Population Displacements Associated with Environmentally Significant Infrastructure Projects

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Marcia Castro[1]
Alexander de Sherbinin[2]
Shalini Vajjhala[3]

[1] Department of Global Health and Population, Harvard School of Public Health
[2] Center for International Earth Science Information Network (CIESIN), the Earth Institute at Columbia University
[3] Resources for the Future

Outline

1. Introduction
   - Overview & World Bank regulations
   - Environmental impacts of major infrastructure projects
2. Population displacements associated with large infrastructure
   - Typology of displacements
   - Case Studies
     - Mali
     - Brazil
     - South America
     - Pakistan
3. Future potential migration owing to large scale migration/adaptation projects
   - Mitigation Projects
   - Adaptation Projects
4. Conclusions: What does the past tell us about the future?

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Overview & Environmental Impacts of Major Infrastructure

SECTION 1

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Overview

- Thesis: We can learn from major infrastructure projects in the past to understand what may happen through large-scale climate change adaptation projects in the future
  - Voluntary resettlement in response to climate pressures
  - Involuntary resettlement from major adaptation projects
- World Bank regulations (OP 4.12 and OD 4.30)
  - Limit displacement / resettlement, where possible
  - Where unavoidable, resettlement should extend overarching development objectives and benefits

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Econ & Social Risks of Displacement

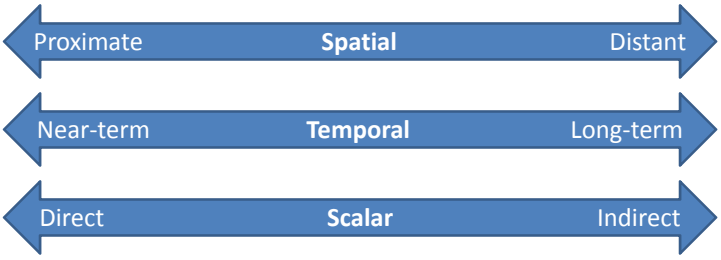
1-3. Loss of Land, Employment, Shelter

4. Marginalization *(reduced economic mobility)*
5. Increased morbidity and mortality
6. Greater food insecurity
7. Loss of access to common property/services
8. Social disarticulation *(break-up of community organizations and other groups)*

Source: Cernea, M., 2000. *Risks, Safeguards, and Reconstruction: A Model for Population Displacement and Resettlement*. The World Bank.

Environmental Impacts of Major Infrastructure Projects

- Potentially countervailing objectives
  - Infrastructure in response to changing climate (drought, flood, disasters) to limit climate-induced population displacement
  - Efforts to mitigate climate change or promote adaptation resulting in other infrastructure induced displacement
- Dimensions of environmental impacts



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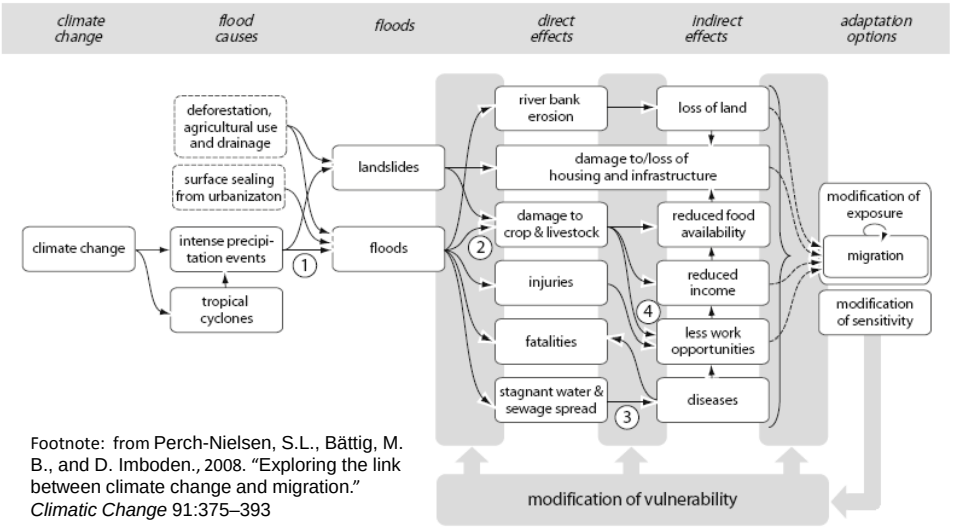
Example: Climate-Induced Migration



