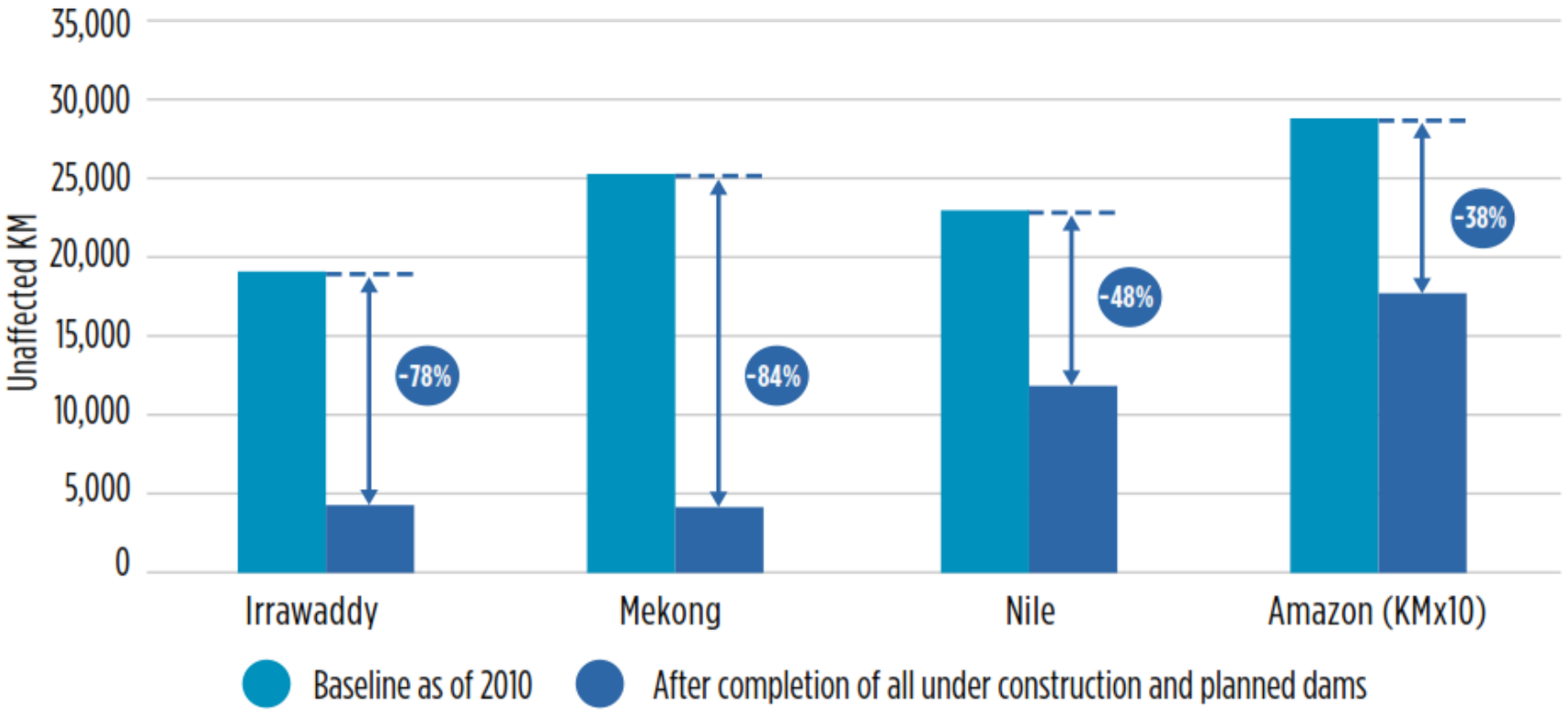
d. For continents, existing capacity from International Hydropower Association, under construction from Zarfl (2014), and "planned" is derived from the 2050 "2 degree" scenario of the International Energy Agency.

e. For basins, under construction and planned are from Zarfl (2014), existing collected from various sources.



The majority of hydropower expansion will occur in basins with the greatest freshwater fish harvests (and other ecosystem services of value to rural communities) and greatest richness of fish species.

