Drought Risk Management

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Outline

- Context and Characteristics
- Why drought? What is drought?
- Risk Management Planning
  - Vulnerability
  - Impacts
- Drought Mitigation Planning
- Toward a Global Drought Early Warning and Information System (GDEWIS)
- Summary

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Drought: "a force for truth"

- ***"Societies will manage climate change in the same way they will manage droughts (for better or worse)"***
- Analysis of drought risk management is the ***starting point*** for a comprehensive institutional analysis
- Stress from drought highlights:
  - ***Strengths and weaknesses*** that are usually hidden
  - ***Political priorities*** and underlying ***cultural values*** revealed by difficult choices

(Daniel Connell, Australian National University, 2010)

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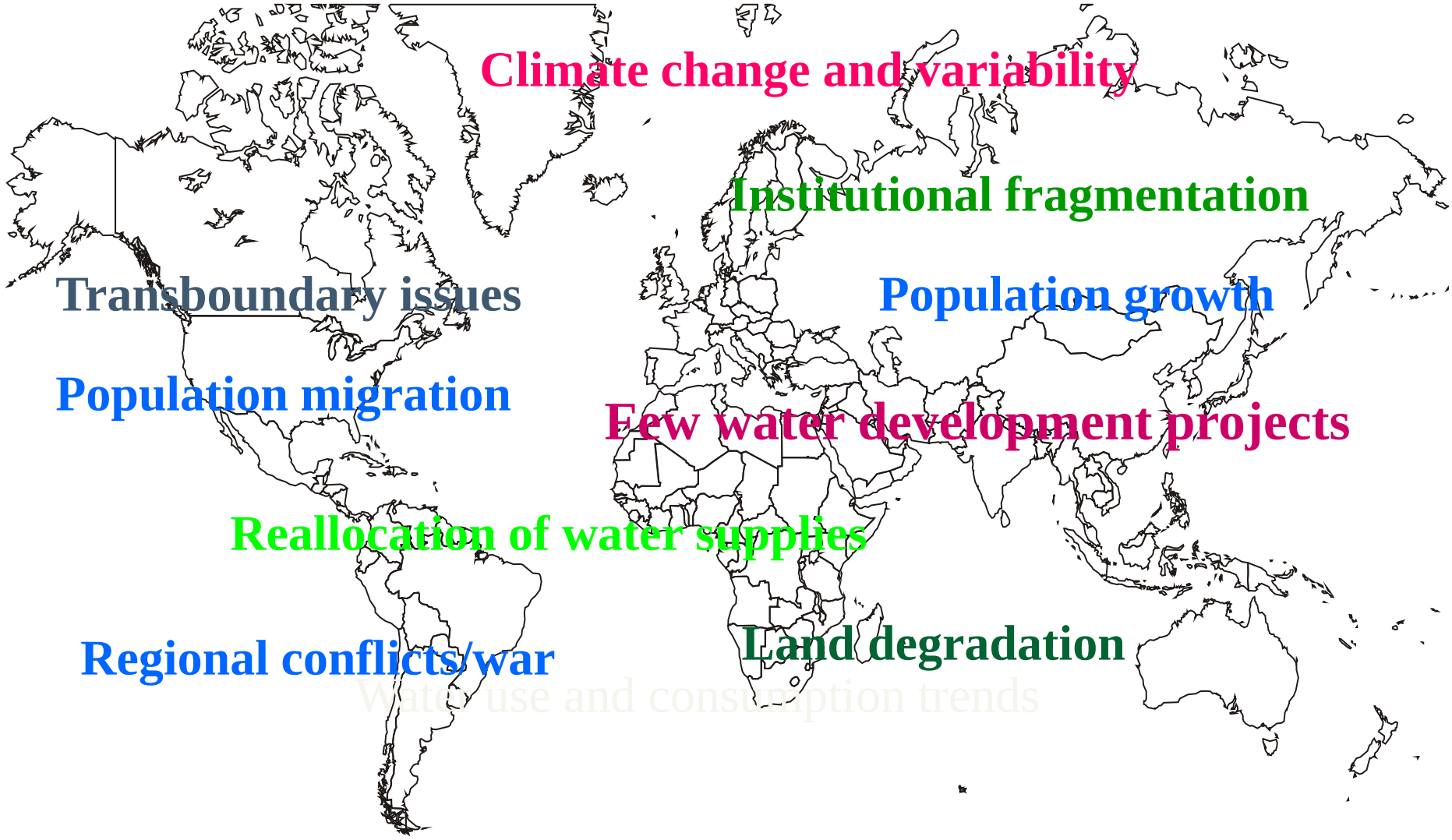
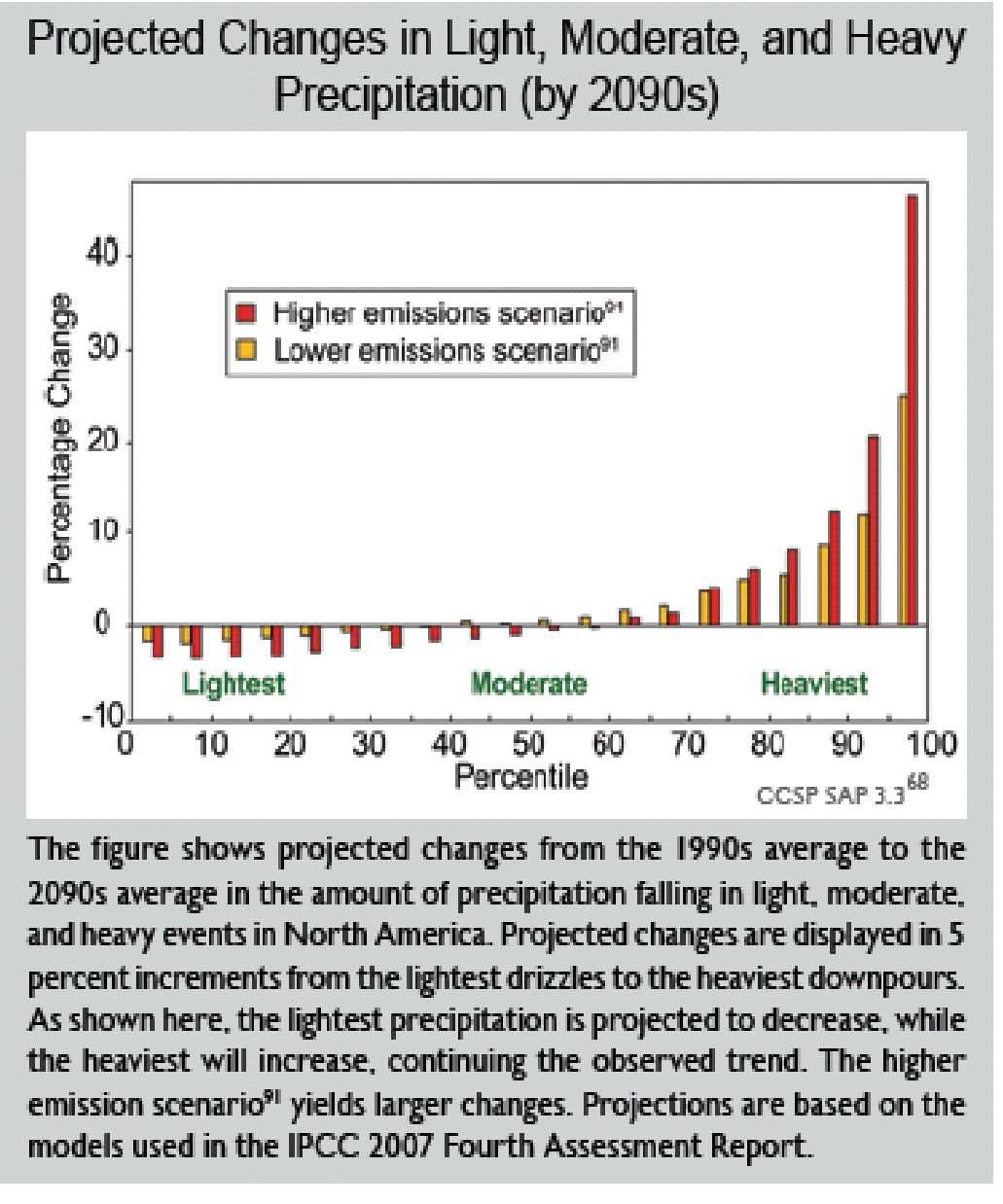
Future Challenges in Water Resources Management



