Free-flowing Rivers in the Amazon Region

Objectives

- Value of Free-flowing rivers
- Global Methods & Assessment
- Amazon Methods & Assessment
- Examples for Discussion

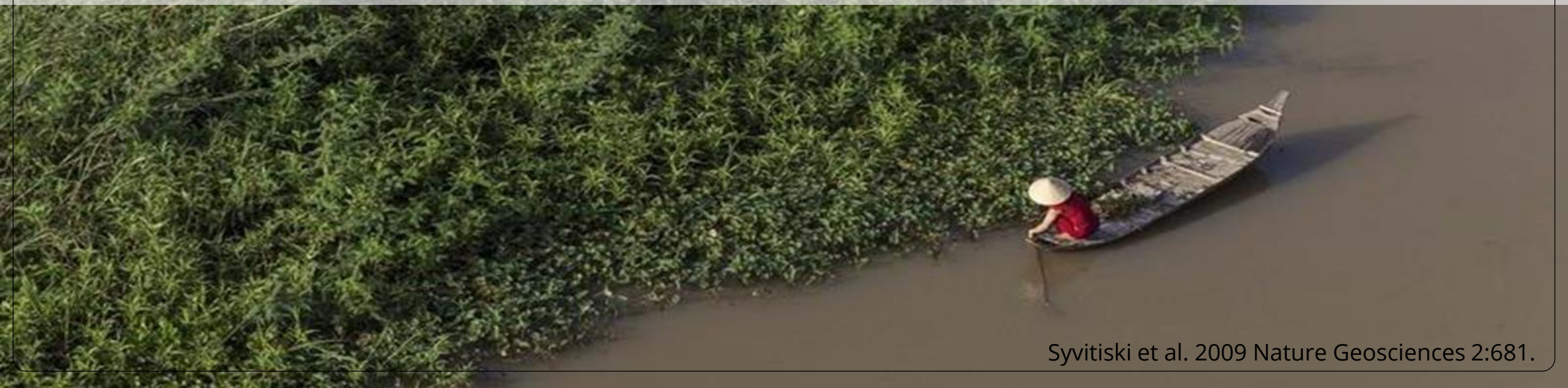
Fisheries

Globally 11.5 million tons catch/year from inland fisheries, worth > $43 billion USD

Funge-Smith, S.J. 2018. Review of the state of world fishery resources: inland fisheries. FAO.

Nutrient Cycling and Sediment Delivery

Among affected major river deltas, sediment capture by upstream dams ranges from 50-98%



Syvitiski et al. 2009 Nature Geosciences 2:681.

Biodiversity

84% decline in freshwater species populations on average since 1970

WWF and ZSL. 2020. A deep dive into freshwater. Living Planet Report 2020.

VALUES OF FREE FLOWING RIVERS

CULTURAL VALUES

In places around the world, free-flowing rivers hold cultural and spiritual importance.

RECREATION

Pristine scenery and natural flows often offer recreational and business opportunities, including rafting, fly-fishing and wildlife watching.

HEALTHY FLOODPLAINS

Free-flowing rivers support healthy floodplains, which help reduce risks from floods and droughts.

BIODIVERSITY

Free-flowing rivers are among the most ecologically important freshwater habitats, places where vulnerable species can thrive and adapt to climate change.

SEDIMENT TRANSFER

Free-flowing rivers balance nutrients in soil and carry sediment downstream, including to deltas challenged by rising sea levels.

FISH STOCKS

Tens of millions of people depend on freshwater fish populations, many of which require certain natural conditions - such as seasonal flows and temperature changes - in order to breed and thrive.

FLOODPLAIN AGRICULTURE

An important livelihood and food source in parts of the world, this kind of farming requires a naturally flowing river to seasonally bring nutrients, sediment, and water.

McGill

Stanford University

THE UNIVERSITY of WISCONSIN MADISON

The Nature Conservancy

EBERHARD KARLS
UNIVERSITÄT
TÜBINGEN

What is a Free-flowing River?

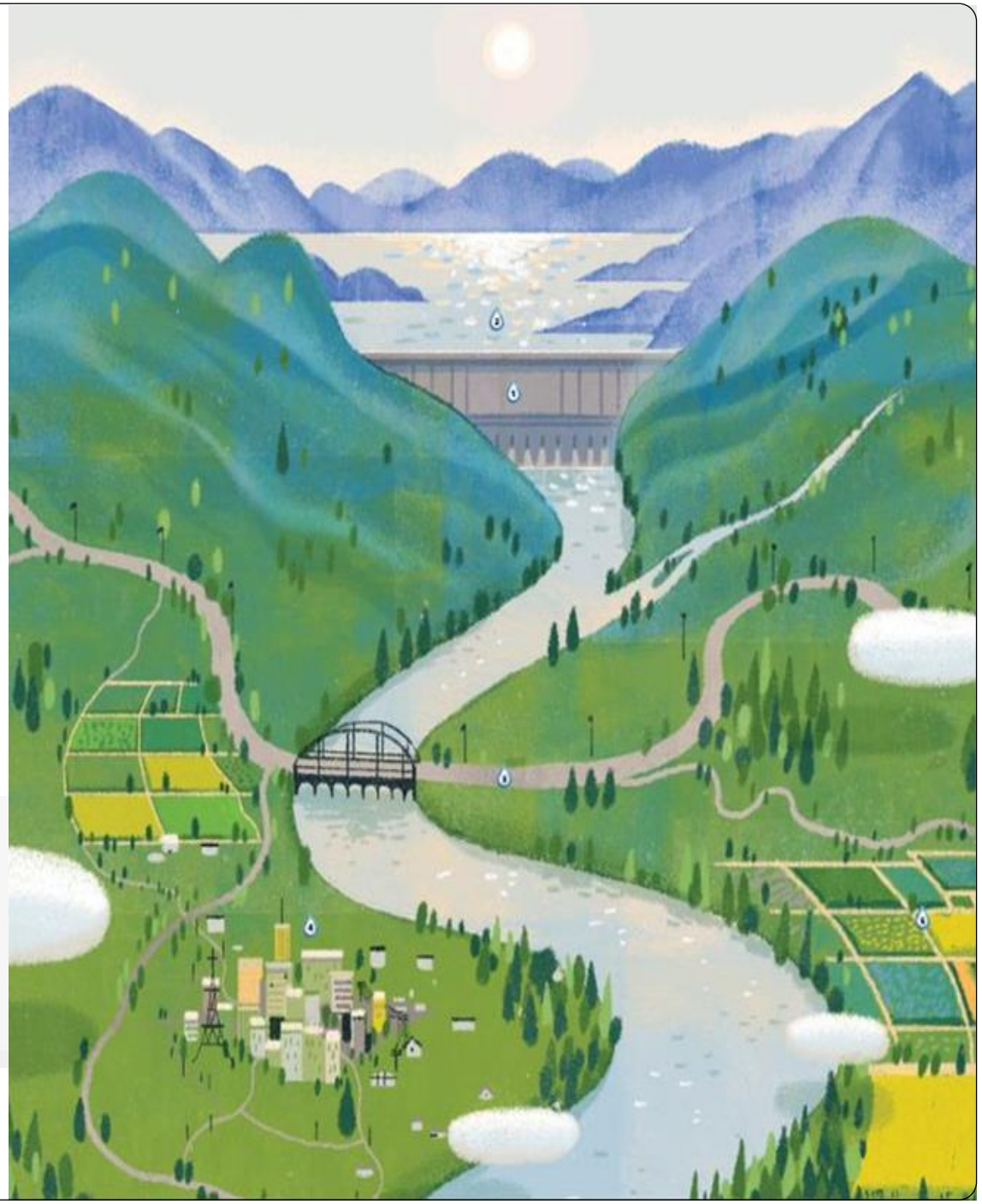
A ***free-flowing river*** occurs where natural aquatic ecosystem functions and services are largely unaffected by anthropogenic changes **to fluvial connectivity** allowing an unobstructed exchange of material, species and energy within the river system and beyond.