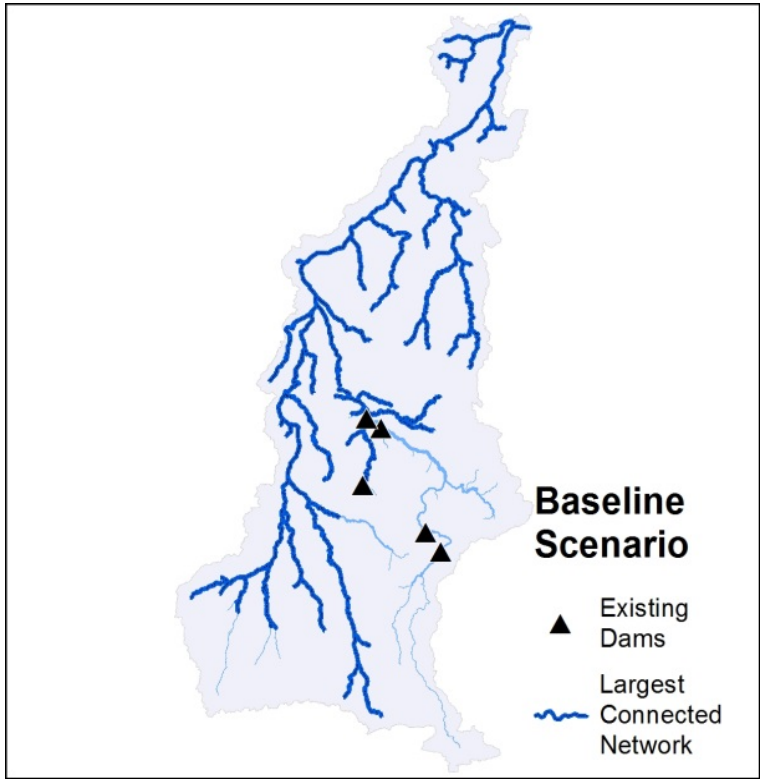
In a number of important river basins, the length of river channel (km) unaffected by dams will decline dramatically with business-as-usual expansion of hydropower (length of river channel include main-stem river and major tributaries).



