

Cumulative impacts on indigenous people by infrastructure in the Amazon



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Special Chair FAPESP
Project: After **hydropower**
dams: **social and**
environmental processes
that occur after the
construction of Belo Monte,
Jirau and Santo Antônio **in**
Brazilian Amazon



GT Infraestrutura
e Justiça
Socioambiental
workforce **Infrastructure Social-
Environmental Justice**

TRANSPORT sector

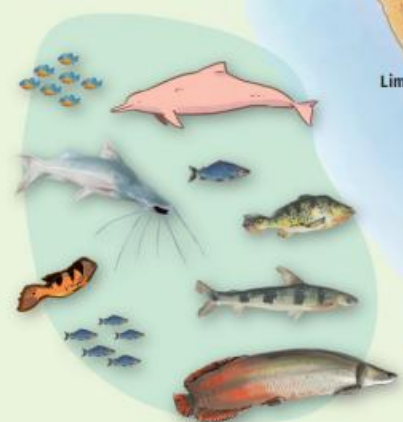


The global importance of the Amazon waters

The Amazon is Earth's largest freshwater system. Its waters are born in the Andes and flow to the Atlantic in the form of rivers, oxbow lakes, wetlands, and as moisture in the atmosphere. These different freshwater habitats sustain an astonishing biological diversity as well as the lives of millions of people across eight countries, from the eastern side of the Andean mountains range to the estuary, more than six thousand kilometers away. Through evaporation, water from these habitats also forms aerial rivers that flow across great distances and influence regional and global climatic patterns.

1 Aquatic biodiversity

With more than 2,500 species of fish recorded, the Amazon is the most biologically diverse river basin on the planet. It also harbors a high richness of mammals, reptiles, and amphibians that play important ecological roles, such as seed dispersal.



+2,500
species of fish have
been described
in Amazonian
waters.

2 Climate

The water that flows through the Amazon Basin ends up in the Atlantic Ocean. The Amazon supplies more water to the oceans than any other river in the world. As this water evaporates, it creates "flying rivers" - moisture that is transported through the air - a key driver of regional and global climatic patterns.

16%

of the total water
discharged annually
into Earth's oceans is
provided by the
Amazon Basin.

47 million

people live in the Amazon
Basin, including 350
indigenous groups, in
eight countries.

3 The people

People have lived in the Amazon for thousands of years, co-evolving with the Amazon's freshwaters, which provide food, shape culture and spirituality, and sustain livelihoods. If well-managed, natural resources from its aquatic and terrestrial ecosystems could contribute to a sustainable and equitable economy that benefits people locally, regionally, and globally.



15%
of the Amazon Basin
is covered by water
at some point during
the year.