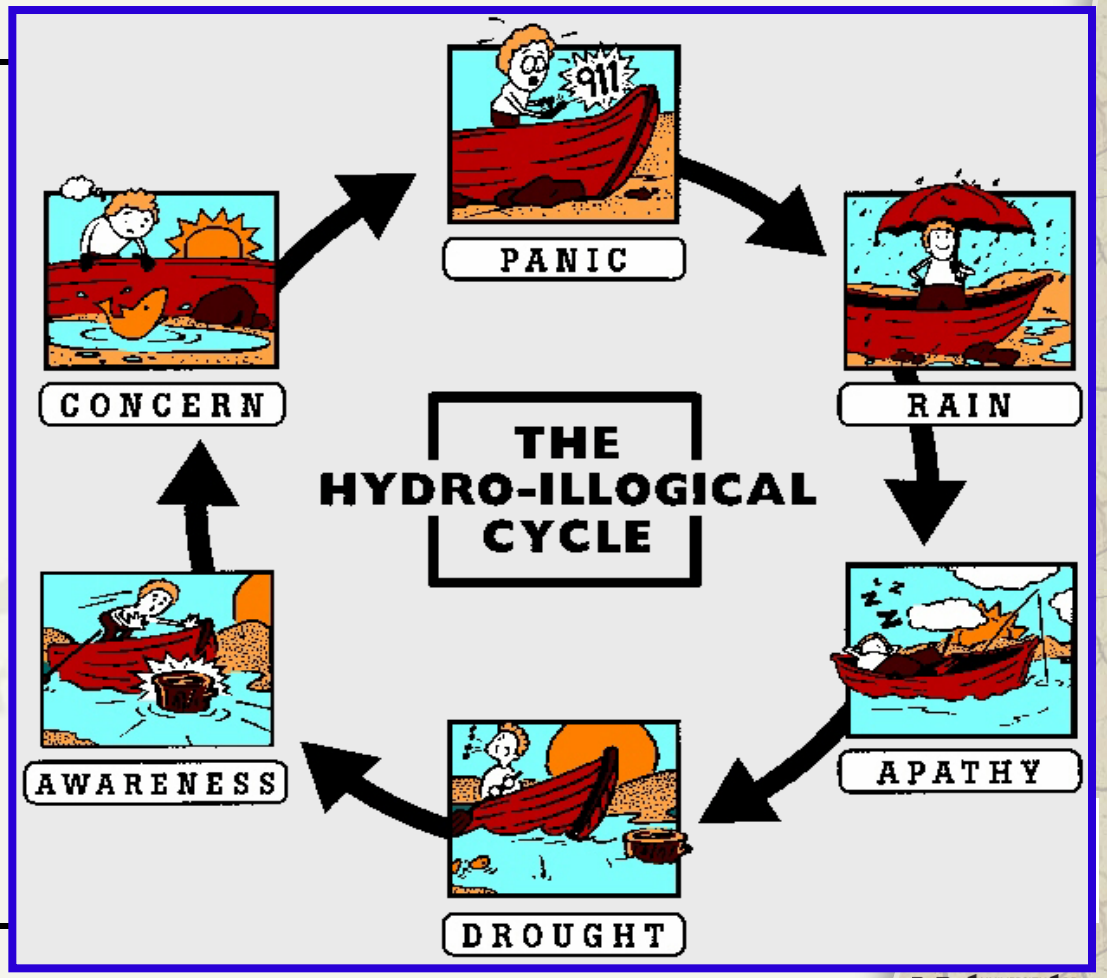
Extreme Events

- Less light rainfall events
- Heavier rainfall events
- 1 in 20 year event could change to 1 in 4-15 year event
- Increased drought in some areas

