Big Dams Panel

GEOG 412 Team A

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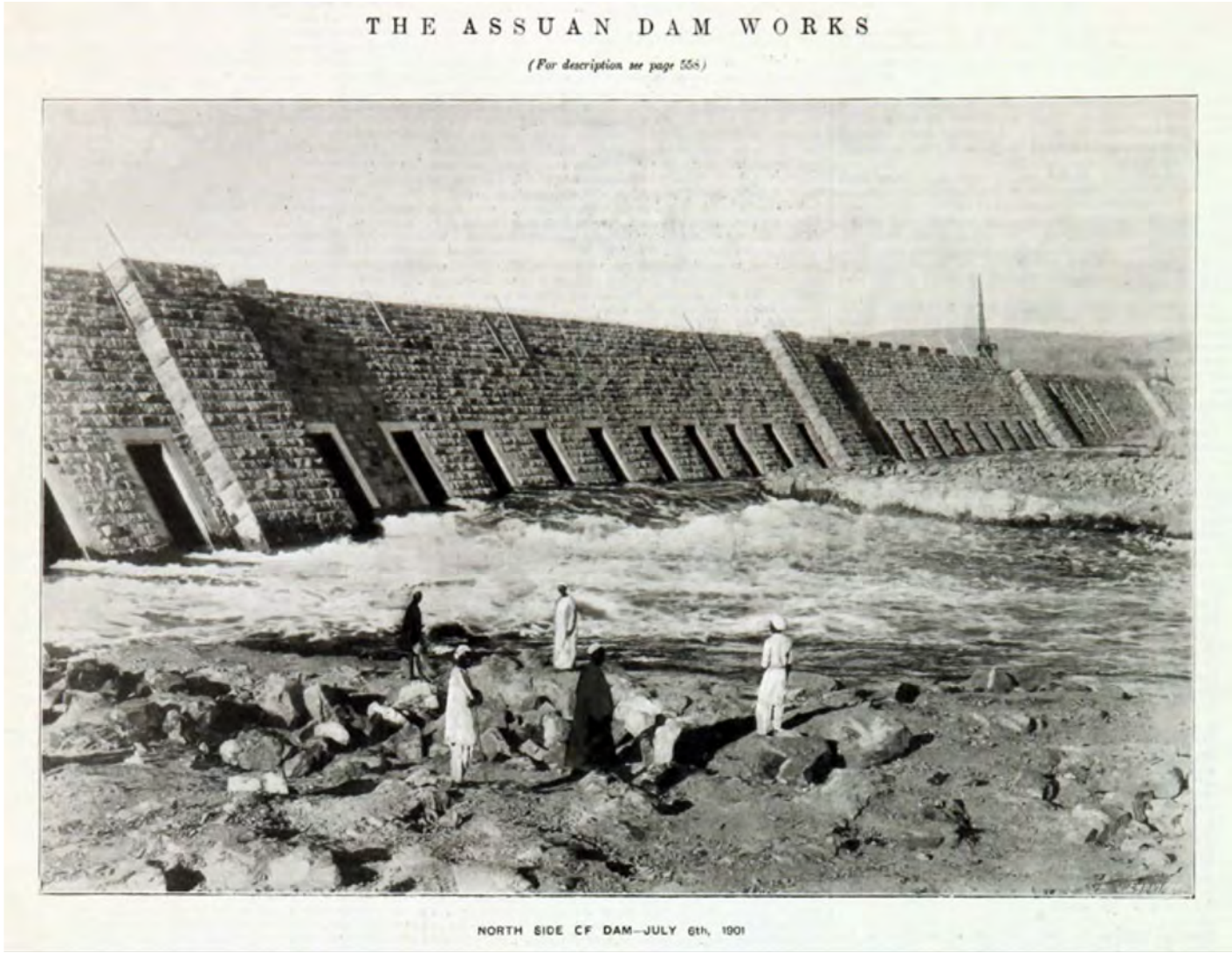
Outline