■ Main wetlands and
flooded forests
➔ Hydrological cycle

Source: Jenkins et al (2025) & Aguas Amazonicas

Amazon hydropower

Brazil: ~63% Hydropower

Largest recent run-of-river hydropower
in the Amazon

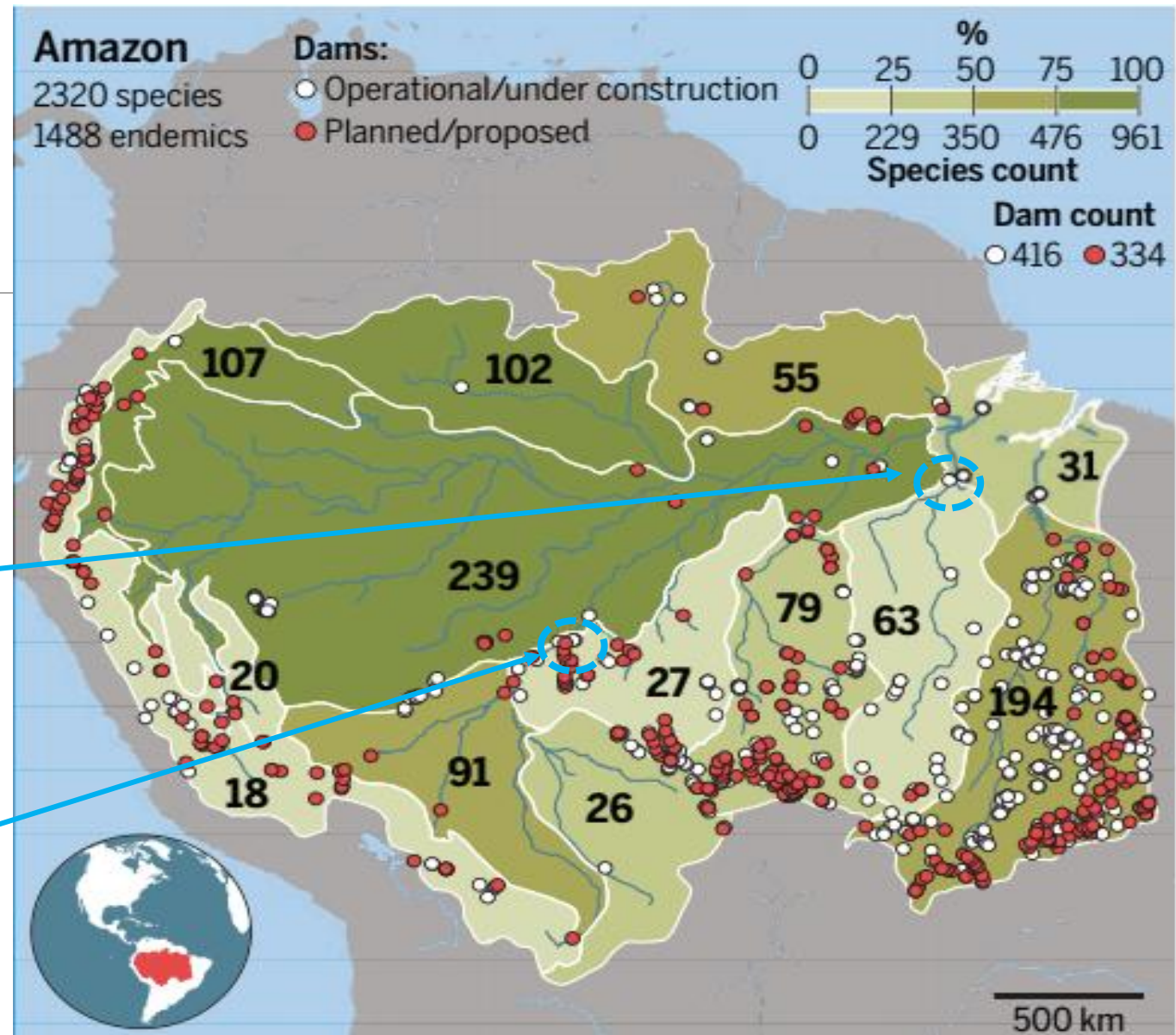
- **Belo Monte Dam**

Xingu River

Flow diversion = dewatered stretch

- **Santo Antônio & Jirau Dams**

Madeira River



Source: Winemiller et al (2016)