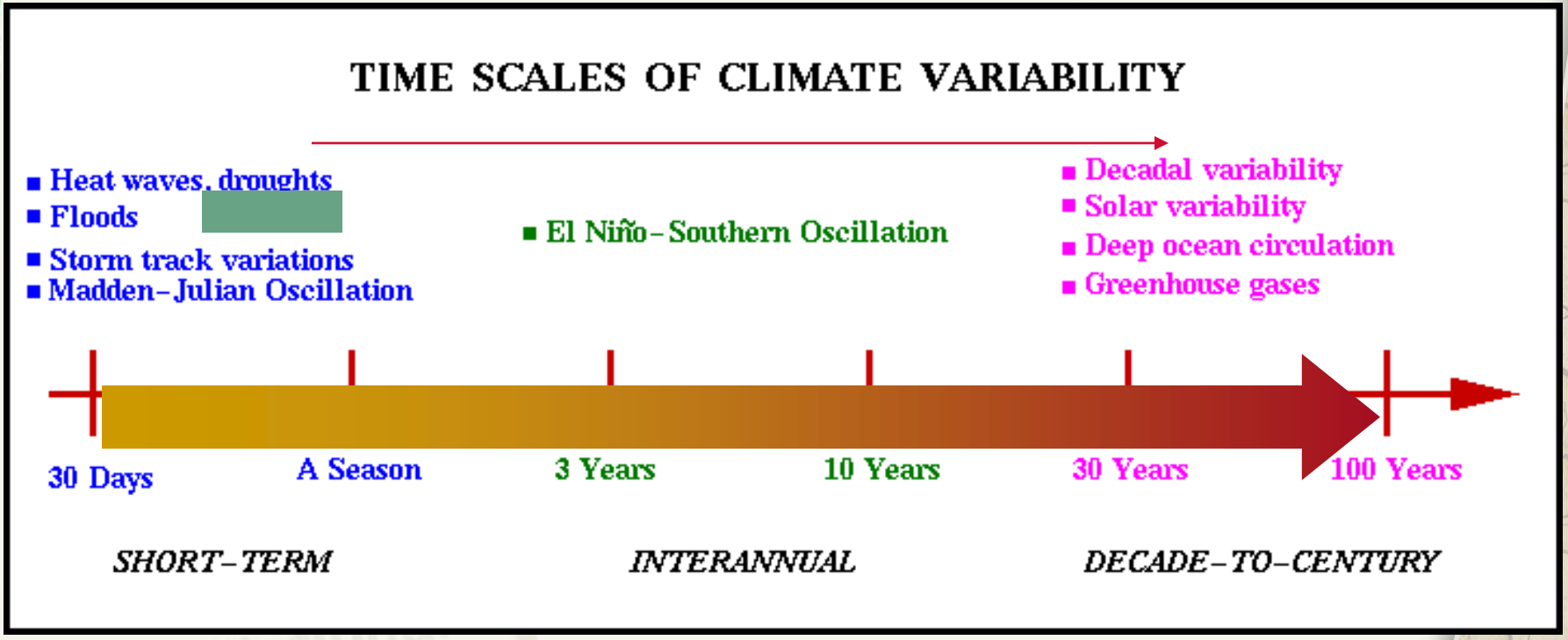


Characteristics of Crisis Management

- reactive, post-impact
- poorly coordinated
- untimely
- poorly targeted
- Ineffective at reducing underlying risk



Why Drought?