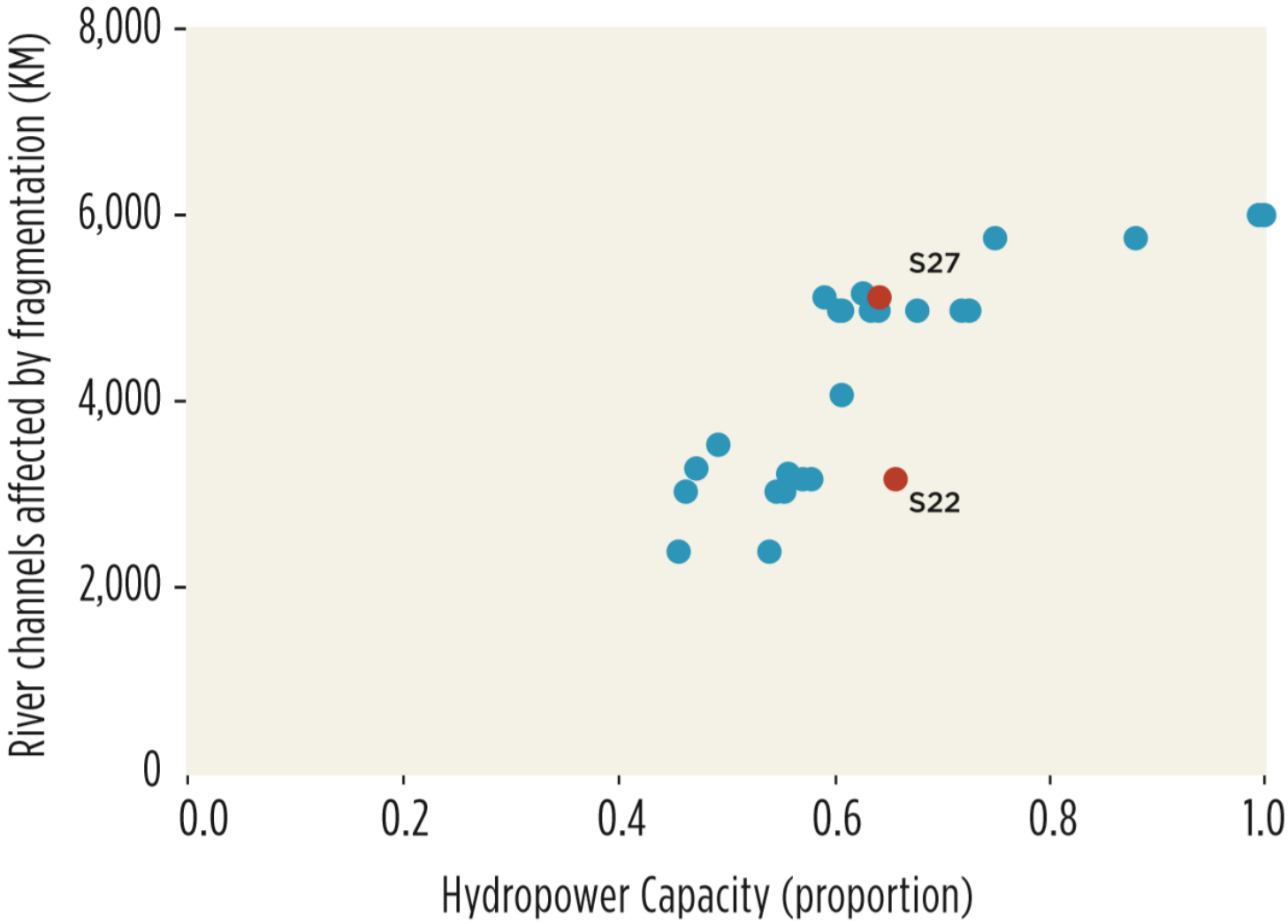
Site-scale impacts and mitigation

Location, location, location

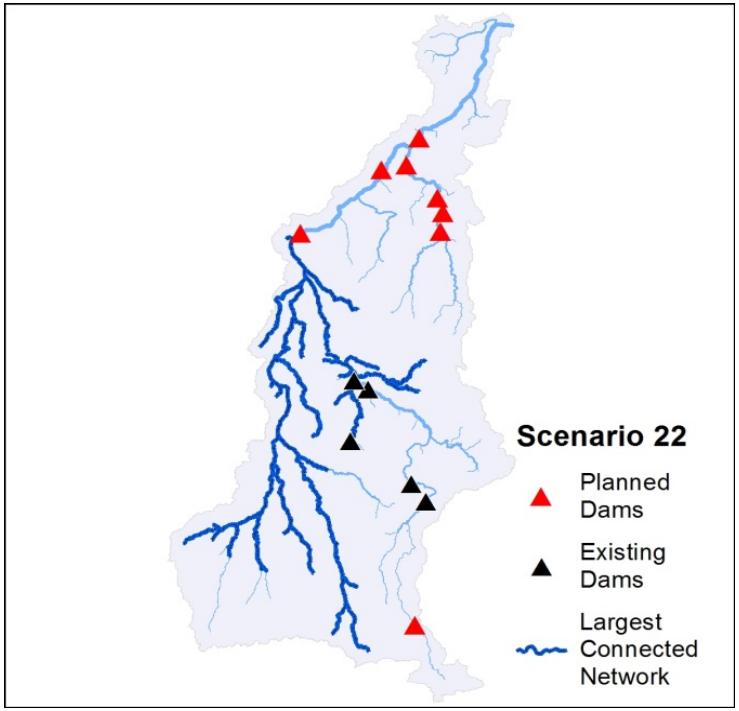
Tapajos River, Brazil

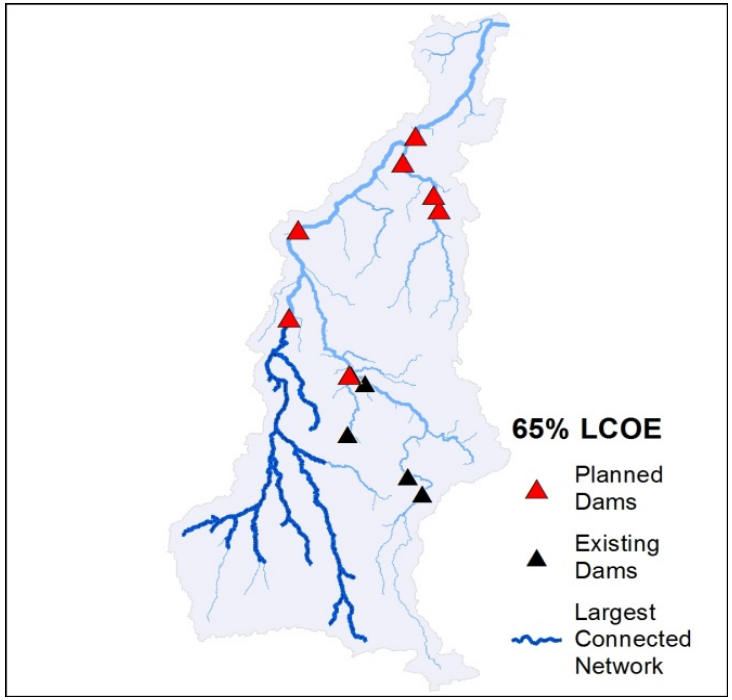