Longitudinally,

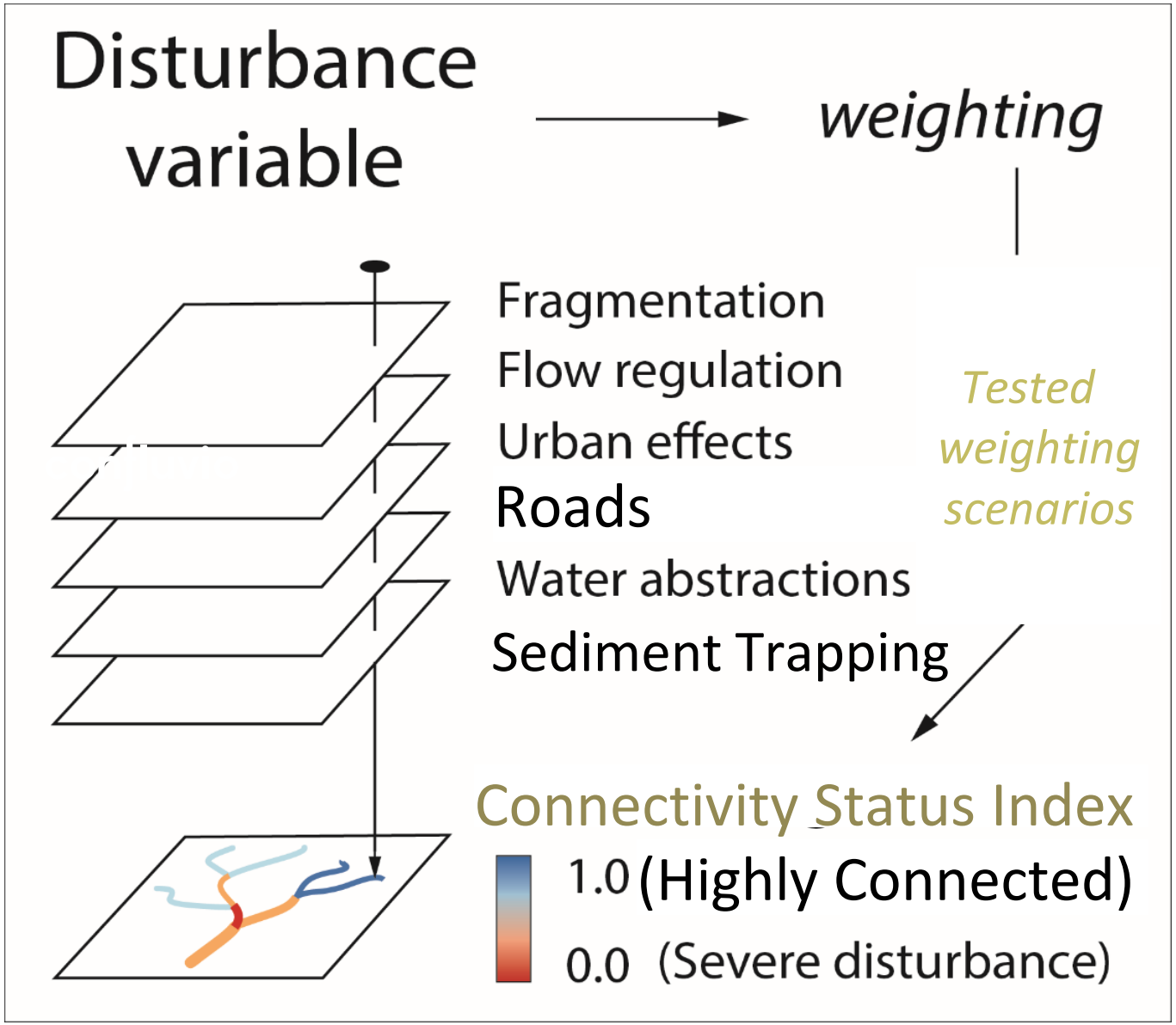
Laterally,

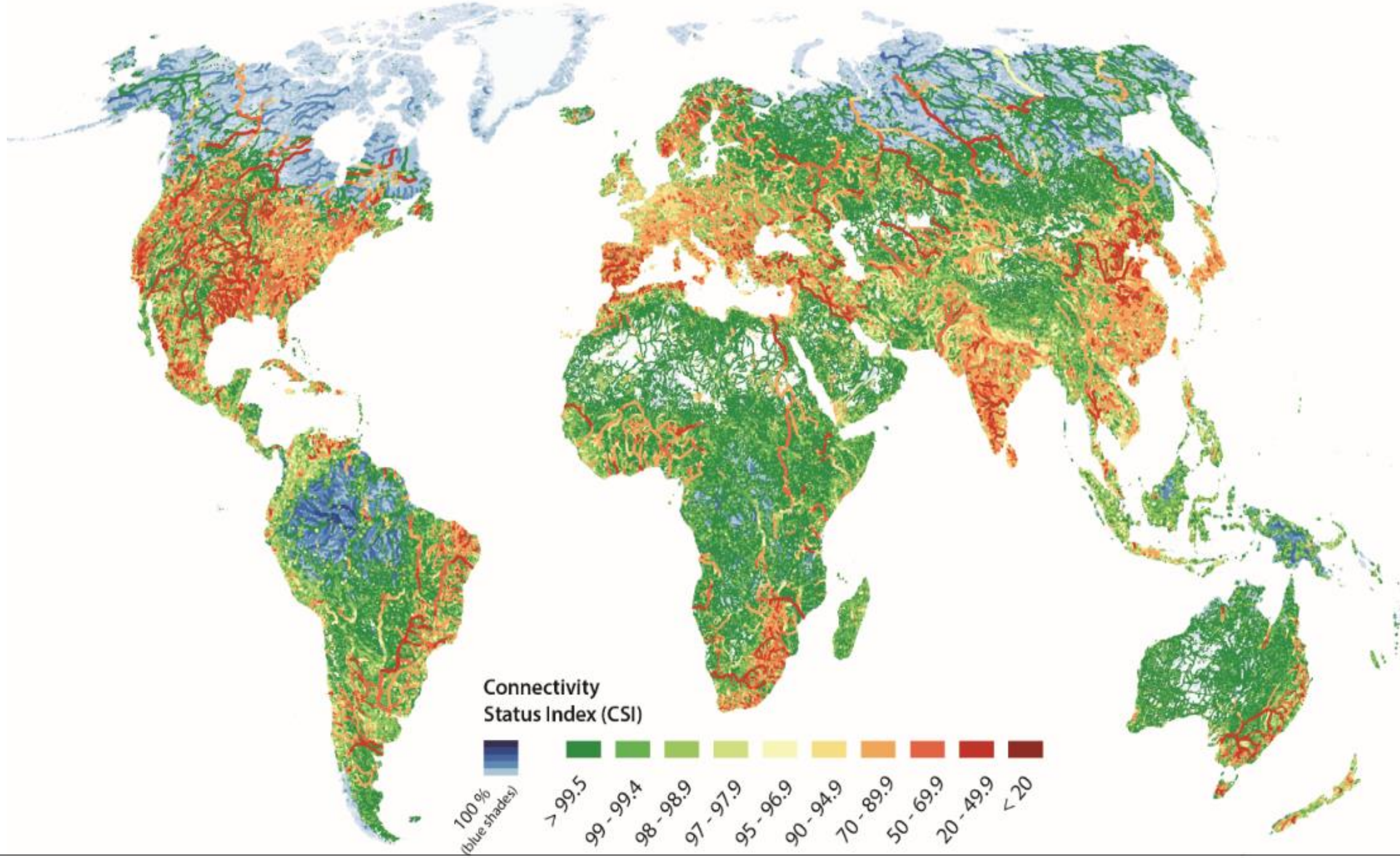
Temporally,

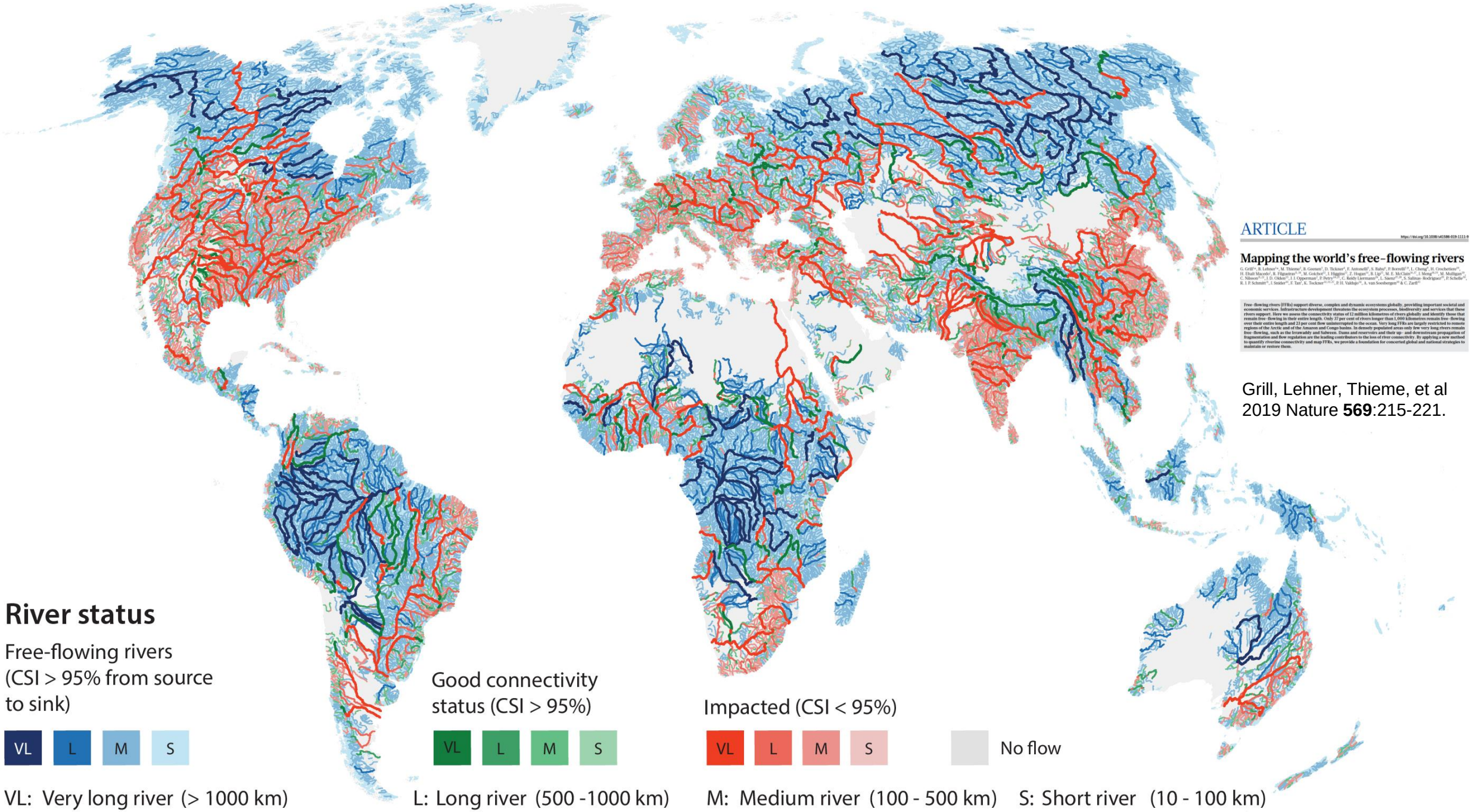
Vertically,



Methods


Disturbance variable
weighting
Fragmentation
Flow regulation
Urban effects
Roads
Water abstractions
Sediment Trapping
Tested weighting scenarios
Connectivity Status Index
1.0 (Highly Connected)
0.0 (Severe disturbance)


Connectivity
Status Index (CSI)
100 %
(blue shades)
> 99.5
99 - 99.4
98 - 98.9
97 - 97.9
95 - 96.9
90 - 94.9
70 - 89.9
50 - 69.9
20 - 49.9
< 20