Amazon transport infrastructure

Logistic & Transport intermodal
corridors

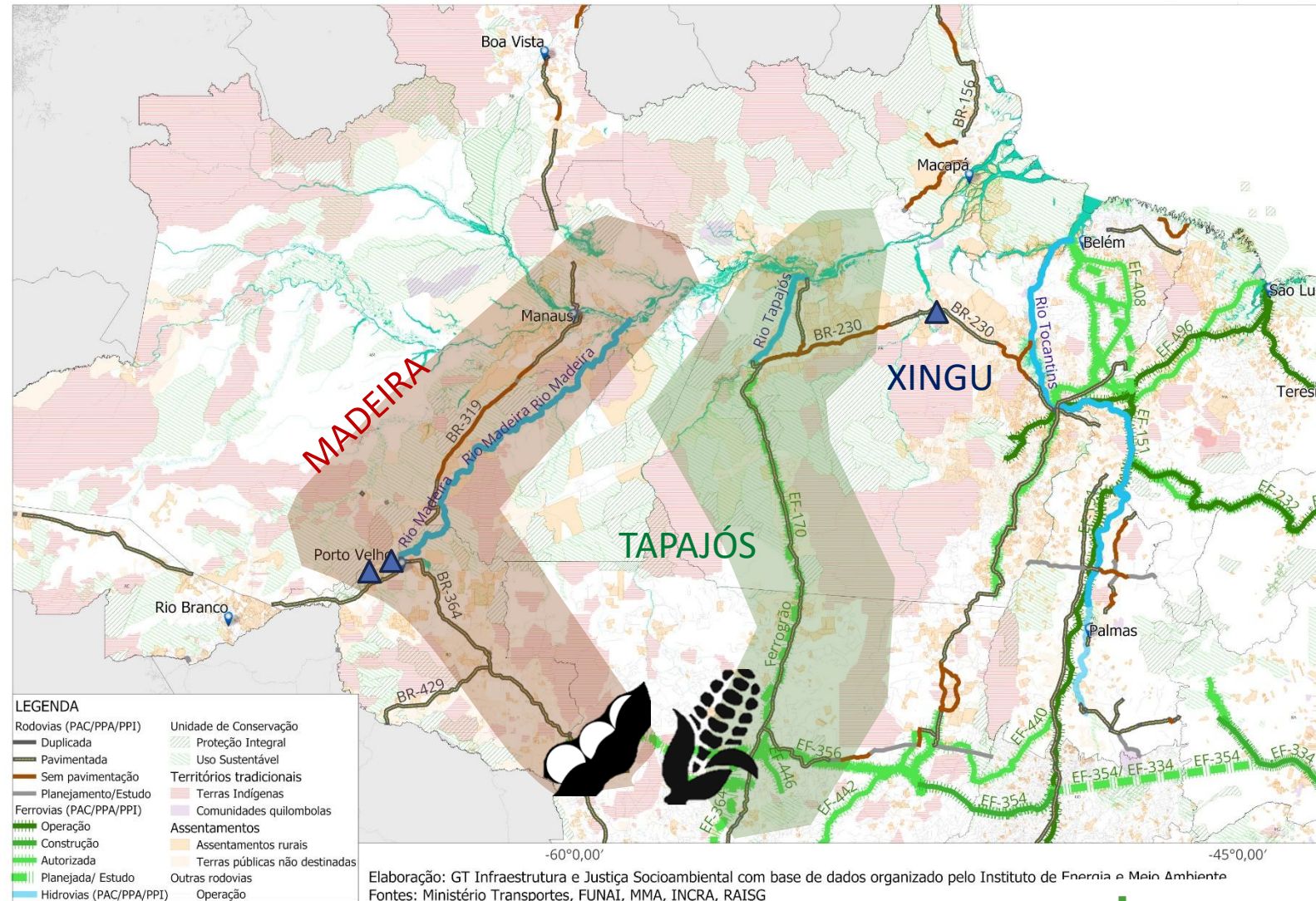


Agribusiness expansion

Soybean & corn → exportation

▲ Santo Antonio, Jirau, Belo Monte DAMS

INFRAESTRUTURA DE TRANSPORTES NA AMAZÔNIA BRASILEIRA
Planejamento do governo federal com obras do PAC - Programa de Aceleração do Crescimento.
Recursos do PPA - Plano Plurianual (verba pública) ou do PPI - Programa de Parceria de Investimentos (concessão a empresas privadas)



Objective: discuss cumulative impacts of infrastructures (energy and transport) and mining activity in three watersheds in the Brazilian Amazon: Madeira, Tapajós, and Xingu.

People's Summit – COP30 March

Local Workshops



Photos: GT Infra



gt
infra

INFRAESTRUTURA
E JUSTIÇA SOCIOAMBIENTAL

literature review, field research, and **participative Impact Assessment methods, community-based monitoring, alliances and advocacy**, a work-in-progress with local communities is presented to reveal perceptions of cumulative impacts from these territories

MADEIRA RIVER

DRIVERS:

HYDROPOWER (downstream)

+ Illegal gold mining

+ Shipping channel (dredging)

+ Extreme climate events

- Fragmentation connectivity

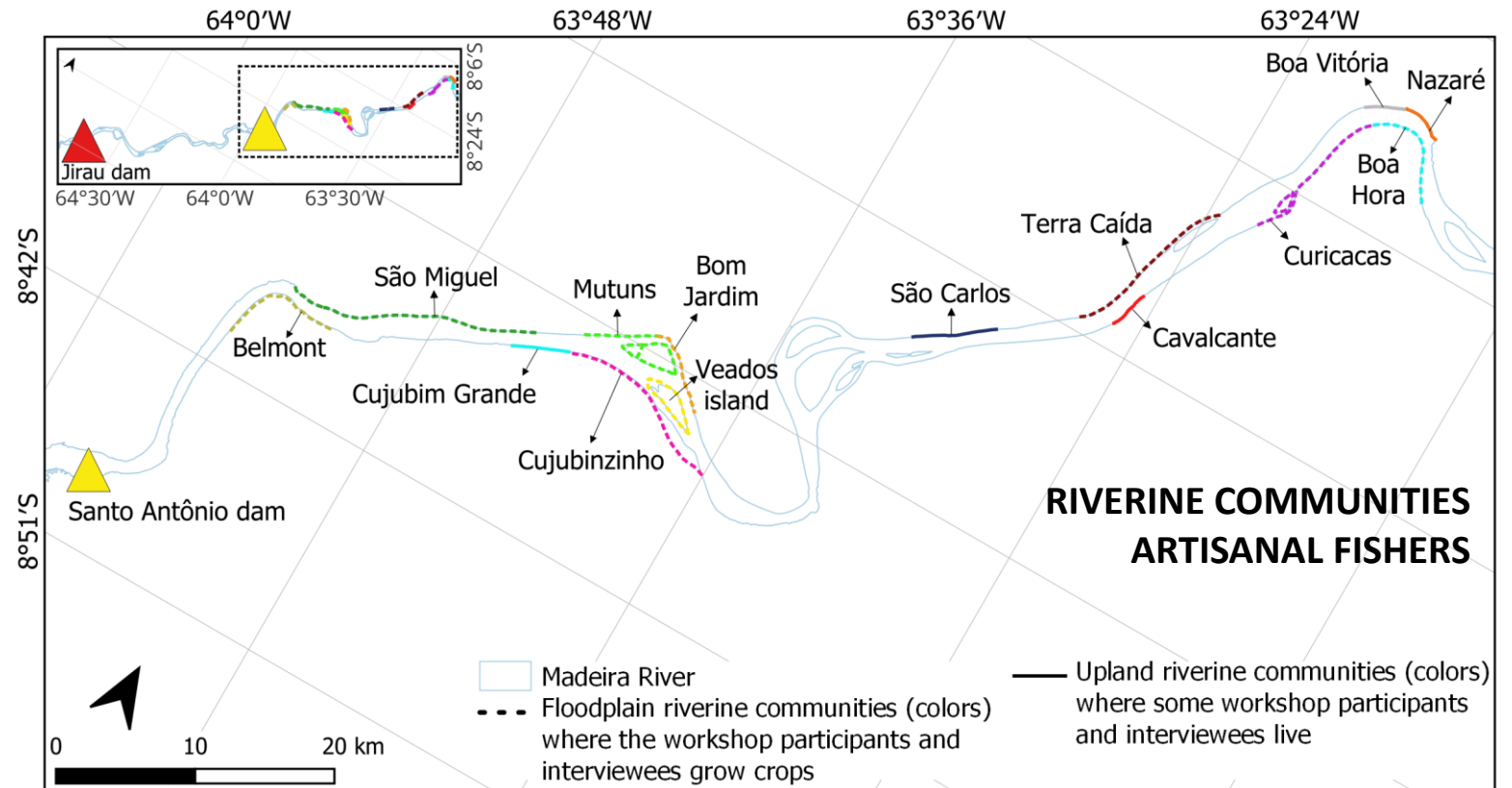
Decline fisheries

↓ 37% catch rate

- Hydrosedimentology dynamics

↓ Floodplain fertility (P, K, Ca, Mg)

