



# **Who Will Bear the Burden of Climate Adaptation? Contrasting North and South, East and West**

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Population-Environment- Health Outcomes



# Climate Adaptation Priorities

1. Public Health/Safety
2. Food security
3. Resource security
4. Asset/wealth/livelihood protection



# North and South

Risks 1-2 are much higher in the South, 3 about even, and 4 much higher (in absolute terms) in the North.

Conclusion: In the

- South, emphasis will be on protecting people
- North, emphasis will be on protecting assets (wealth)

- Climate adaptation will entail large adjustment costs, either via relocation or investment.
- Low income countries by definition have limited savings, and thus will be driven toward relocation.
- This will arouse socio-political friction, which can be expected to trigger a combination of defensive action and conflict.
- Among the most potent defenses would be multilateral commitments to make the investments needed for Southern adaptation, and this category will probably come to dominate North-South assistance flows.
- The ultimate question: How much can the North be persuaded to commit?
- Answer: Depends on shared interests.

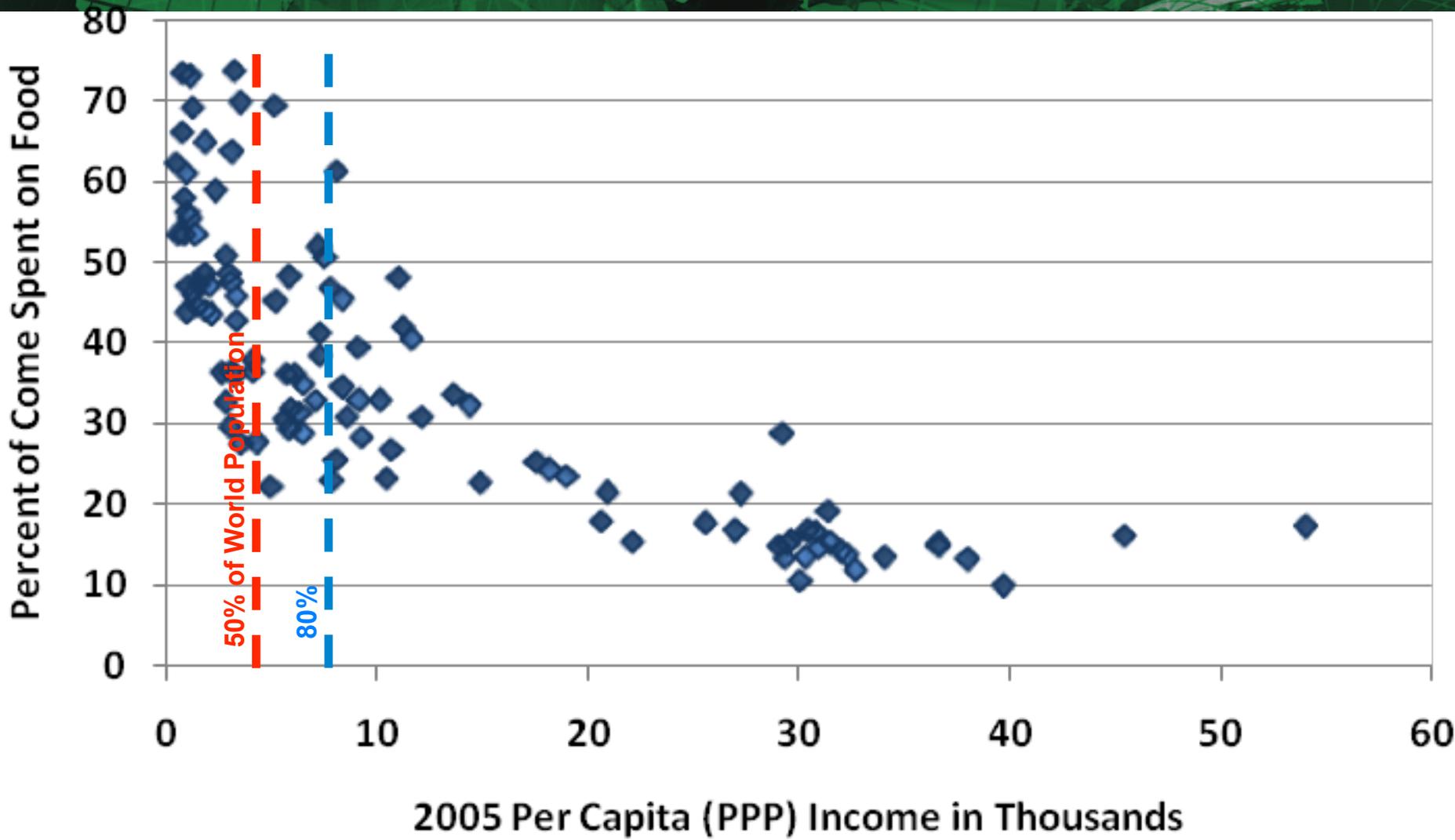
- The resources needed to adapt, both financial and technological, probably exist.
- Deploying them will have opportunity costs, however, and for public funds this means significant
  - Equity considerations: Should
    - Modesto homeowners pay for Malibu seawalls?
    - Palm Springs pay to fight fires in Truckee?
    - La Jolla pay for San Joaquin Delta restoration?
  - Efficiency Considerations: How should governments
    - Respond to uncertainty
    - Influence risk taking
    - Promote innovation