ARTICLE

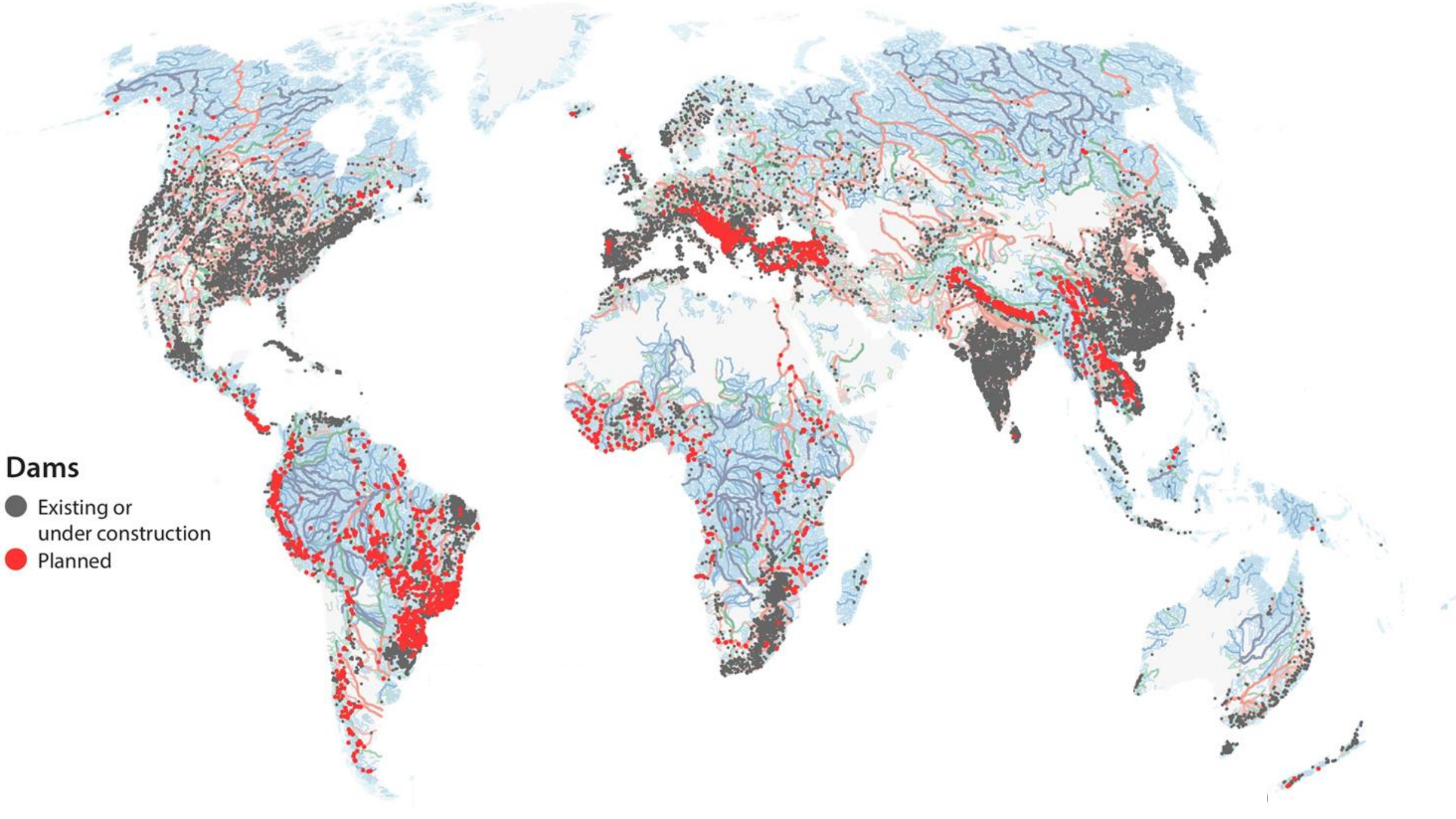
https://doi.org/10.1038/s41586-019-1111-9

Mapping the world's free-flowing rivers

G. Grill[1*], B. Lehner[1*], M. Thieme[2], B. Geenen[3], D. Tickner[4], F. Antonelli[5], S. Babu[6], P. Borrelli[7,8], L. Cheng[9], H. Crochetiere[10], H. Ehalt Macedo[1], R. Filgueiras[11,12], M. Goichot[13], J. Higgins[14], Z. Hogan[15], B. Lip[1], M. E. McClain[16,17], J. Meng[18,19], M. Mulligan[20], C. Nilsson[21,22], J. D. Olden[23], J. J. Opperman[24], P. Petry[25,26], C. Reidy Liermann[27], L. Sáenz[28,29], S. Salinas-Rodríguez[30], P. Schelle[31], R. J. P. Schmitt[32], J. Snider[33], F. Tan[1], K. Tockner[22,34,35], P. H. Valbo-Jørgensen[36], A. van Soesbergen[37] & C. Zarfl[22]

Free-flowing rivers (FFRs) support diverse, complex and dynamic ecosystems globally, providing important societal and economic services. Infrastructure development threatens the ecosystem processes, biodiversity and services that these rivers support. Here we assess the connectivity status of 12 million kilometres of rivers globally and identify those that remain free-flowing in their entire length. Only 37 per cent of rivers longer than 1,000 kilometres remain free-flowing over their entire length and 23 per cent flow uninterrupted to the ocean. Very long FFRs are largely restricted to remote regions of the Arctic and of the Amazon and Congo basins. In densely populated areas only few very long rivers remain free-flowing, such as the Irrawaddy and Salween. Dams and reservoirs and their up- and downstream propagation of fragmentation and flow regulation are the leading contributors to the loss of river connectivity. By applying a new method to quantify riverine connectivity and map FFRs, we provide a foundation for concerted global and national strategies to maintain or restore them.

Grill, Lehner, Thieme, et al 2019 Nature **569**:215-221.


Dams
Existing or
under construction
Planned

The Great Challenge

Future electricity systems must be : LowCx3

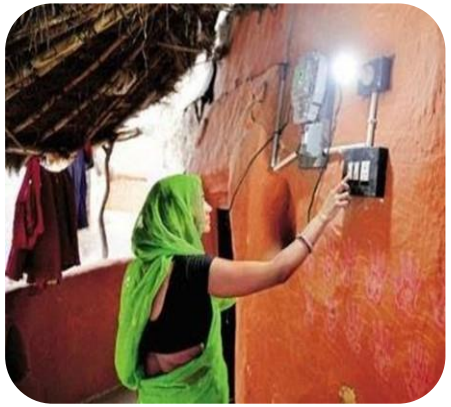
Low Carbon

Renewable and low carbon to maintain a stable climate

Low Cost

Affordable and reliable to power economies

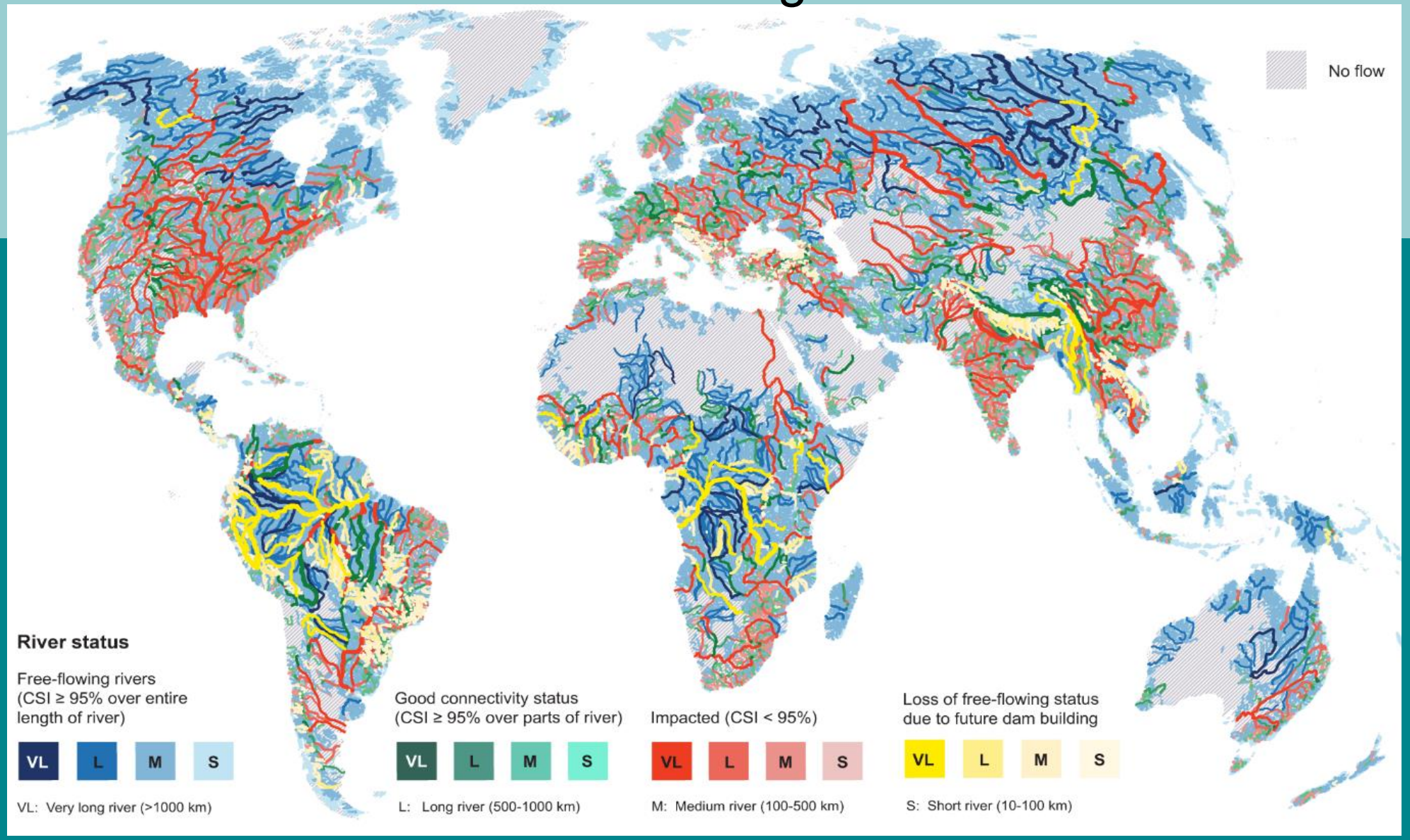
Accessible to the billion people currently lacking access to electricity