Footnote: from Perch-Nielsen, S.L., Bättig, M. B., and D. Imboden., 2008. "Exploring the link between climate change and migration." *Climatic Change* 91:375–393

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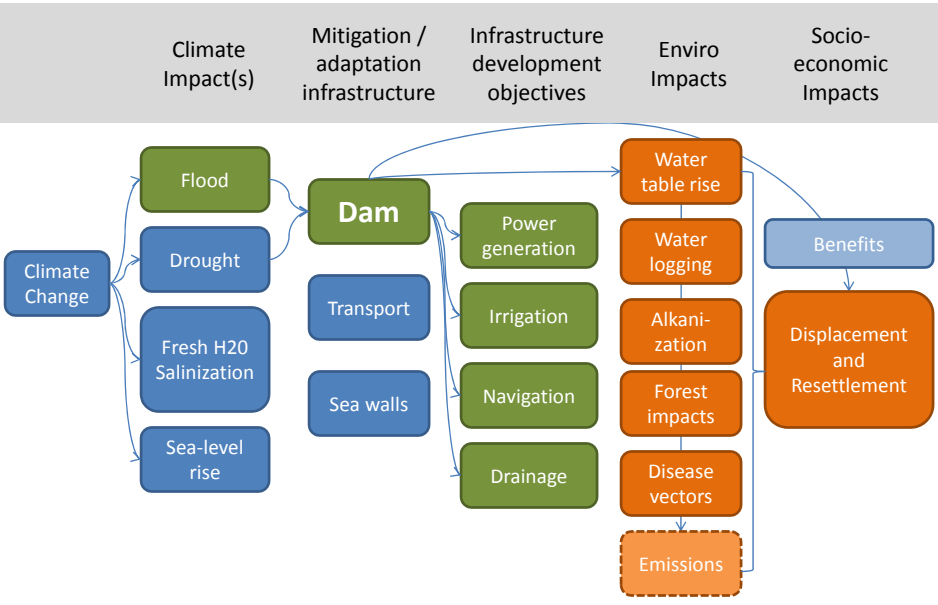
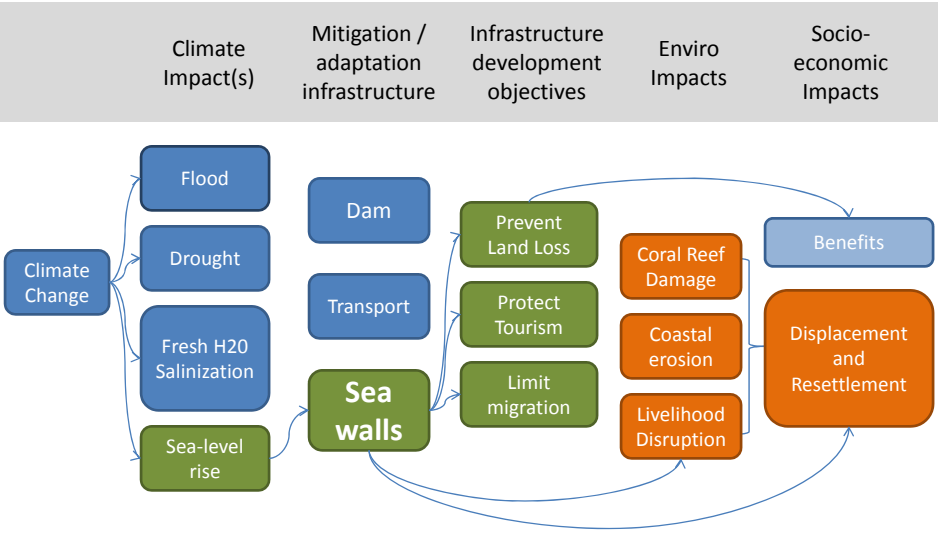
Dam Infrastructure Induced Displacement



Sea Wall (Adaptation) Induced Displacement



Typology of Displacements and Case Studies

SECTION 2

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Typology of Displacements

- Displaced to planned resettlement areas
  - Adaptation of those that have been displaced:
    - Changing economic activity, cultural practices, neighborhood perception
    - Full integration
  - Adaptation of host communities (receiving displaced):
    - Out-migration X Integration
- Displaced without planned resettlement
  - No EIA/HIA or lack of accountability
    - Rupture of social, cultural, and community ties
    - Unclear future prospects
    - Multiple resettlements may be necessary