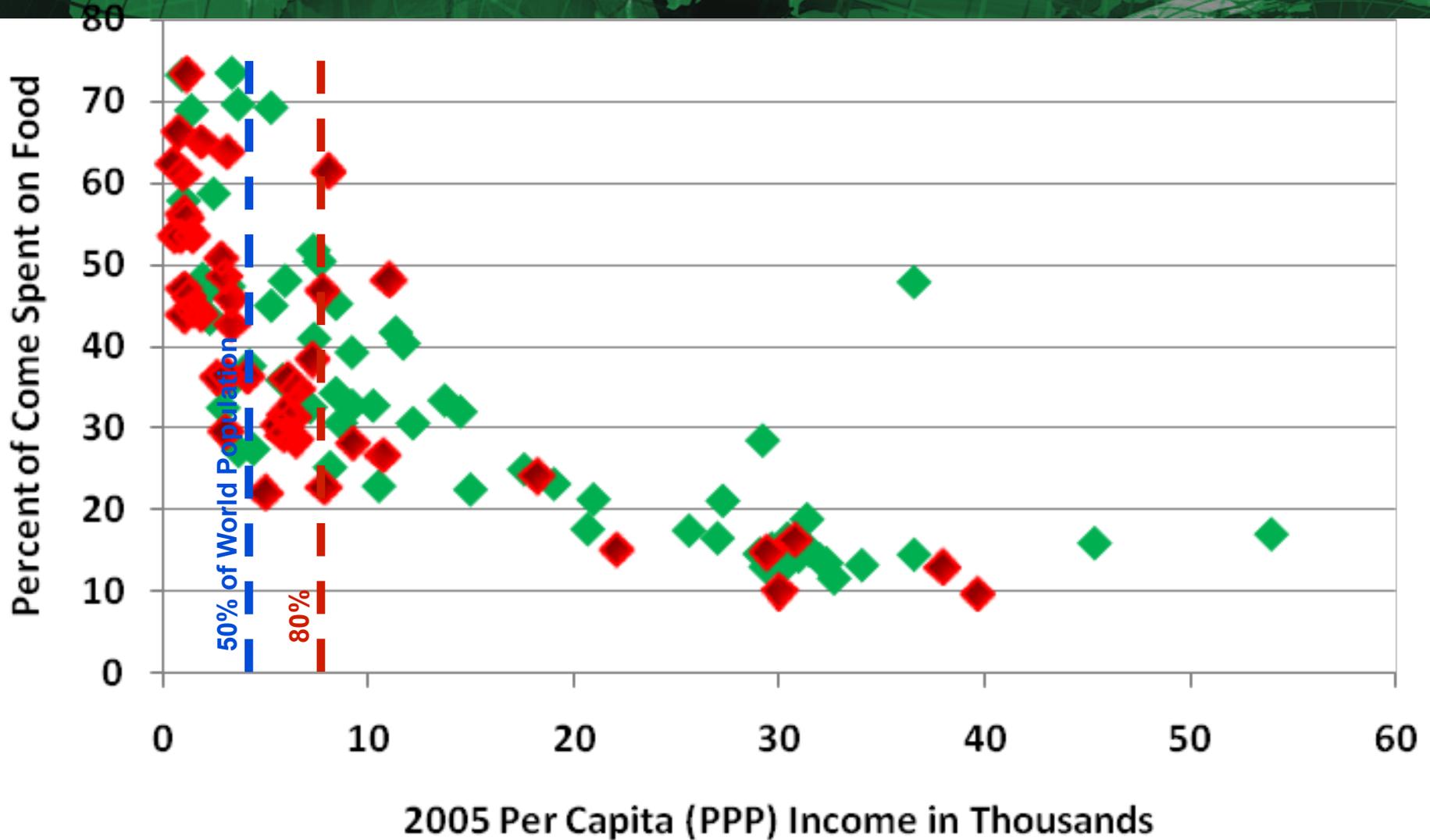
# Food Security

- Mounting evidence suggests crop yields are vulnerable to climate-induced changes in temperature and water, average and variance.
- For the North, this again means investment, especially in agricultural infrastructure and genetic material.
- The South may benefit indirectly from these innovations if there are spillovers and aid is available to implement them, but it is unclear if such transfers will be adequate.

# Food Security and Income



# Tropical Countries in Red





# East and West

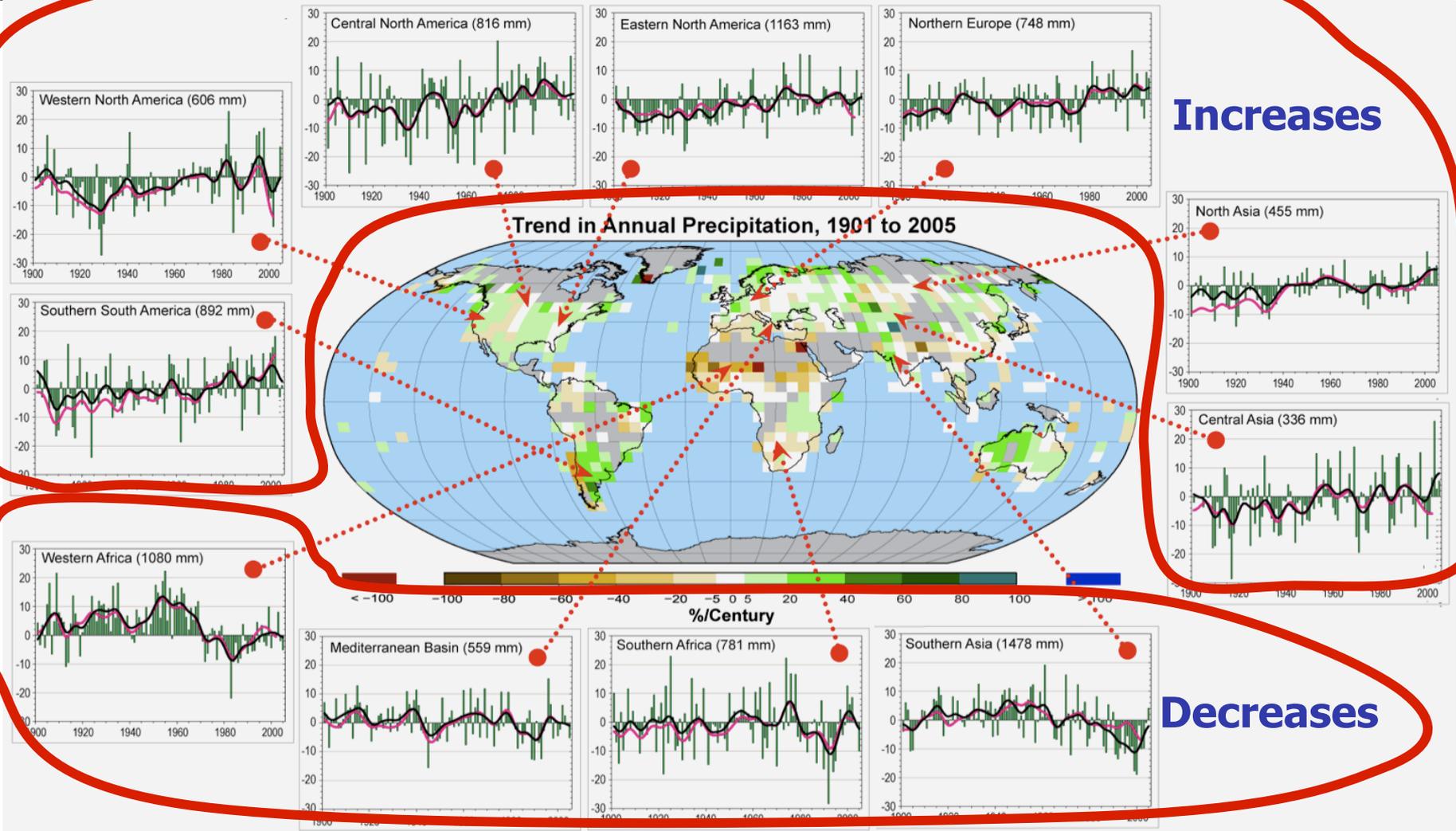
- While these regions have many similarities, their differences are striking in the context of climate adaptation.
- These differences are largely accidents of geology and geography, but they have profound implications for regional and global adaptation.
- The main category of East-West differentiation relates to water.