Droughts span an enormous range of temporal and spatial scales…

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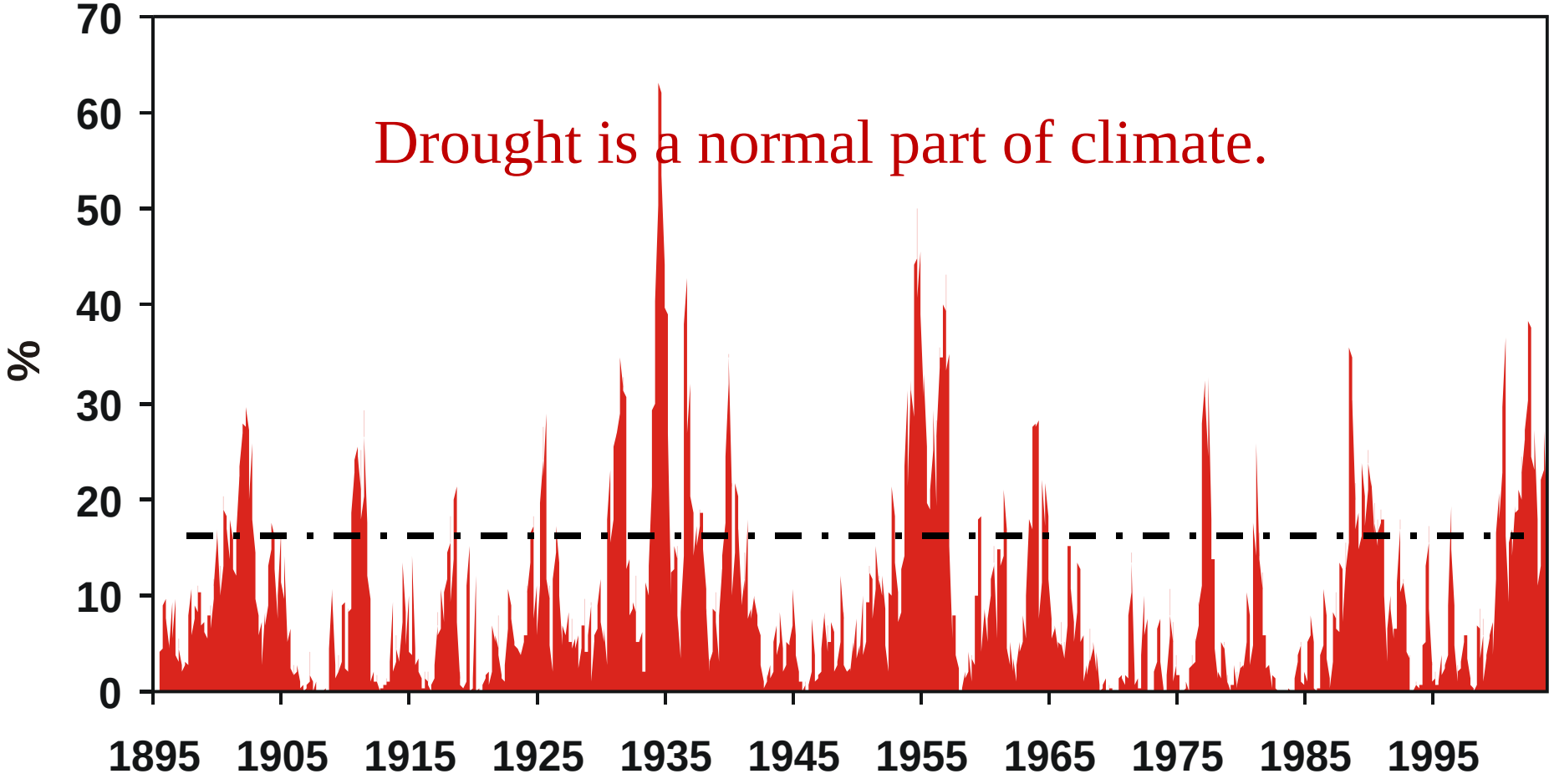
Percent Area of the United States in Severe and Extreme Drought