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Typology of Displacements

- Infrastructure projects also create in-migration:
  - Temporary jobs related to project's construction
    - Unskilled/semi-skilled/skilled/professional labor
      - Expectations often exceed demand for labor, putting more pressure on the environment and on local services (e.g., health care and housing)
  - Attraction to new infrastructure (e.g. roads, water, electricity)
    - Corporations
    - Land speculators
    - Small businesses
    - Migrants attracted by the expectation of economic payoffs
- Projects may cause out-migration of local population not directly displaced by the project, but unable to cope with negative consequences

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Case Studies

Mali
- Office du Niger - Inland Delta
- Manantali Dam

Brazil
- Tucuruí Dam, Pará (Amazon)
- Balbina Dam, Amazonas (Amazon)

South America
- IIRSA: 360+ regional infrastructure projects

Pakistan
- Indus River Valley barrages

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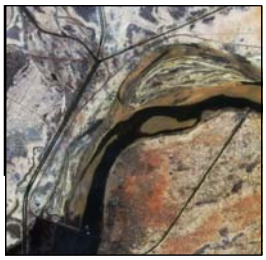
Mali: Office du Niger, Inland Delta

- Example of an infrastructure scheme that displaced few and attracted new settlers.
- **Purpose**: In 1930s Office du Niger (ON) created with plans for 1m hectares of long-staple cotton with 1.5m new inhabitants. Forced labor and resettlement provided the labor. [1] Rice replaced cotton in 1960s.
- **Environmental impacts**: Water table rise, water logging, alkalinization require improved drainage.[2]
- **Population impacts:**
  - **1961**: 45,000 ha were developed with 37,000 people residing there, but by 1964 the pop declined to 33,000.[1]
  - **Late 1970s**: 53,000 settlers.
  - **1992**: 47,000 ha of improved lands, and 132,235 people resided there.[2]
  - Yields and incomes have risen in recent years owing to reforms.



Footnotes: (1) Watkins, T. "The Office du Niger and the Scheme to Irrigate the Sahara Desert". Available at http://www.sjsu.edu/faculty/watkins/officeduniger.htm. (2) Aw, D, and G. Diemer . 2005. Making a Large Irrigation Scheme Work: A Case Study from Mali. Washington DC: World Bank.

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Mali: Manantali Dam

- Located on the Senegal River, construction completed in 1987, displacing 10-12,000 people.
- **Purpose**: hydroelectric power generation, increased dry season flows for irrigated agriculture, and navigation.
- **Environmental Impacts**: Has had major impacts on flood-recession farming, fisheries, pastoralism, ground water resources, riverine forests, and water-borne diseases. The conversion from flood-recession farming to irrigated agriculture has been much slower and costlier than expected. Irrigated agriculture has actually been less productive than flood-recession farming, and contributes to water-borne diseases via irrigation canals and water-storage areas. [1]
- **Population impacts**: A land grab by Moors in 1989, intent on resting valuable river lands from traditional Hal Pulaar communities, led to the forced expulsion of ~70,000 black Mauritanians. [2] In 2007, 20,000 still remained in camps in Senegal.[3]

Footnotes: (1) Pottinger , L. 1997. "Manantali Dam Changes Will Make a Bad Situation Worse", http://www.africaaction.org/docs97/ irn9711.htm. (2) de Sherbinin, A. 1992. "Mauritanian Refugees: Casualties of Rural Development?" Paper presennted at the Annual Meeting of the Association of American Geographers. (3) "New Hope for Long Suffering Mauritanian Refugees", http://en.afrik.com/ article12370.html (more: http://internationalrivers.org/en/node/665)

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Brazil: Tucuruí Dam, Pará (Amazon)

- **Purpose**: Electricity generation (subsidized energy provided to the aluminum industry)
- **EIA:** Construction predates Brazil's 1986 requirement of an Environmental Impact Assessment.
- **Environmental impacts:** Only 30% of the area was cleared before flooding (part of the submerged timber was later logged with a special underwater chainsaw). Over time turbines suffer corrosion as a result of water acidity due to the decomposition of flooded vegetation. The area of the reservoir's water surface at a water level of 72 m officially 2430 km^2. The loss of forest caused by Tucuruí was not limited to the area flooded. There was a major reduction in fish species.
- **Population impacts:** >32,000 people displaced; several remained without a home one year after the reservoir was filled; others were moved twice, since the initial relocation site ended up flooded; those without land title were denied assistance. More than 1/3 of the flooded area belonged to an indigenous group that was relocated 5 times within a period of 6 years.