# Water Risk

- Water is life, and changing water is going to change our lives.
- Because climate is the most important determinant of water availability, climate change will dramatically affect this essential resource.
- These changes will present risks from three directions:
  1. Sky – changing rainfall and storm behavior
  2. Mountains – loss of water storage capacity
  3. Sea – rising and more variable sea level

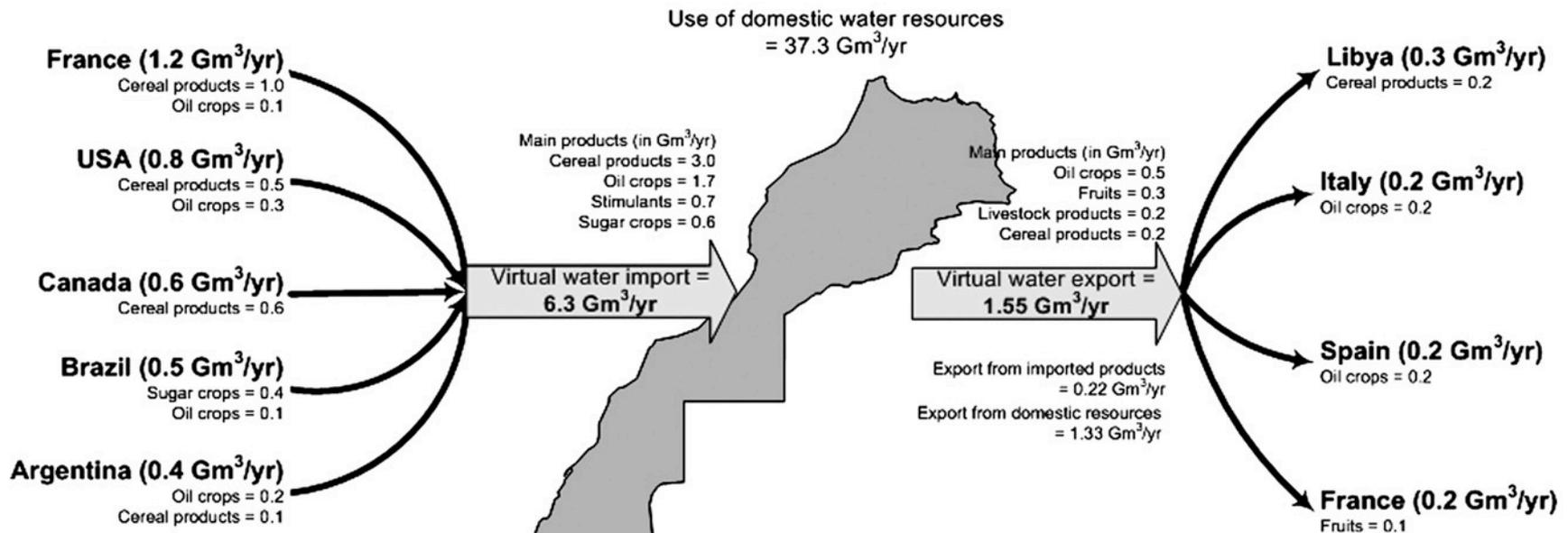
# Water from the Sky: Land precipitation is changing significantly over large areas



# Trade in Water Services: A partial solution

- Water pricing
- Ag. Biotech
- Contracting in regional agro-food supply chains
- Trade policy – import water services