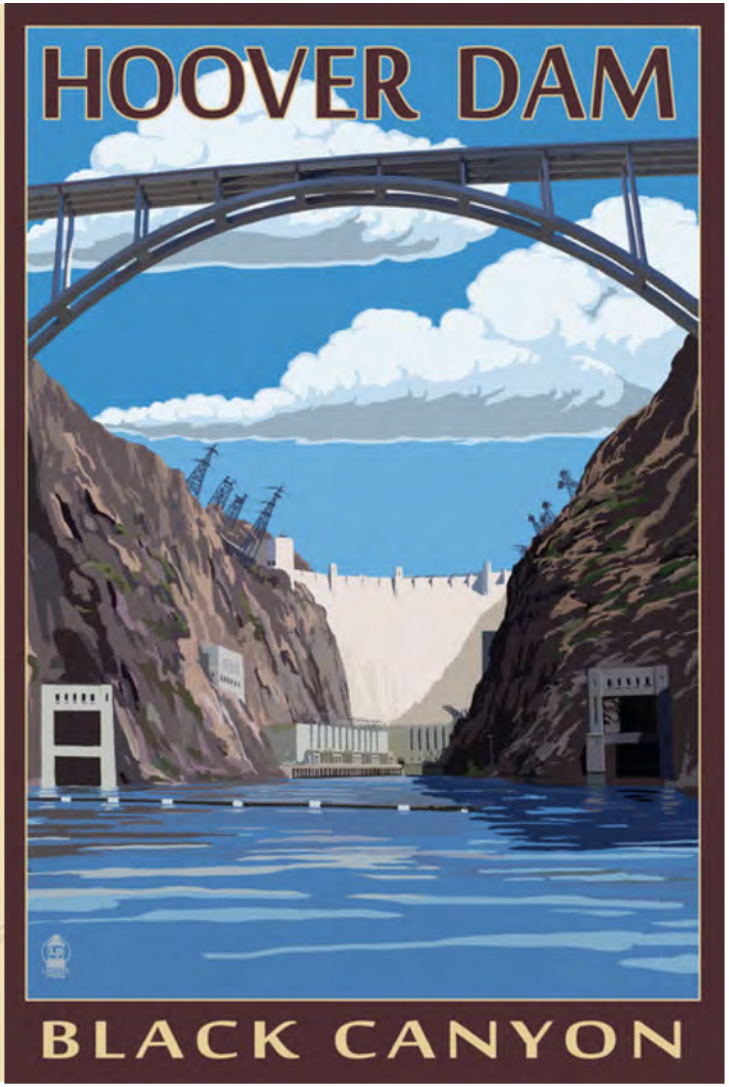
1. History of dams
2. Political implications
    a. International politics
    b. Intranational politics
3. The Economics of Dams
4. Environmental effects
    a. Abiotic
    b. Biotic
5. Social consequences
6. Technological Innovation