Brazil: Balbina Dam, Amazonas (Amazon)

- One the greatest mistakes and ecological disasters that the Amazon has witnessed – has a reservoir of 2,360 km^2 and generates only 250 MW – or 9.4 km2/MW.
- **Purpose**: Supply electricity to Manuas, Amazonas' capital.
- **EIA:** Construction predates Brazil's 1986 requirement of an Environmental Impact Assessment.
- **Population displacement:** Mitigation programs to assist the population came in short, and were reduced over time. Additionally, one indigenous group was so severely impacted by the dam that accusations of genocide were set forth at the 4th Bertrand Russel Tribunal in Rotterdam in 1980.
- **Environmental Impacts:** Only 2% of the reservoir area cleared before flooding; decomposing trees generate CO2 and CH4 (methane) - in 1990 the emission levels were 22.6 times more than would have been emitted by fossil fuel generating the same amount of energy.

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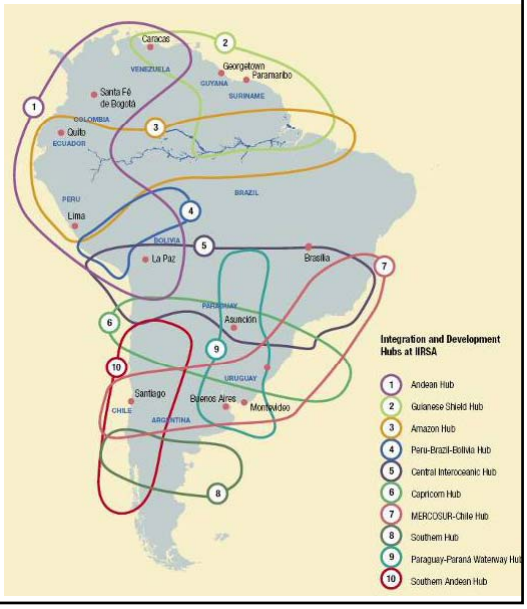
South America: IIRSA

- Initiative for the Integration of Regional Infrastructure in South America (IIRSA)
- **Purpose**: Regional integration; launched in 2000
- **EIA:** More than 360 infrastructure projects, mainly transportation (roads, ports, airports, waterways, bridges, and railroads) and energy (hydropowers, gas pipelines, and transmission lines). Each project will require a separate assessment.
- **Estimated Impacts:** Will directly impact ~ 2.5 million km^2 in South America, including, just in Brazil, 137 conservation units, 107 indigenous areas, and 484 areas considered of high priority for conservation due to biodiversity.



Pakistan: Indus River Valley

- The first irrigation canals were built by the peoples of the Indus Valley Civilization. Today, dams and barrages along the Indus support 90% of the country's agriculture, and provide water to Karachi, a city of 18m.
- **Purpose**: Water for agriculture and urban industrial and domestic use.
- **Environmental impacts**: A total drying of the Indus delta, including die off of mangroves and fisheries.
- **Population impacts**: Without the barrages, a large percentage of Pakistan's population could not be supported.

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Future Displacements Owing to Mitigation & Adaptation Projects