Risk to sandbanks → habitats



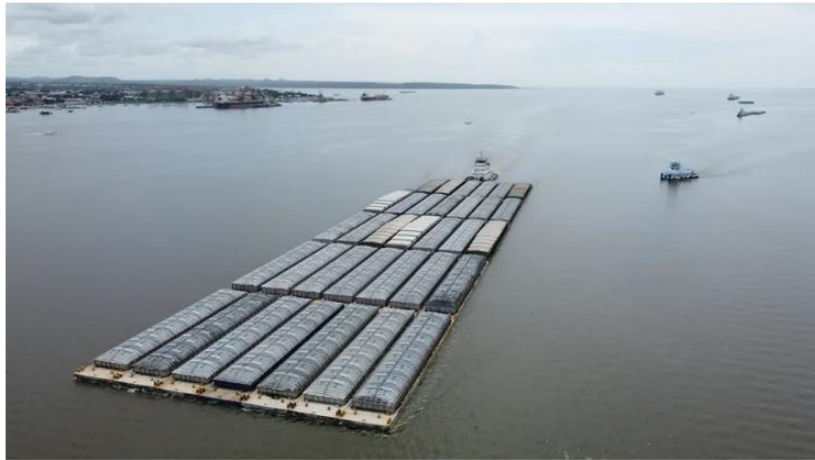
Lobo et al (2025); Mandai (2025); Mandai et al, in press; Arantes et al (2022).

Madeira River

Megacomboio de 35 barcas transportará grãos no Arco Norte

Embarcações levarão 70 mil toneladas de soja e milho pelos rios Tapajós, Amazonas e Pará

Por Fernanda Pressinott, Valor — São Paulo
 01/12/2022 16h47 - Atualizado há 3 anos



Megacomboio de barcas de grãos da Hidrovias do Brasil rumo ao Arco Norte — Foto: Divulgação

System thinking & cumulative impacts

Vennix (1996), Haraldsson (2004)