Example: Moroccan Embodied Water Trade



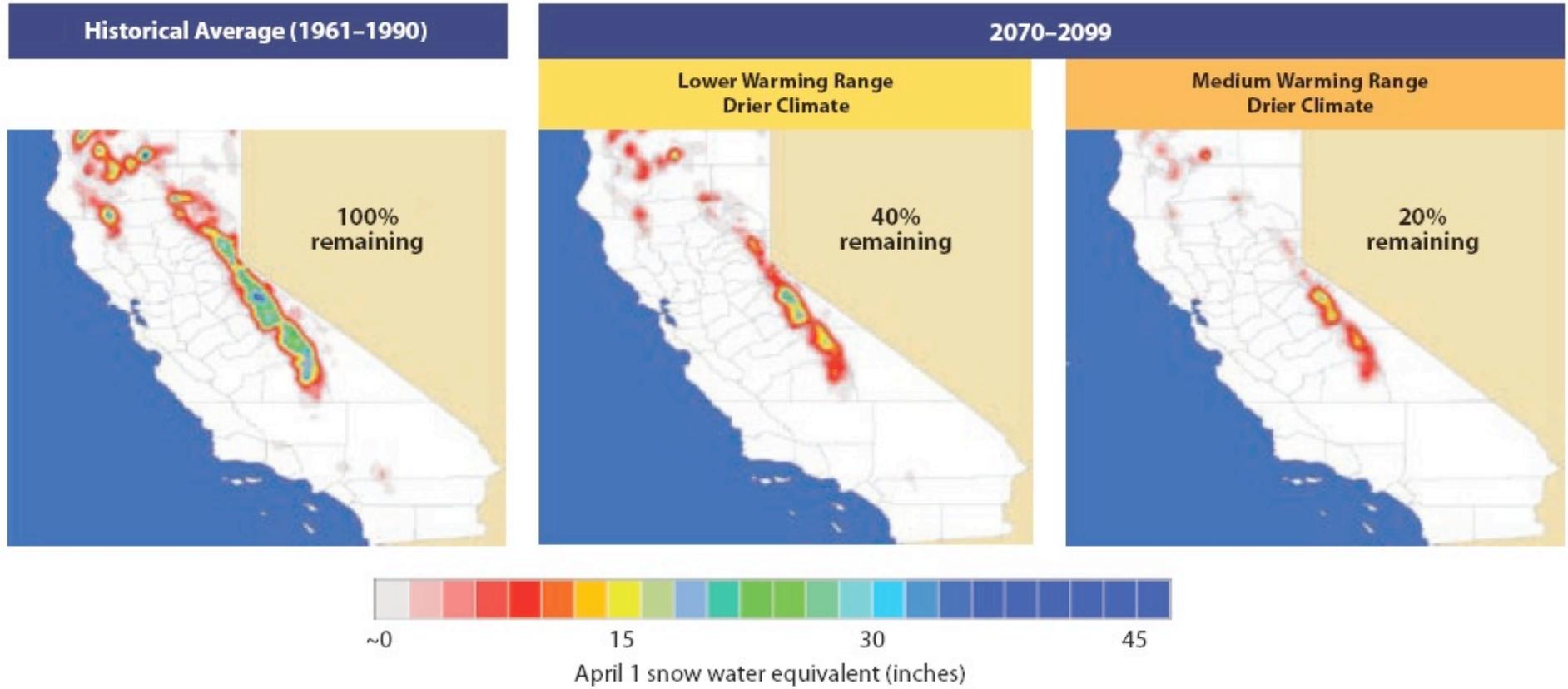
Source: Hoekstra and Chapagain: 2007



# Water from the Mountains

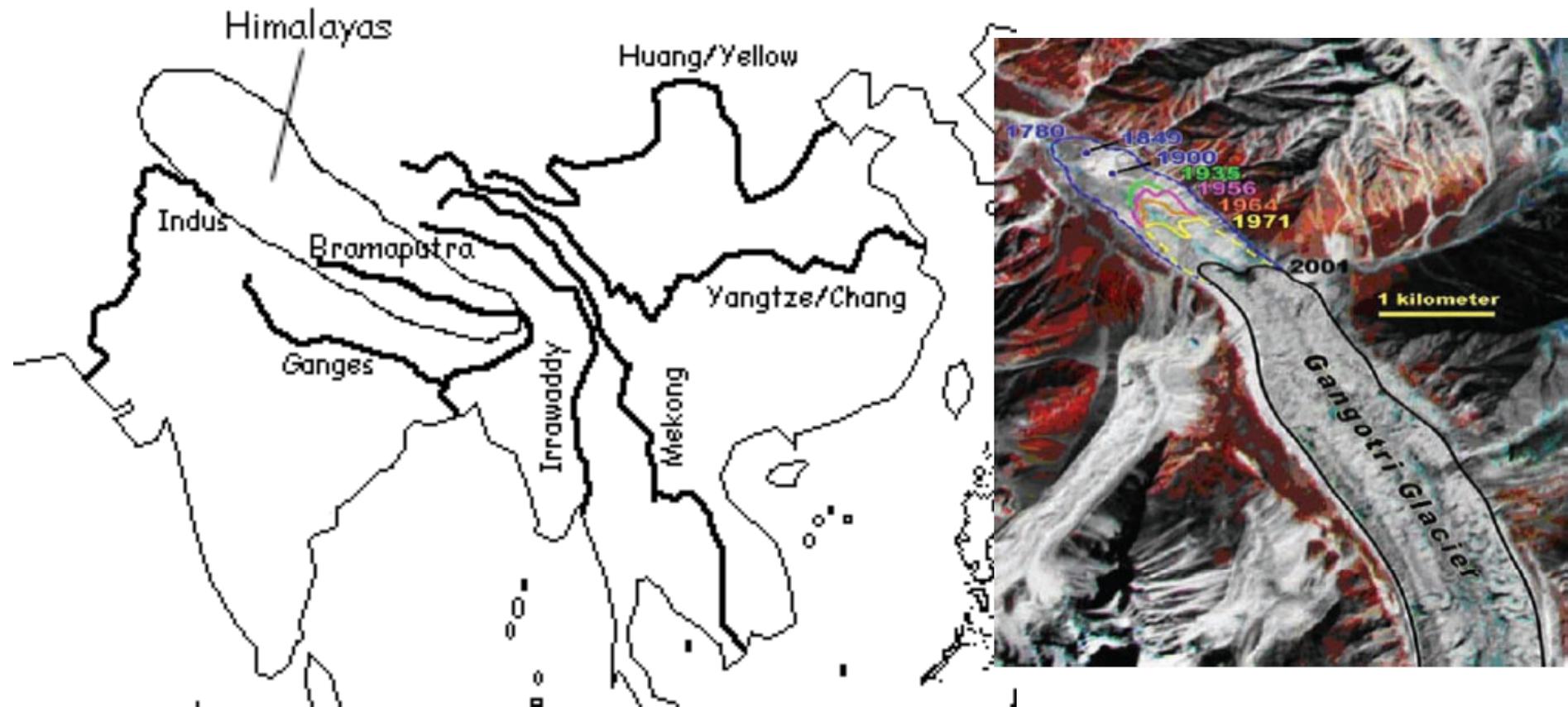
- Snow and ice are the planet's second largest fresh water storage facility (after ground water).
- Short term change
  - Temperature rise causes stream flow to increase in spring and decrease in summer
  - Water demand is highest during summer
  - Reduced contribution of snowmelt from lower elevation is counteracted by increased glacier melt from higher elevation
- Long term change
  - Stream flow initially increases as glaciers melt, then decreases when glaciers are depleted