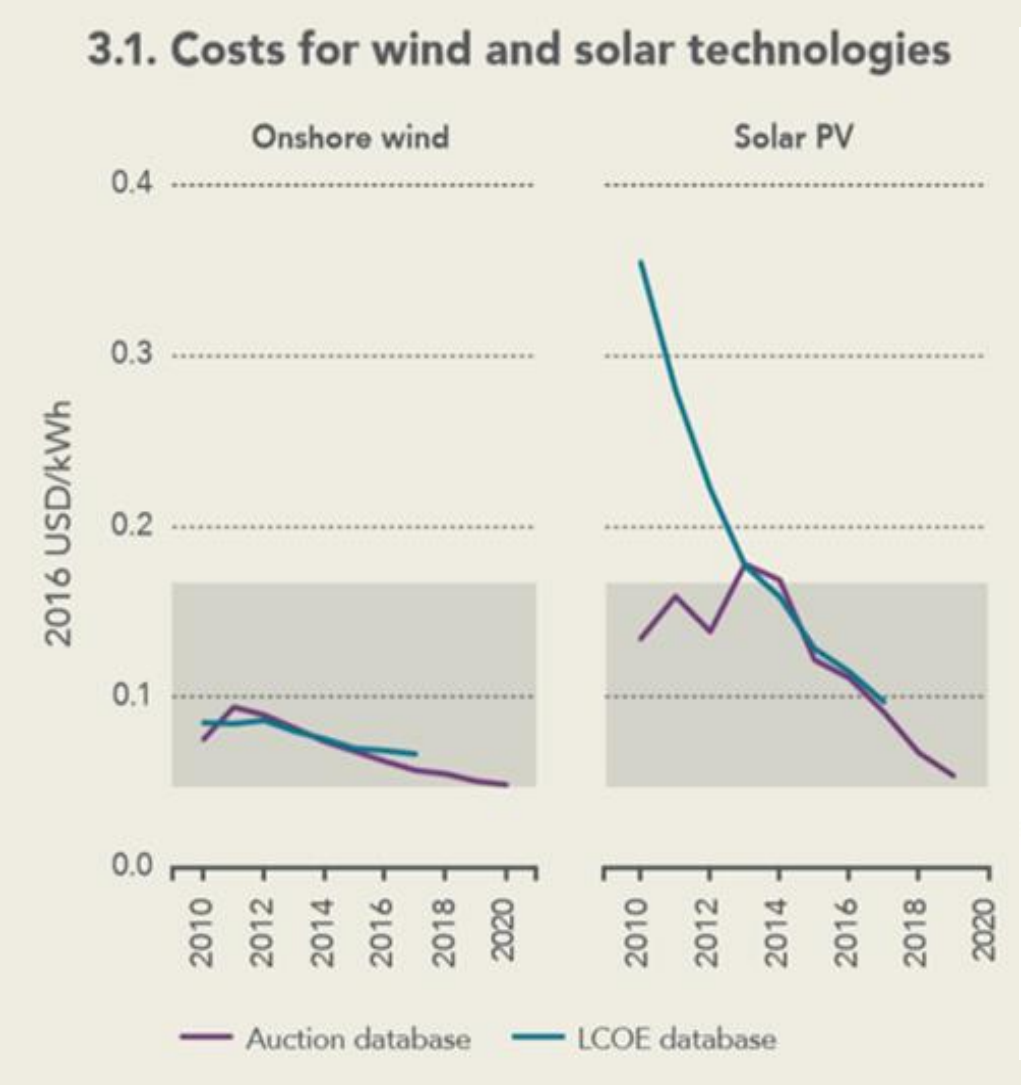
Low Conflict

Consistent with healthy rivers and lands and protective of the **communities** that depend on them

Less than ~ 2% of generation/year needed for 1.5° C is from dams planned on free-flowing rivers.



Rapidly Dropping Costs of Wind & Solar




Amazon Free-flowing Rivers

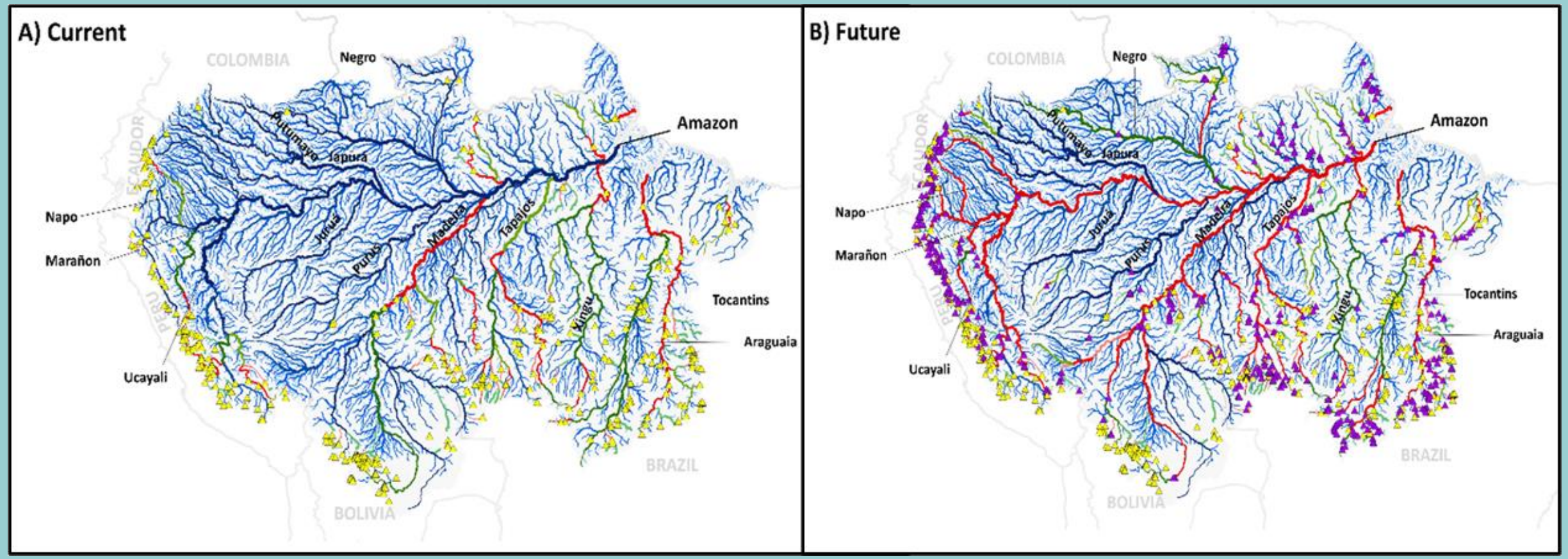
Amazon Basin Importance

- Most biodiverse globally for Freshwater species
- 60 thousand different species
- 15% of the world biodiversity
- Largest discharge
  - 20% of global surface water
- Cultural Diversity
  - Covers 9 countries
  - More than 200 languages and 200 different indigenous peoples
- Industrial cities alongside indigenous peoples

fundación
omacha

Methods

- Collaborative research with 9 organizations
- Updated Dams database: 487 built or under construction; 499 proposed
- Calibrated model parameters using information on known FFR in the Amazon
- Compiled species distribution ranges for subset of migratory fish and river turtles (>500 km) and river dolphins