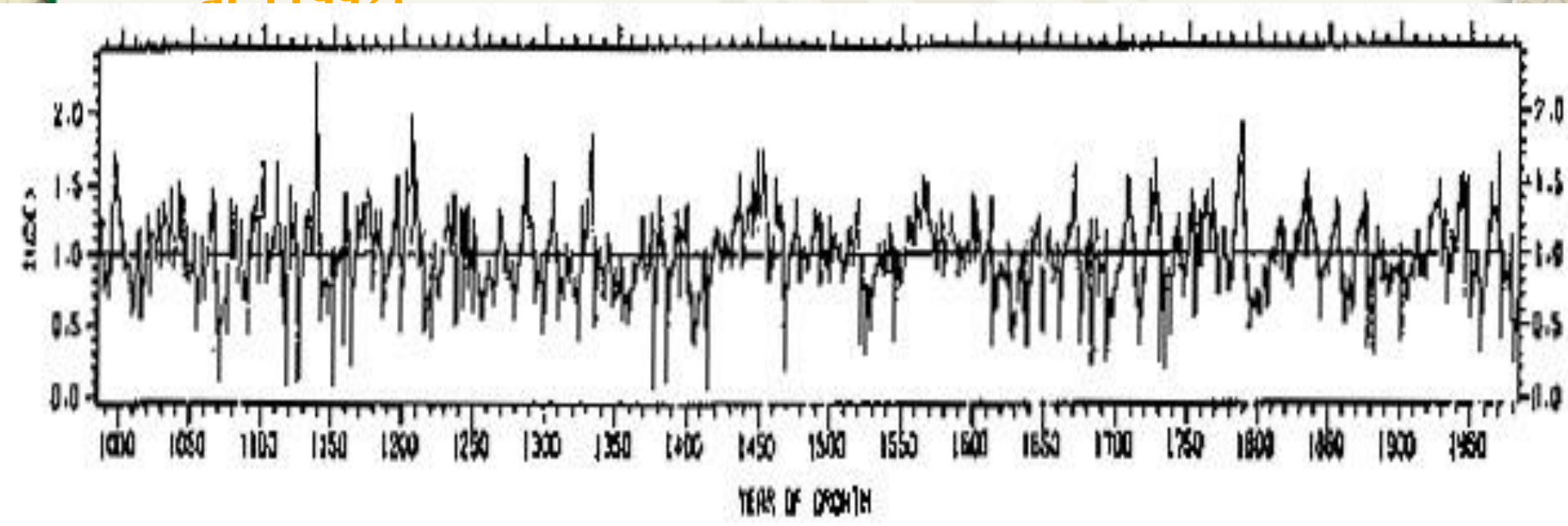
January 1895–December 2003



Based on data from the National Climatic Data Center/NOAA

Drought is a Normal Part of Climate

Use of Tree Ring Methodology to Characterize Historical Drought over a Period of 1000 Years (Cedar Tree of Middle Atlas, Morocco) Source: Chbouki et al. (1992)



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"Stationarity is Dead"

- **Stationarity: natural systems operate within an unchanging envelope of variability**
- **Climate change undermines the assumption of stationarity in water management**
- **Can't only use the past as a guide**
- **Need new scenarios and management ideas for an uncertain future**

Milly et al. (2008) Stationarity is Dead: Wither Water Management? Science, Vol. 319, 573-574

Drought: a deficiency of precipitation from expected or "normal" that, when extended over a season or longer period of time, is insufficient to meet the demands of human activities and the environment.