Ancient Dams

Early 20th century: 1900s

Aswan Low Dam





Early 20th century: 1930s

Hoover Dam

Late 20th century: 1970s

Environmentalist movement

Late 20th century (1990s) into the 21st century

World Commission on Dams

Created by QualityIcons
from Noun Project

Governance

Created by priyanka
from Noun Project

Geostrategic
Development

Created by monkik
from Noun Project

Foreign
Relations

INTERNATIONAL POLITICS: BIG DAMS

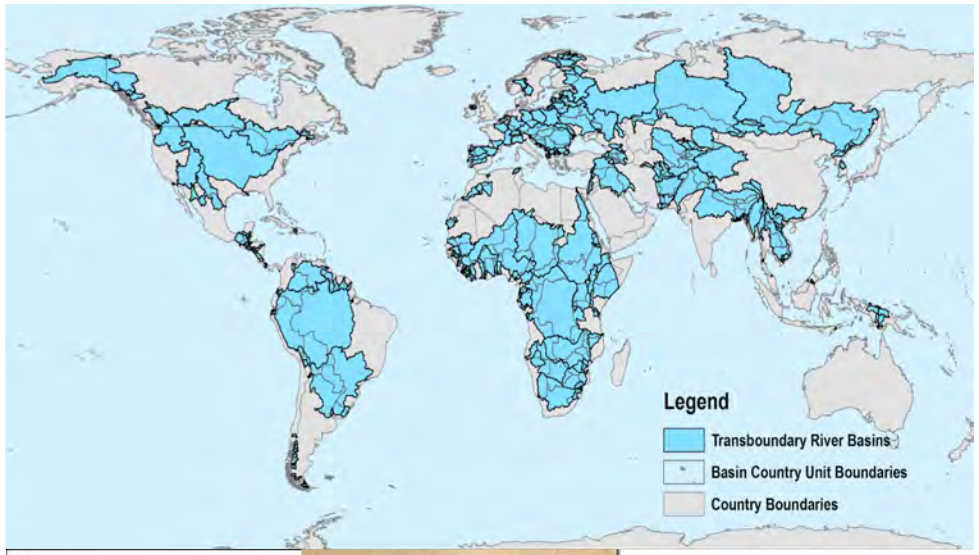
TRANSBOUNDARY GOVERNANCE

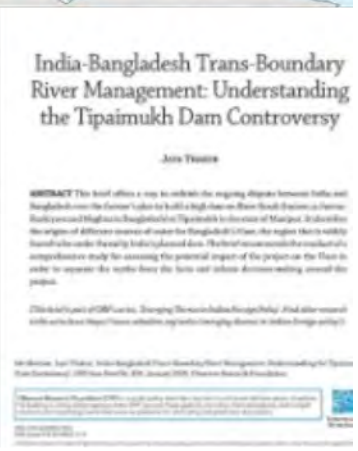
How to govern?

- International Law (Binding)
- International guidelines (Normative rules… like the World Commission on Dams)
- Regional: Treaties, agencies, formal governance institutions. (Binding)

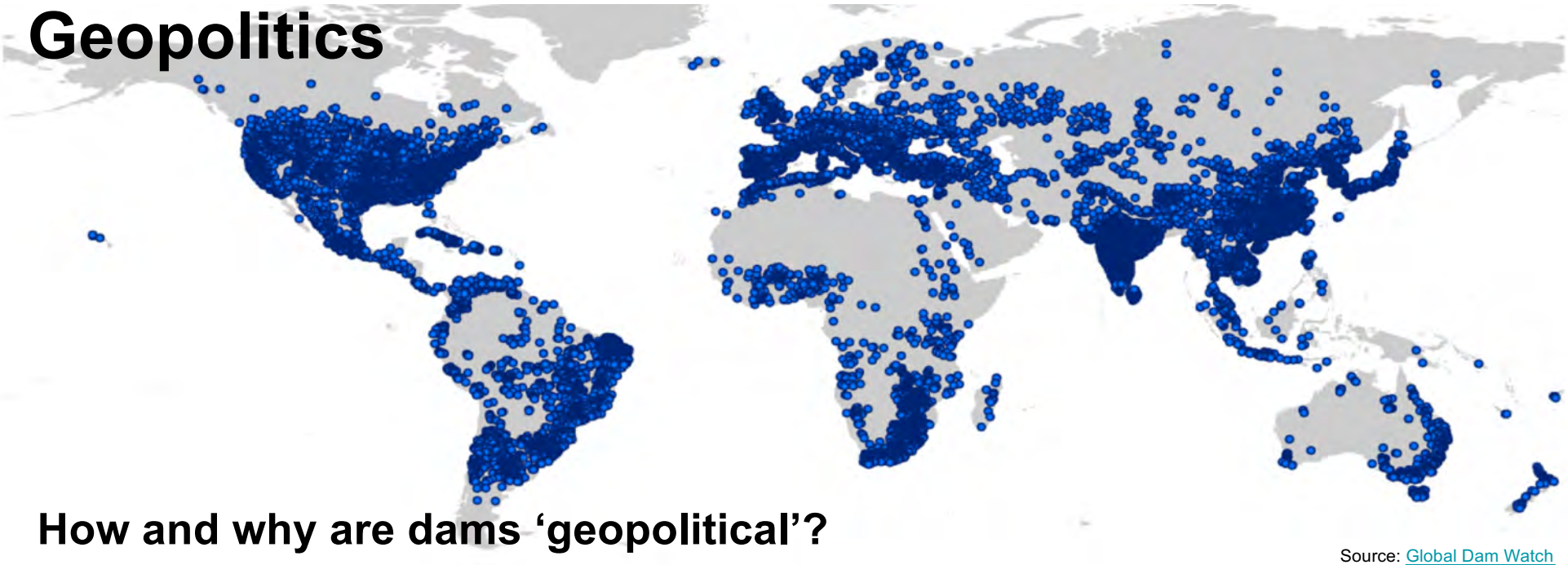
What to govern?

- Compensation for social and environmental impacts in downstream nations
- Negotiating discharge volumes
- Acceptable uses of shared water





Geopolitics



How and why are dams ‘geopolitical’?