# Reduction in the Sierra Snowpack

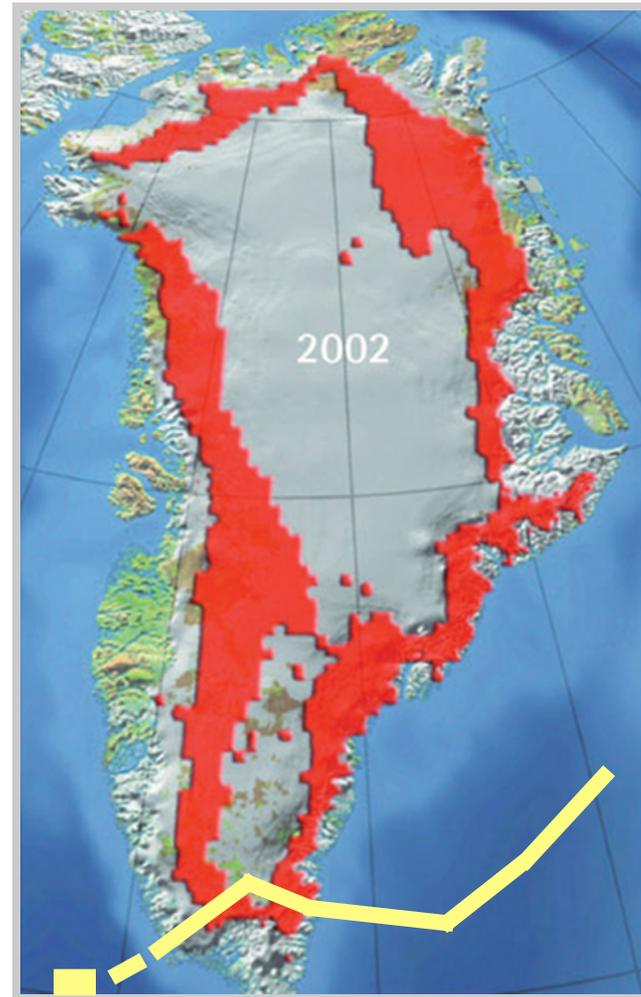


**Notes and Source:** “Lower Warming Range Drier Climate” is based on an GFDL B1 scenario; “Medium Warming Range Drier Climate” is based on a GFDL A2 scenario. Luers et al., 2006.