Drought is:

- *a temporary aberration*
- *a relative condition*
- *aggravated by temperature, high winds, and low RH*

Drought differs from other natural hazards

- ***Slow-onset***, creeping phenomena (difficult to tell when it starts and ends)
- Absence of universal ***definition*** (leads to inaction)
- Impacts are ***non-structural*** and spread over ***large areas*** (makes assessment and response difficult; mitigation actions less obvious)
- ***RESULT***, progress on drought preparedness has been slow

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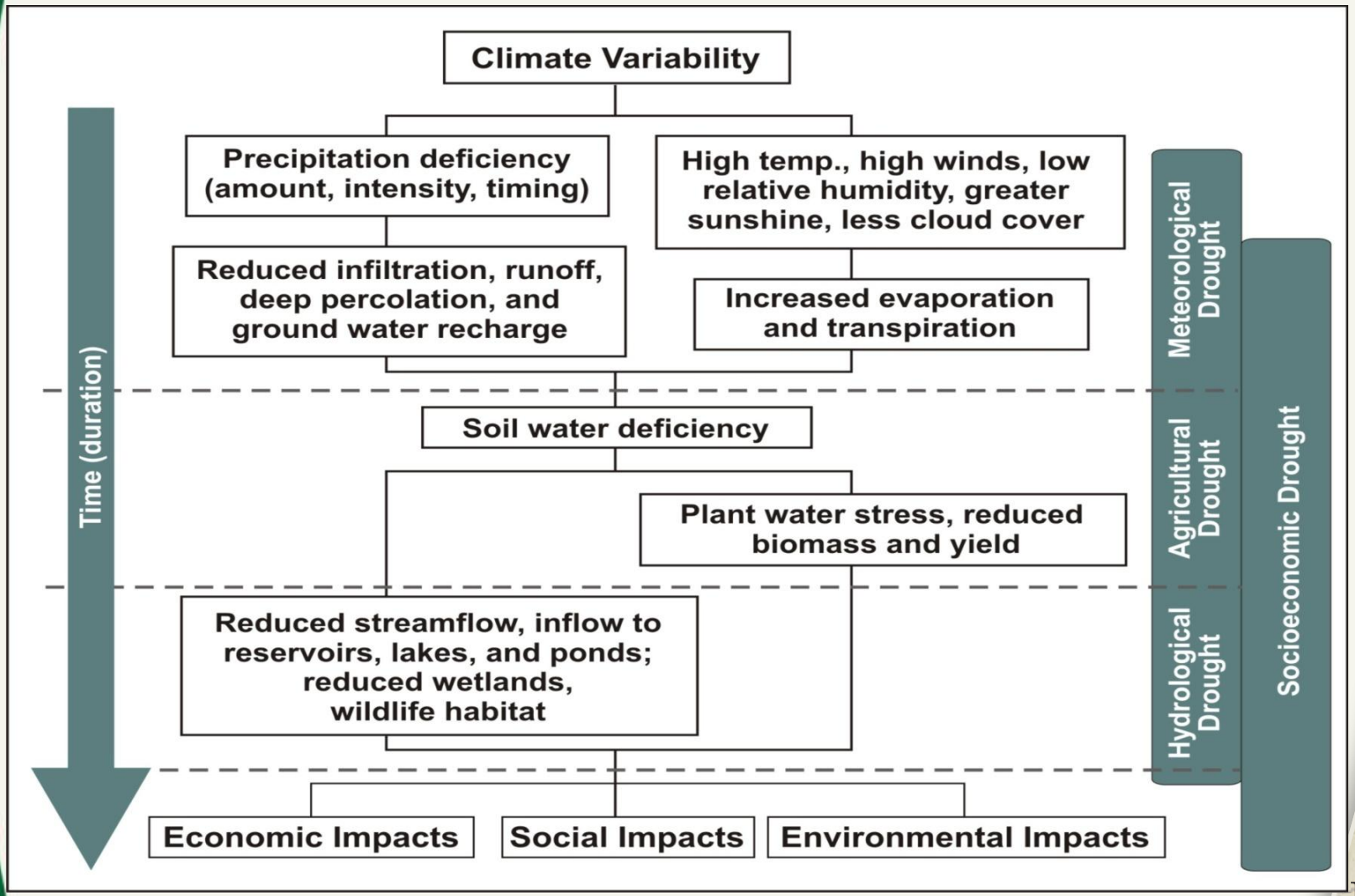
Types of Drought