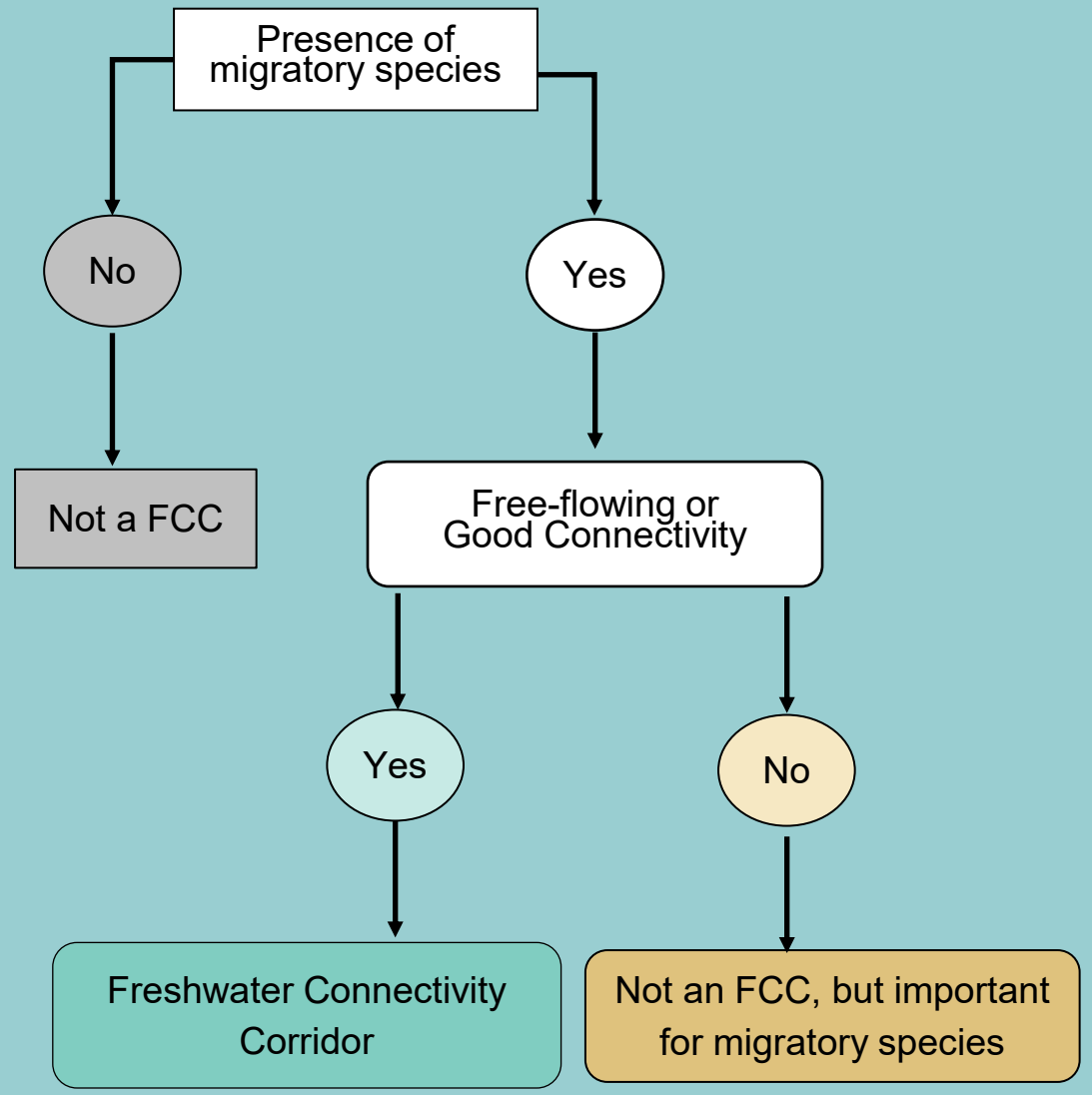


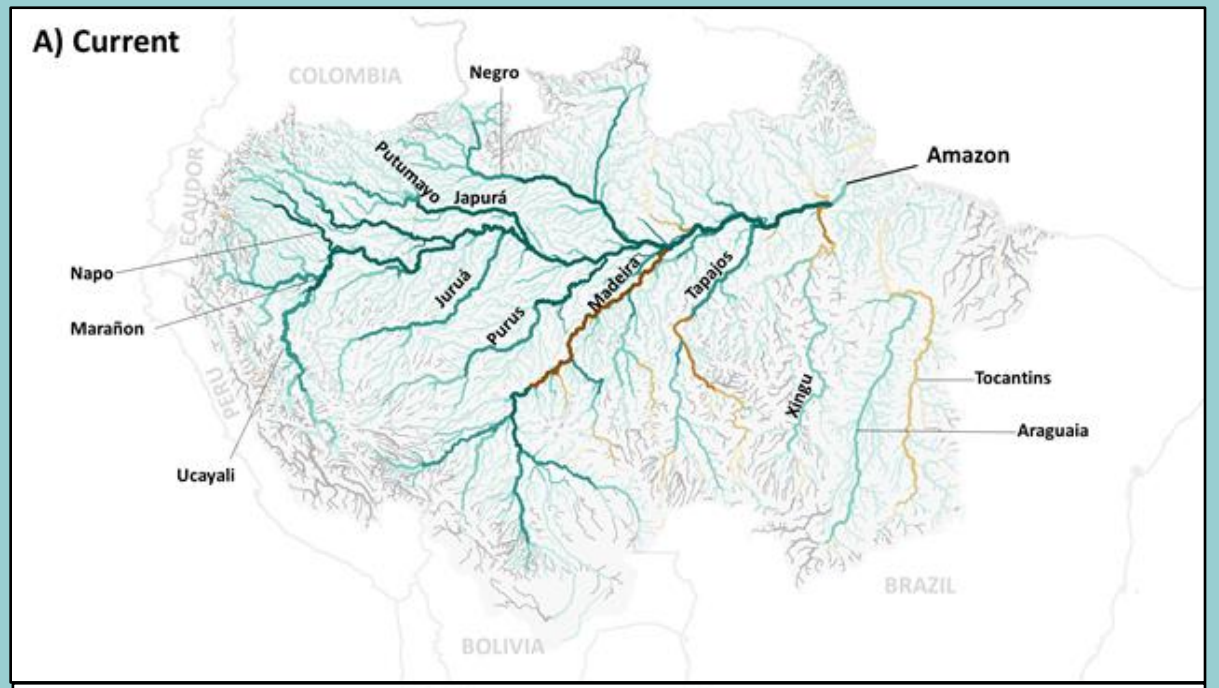
River Status

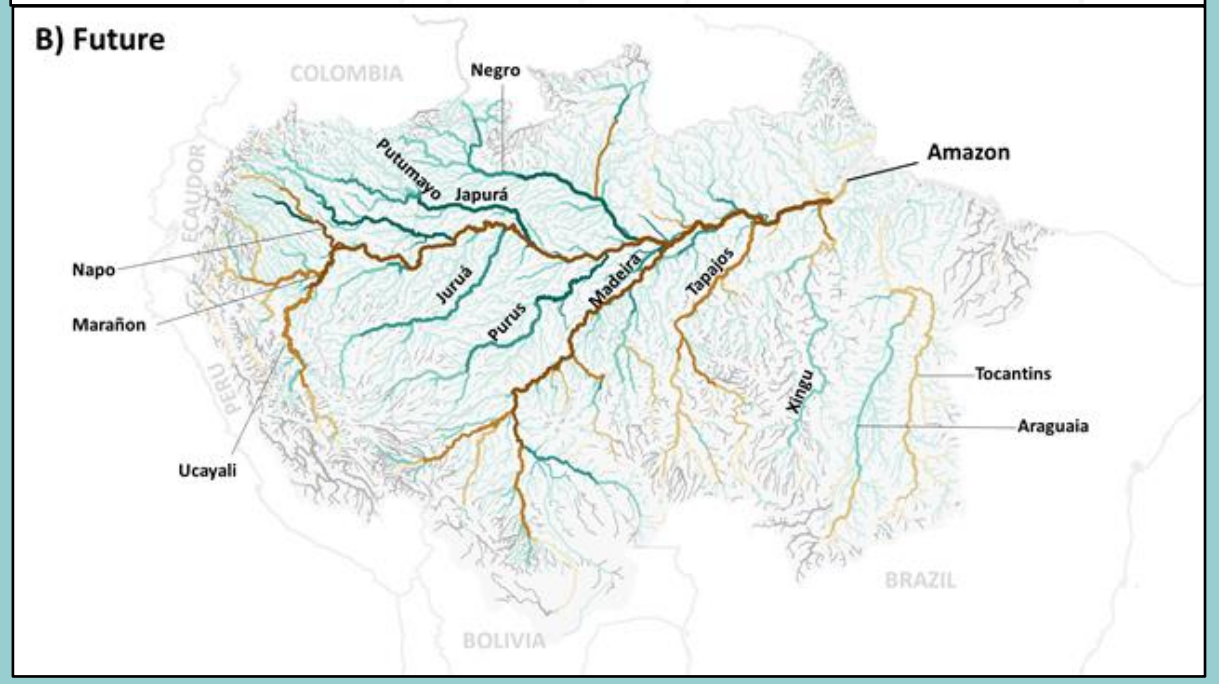
	Very long	Long	Medium	Short
Free-flowing				
Good connectivity				
Impacted				

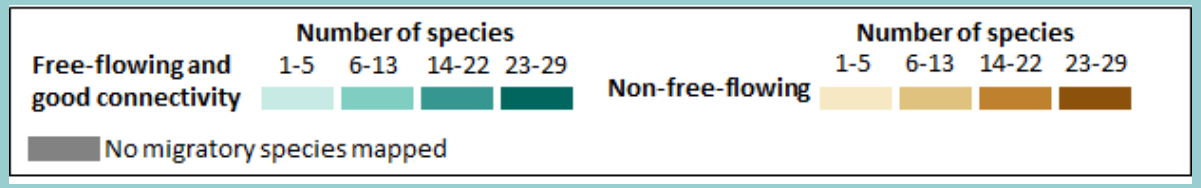
Very Long: >1000 km| Long: 500-1000 km| Medium: 100-500 km| Short: 10-100 km

Existing Dams Planned Dams


Presence of migratory species
No
Yes
Not a FCC
Free-flowing or Good Connectivity
Yes
No
Freshwater Connectivity Corridor
Not an FCC, but important for migratory species