Source: Global Dam Watch

- Consolidating regional power
  - Securing water resources in a warming world.
  - Planning for future needs with trends of social and economic growth
- Improving foreign relations by sharing benefits of big dams.
- Aggravating existing diplomatic tensions through competition for water resources.

Image from Global Water Blog

CASE STUDY: *Ilsu Dam, Turkey.*

- 2018: Turkey's 1,200 megawatt Ilsu Dam on the Tigris River came online.
- Ilsu and Turkish goals:
  - Energy sovereignty
  - Growth of agriculture, industry, population.
  - Improvement of national living standards (higher consumption)

- Turkey, Syria and Iraq share Tigris-Euphrates Basin.
- Nations have complex, uneven water use agreements.
- Socioeconomic impacts in Iraq ---> domestic protest, low-level trade war with Turkey.

Intra-national Politics and Big Dams

- Political economy of dam building and developing state attempts to secure international developmental aid

- Perceived benefits from projections of demand

- History of top-down, technocratic dam management in many nations

- - Nations have simultaneously incentivized dam building while regulating it

Photo: Construction of the Three Gorges Dam along the Yangtze River in China
Source: SceinceSourceImages

Challenges going forward

- Local government circumvention
- Increasingly lax standards
- Project stranding

Photo: abandoned dam at La Colle Falls in Saskatchewan, Canada
Source: Jordan Cooper on Flickr

India and its Increasingly Lax Standards

- State pressured to respond to demand projections

- Removal of safeguards
- Lax monitoring
- Limiting of public discourse

Photo: hydropower facility in the Indian Himalayas
Source: Geotechpedia

Economics: (Dam)aging Evidence?

Nico Jimenez

Fun(dam)ental Shifts

Looking Back

- More than **$2 trillion USD** in total investments worldwide in 20th century
- Peak in 1970s, where an average of two or three large dams commissioned each day
- Little regard for social or environmental impacts in construction or operational costs

Source: Bhakra Dam, India

Moving Forward

- Full cost of large dams have emerged as serious public concern
- Imperative of integrating a **triple bottom line** approach: economically viable, socially equitable, and environmentally sustainable
- Better and continued monitoring and independent analyses of dams a necessity

Source: Triple Bottom Line

(Dam)ned if we do, (Dam)ned if we don't

Costs

- High degree of **variability** of dams in achieving technical, financial, and economic targets
- Substantial cost overruns and tendency towards delays

Source: Xayaburi Dam Threatens Mekong Basin Food Supply

Benefits

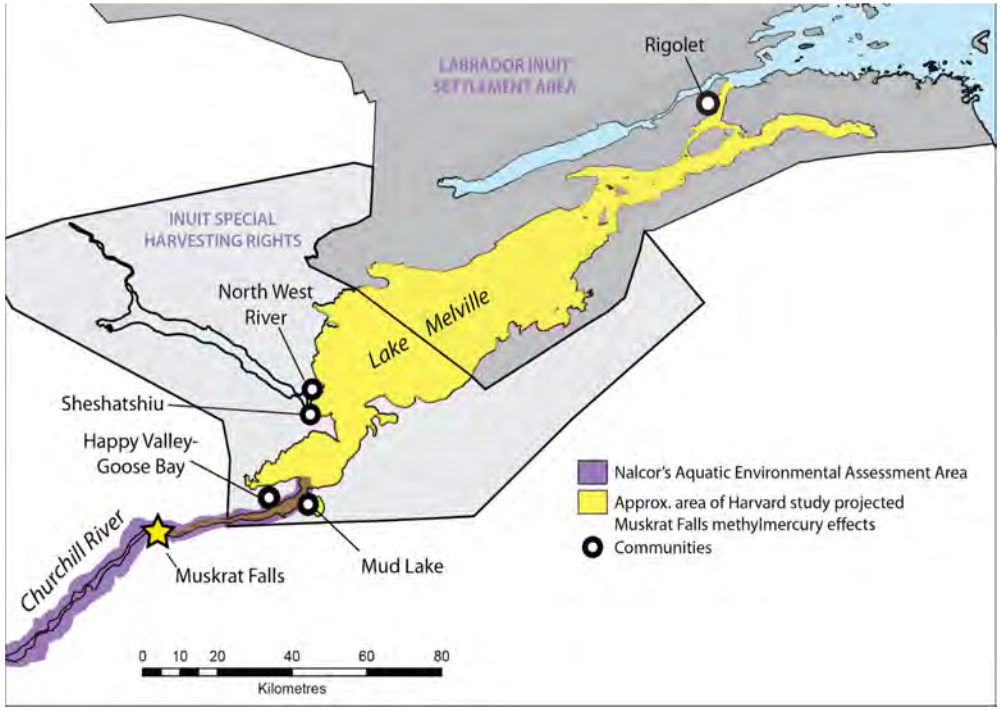
- Dams are promoted as an important way to meet water and energy needs, supporting economic development
- Services produced by dams are considerable – 12-16% of world **food production**, 19% of world **electricity** supply