Hydropower and fragmentation, Tapajos River



Alternative scenarios for Tapajos





These two scenarios provide same level of energy development (65% of basin inventory), but Scenario 22(left) maintains nearly twice as much connected channel network with 5% greater overall cost.

Cost curves for hydropower projects on the Tapajos River

Figure B.1a. Scenario 27

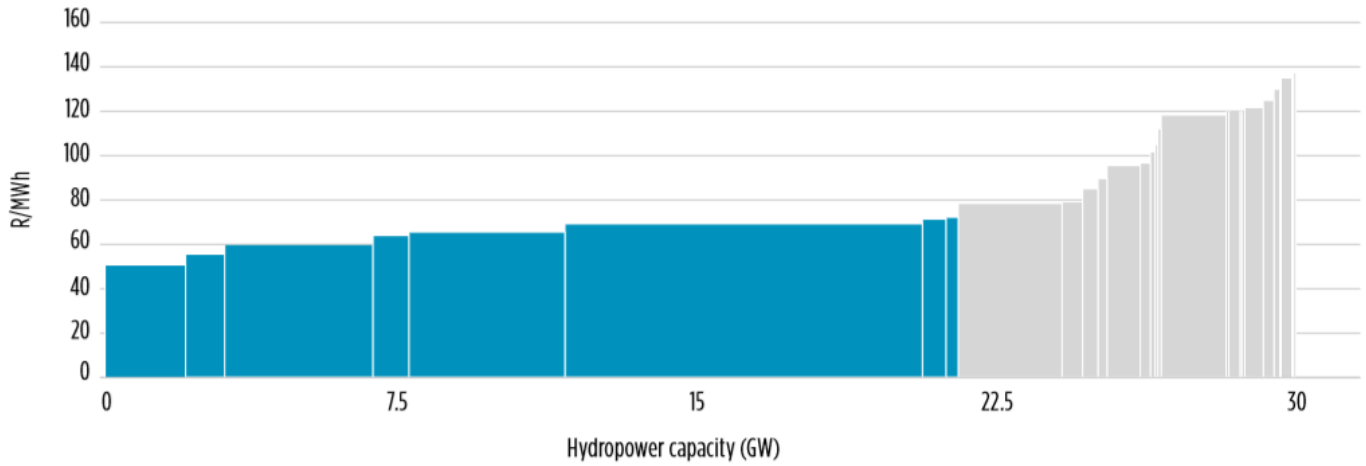
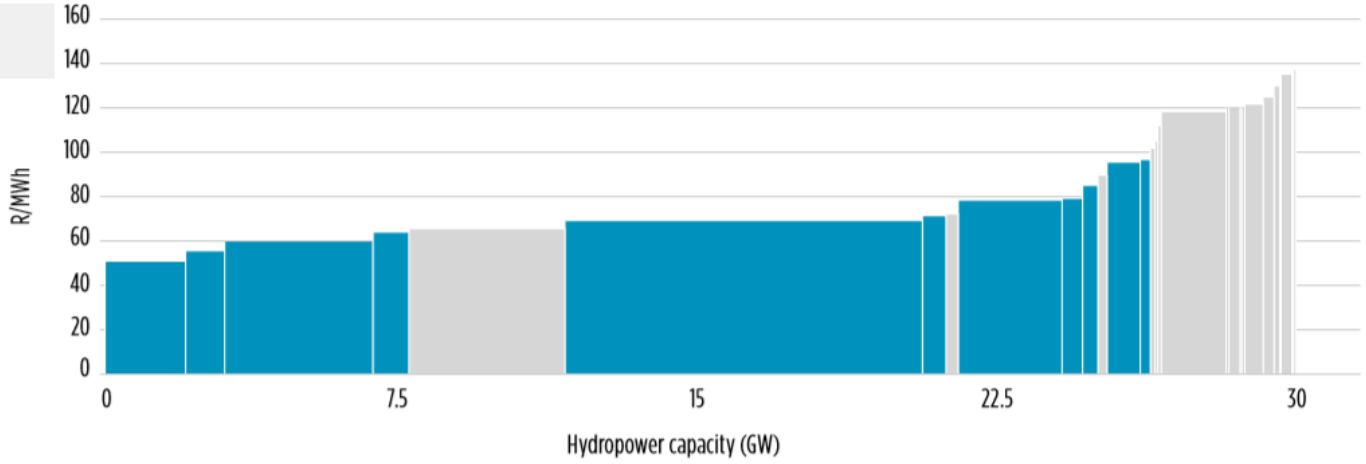