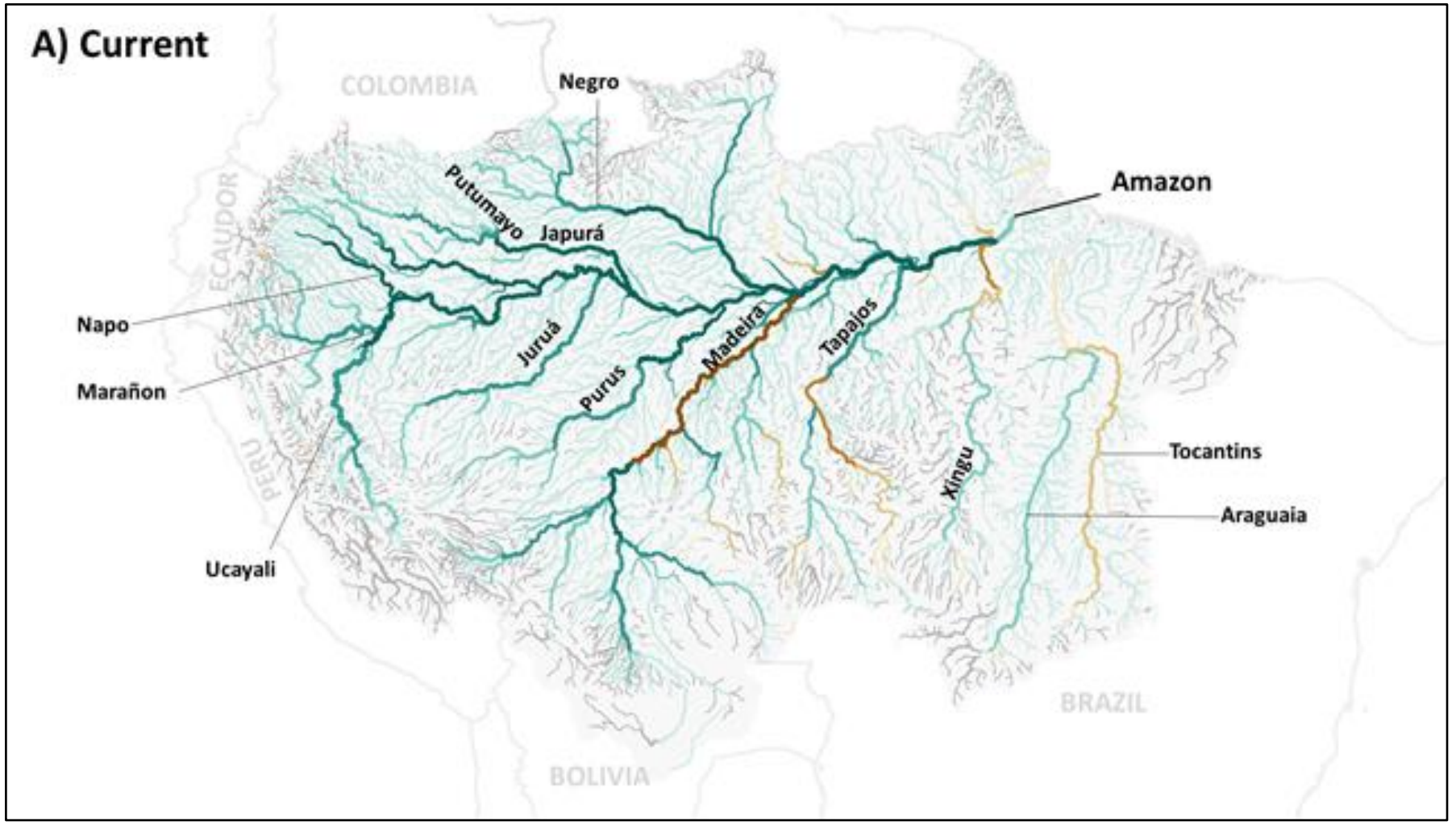

A) Current
COLOMBIA
ECUADOR
PERU
BRAZIL
BOLIVIA
Negro
Putumayo
Japurá
Amazon
Napo
Marañon
Juruá
Purus
Madeira
Tapajos
Xingu
Tocantins
Araguaia
Ucayali

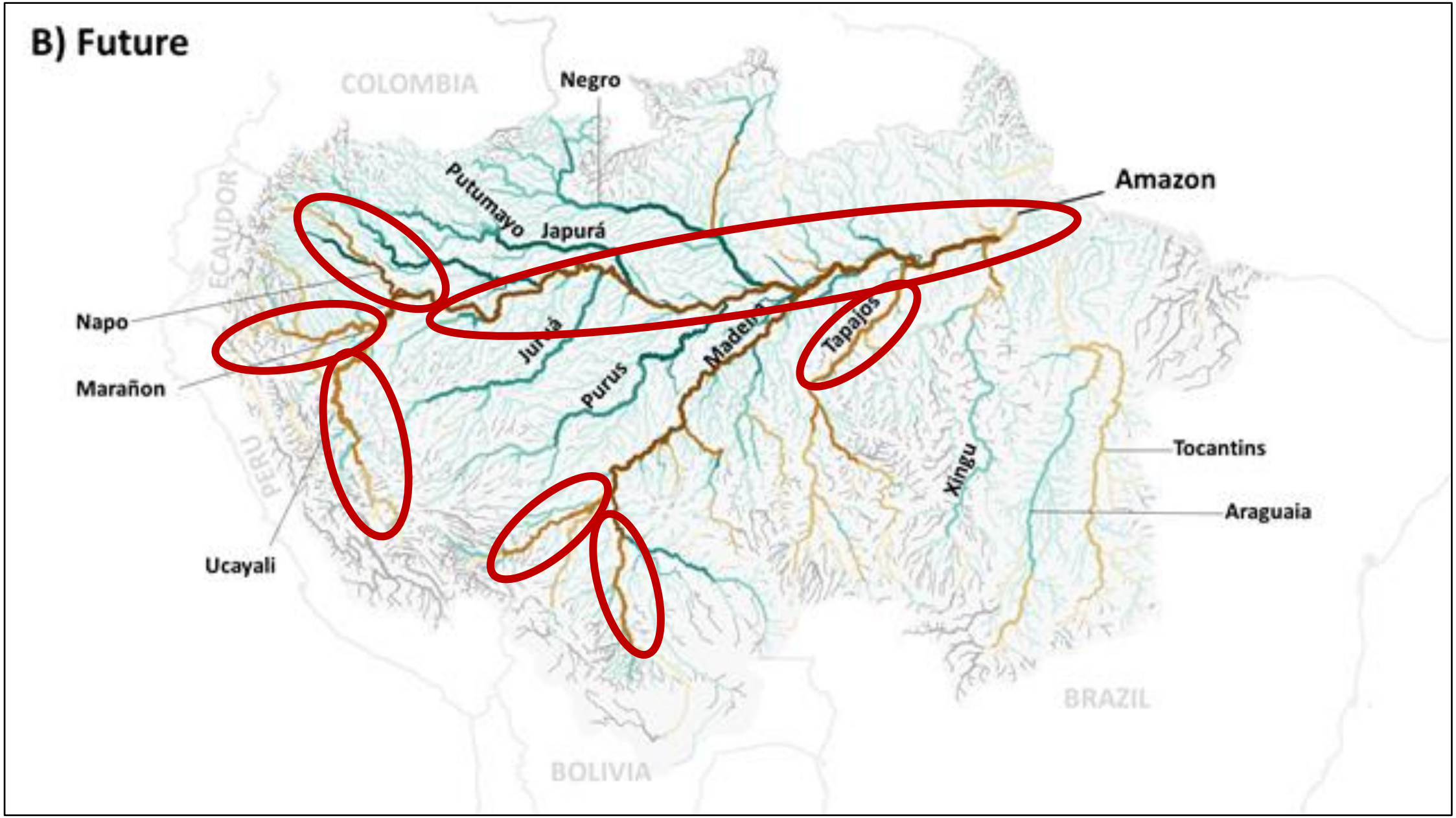

B) Future
COLOMBIA
ECUADOR
PERU
BRAZIL
BOLIVIA
Negro
Putumayo
Japurá
Amazon
Napo
Marañon
Juruá
Purus
Madeira
Tapajos
Xingu
Tocantins
Araguaia
Ucayali


Number of species
Free-flowing and good connectivity
1-5
6-13
14-22
23-29
Number of species
Non-free-flowing
1-5
6-13
14-22
23-29
No migratory species mapped

Most Species-Rich Connectivity Corridors

River	Current Connectivity Status
Amazon*	Free-flowing
Negro*	Free-flowing
Marañon*	Free-flowing
Japurá	Free-flowing
Nanay	Free-flowing
Napo*	Free-flowing
Putumayo	Free-flowing
Purus	Free-flowing
Preto do Igapó Açu*	Free-flowing
Ucayali*	Free-flowing
Juruá	Free-flowing




B) Future
COLOMBIA
ECAUDOR
PERU
BOLIVIA
BRAZIL
Negro
Putumayo
Japurá
Amazon
Napo
Marañon
Ucayali
Purus
Tapajos
Xingu
Tocantins
Araguaia

CRÓNICA DE UNA EXTINCIÓN ANUNCIADA EN BOLIVIA

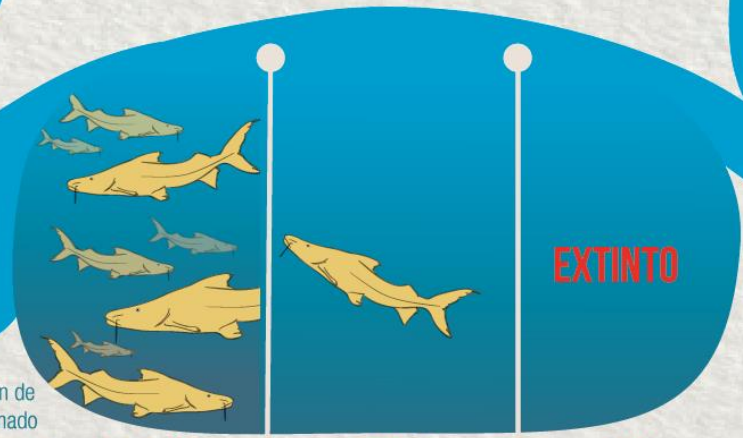
El DORADO o plateado *(gilded catfish; Brachyplatystoma rousseauxii)* **migra** aproximadamente **4000 km a lo largo de su ciclo de vida**, utilizando toda la cuenca amazónica. Nace en las cabeceras de los ríos amazónicos en Bolivia, Colombia, Ecuador y Perú. Las larvas derivan hasta la desembocadura del río Amazonas, donde se alimentan y crecen durante dos años. Una vez que llegan a tener aproximadamente cinco kg, inician la migración río arriba para retornar a la cabecera donde nacieron, para reproducirse y de esta manera completar su ciclo.

1 REPRESAS HIDROELÉCTRICAS en el río Madera, construídas entre 2009 y 2014, BLOQUEAN el paso de los adultos y de las larvas del dorado.

2 EL DORADO en la cuenca del río Madera ya no puede llegar a su zona de reproducción, que se encuentra en las cabeceras de los ríos amazónicos bolivianos y peruanos.