+ HYDROPOWER

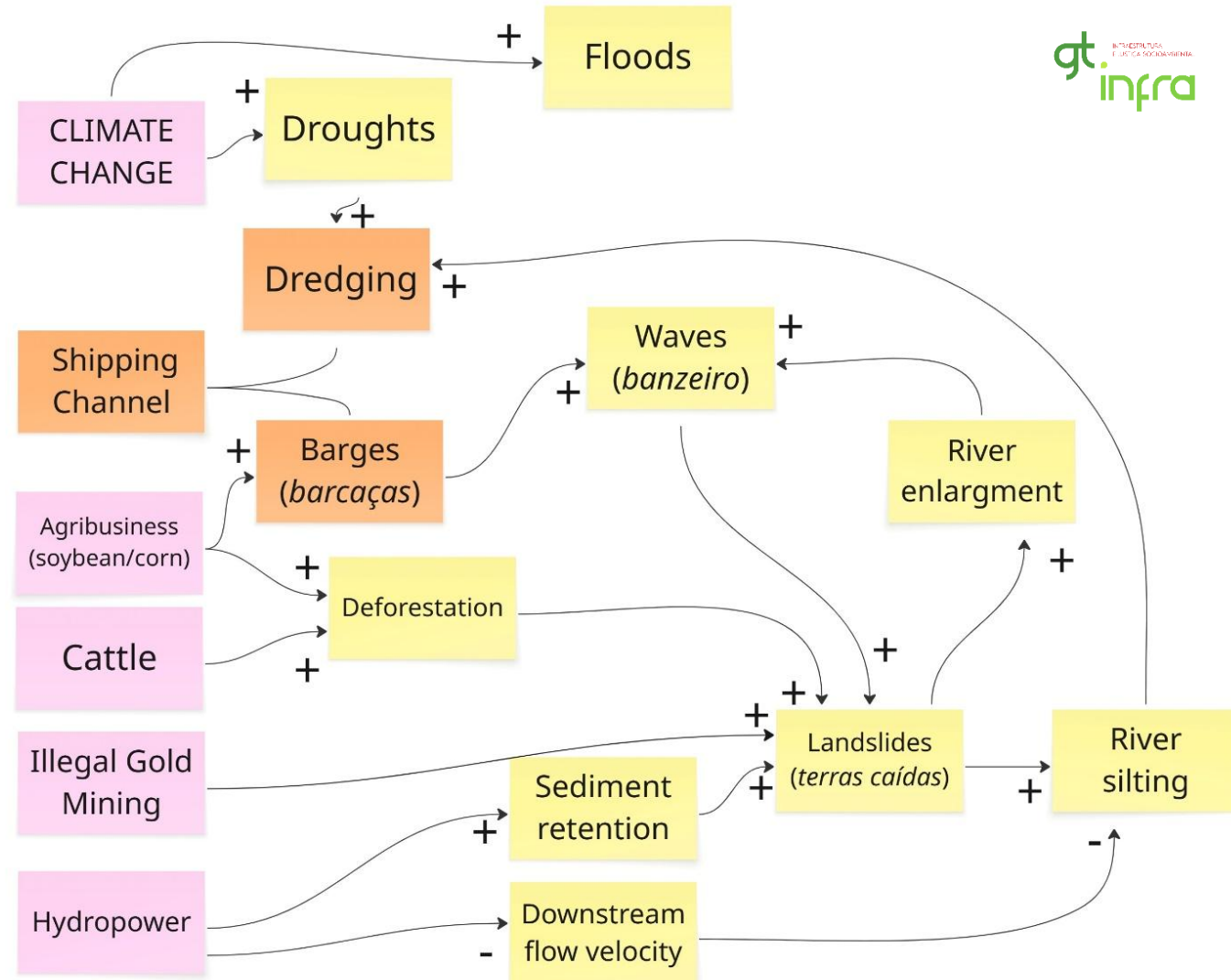
+ SHIPPING CHANNEL

+ILLEGAL GOLD MINING

+ CLIMATE CHANGE

+ MONOCULTURE EXPANSION

+ DEFORESTATION

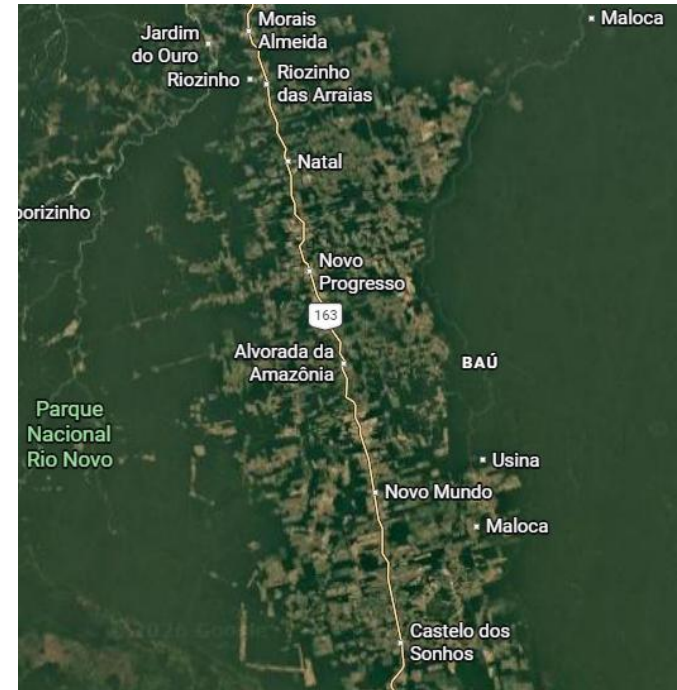
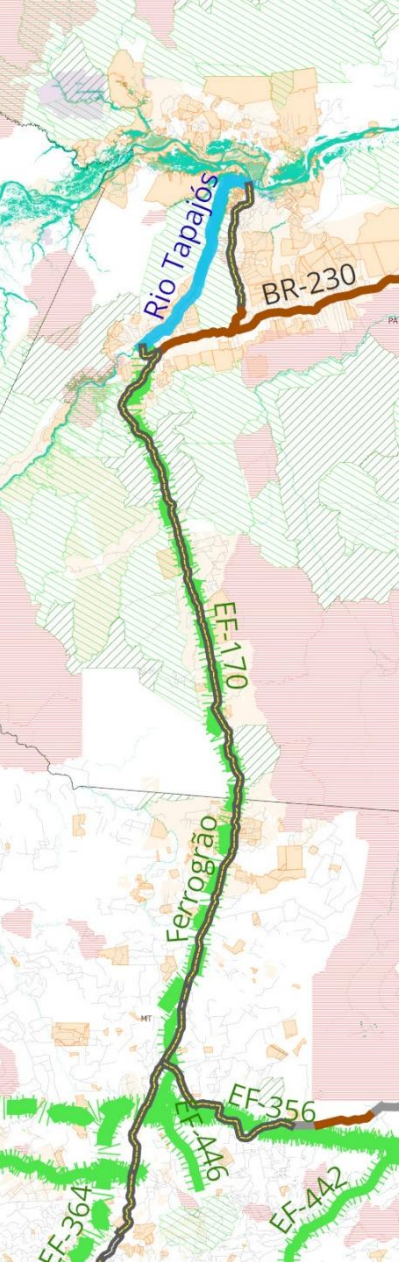


Tapajós River

- + Shipping Channel – Dredging riverbed
- + Grain Ports in Tapajós River – territorial conflicts
 - fishers, urban and indigenous communities
- + Road BR-163
- + Ferrogrão Project (planned) – railway for grain commodities
- + Gold mining