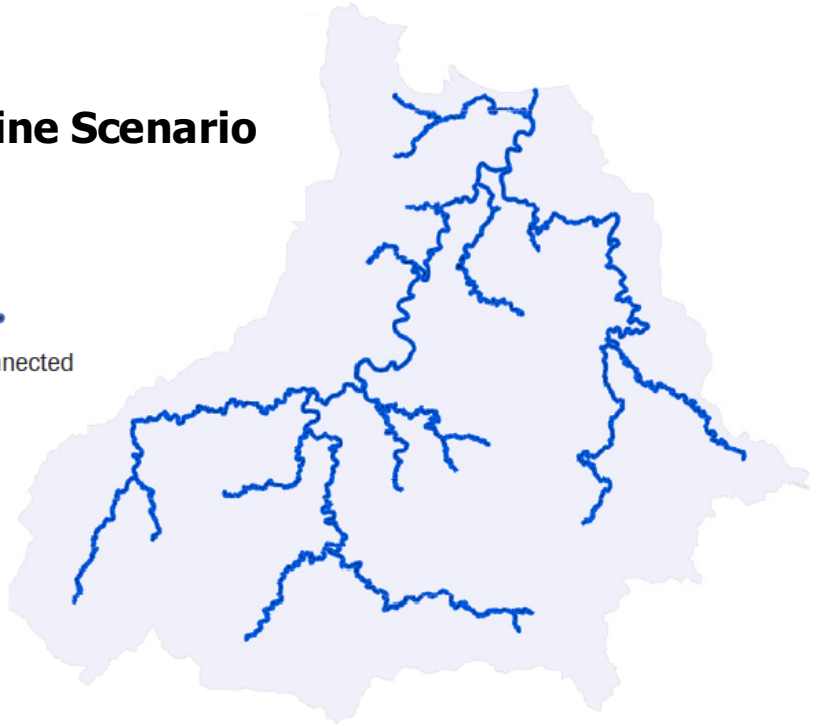
Figure B.1b. Scenario 22



Coatzacoalcos River, Mexico

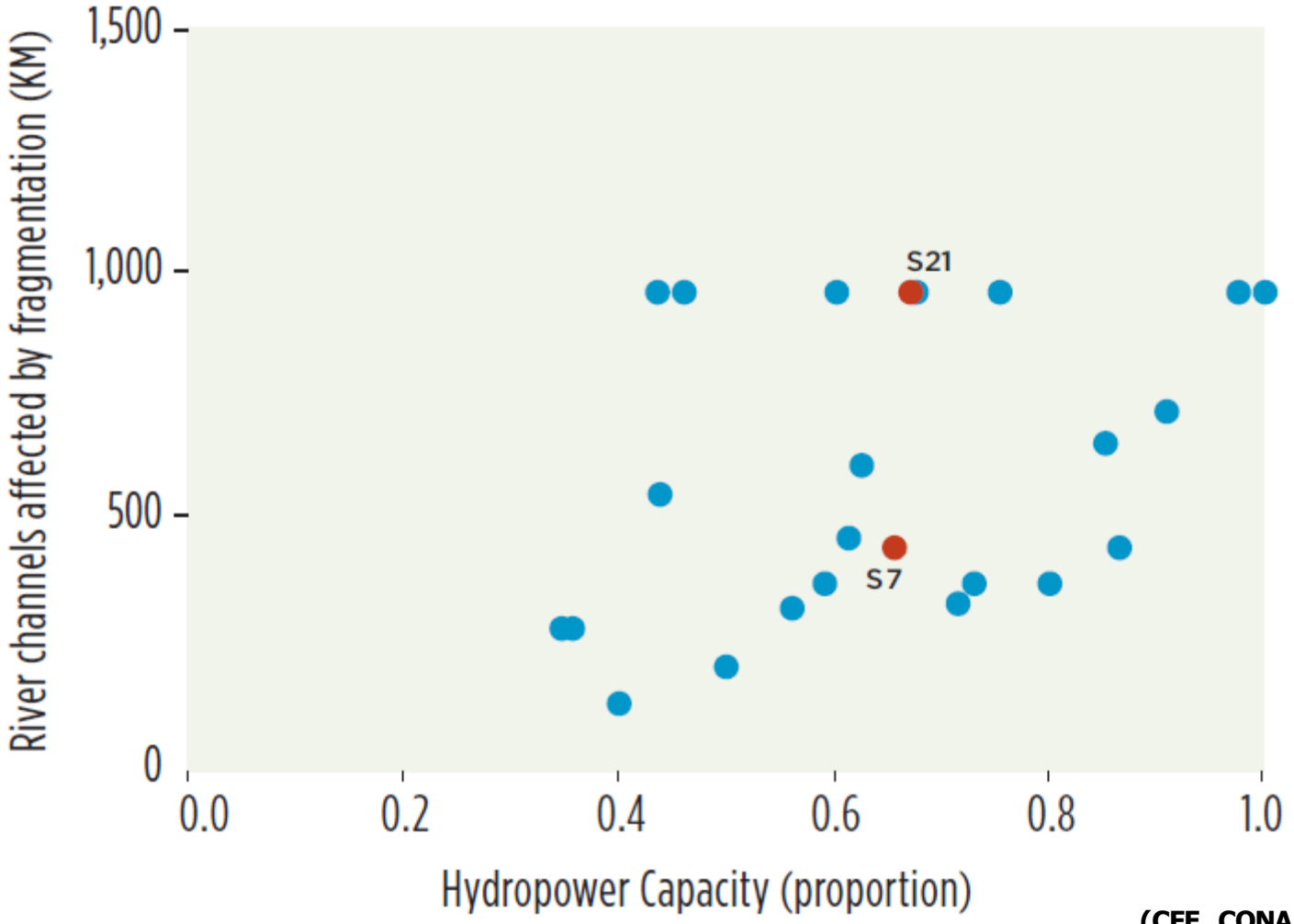
Baseline Scenario

Longest Connected Network