# The Himalayan Plateau Delivers Water to Countries Comprising nearly Half of Humanity

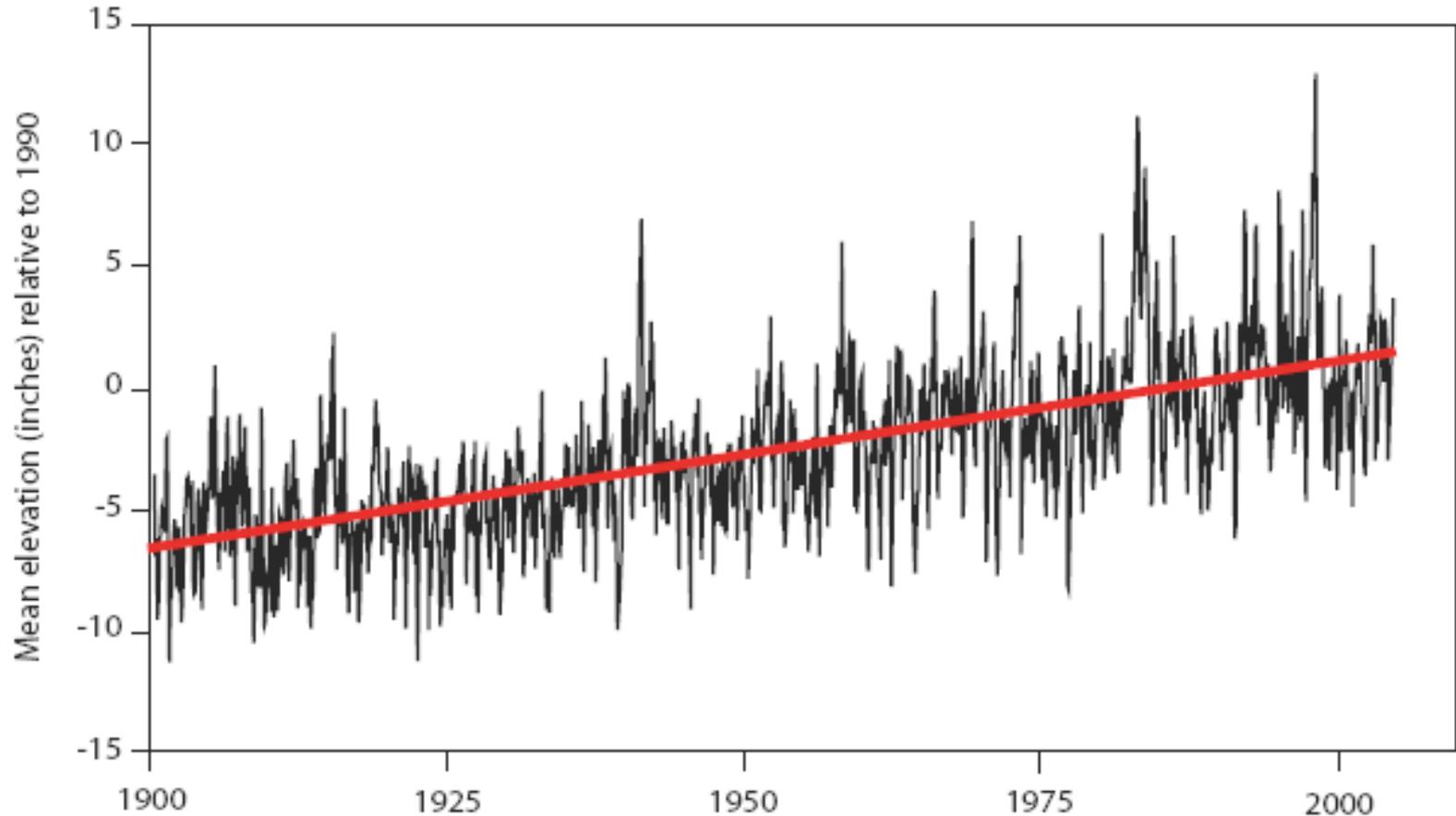


# Water from the Sea: Hope you like it.



Red areas on these two images show the expansion of seasonal melting of the Greenland ice sheet from 1992 to 2002. Yellow line shows the temperature trend, 1°C from 1900 to 2000

# Sea Level is not Static: San Francisco, 1900-2000



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"Medium Warming Range Drier Climate" is based on a GFDL A2 scenario. Luers et al., 2006.