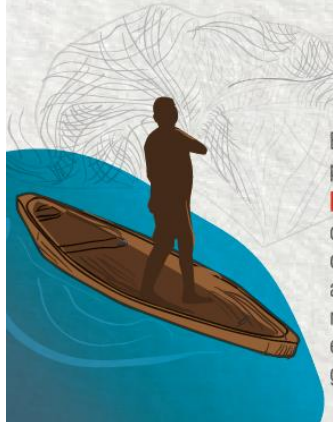
3

4



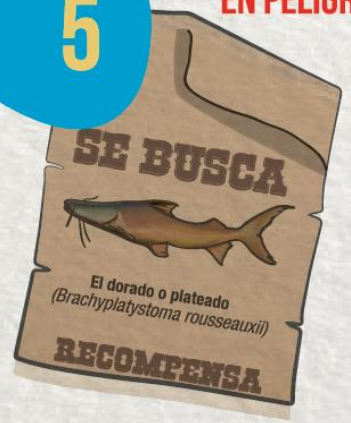
100% 2008 • 10% 2018 • 0% 2024

En 2018, la población de dorado se había diezmado al **10%**, y se estima que la especie se extinguirá en la Amazonia boliviana en el año 2024.



Entre 1998 y 2018 pescadores y científicos **MONITOREARON** conjuntamente las capturas del dorado en las cabeceras amazónicas de Bolivia. Estos registros demostraron que la especie está desapareciendo gradualmente.

5 EN PELIGRO CRÍTICO

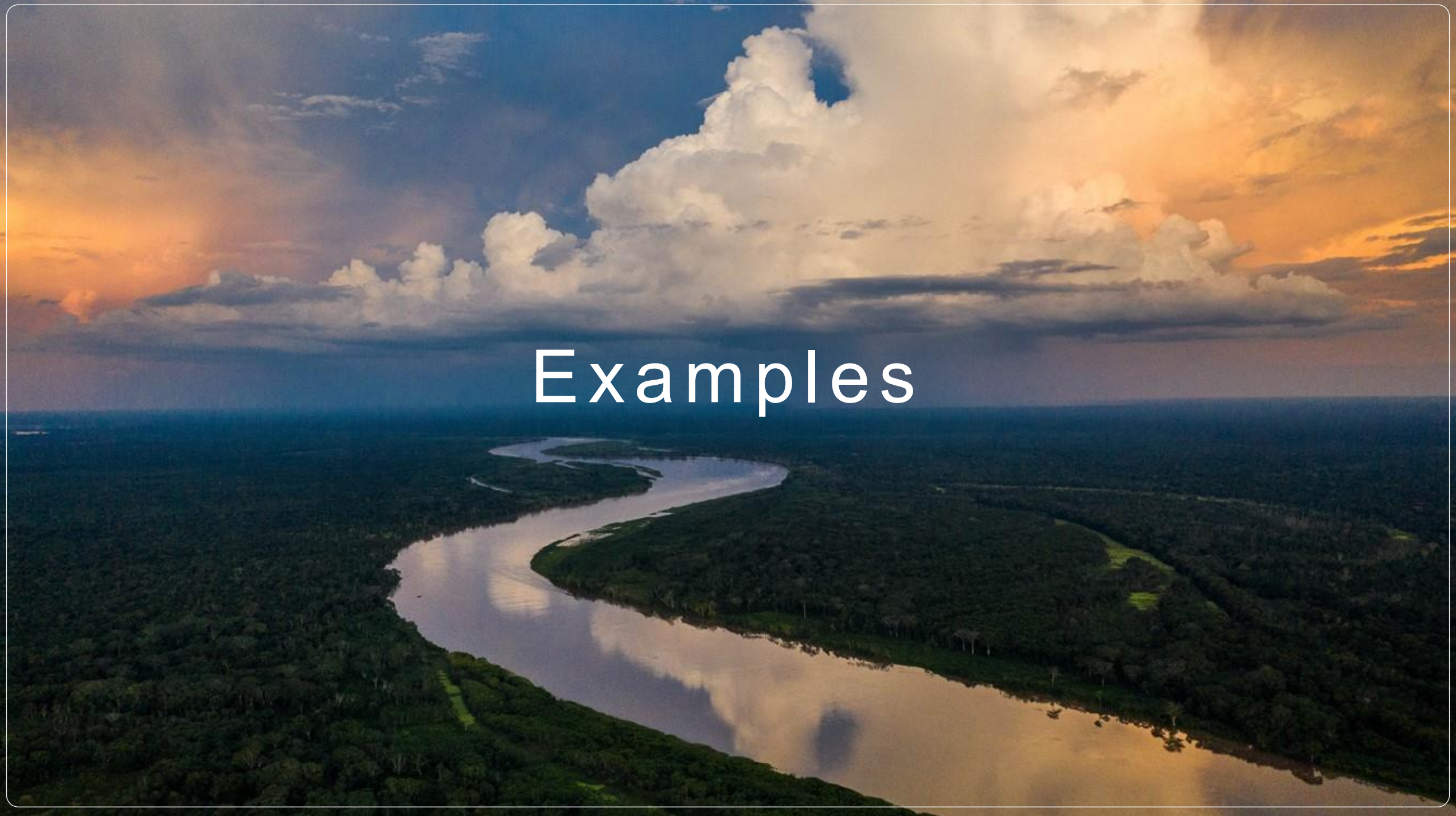


Se ha propuesto el cambio de categoría de conservación (UICN) del dorado a **EN PELIGRO CRÍTICO.**

6 QUÉ HACER PARA CONSERVAR EL DORADO Y LAS OTRAS ESPECIES MIGRATORIAS ?

- Mantener al máximo la conectividad de los ríos amazónicos y promover la creación de corredores de ríos libres de barreras.
- Mantener las funciones ecosistémicas acuáticas.
- Investigar el estado de conservación de todas las especies migratorias.
- Visibilizar y valorizar la contribución del pescador artesanal a la seguridad alimentaria.
- Elaborar legislación pesquera específica para bagres migratorios, armonizada entre los países amazónicos.
- Proteger las confluencias de ríos y cabeceras de las cuencas (zonas de desove).
- Prevenir, mitigar y compensar los impactos sociales y ambientales causados por grandes obras que se constituyen en barreras en los ríos.
- Promover y gestionar manejo pesquero transfronterizo participativo en la macrocuenca amazónica.

FAUNAGUA WWF

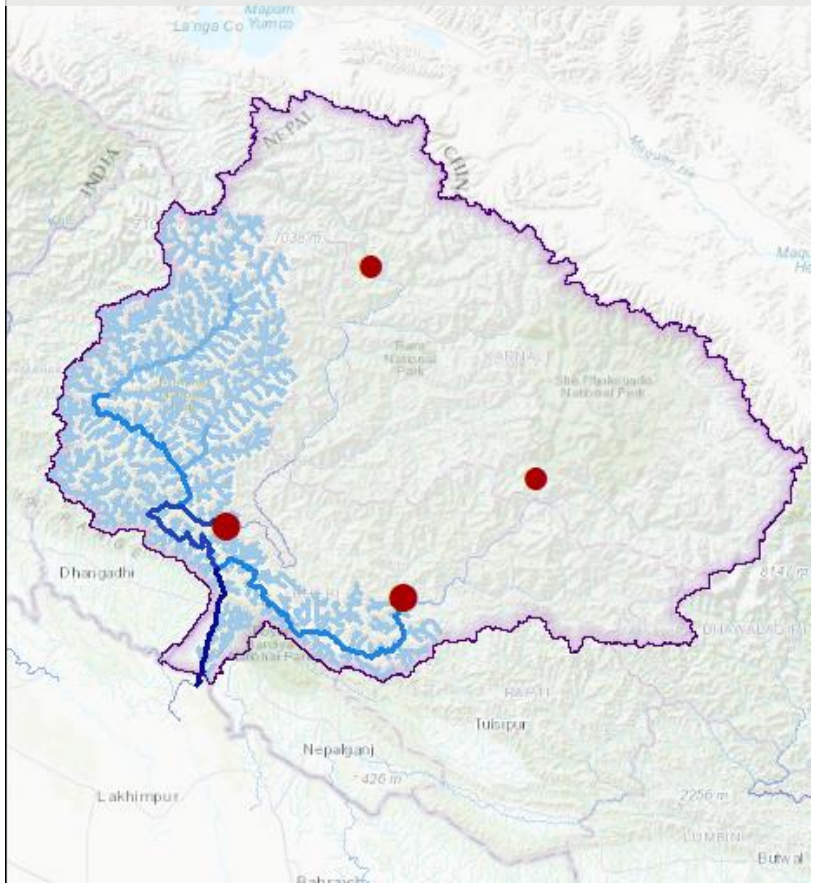

Examples

Basin Scale Planning

Low Connectivity

2, 294 MW

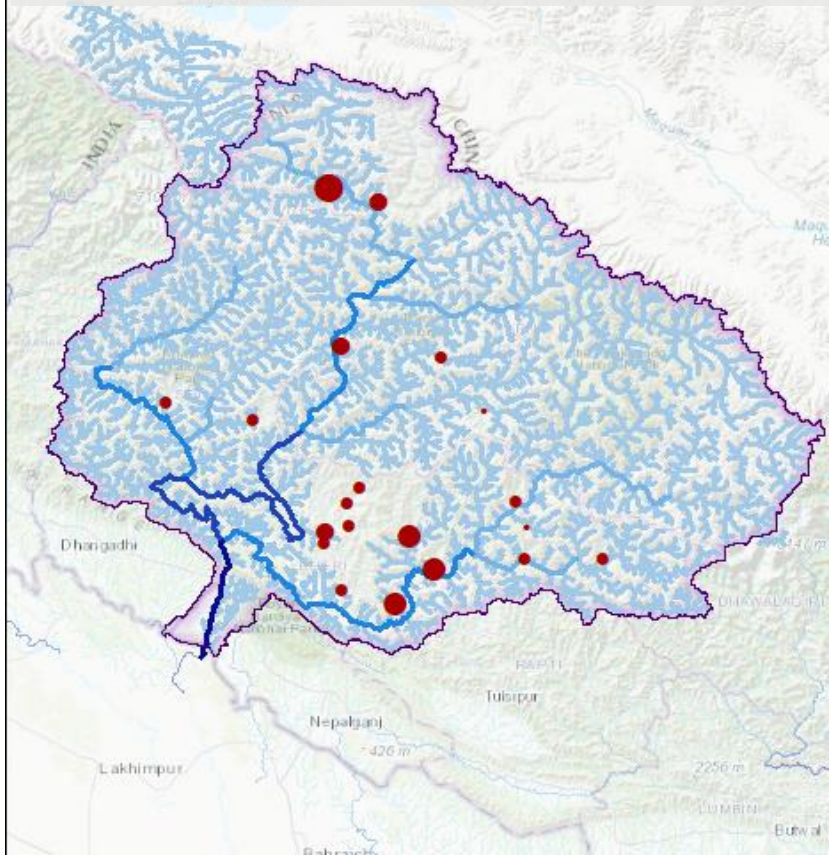
790km (large rivers)