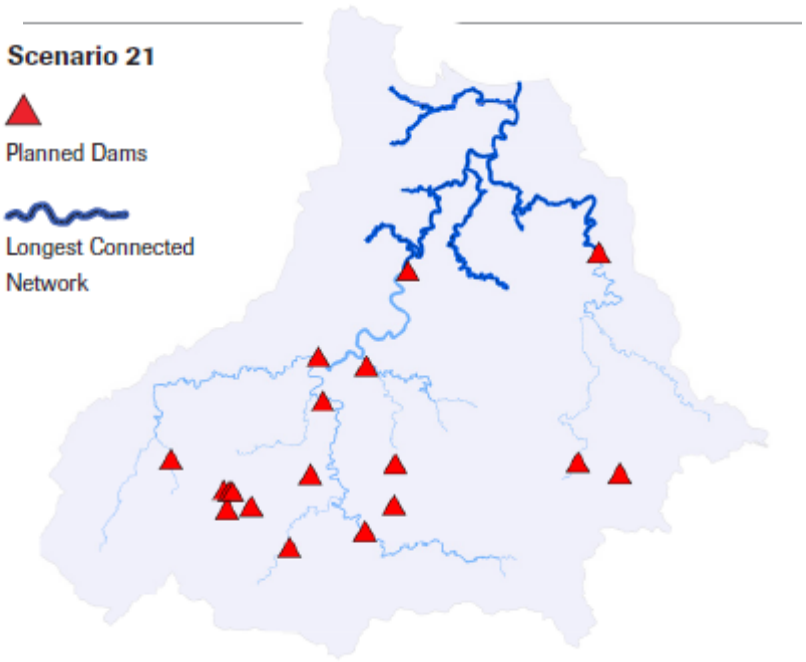
(CFE, CONABIO, TNC 2014)

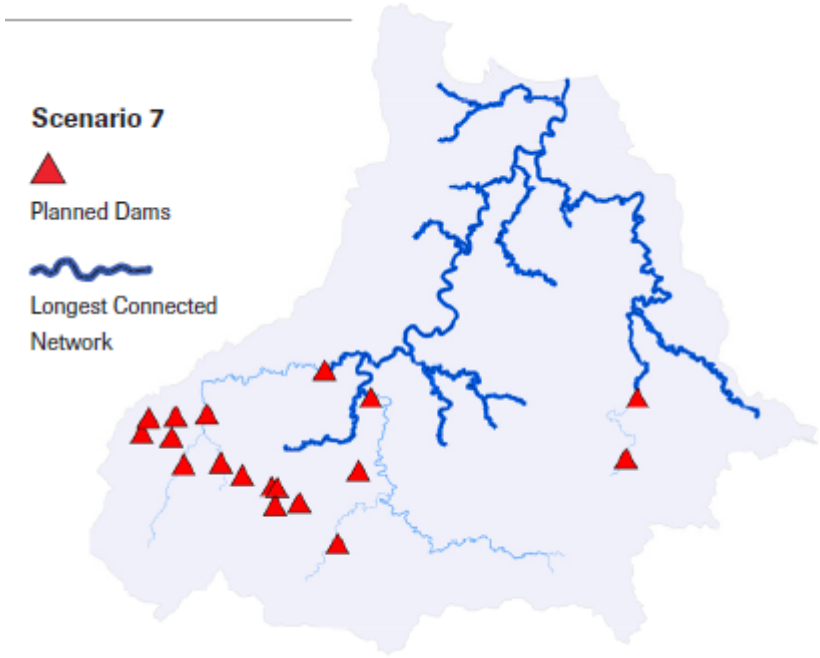
Hydropower and fragmentation, Coatzacoalcos River



(CFE, CONABIO, TNC 2014)