Mercury contamination in Munduruku (Basta et al, 2021)

Logistic corridors cumulative impacts



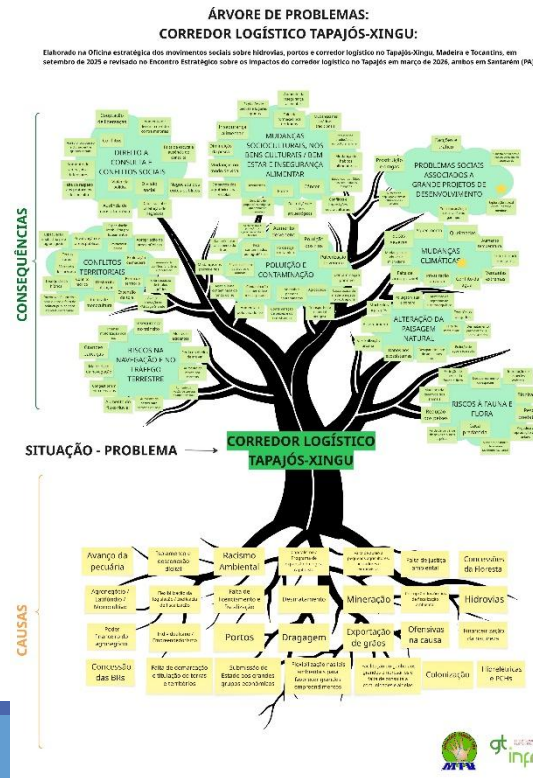
Participatory IA



Indigenous People, riverine, artisanal fishers, social movements, local organizations

LOCAL ALLIANCES / NETWORKS/ MOVEMENTS

- Participatory mapping (social cartography)
- Problems tree
- Critical Decision Factors
- Social-Environmental Indicators for Logistic National Plan



PHOTOS: GT Infra

Xingu River

BELO MONTE DAM

Dewatered stretch

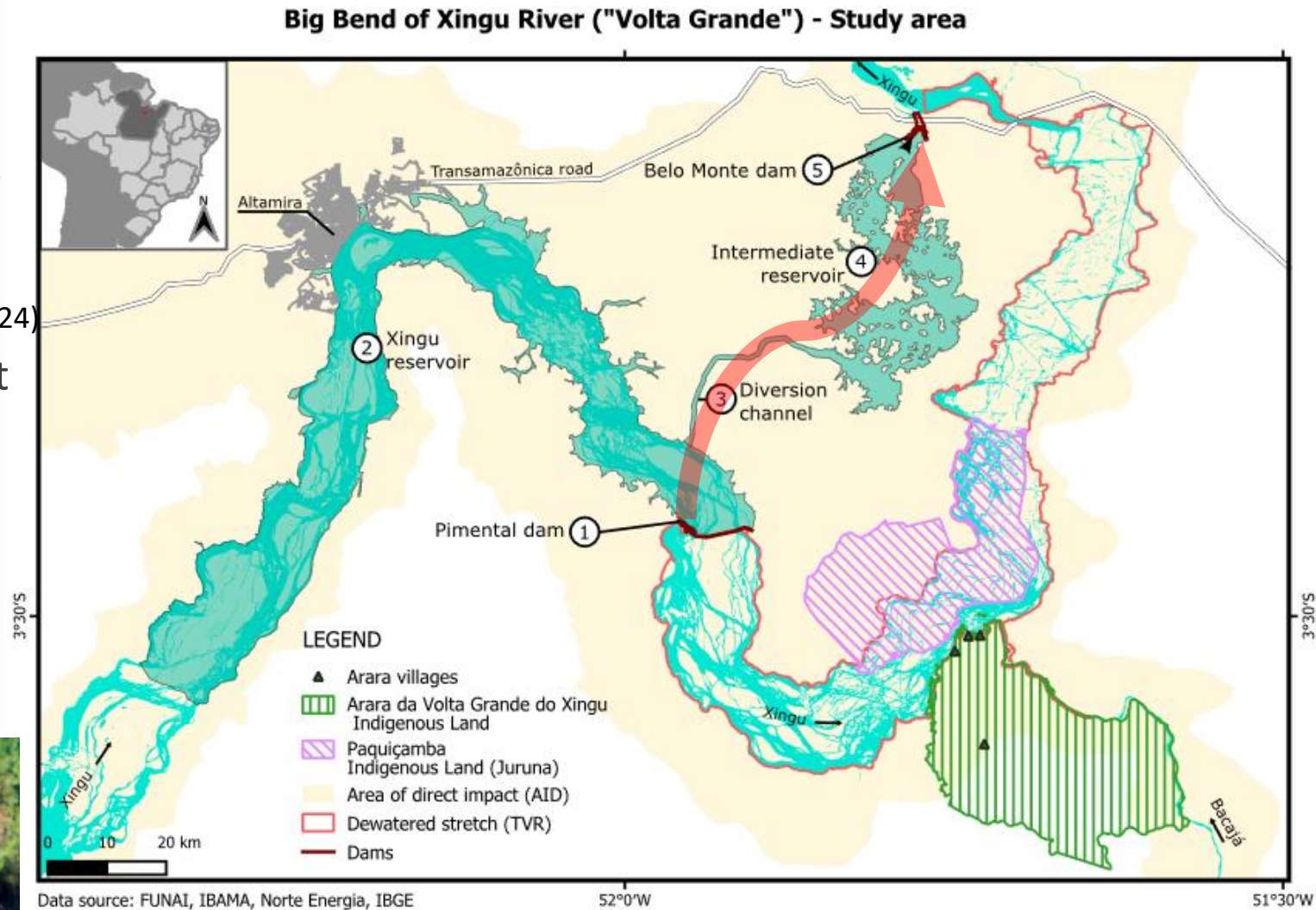
- flow diversion (34-**89%**) Utsunomiya et al (2024)
- Ethnocide (MPF) | Interamerican Court IACHR

