

Peak Water, Climate, and National Water Strategies

for the US EPA Climate and Water

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Public Health



Infrastructure



Forestry



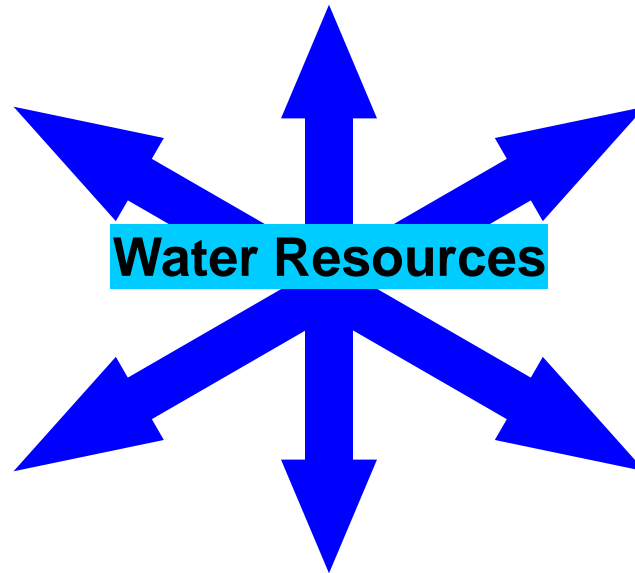
Energy



Environment



Agriculture



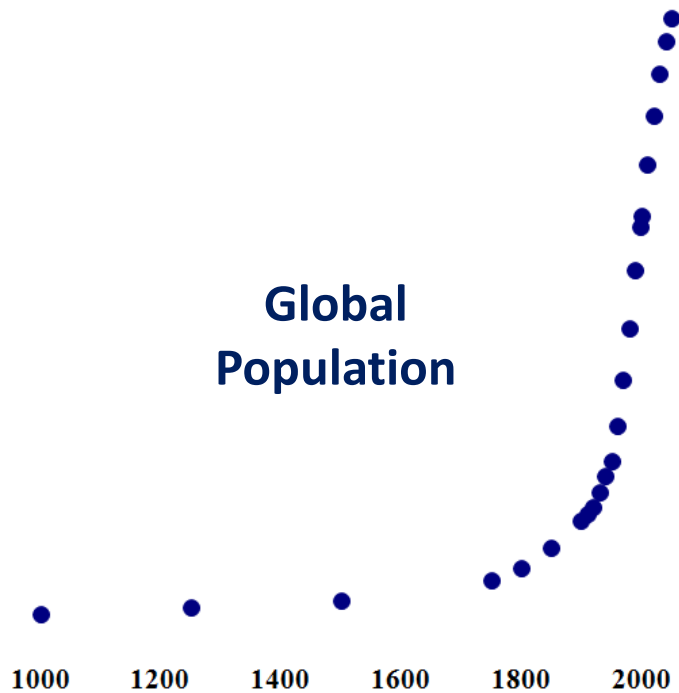
Peak Water

Gleick, P.H. and M. Palaniappan. 2010. "Peak Water: Conceptual and Practical Limits to Freshwater Withdrawal and Use." Proceedings of the National Academy of Sciences (PNAS), Vol. 107, No. 25. www.pnas.org/cgi/doi/10.1073/pnas.1004812107.

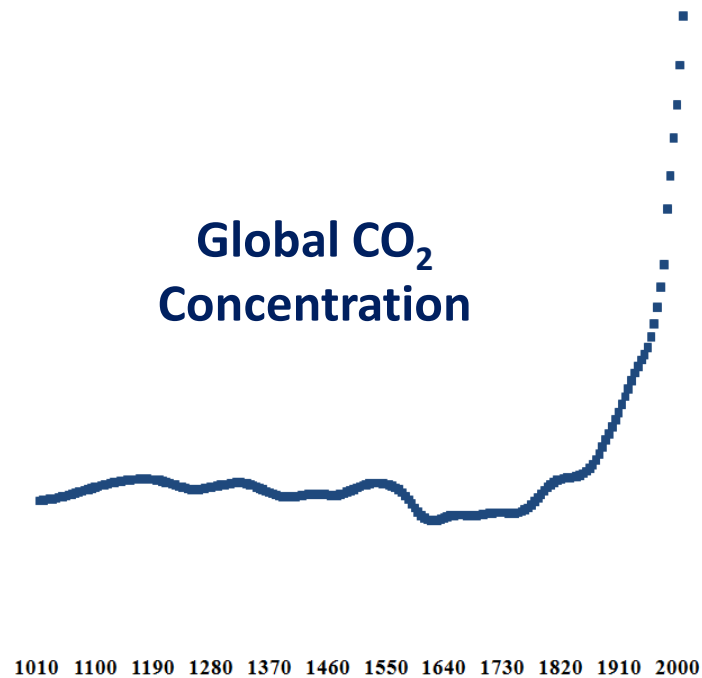
Renewable or Non-Renewable?

- Non-renewable resources are “stock” limited.
- Renewable resources are “flow” limited.
- Water uniquely exhibits characteristics of both: overall renewable but with some fixed, isolated non-renewable stocks.

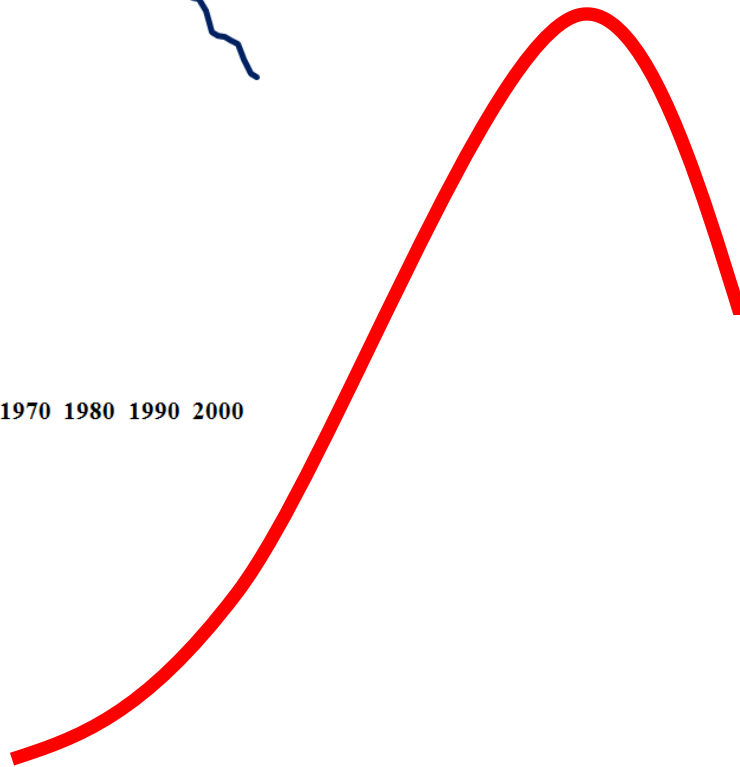
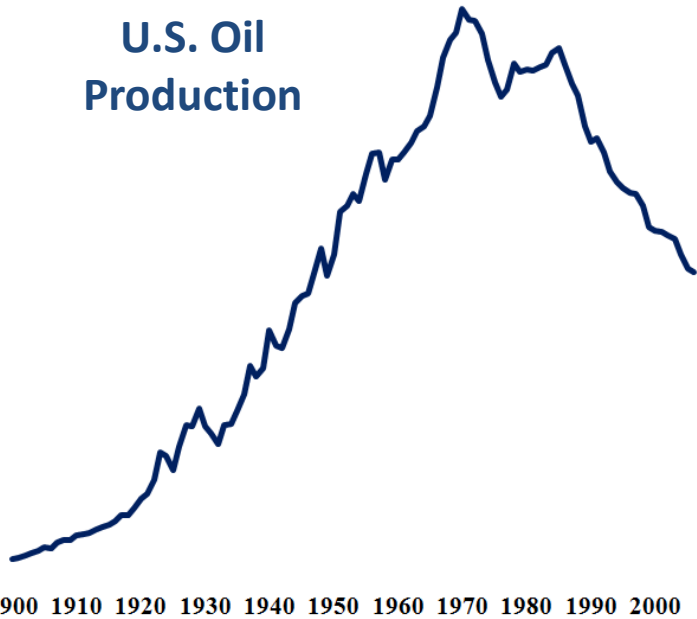
**Global
Population**