Alternative scenarios for Coatzacoalcos

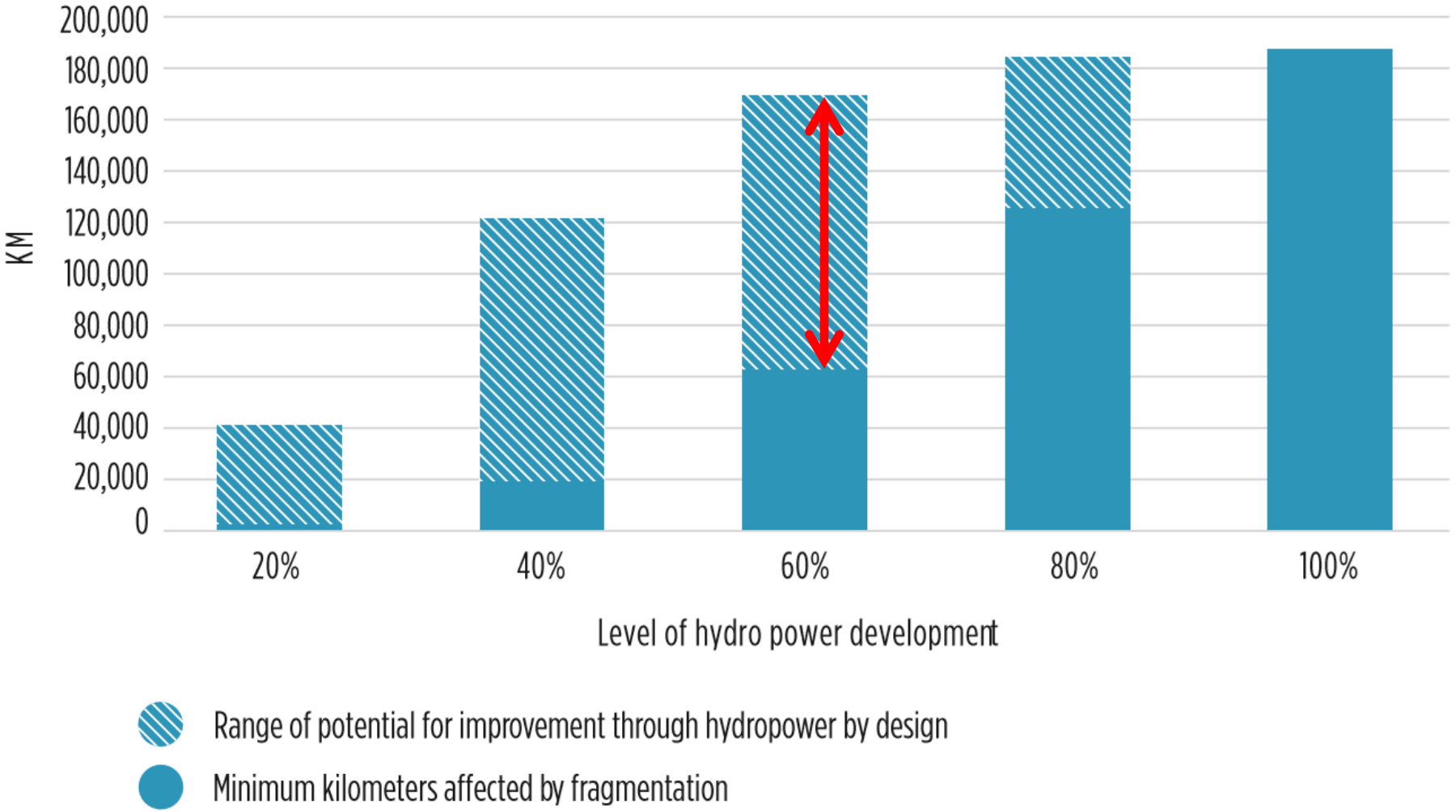




These two scenarios provide the same level of energy development (67% of basin inventory), but Scenario 7 (right) maintains nearly twice as much connected channel network

(CFE, CONABIO, TNC 2014)

At the global scale, application of Hydropower by Design could reduce the amount of river length lost to fragmentation by approximately 100,000 km compared to business-as-usual approaches under a wide range of development levels.



"The significant increase in hydropower capacity over the last 10 years is anticipated in many scenarios to continue in the near term (2020) and medium term (2030), *with various environmental and social concerns representing perhaps the largest challenges to continued deployment if not carefully managed*."

Kumar, A., et al. (2011). Hydropower. In IPCC Special Report on Renewable Energy Sources and Climate Change Mitigation (emphasis added)

Opportunities and challenges

- First estimate: best practices at project and system scale would add 5 - 20% in costs
- Business case: potential benefits in terms of risk management
- Economic case: broader benefits for countries

Opportunities and challenges – durable protection for rivers

- Designation as protected area
- Offset or compensation site
- Removed from planning, licensing systems