+ Climate change | El Niño 23/24

+ Belo Sun Mining



PHOTO: Estadão (2009)



Xingu River

BELO MONTE DAM

Dewatered stretch

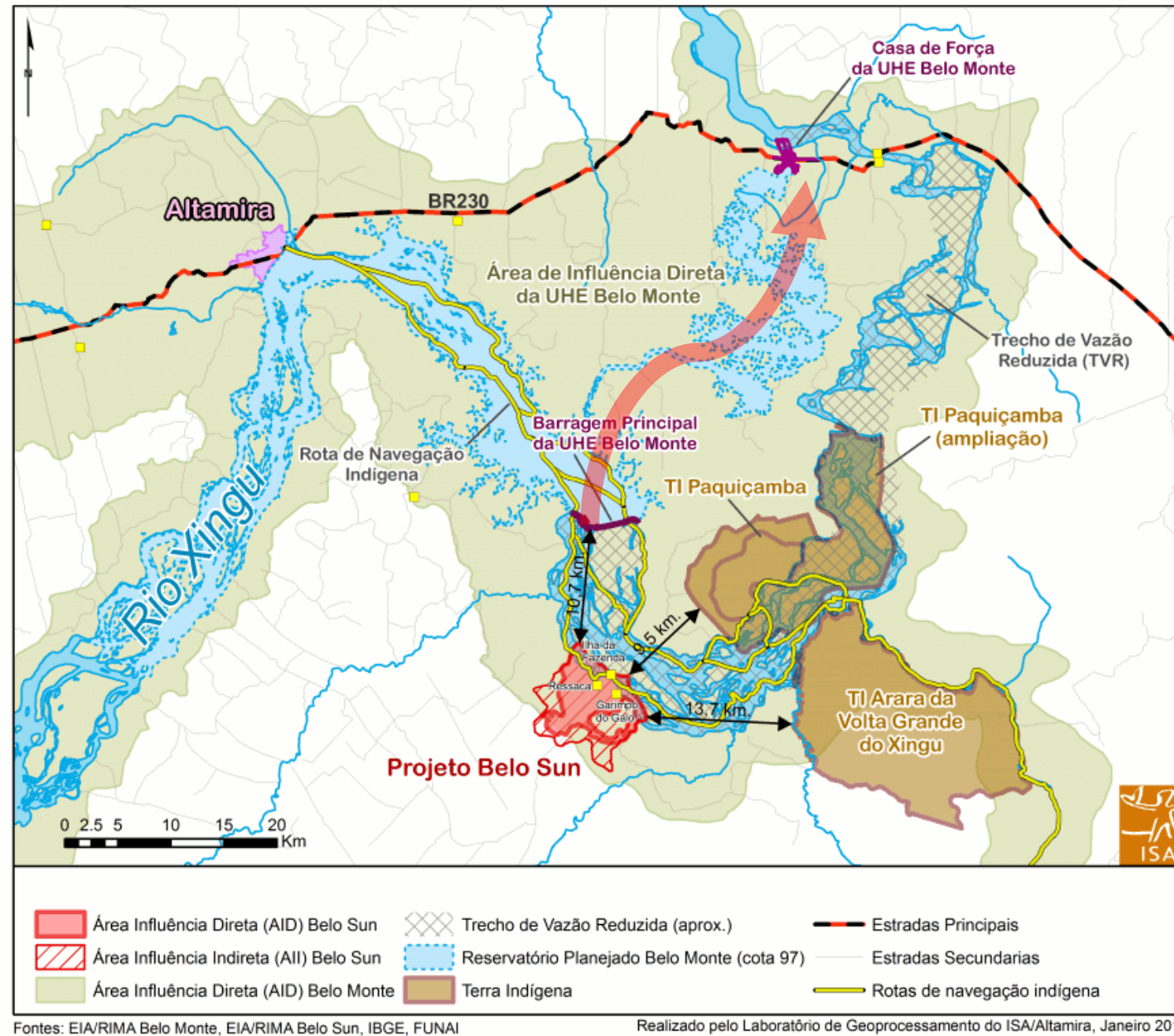
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PHOTO: Estadão (2009)



Community-led IA

Free, Prior, Informed Consent

Self-determination

Indigenous-led

Territory ownership

Unvisibility → Exist → To be heard →
Influence in Decision making

Consultation protocols – FPIC for each
social group

Territorial and Environmental Management
Plan (PGTAs)