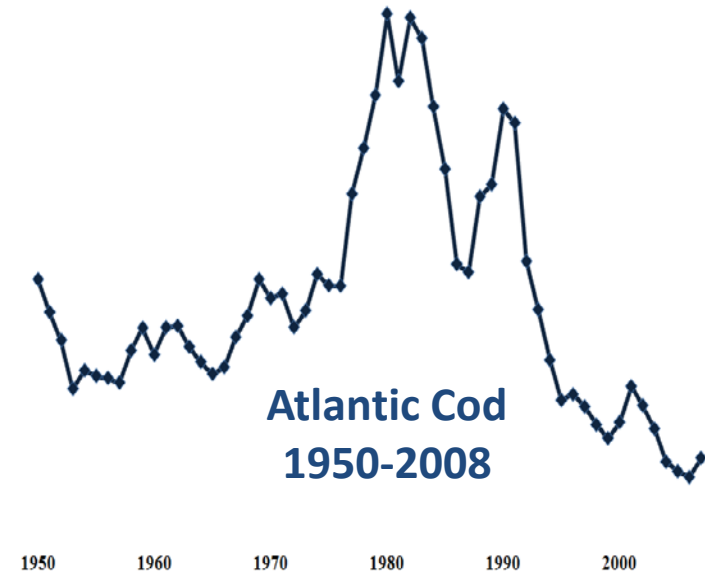
**Global CO₂
Concentration**



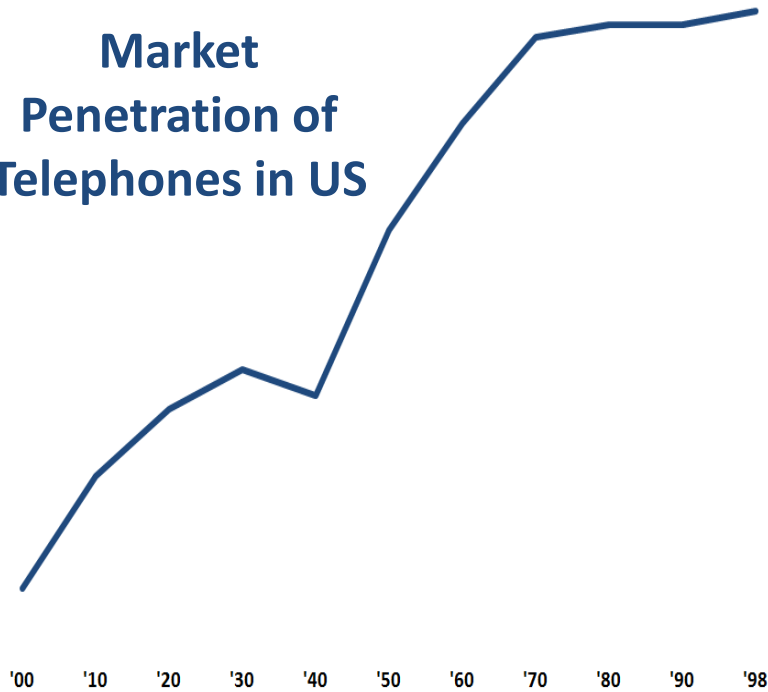
U.S. Oil Production



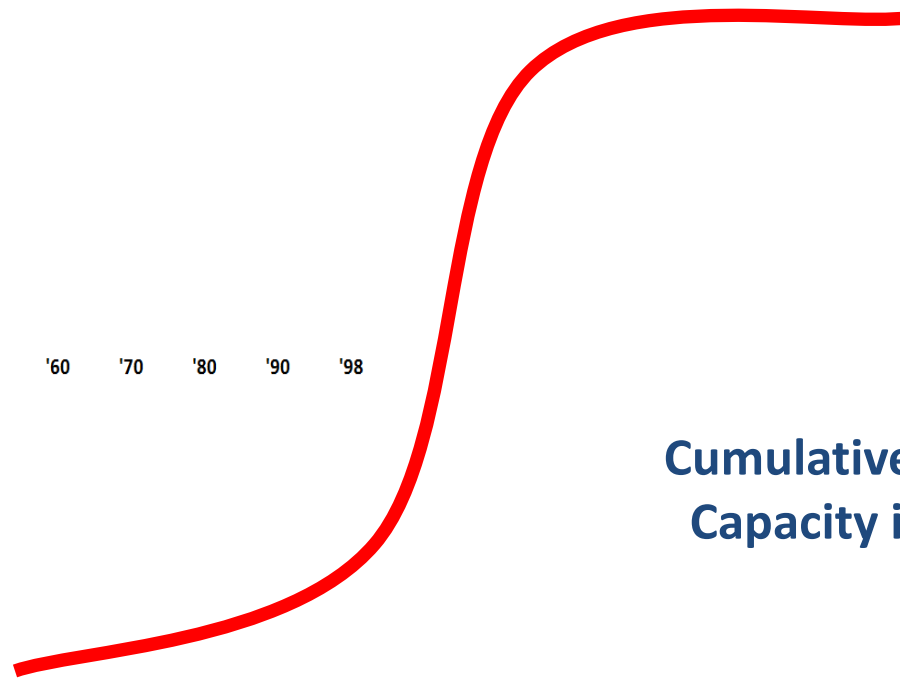
Atlantic Cod 1950-2008



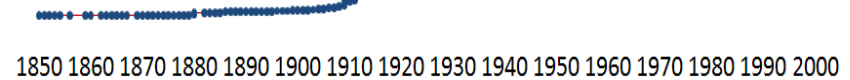
**Market
Penetration of
Telephones in US**