# *San Francisco International Airport*

One Meter Sea Level Rise



5 October 2011

# Climate Refugees: Everybody's problem

## Potential impact of sea-level rise on Bangladesh



Today

Total population: 112 Million

Total land area: 134,000 km<sup>2</sup>

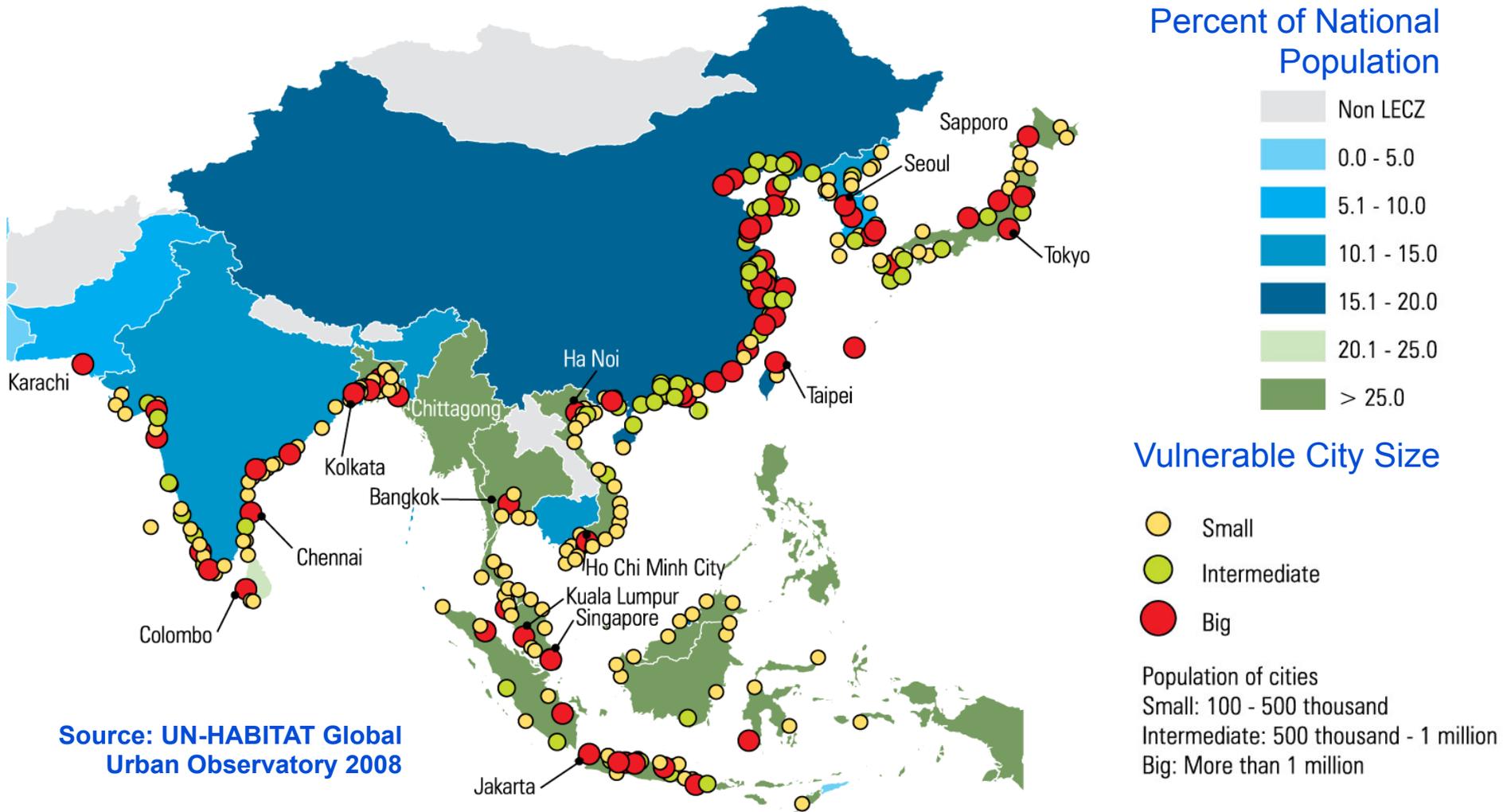


1.5 m - Impact

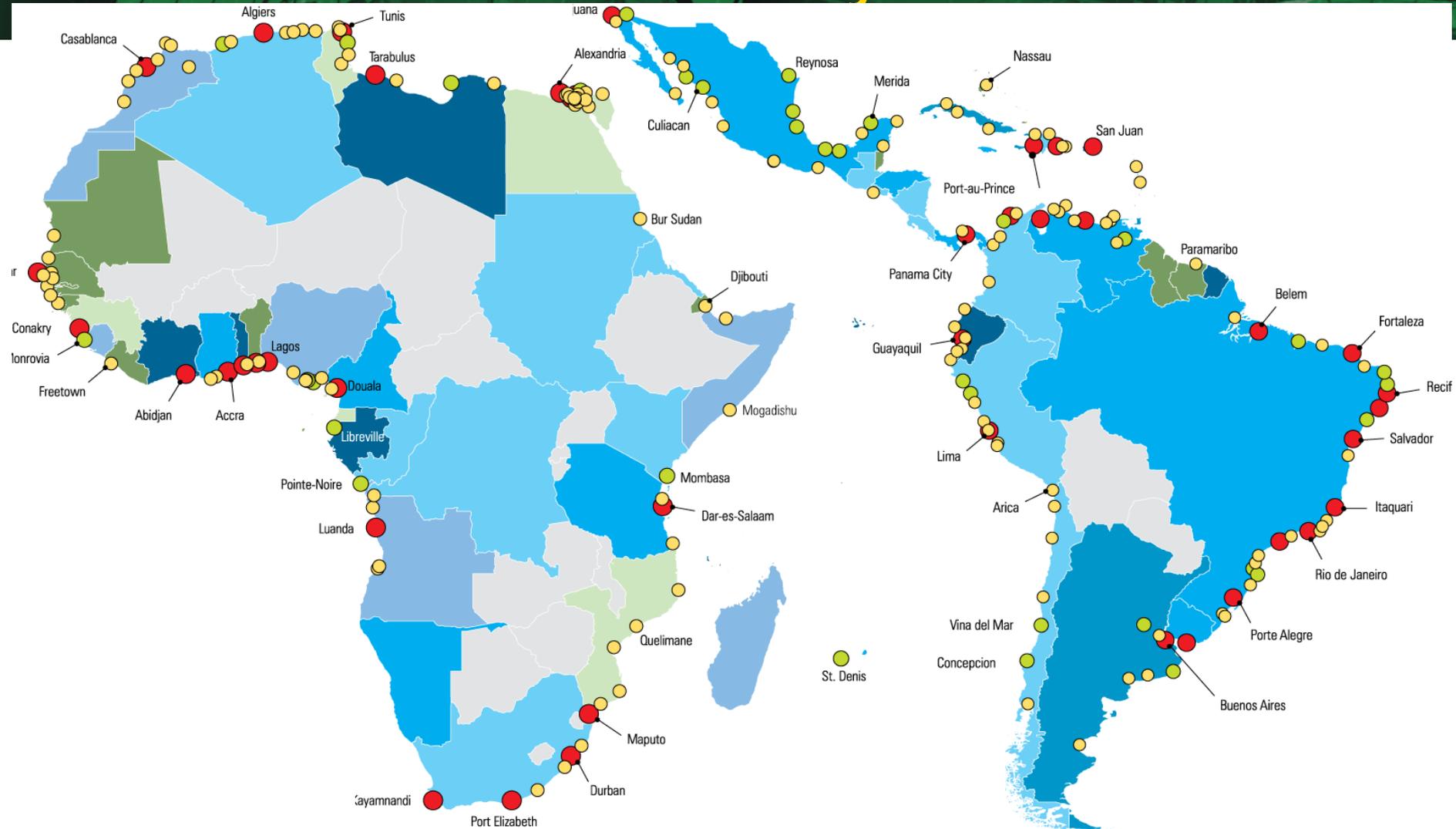
Total population affected: 17 Million (15%)

Total land area affected: 22,000 km<sup>2</sup> (16%)

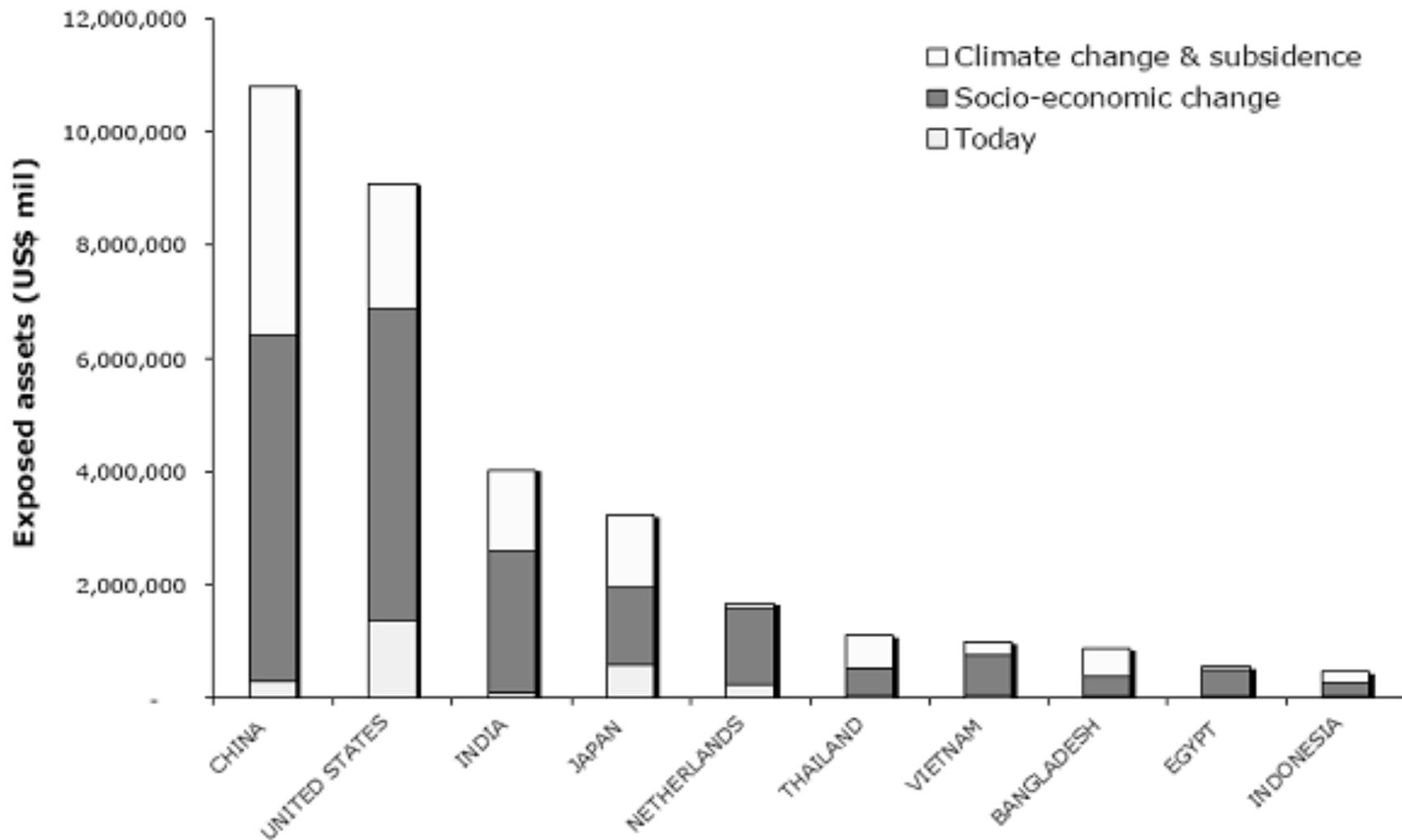
# Asia: 90% of Sea Level Population Risk