SECTION 3

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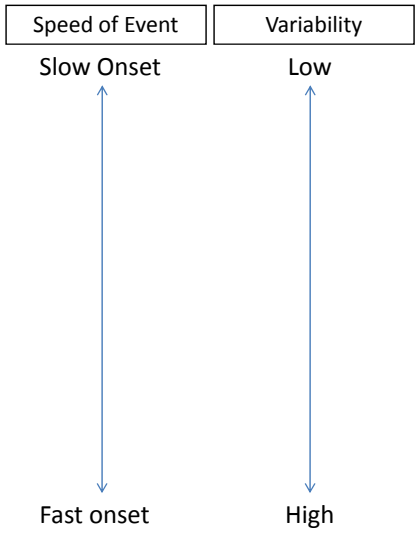
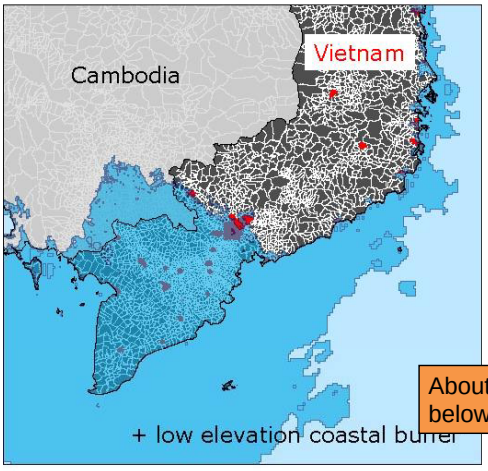
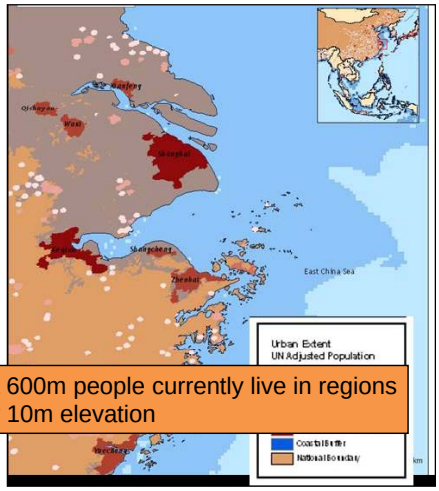
Climate change events

- Sea level rise:
  - Rising average sea level
  - Salt water intrusion in aquifers
- Water availability
  - Increasing
  - Decreasing
- Extreme weather events
  - Droughts
  - Heat waves
  - Violent Storms
  - Floods



Sea Level Rise





About 600m people currently live in regions below 10m elevation

Source: Balk, D., G. McGranahan, and B. Anderson. 2006. *Population and Land Area in Distribution in Urban Coastal Zones A Systematic Assessment.* Earth System Science Partnership Open Science Meeting, Nov 2006, Beijing.

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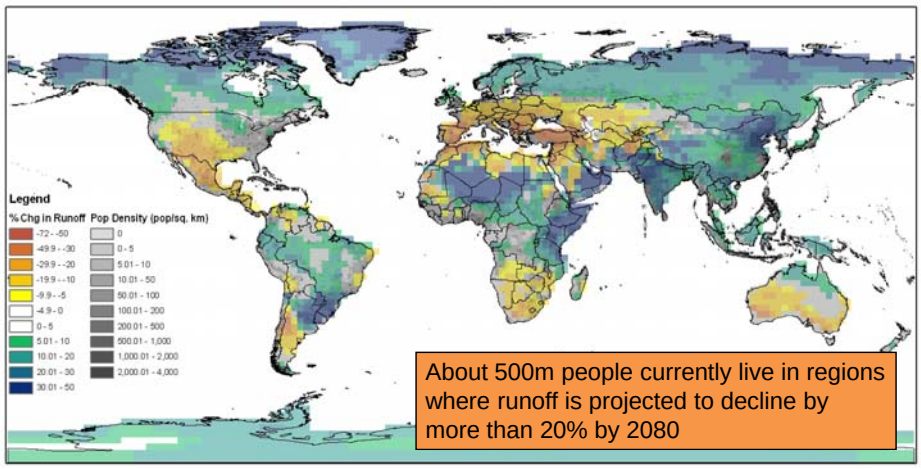
Water Availability



Source: Adamo and de Sherbinin (2009 forthcoming). The impact of climate change on the spatial distribution of populations and migration. Proceedings of the Expert Group Meeting on Migration, UN Population Division.