**Community-Led Impact Assessment
and Free, Prior, and Informed Consent
as Mechanisms to Advance Self-
Determination and a Fair Transition
for Indigenous Peoples**

Philippe Hanna, Renata Utsunomiya, and Frank Vanclay

SPRINGER NATURE Reference

**LIVING
EDITION** [↓]

The Palgrave
Handbook of
Social License to
Operate and Energy
Transitions

palgrave
macmillan

Community-led monitoring MATI

MATI – VGX: Monitoramento Ambiental e Territorial Independente da Volta Grande do Xingu



Community-led intercultural research institute

Indigenous peoples, Riverine communities + Academics

Monitor the impacts of the Belo Monte dam



■ INFORMATION BATTLE

Assessing reports – Prosecutor Ministry (MPF)

Combatting misinformation/desinformation

Proponent-led licensing



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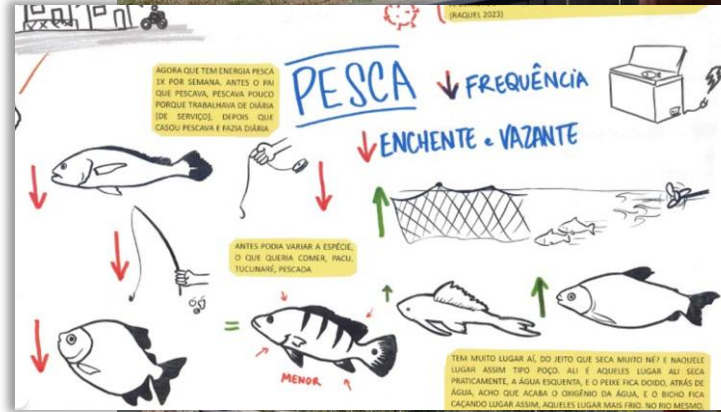
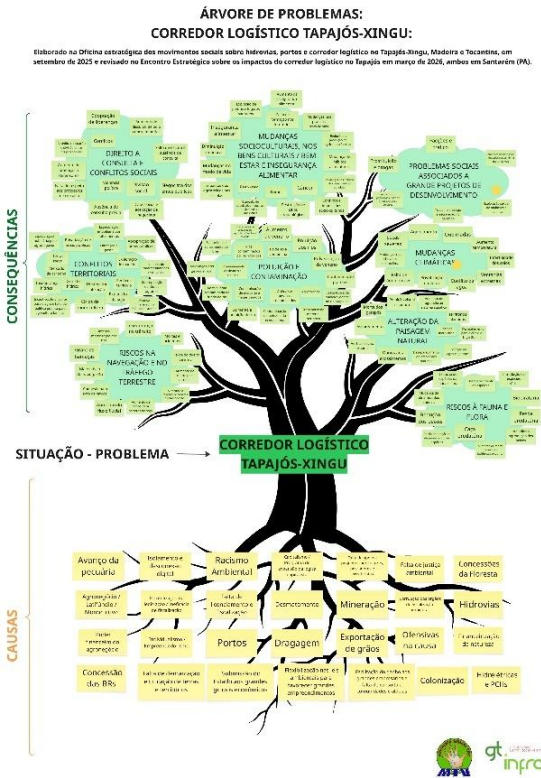


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piracema do barracão

Graphic Facilitation

Visual & Art-based methods

Problems tree



PHOTOS: Utsunomiya

Arara Indigenous Art & Social-Ecological system

Utsunomiya (2025)



“Cultural Arara Fishing”
ARTIST: Adailton Arara

Final remarks

New policies/projects– territories already impacted by multiple drivers

Contexts of weak governance and lack of enforcement

Lack of experiential learning & adaptive management

Large projects: Regional development Vs Inequality and Deforestation

Lack of SEA for Transport/Logistics sector (Siqueira-Gay et al, 2026)

Climate change

- Extreme events – undermine local livelihoods
- Aerial Rivers and Rain in Central Brazil → Deforestation and Amazon forest tipping-point

Indigenous-led assessment and monitoring – lack of participation in Decision-making

Transdisciplinarity and codevelopment of methodologies – networks, aliances...

Acknowledgements

FAPESP Agency,

Project SPEC: “After hydropower dams: social and environmental processes that occur after the construction of Belo Monte, Jirau and Santo Antônio in Brazilian Amazon” Indigenous People, riverine, other traditional communities, social movements, local organizations evolved in the alliances and activities with GT Infra;

Main References

UTSUNOMIYA, R. et al. Dewatering the Xingu River: hydrological alterations and biocultural connections among the Arara Indigenous People in the Volta Grande region, Brazilian Amazon. Regional Environmental Change, [s. l.], v. 24, n. 2, 2024.

HANNA, P., UTSUNOMIYA, R., VANCLAY, F. (2026). Community-Led Impact Assessment and Free, Prior, and Informed Consent as Mechanisms to Advance Self-Determination and a Fair Transition for Indigenous Peoples. In: Wood, Geoffrey. The Palgrave Handbook of Social License to Operate and Energy Transitions. Candel: Palgrave Macmillan Cham, 2026.





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Message me your questions or comments in the IAIA26 app.



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