Source: Three Gorges Dam, Yangtze RIver

(Dam)nified Case Study: Muskrat Falls

- Original $6.2 billion price tag doubled to $12.7 billion (CDN) investment
- Hydroelectric facility one year behind schedule, pushing Newfoundland economy to brink of bankruptcy
- Increase provincial gross debt by 50% and double electricity rates to 23.3 cents per kwh into 2022

Source: Muskrat Falls Dam



Source: Muskrat Falls Dam Map

Environmental Impacts

Abiotic Environmental Impacts

Alterations to water flow regimes and surrounding ecosystem

- Timing and amount of discharge
- Upstream: Stagnation, flooding
- Downstream: Lack of seasonal variation, reduced peak flows

Alterations to water content

- Sedimentation, nutrient pollution, toxic metals accumulation
- Temperature variations

Climatic Impacts and Carbon Capturing

- Microclimatic and regional climate changes
- Eutrophication and emission of CO_2, CH_4, N_2O

La Grande Hydroelectric Complex

Abiotic Environmental Impacts

Northern Quebec, Canada:

1973-Present

- Total mercury (THg) in all fish species studied increased rapidly after impoundment.
- Representative of impacts on and of abiotic environmental components (water composition).
- A return to average levels: 10–20 years after flooding (non piscivorous) and 20–31 years (piscivorous), if no additional flooding occurred.
- Expected average winter runoff rate increase of 52%, with 6% decrease in summer runoff rate