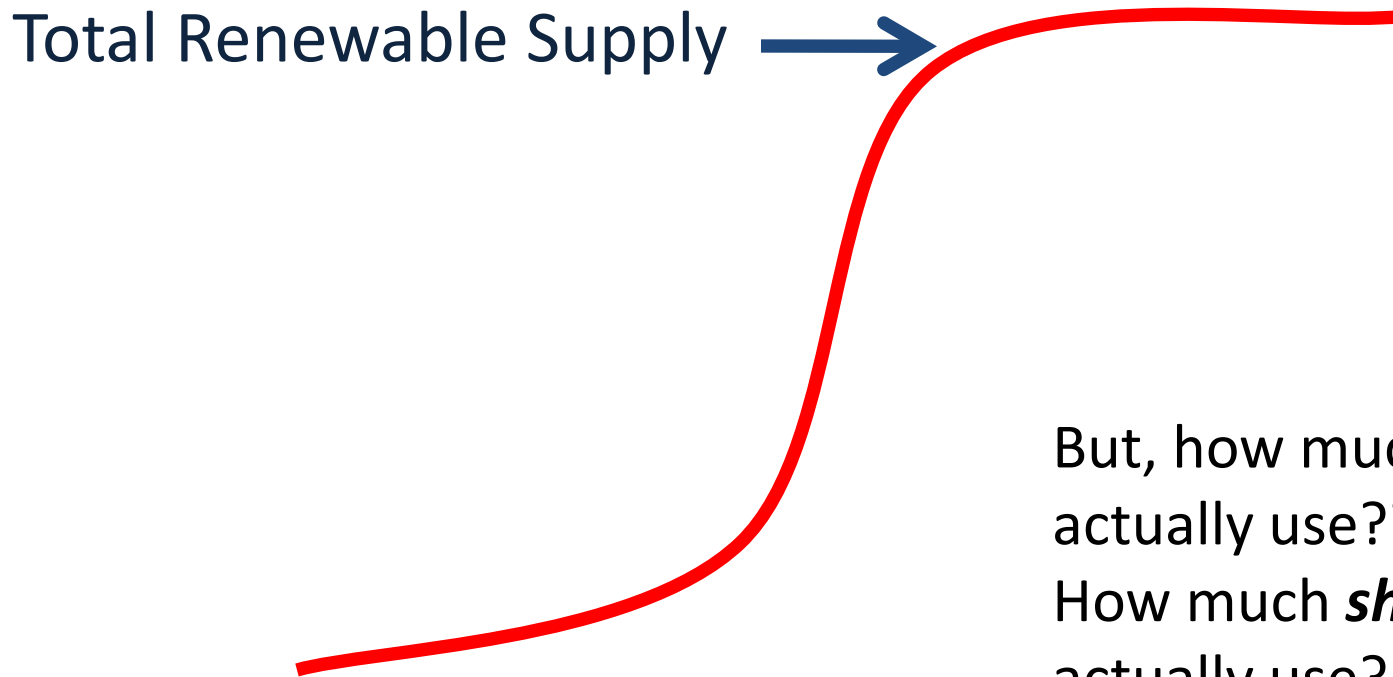
**Ecosystem
carrying capacities**



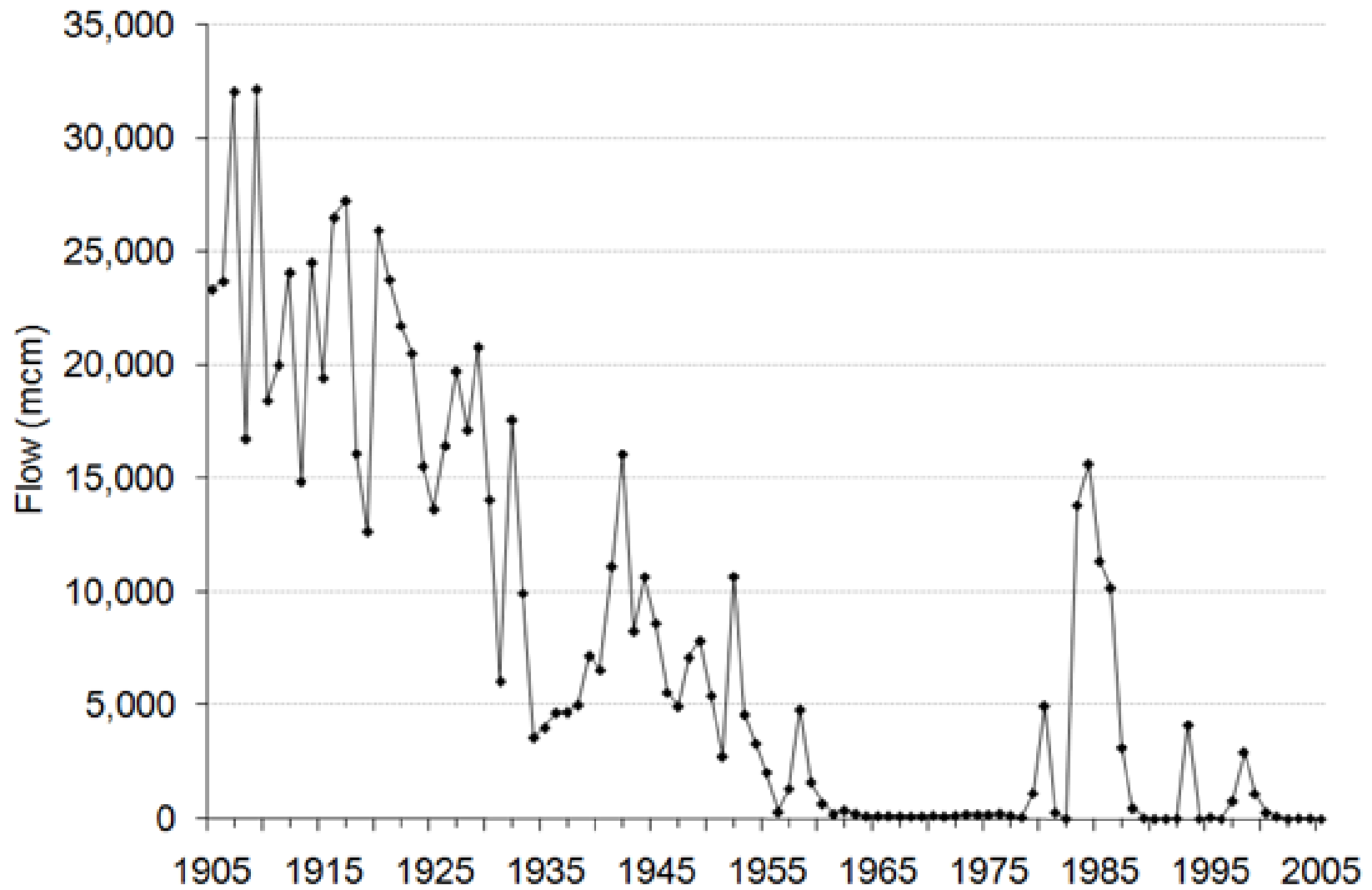
**Cumulative Dam
Capacity in US**



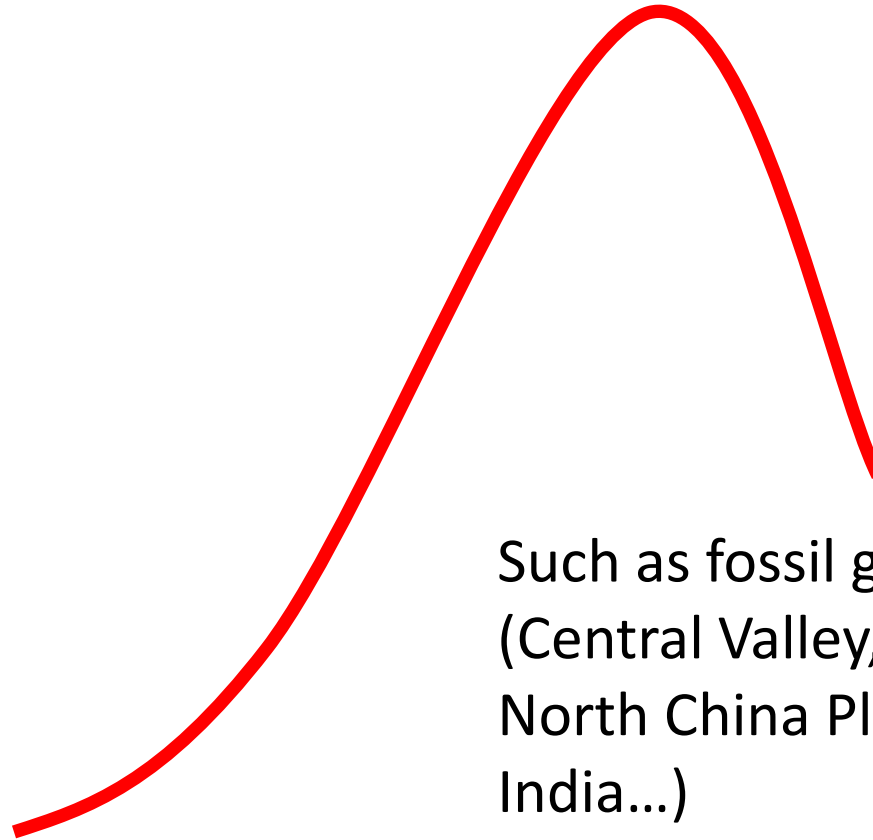
Peak Renewable Water



Total Colorado River Flow at the Delta

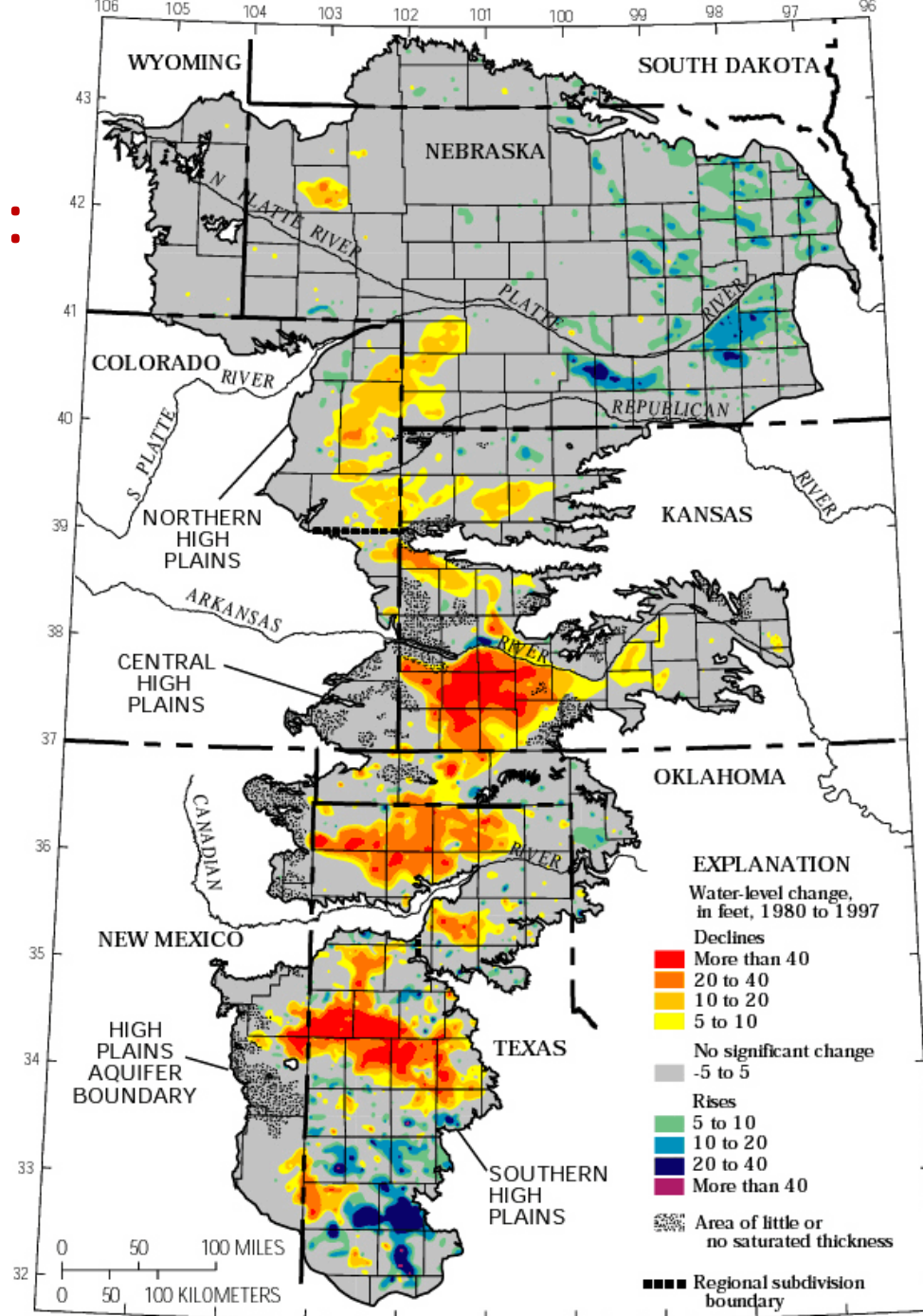


Peak “Non-Renewable” Water



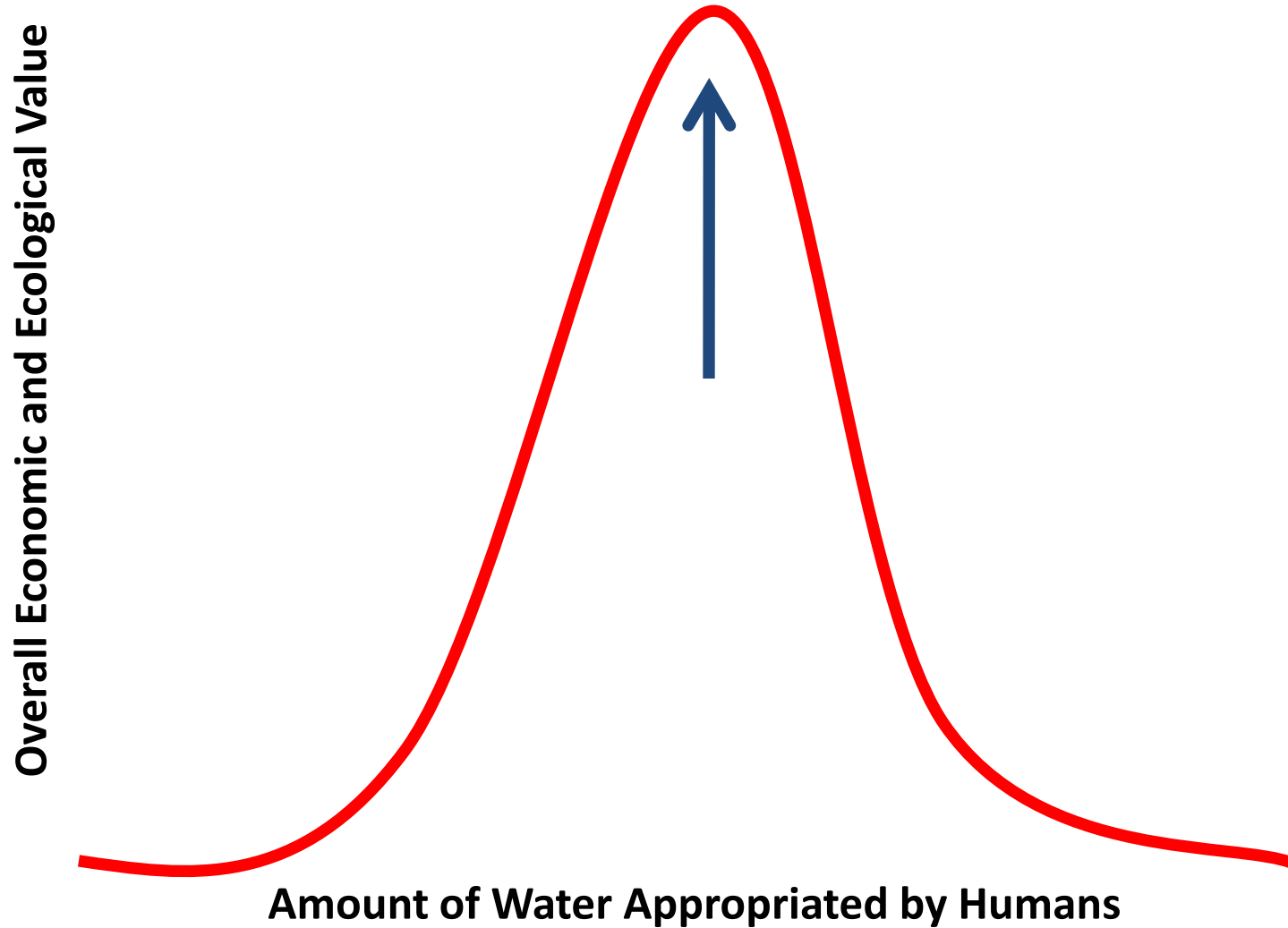
Such as fossil groundwater
(Central Valley, Ogallala, Libya,
North China Plains, central
India...)

Non-Renewable Groundwater Use: Ogallala Aquifer



Source: USGS, Fischer et al. Open-File Report 99-197

Peak “Ecological” Water



So, What Does Peak Water Mean?

- We'll never “run out” of water overall. It is (mostly) renewable.
- Where water is “non-renewable” we *will* run into stock constraints.
- We will run up against “flow” limits that are a combination of natural and economic constraints.
- We are increasingly hitting (or exceeding) peak “ecological” water limits.

Climate and Water

Climate Breakthrough

- Clean energy investments
- Greenhouse gas regulations
- Official comments at the highest level
- IPCC AR5; new National Climate Assessment

Tuesday, June 25th, 2013

President Obama's Plan to Fight Climate Change



SHARE ON FACEBOOK



SHARE ON TWITTER

President Obama believes we have a moral obligation to lead the fight against carbon pollution. Share the details of his plan to help make sure people in your community know the facts, and [click here](#) for the latest info on how climate change is affecting the U.S.

CLIMATE CHANGE

AND PRESIDENT OBAMA'S ACTION PLAN

PRESIDENT OBAMA HAS ANNOUNCED A SERIES OF EXECUTIVE ACTIONS TO REDUCE CARBON POLLUTION, PREPARE THE U.S. FOR THE IMPACTS OF CLIMATE CHANGE, AND LEAD INTERNATIONAL EFFORTS TO ADDRESS GLOBAL CLIMATE CHANGE.