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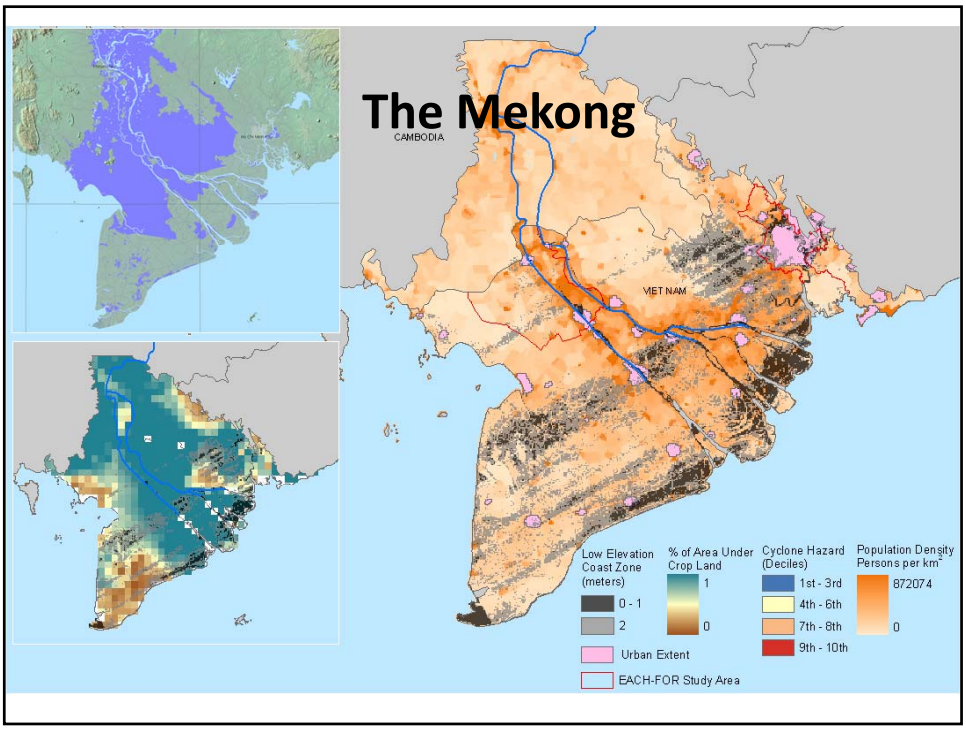
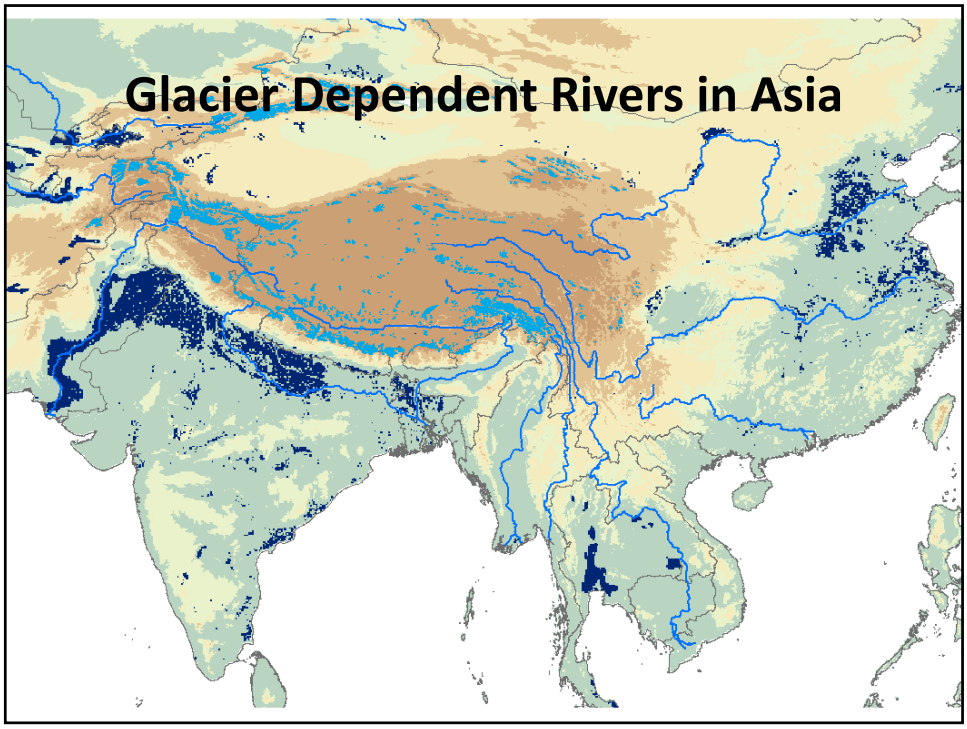
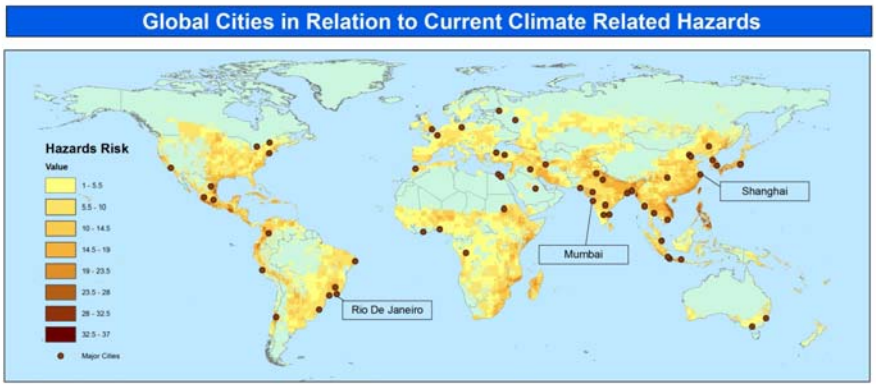