Biotic Environmental Impacts

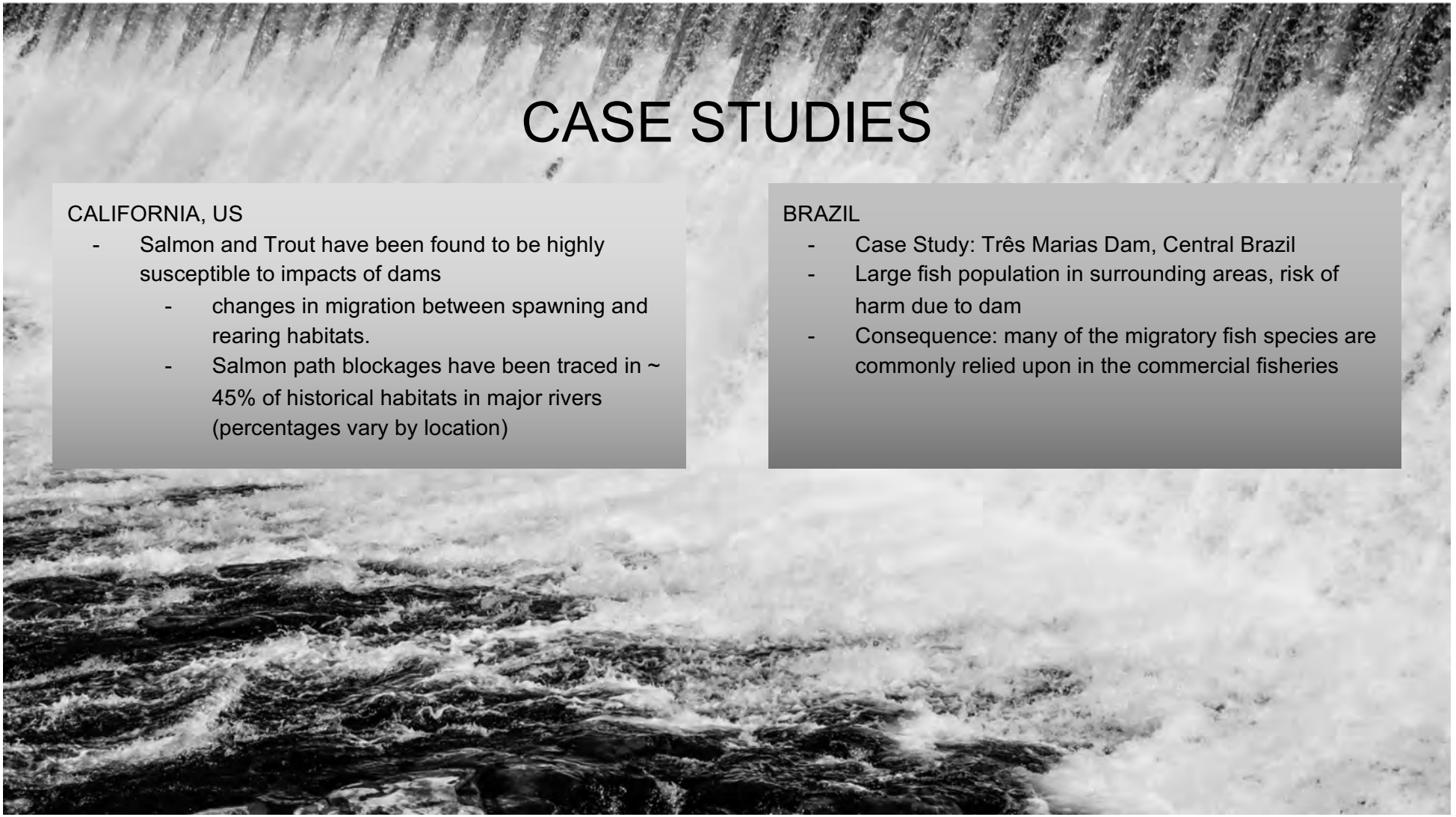
UPSTREAM

- Impact widespread and varied (ex: dam structure, sediment, climate)
- Harmful clearing and repurposing of land.
- Disruption of free-flowing streams
- Rise of artificial systems
- High risk habitats for plants and animals
- Bottom-up consequences
- Ex: Sivilay villages (near central Laos) forced to resettle 4km upstream, further away from necessary resources.

DOWNSTREAM

- Environmental Stream-side degradation
- Disrupted fish migration
- Sediment and habitat destruction
- Overall biodiversity hindered
- All dependant on variables such as dam size, location, operation

CASE STUDIES



CALIFORNIA, US

- Salmon and Trout have been found to be highly susceptible to impacts of dams
  - changes in migration between spawning and rearing habitats.
  - Salmon path blockages have been traced in ~ 45% of historical habitats in major rivers (percentages vary by location)

BRAZIL

- Case Study: Três Marias Dam, Central Brazil
- Large fish population in surrounding areas, risk of harm due to dam
- Consequence: many of the migratory fish species are commonly relied upon in the commercial fisheries

DAM REMOVAL

- Restorative goal
- Unreliable outcome
- Removal of large dams has a high risk potential to restore habitat connectivity and flow regimes
- Endangered species were found to have a negative response to dam removal