Water and the New National Climate Assessment (NCA)

- There are hundreds of pages of information, observations, projections, and conclusions to absorb – almost all of it bad news. Here are some of the most important conclusions **related to U.S. water resources**:





Increased
air temperature

Climate Change Effects on Water Resources

Total precipitation may increase or decrease



More precipitation as rain than snow
due to higher temperatures



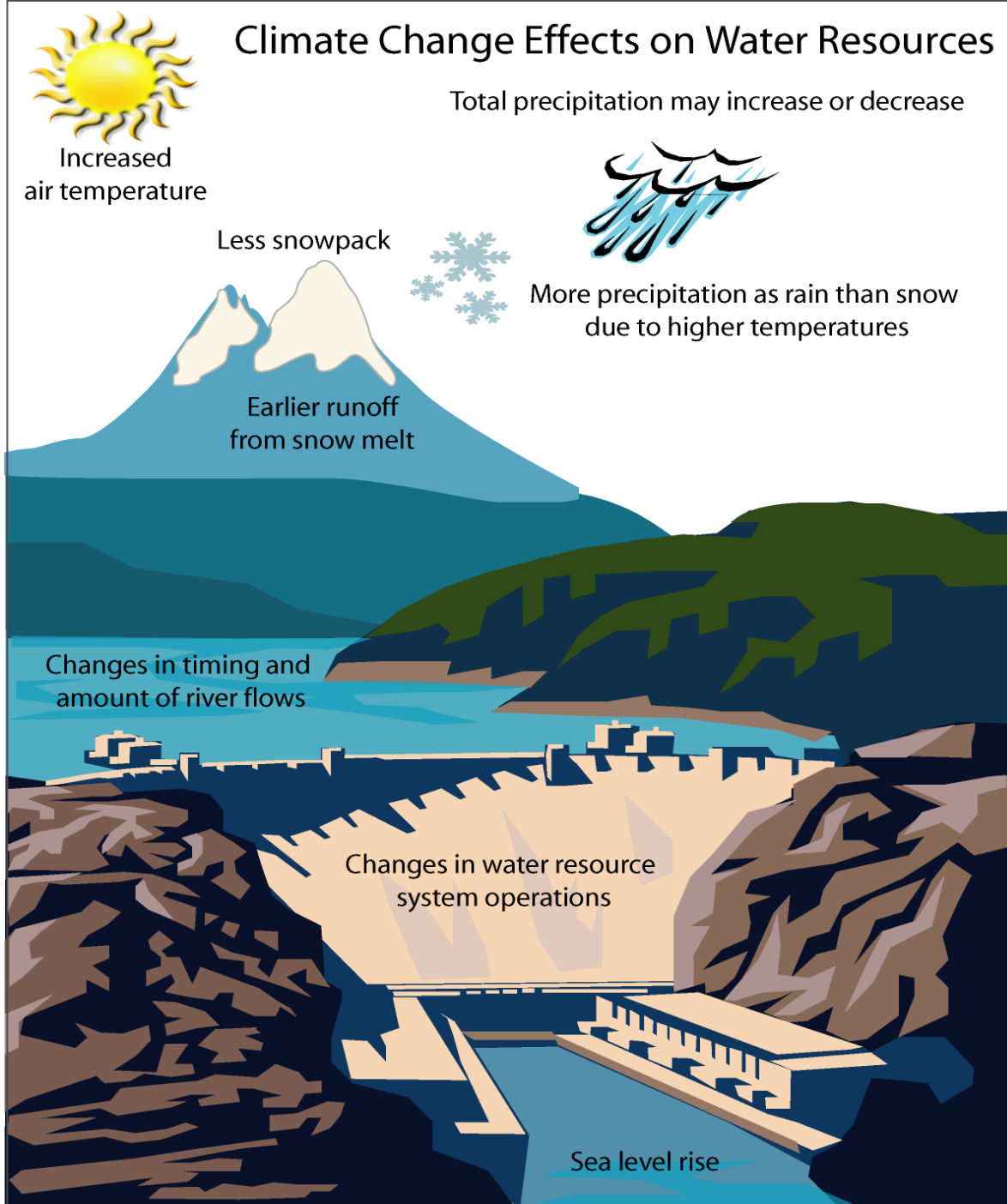
Less snowpack

Earlier runoff
from snow melt

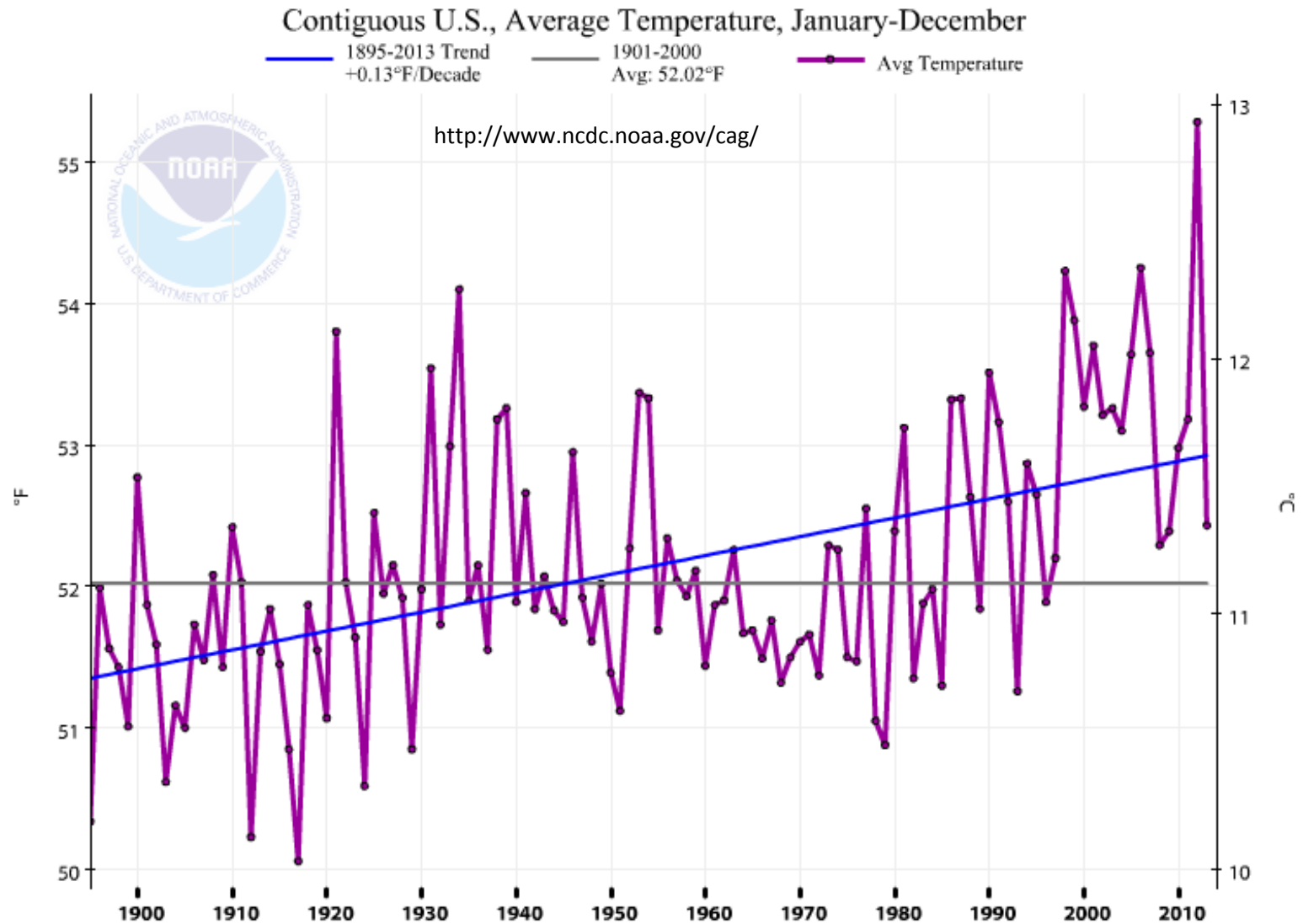
Changes in timing and
amount of river flows