High Connectivity

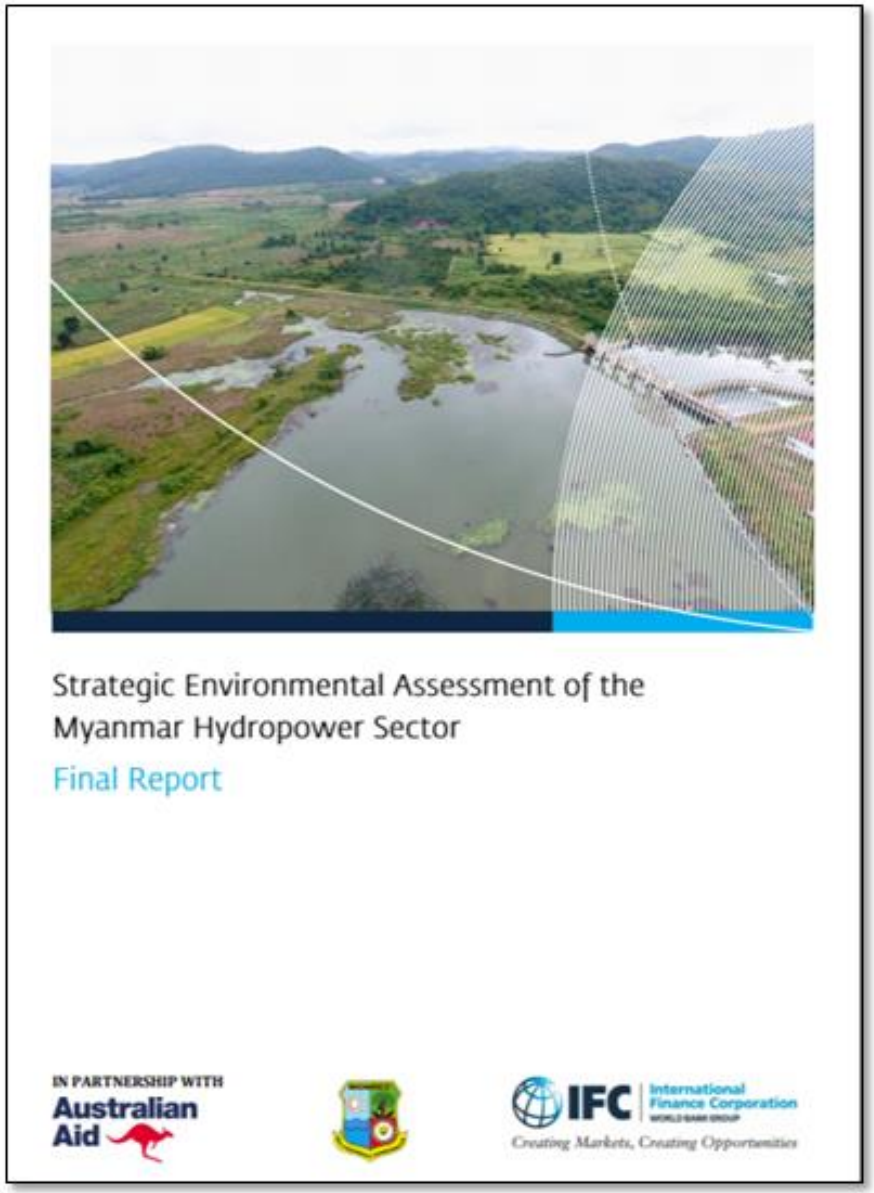
2,055 MW

1,951 km (large rivers)



Example from Karnali Basin, Nepal

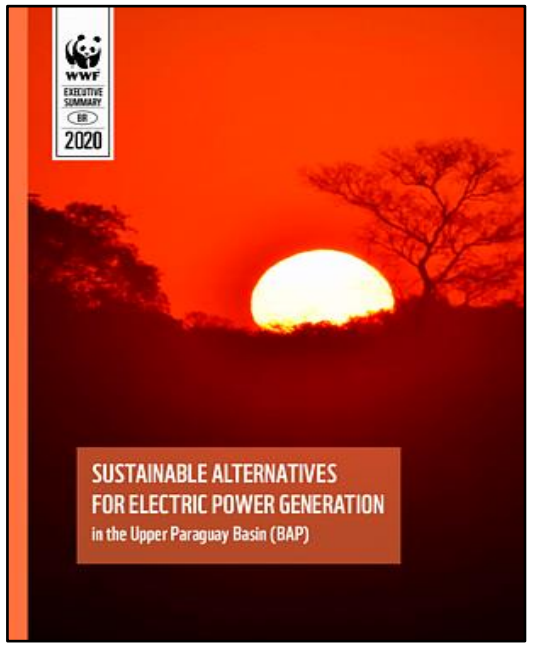
Strategic Environmental Assessments

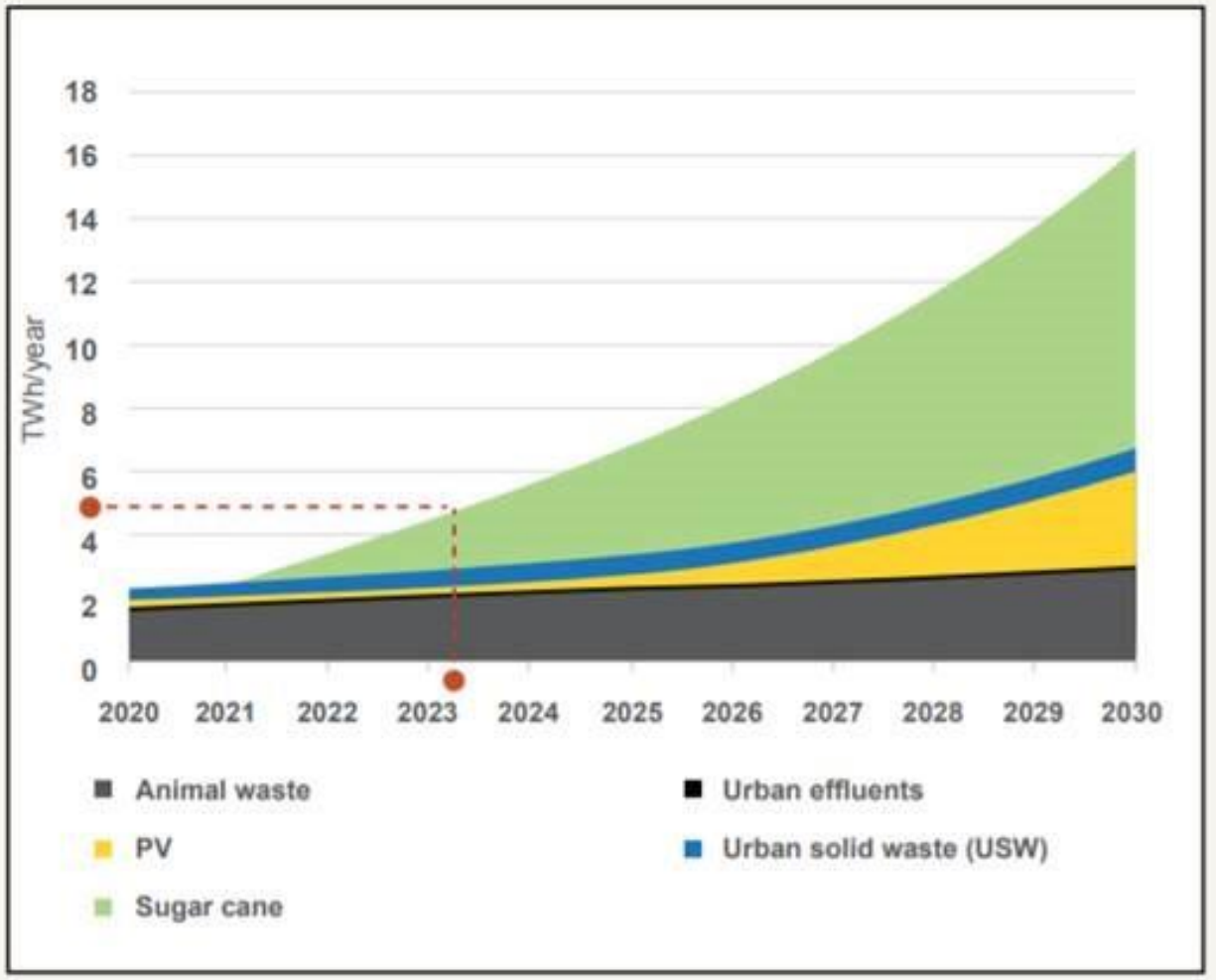


- Basin-scale cumulative assessments, examining environmental and social impacts
- Recommended zoning for development/protection and keeping mainstems of major rivers free-flowing

Alternative Energy Solutions and Options

Upper Paraguay Basin





Picture 23 – Projections of electric power generation in the states of MT and MS. Source: the authors themselves based in (Coelho et al., 2012; IBGE, 2019, ANEEL, 2019)

River or Water Resource Protections

Water Reserves

Mexico National Normative

River-specific designations

Minas Gerais

Conclusions


Thank You