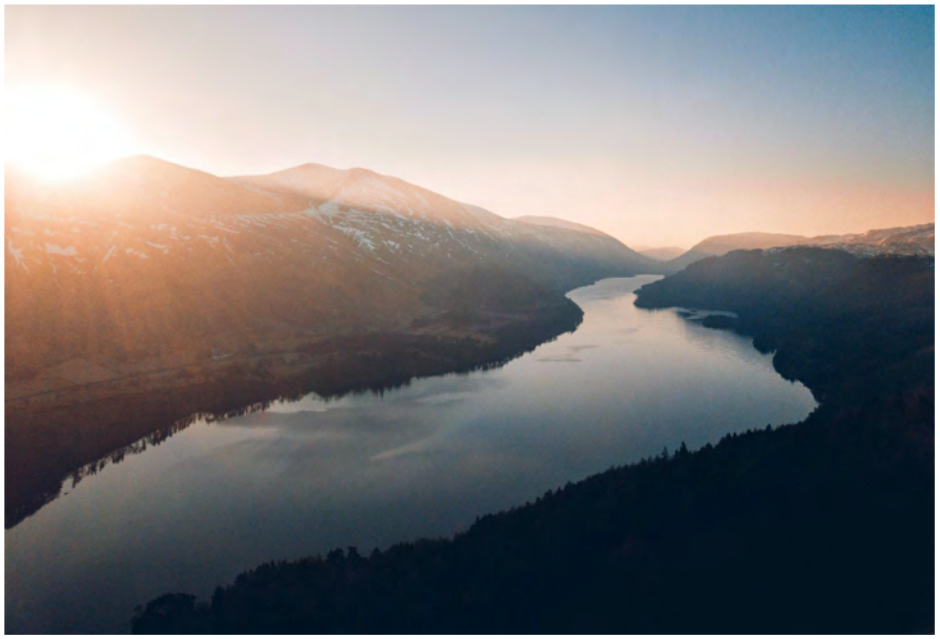
Social Impacts


Site C Dam

Land Use

Protest

What Does the Future Hold?




Three Gorges Dam

Displacement

A Dam Big Mess

Broken Promises

Looking to the Future: Technological Innovations

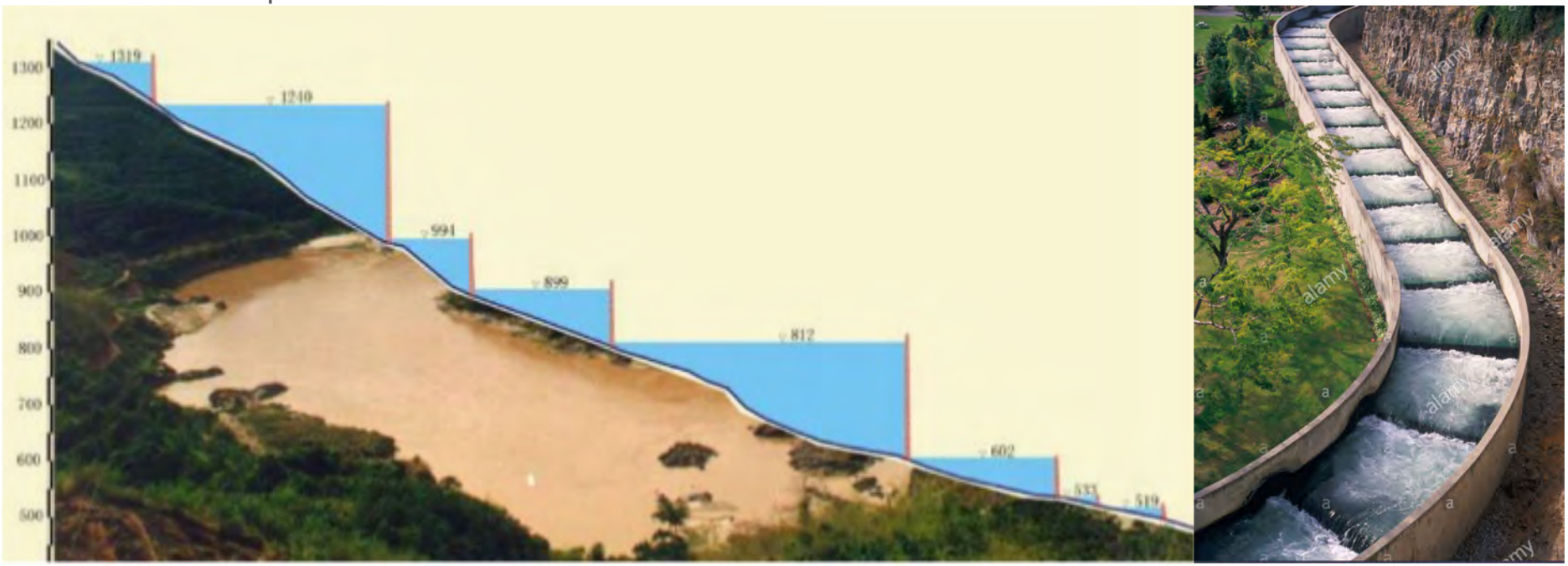
-Renovating existing dams

-Policies and practices for building new dams

-Alternative technologies

Re-Operating Dams

More than just fixing broken parts, it involves adding new components to diversify the dam and lessen environmental impacts



Building New Dams

-EIA's need to be independently funded and have the power to stop a project

-The entire water catchment needs to be considered when designing a new dam

Alternative Hydrokinetic energy

Instream turbine technology is a new for of sustainable hydrokinetic energy which generates power without altering the stream in any major way

Questions