Changes in water resource
system operations

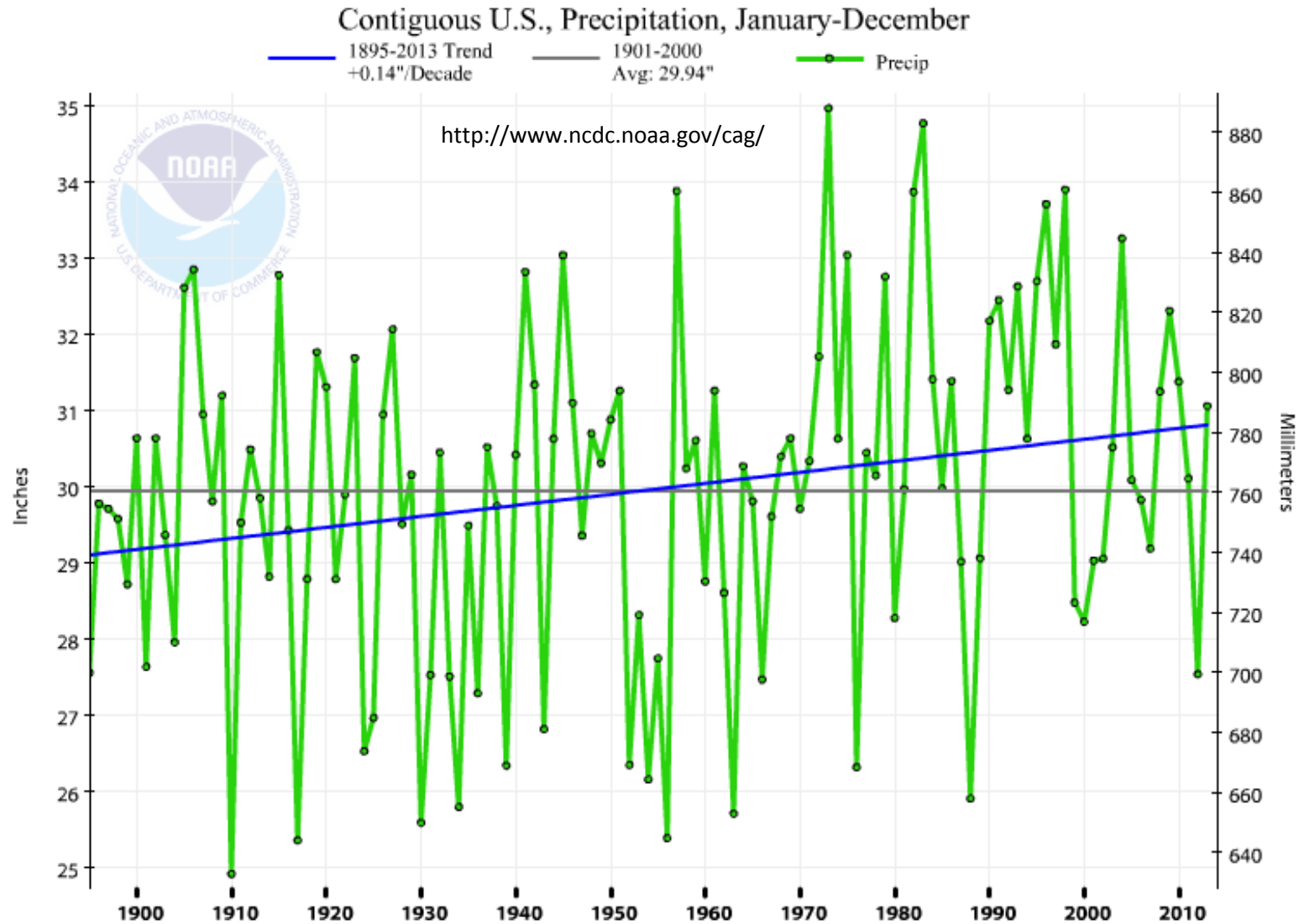
Sea level rise



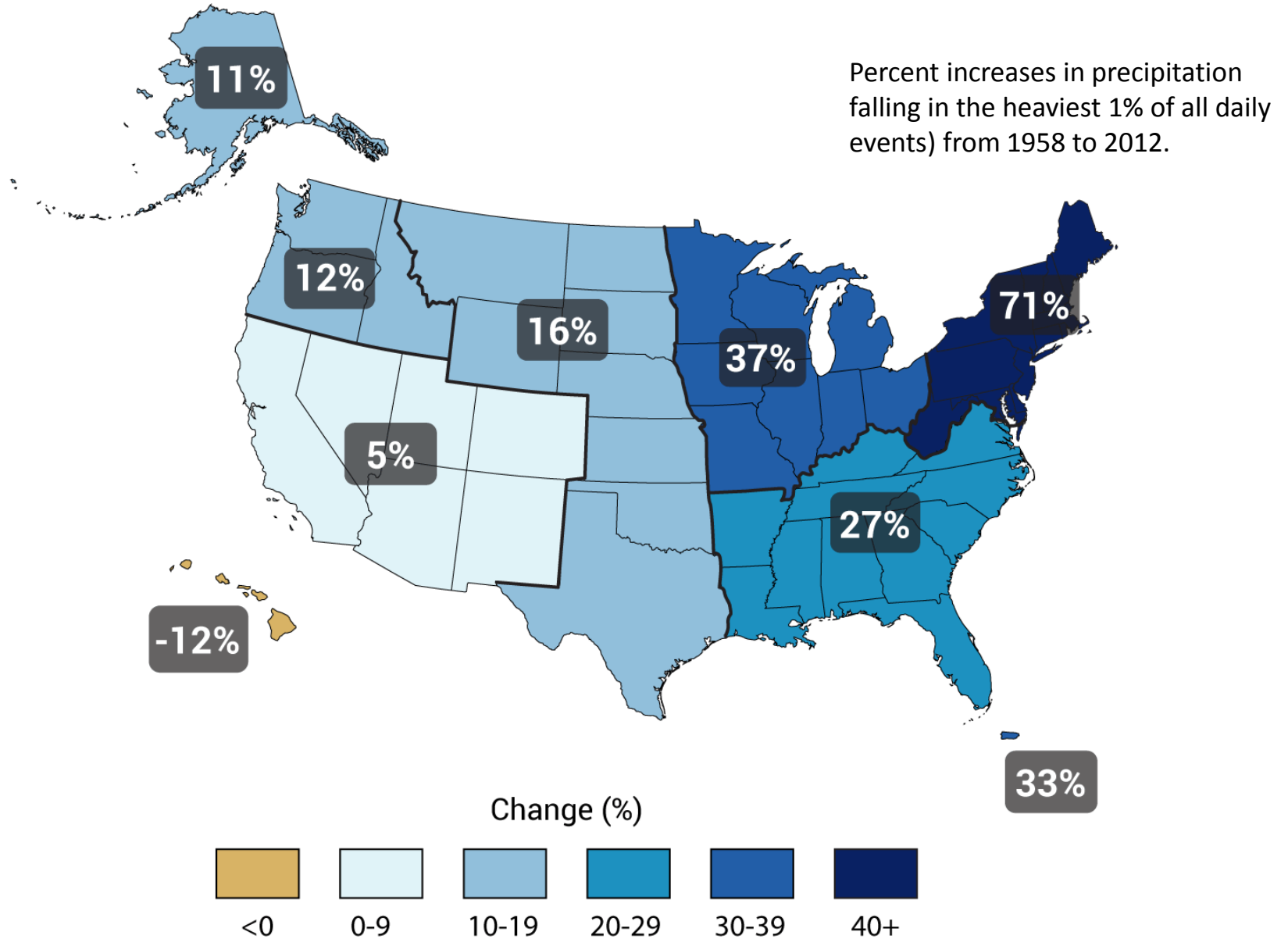
Contiguous US Average Temperatures 1895-2013 and trend



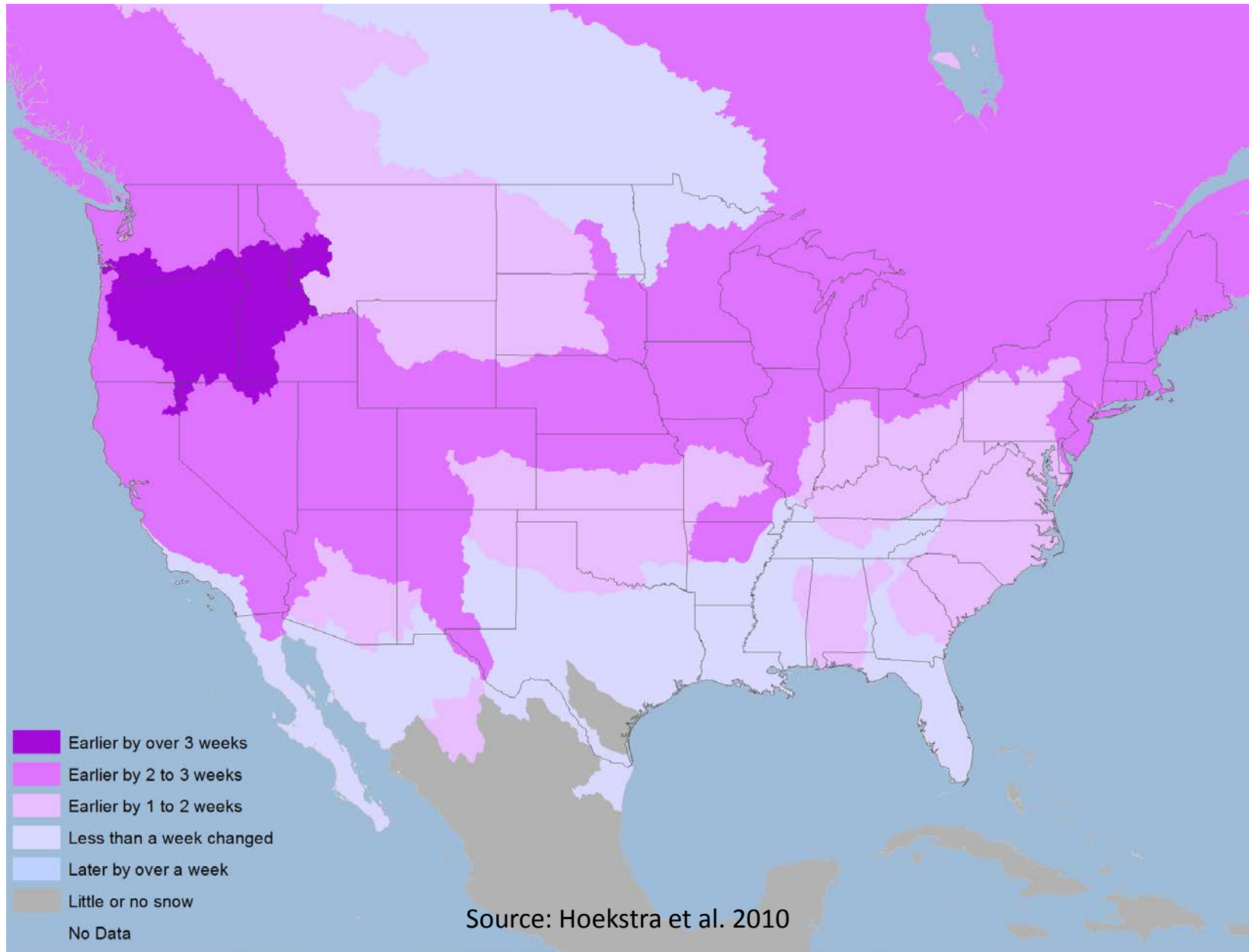
Contiguous US Average Precipitation 1895-2013 and trend