Extreme Weather Events



Hazard risk represents a cumulative score based on risk of cyclones, flooding, landslides and drought.

Source: de Sherbinin, A., A. Schiller, and A. Pulsipher (2007). The vulnerability of global cities to climate hazards. *Environment & Urbanization.* 19(1): 39-64.

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Climate Change Mitigation Projects

Objective	Potential Mitigation Response
Reduce GHG emissions	Hydroelectric facilities, large-scale wind farms
Develop biofuels	Biofuel plantations (jatropha, sugar cane, corn)
Increase "sinks" for GHGs	Forest plantations
Geoengineering	Injecting H_2S or SO_2 high in the stratosphere, tampering with ocean albedo, and possibly terrestrial

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Likely Impacts of Climate Change Requiring Adaptation Infrastructure

Impact	Potential Adaptation Response
Sea level rise, salt-water intrusion	Sea walls, dykes, freshwater injection facilities
Decreasing water availability, increasing droughts	Dams, irrigation works, water transfer schemes, desalination plants
Increasing water availability, increasing floods	Dams, dykes, levees, flood control infrastructure

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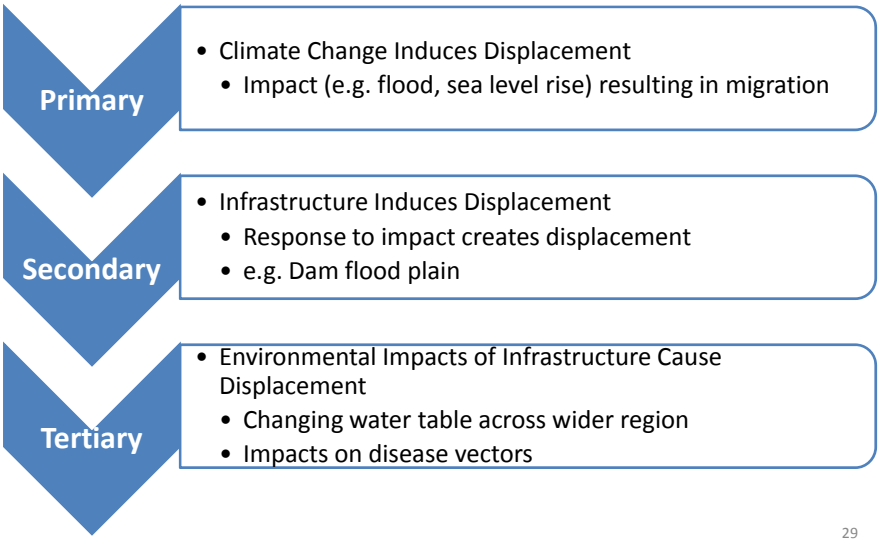
Levels of Displacement



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Conclusions & Further Research

- Not all adaptation will be the result of grass roots efforts to build climate resilience
- Large scale infrastructure will be a part of the mix
- Likely that some resettlement will be inevitable part of both proactive and reactive adaptation projects
  - Minimize climate and resettlement risks to displaced groups
  - Maximize capacity building within larger adaptation processes
- Migration, even when "forced", may be a viable adaptation option
- *"Resettlement is apt to generate opportunities to improve lives, not only disrupt them."* — M. Cernea, 1999

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http://www.populationenvironmentresearch.org

PERN CYBERSEMINAR TO ADDRESS THIS TOPIC IN 2010

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