# Africa and LAC will be more affected by reduced rainfall

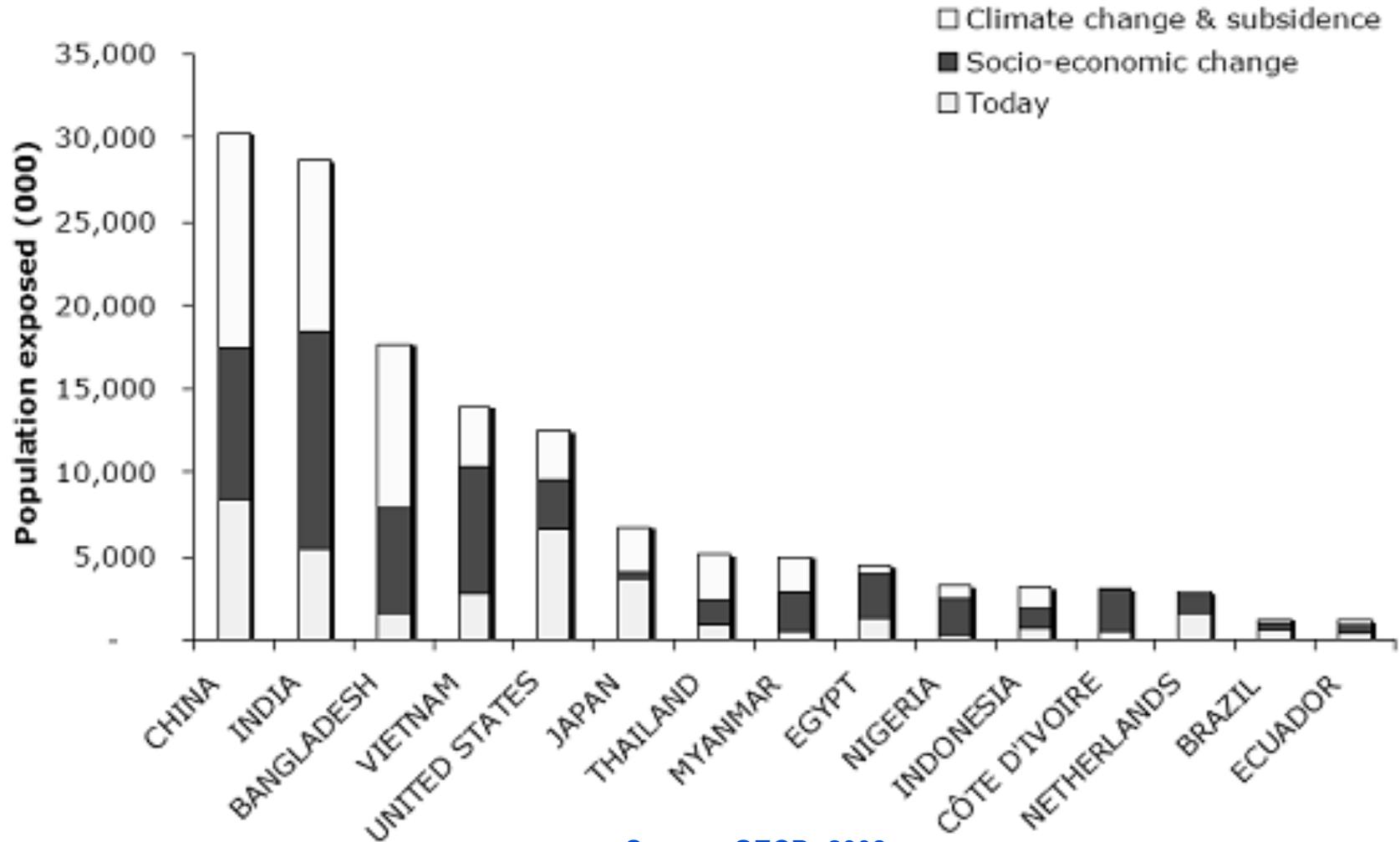


# Top 10 countries by assets exposed today and in the 2070s (OECD median scenario)



Source: OECD: 2008

# Top 15 countries by population exposed today and in the 2070s



Source: OECD: 2008



# A note on adaptation

It is essential to recognize and discriminate between two components of climate and climate-induced processes:

1. Changing mean – adjustment
2. Changing (rising) variance – risk management

Finally: How do we communicate risk?

**Thank  
you**