Observed Change in Very Heavy Precipitation



Snowmelt Will Occur Earlier

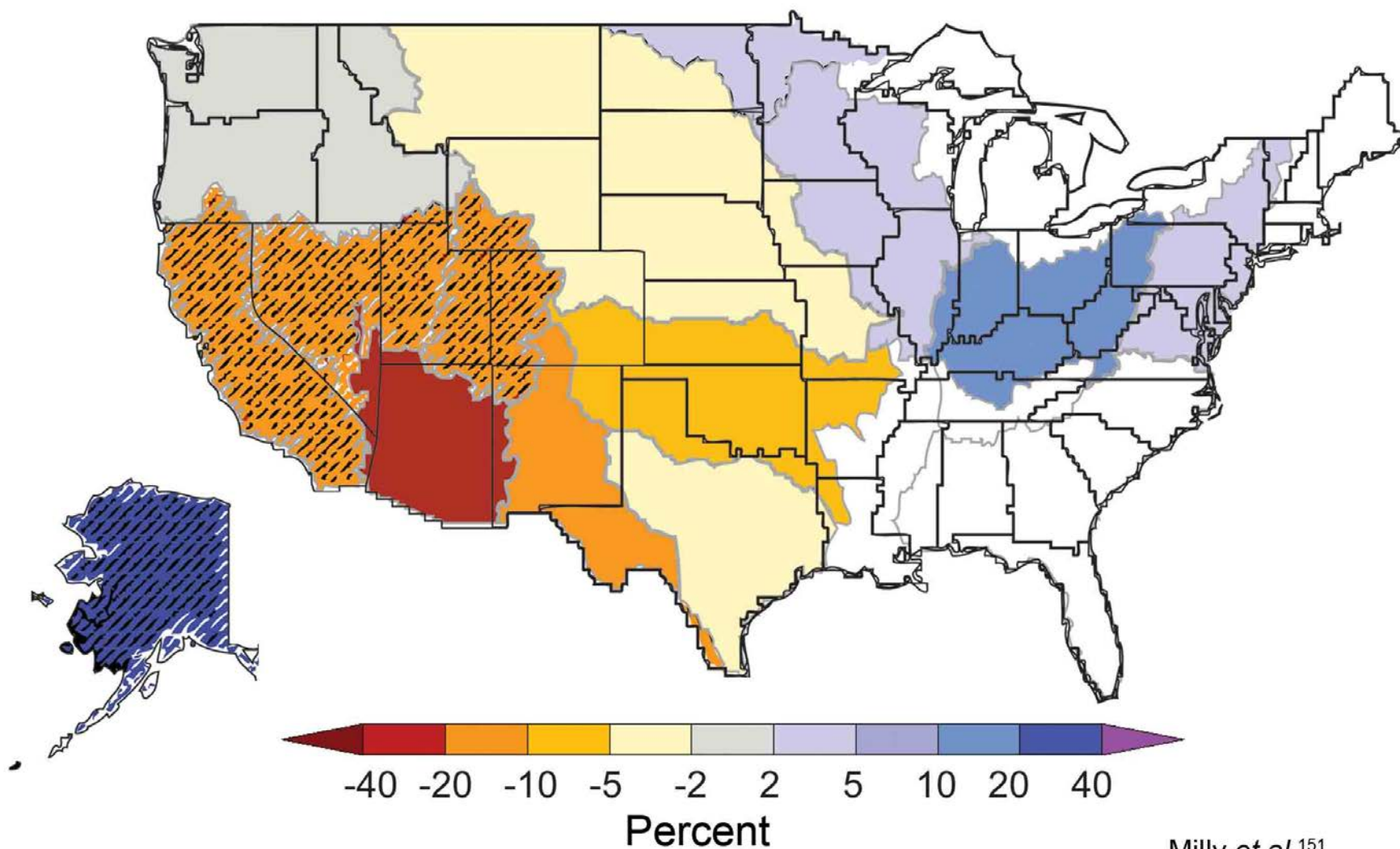


Glaciers are Disappearing



Change in Projected Runoff

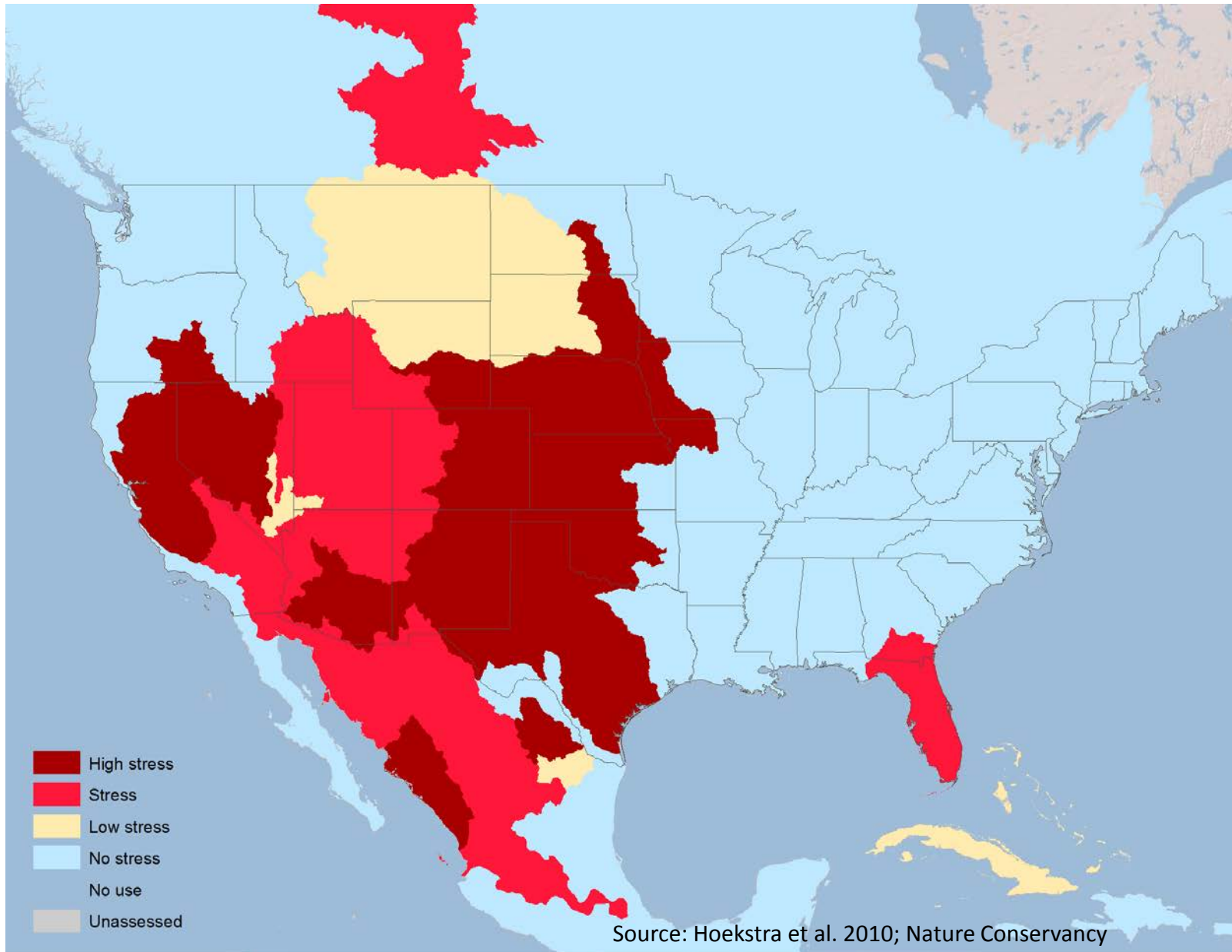
2041-2060 vs. 1901-1970



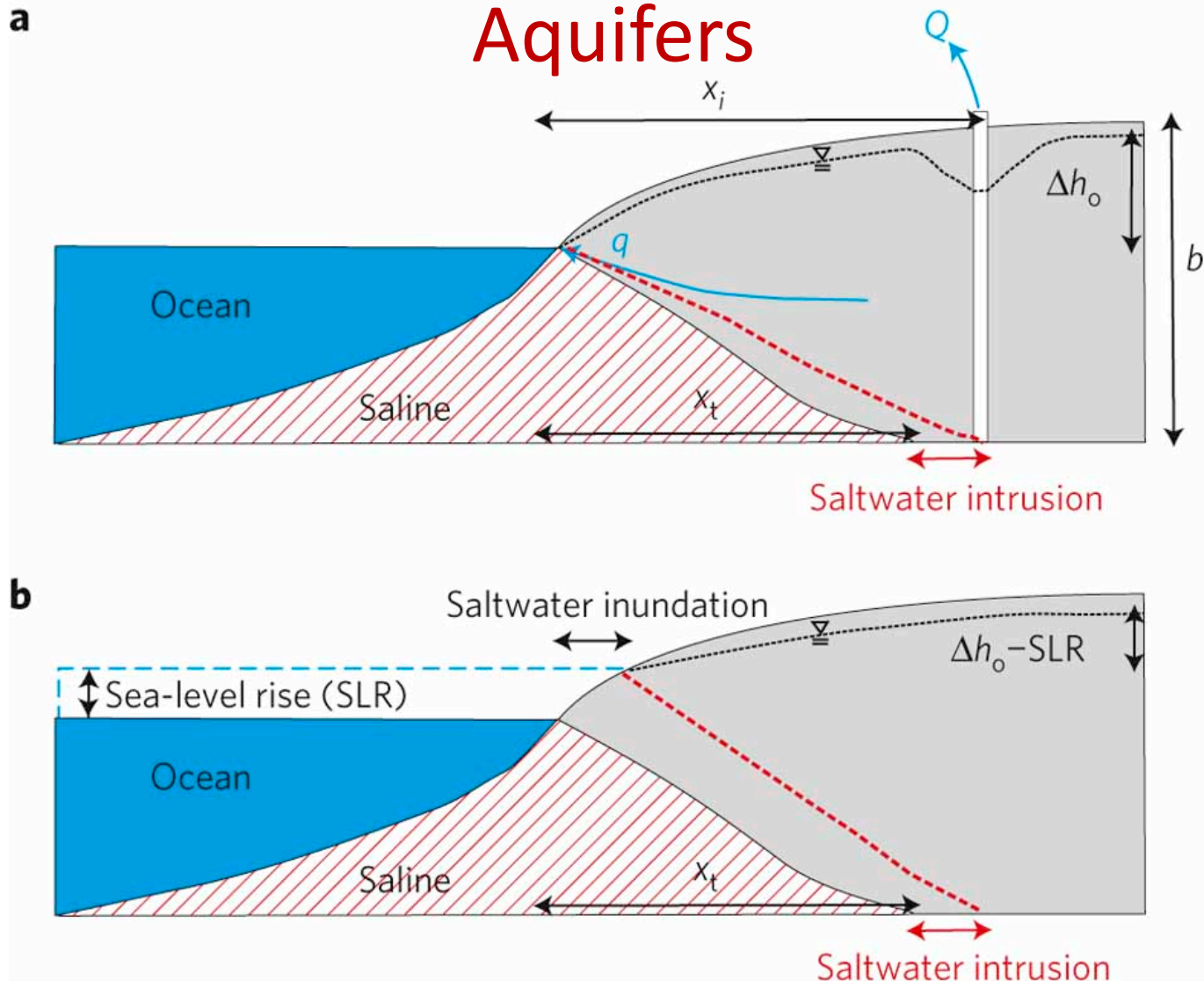
Milly *et al.*¹⁵¹

Source: U.S. Global Change Research Program 2013

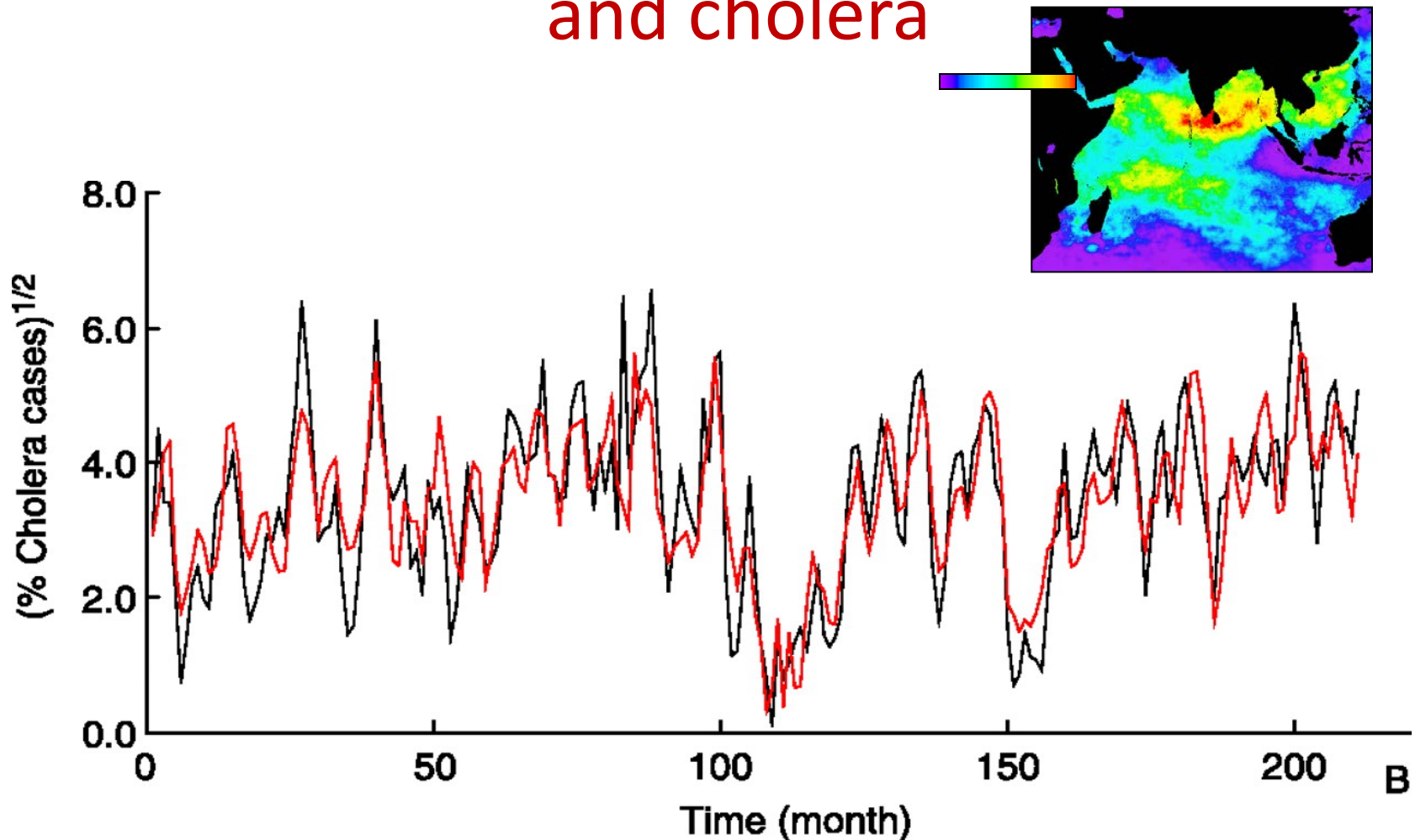
Water “Stress” (Runoff:Water Use)



Sea Level Rise will Contaminate Coastal



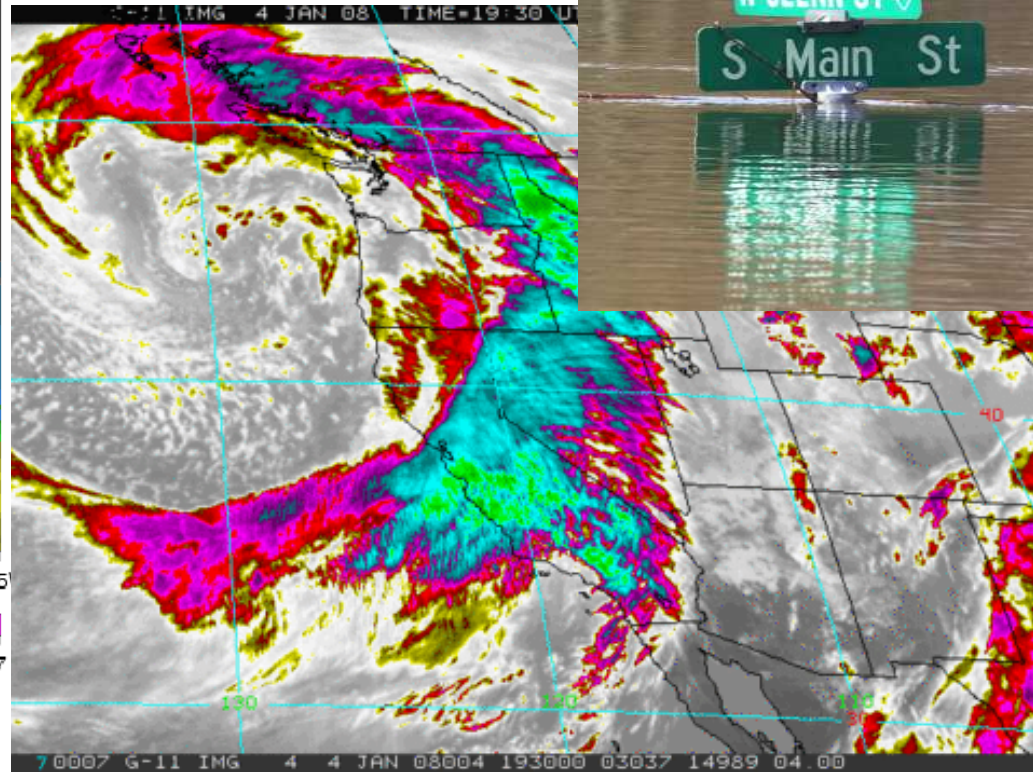
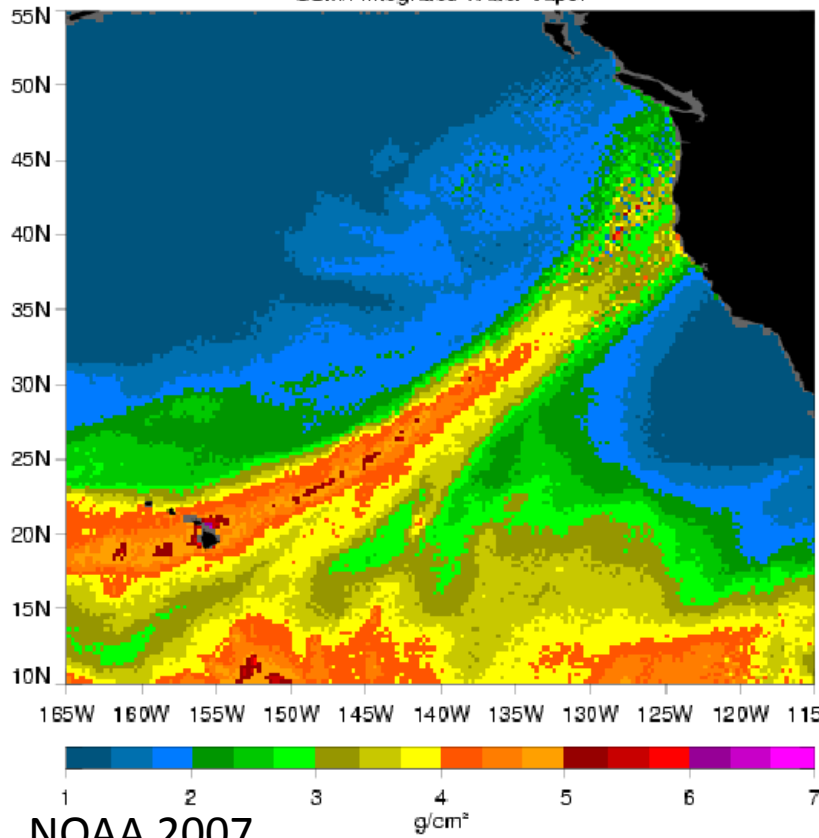
The link between ocean temperatures and cholera



The dynamics of cholera in Bangladesh (black line) are consistent with prediction including remote forcing by (lagged) ENSO (red line).

Improving understanding of extreme events is critical

December 03, 2007 12-24 Z
SSM/I Integrated Water Vapor



Reducing the Risks of Climate Change

- Over 15 years ago, the American Water Works Association recommended that
“while water management systems are often flexible, water agencies should re-examine water system designs and operating rules under a wider range of climatic conditions than traditionally used.”
(AWWA 1997)

The Continued Delay in Taking Action Now
Means:

Rapidly Worsening Impacts and
Unavoidable Adaptation

Adaptation Strategies

- Integrate and coordinate mitigation and adaptation measures.
- Review the advantages and disadvantages of *existing* policies that prepare for unavoidable impacts.
- Explore ways to incorporate adaptation into new planning processes.
- Develop and implement adaptation strategies.
 - Economic
 - Technological
 - Institutional
 - Regulatory
 - Educational

Just a quick reminder of the importance of
the U.S. water system



Peter Gleick 2013

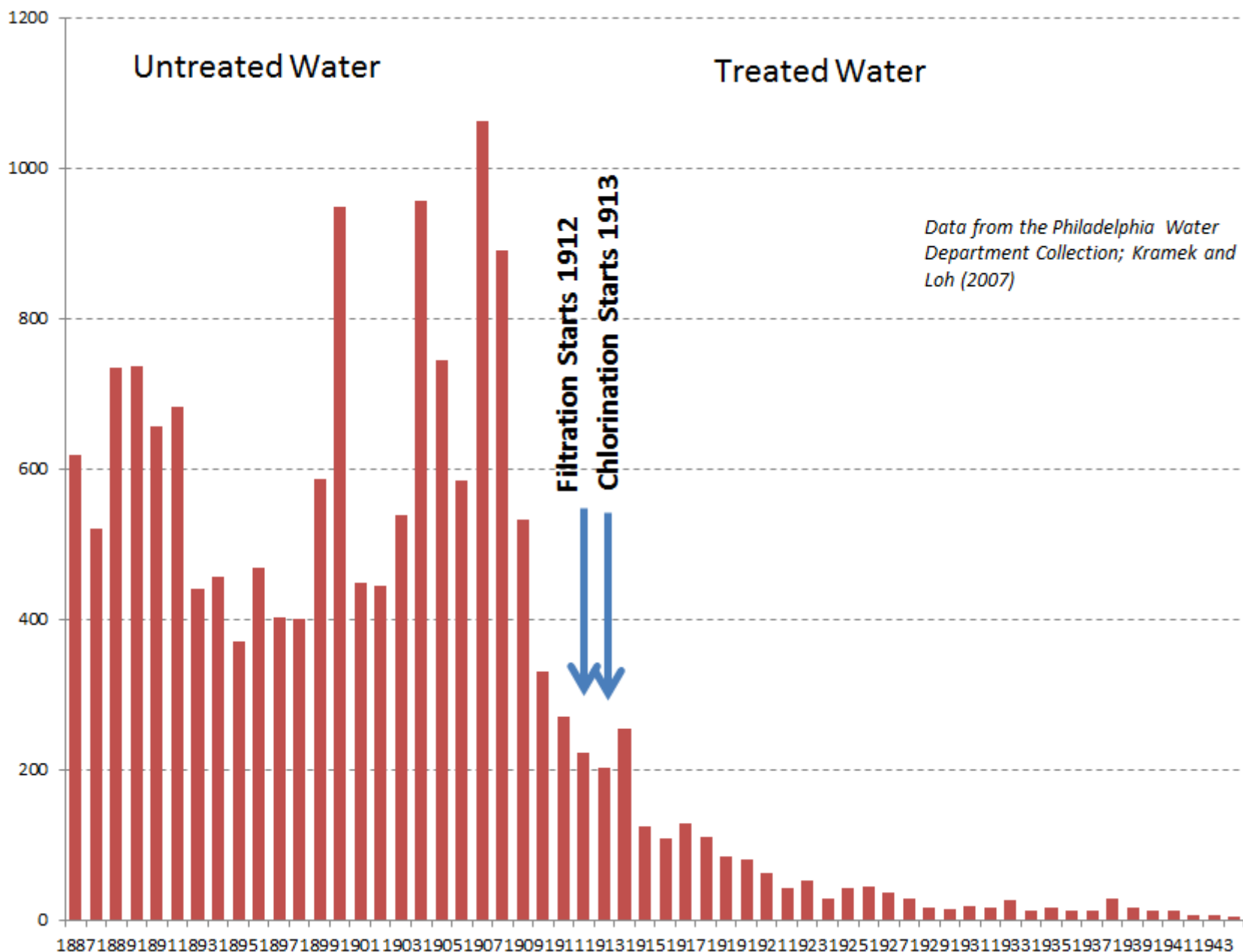


Peter Gleick 2013

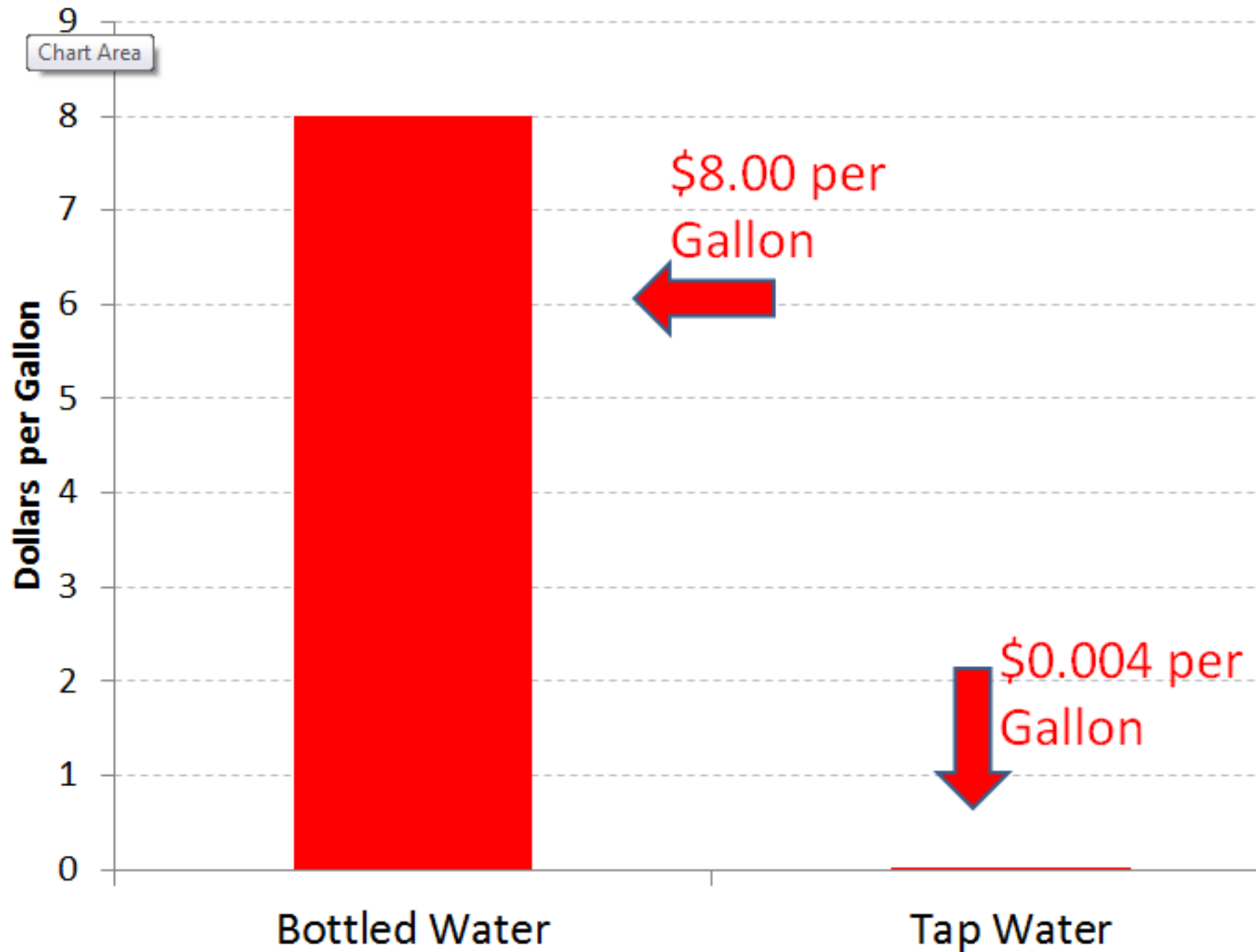
We've Built Vast Water Systems, Now Vulnerable to Changing Climate

Photos by Peter Gleick

Typhoid Deaths (Philadelphia)



The cost of tap water v. bottled water

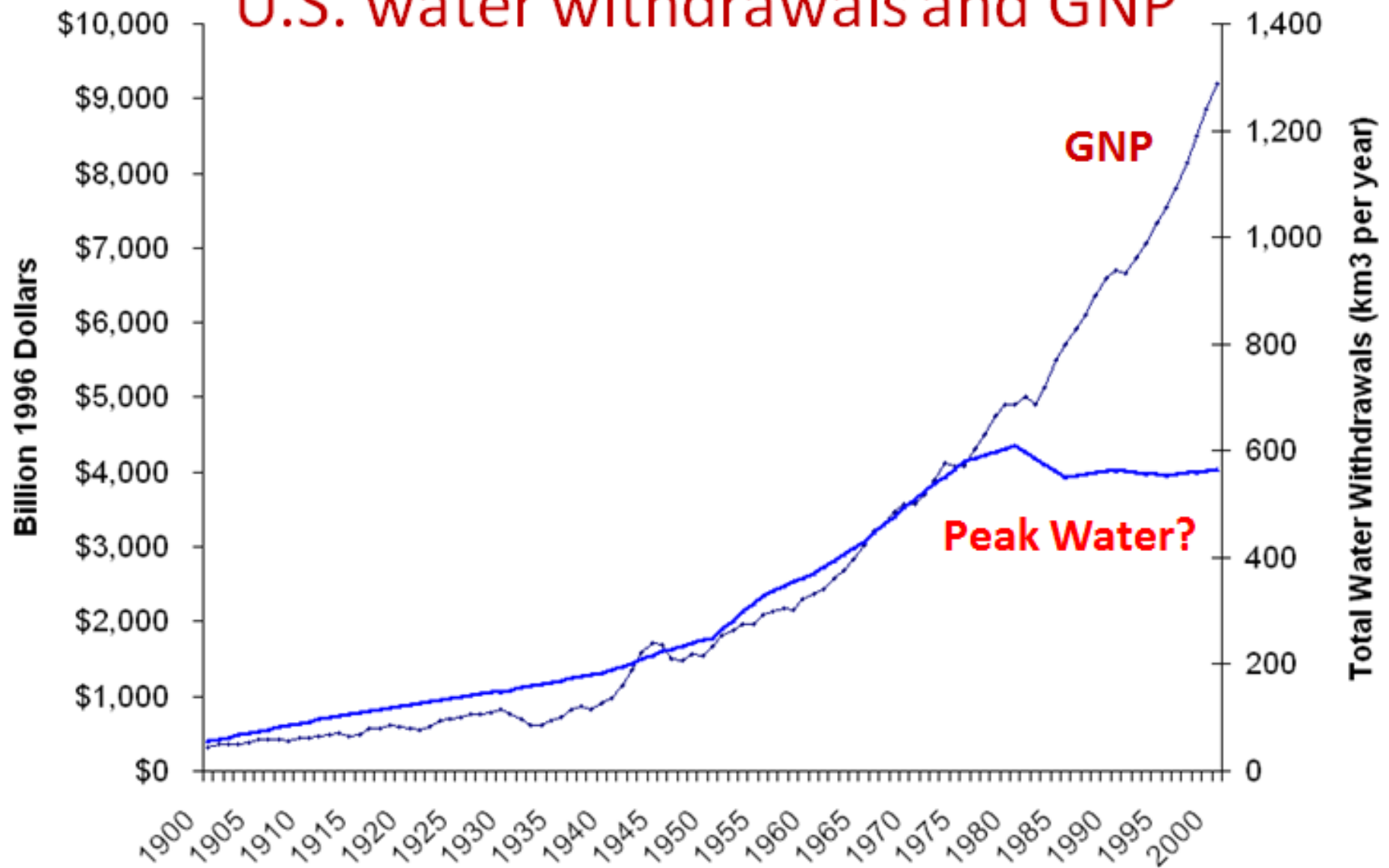


It is time for 21st century solutions

“Soft Path” solutions for water

- Rethink the concept of water “supply.”
- Rethink the concept of water “demand.”
- Protect water quality and match quality of supply to quality of need.
- Use smarter economic tools.
- Protect ecosystem needs and health.
- Improve water institutions, management, and public participation.

U.S. water withdrawals and GNP



A TWENTY-FIRST CENTURY U.S. WATER POLICY



JULIET CHRISTIAN-SMITH and PETER H. GLEICK
FOREWORD BY WILLIAM K. REILLY

Recommendations for Federal Water Policies

- Improve coordination among Federal water-related agencies and programs.
- The nation lacks, and must develop, an adequate understanding of water supply, use, and flows.
- Apply more appropriate economic strategies that encourage sustainable water-use patterns.
- Design water policies and infrastructure to evolve with changing climatic conditions.

Recommendations for Federal Water Policies

- Update and enforce existing Federal water laws
- Pursue decentralized solutions such as water demand management, stormwater capture, recycled water, graywater, and other nontraditional approaches.
- Integrate Federal water policies with other policies, including energy, agriculture, and climate change.
- Fully incorporate environmental justice principles into federal water policy.

Some thoughts for EPA Water

- Climate change isn't separate from what you do; it is central. Mainstream it.
- Invest the time and money to develop tools, methods, data to do so.
- Integrate existing jurisdiction with specific statutory authorities and mandates under the Clean Water Act, Safe Drinking Water Act, etc.
- Continue your efforts with:
 - Infrastructure
 - Watersheds and Wetlands
 - Coastal and Ocean Waters
 - Protecting Water Quality
 - Working with Tribes

Some thoughts for EPA Water

- Expand work with:
 - Climate Ready Water Utilities; Climate Resilience Evaluation and Awareness Tool (CREAT)
 - WaterSense
 - Climate Extension to the Stormwater Calculator (SWC)
 - Energy Audits for Wastewater Utilities
 - Include climate change into water supply EISs
 - Evaluate extreme weather risks: workshops
- Expand efforts that should be more than “regional” such as the extreme weather workshop, the stormwater and climate work, the WaterSense efforts.

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