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ISDR
International Strategy for Disaster Reduction

THE WORLD BANK

Drought Risk Reduction Framework and Practices:

Contributing to the Implementation of the Hyogo Framework for Action

Preliminary version
May 2007

United Nations

Western Drought Coordination Council

How to Reduce Drought Risk

Preparedness and Mitigation Working Group

March 1998

Principal Authors:

Cody Knutson,
National Drought Mitigation Center

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National Drought Mitigation Center

Tom Phillips,
U.S. Bureau of Reclamation

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Risk Management Planning

Risk Management Planning can be described as identifying ***actions that can be taken*** by individual citizens, industry, government, and others ***before a hazard occurs*** to better ***adapt and respond to impacts*** arising from a hazard.

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Risk Analysis =

Risk Assessment + Risk Management

That is, an investigation to better understand the problem and what to do about it <u>before a crisis</u>

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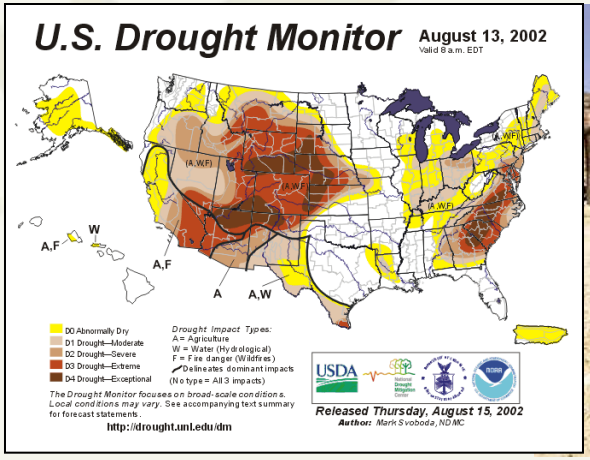
Components of Drought Risk Assessment

Risk = Hazard x Vulnerability

(natural event) (social factors)



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Components of Drought Risk Assessment

Hazard

(Natural Event)

- Severity or magnitude
  - Intensity and duration
- Frequency—probabilities
- Spatial extent
- Trends
  - Historical
  - Future projections

Components of Drought Risk Assessment

Vulnerability

(ability to anticipate, cope with, and recover from drought)

- Population growth
- Population shifts
- Urbanization
- Technology
- Land use practices
- Environmental degradation
- Water use trends
- Government policies
- Environmental awareness

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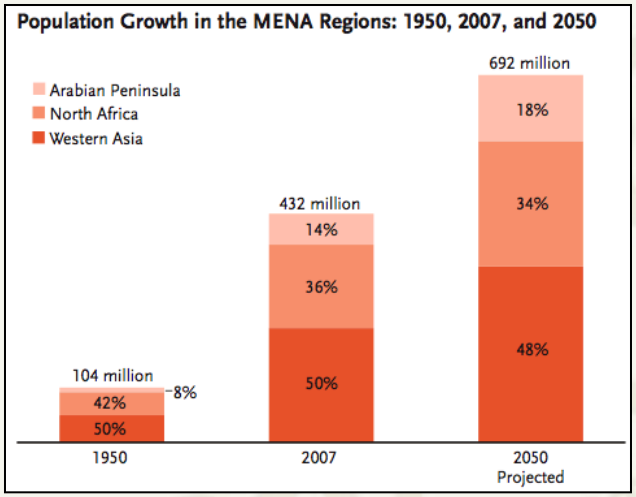
Why Drought Impacts are Occurring?

- what are the underlying vulnerabilities for a particular place?



Must understand drought impacts

- symptoms of underlying vulnerabilities

Economic Category

- Agricultural
- Industry
- Tourism and Recreation
- Energy
- Financial
- Transportation

Social Category

- Stress and Health
- Nutrition
- Recreation
- Public Safety
- Cultural Values
- Aesthetic Values

Environmental Category

- Animal/Plant
- Wetland
- Water Quality

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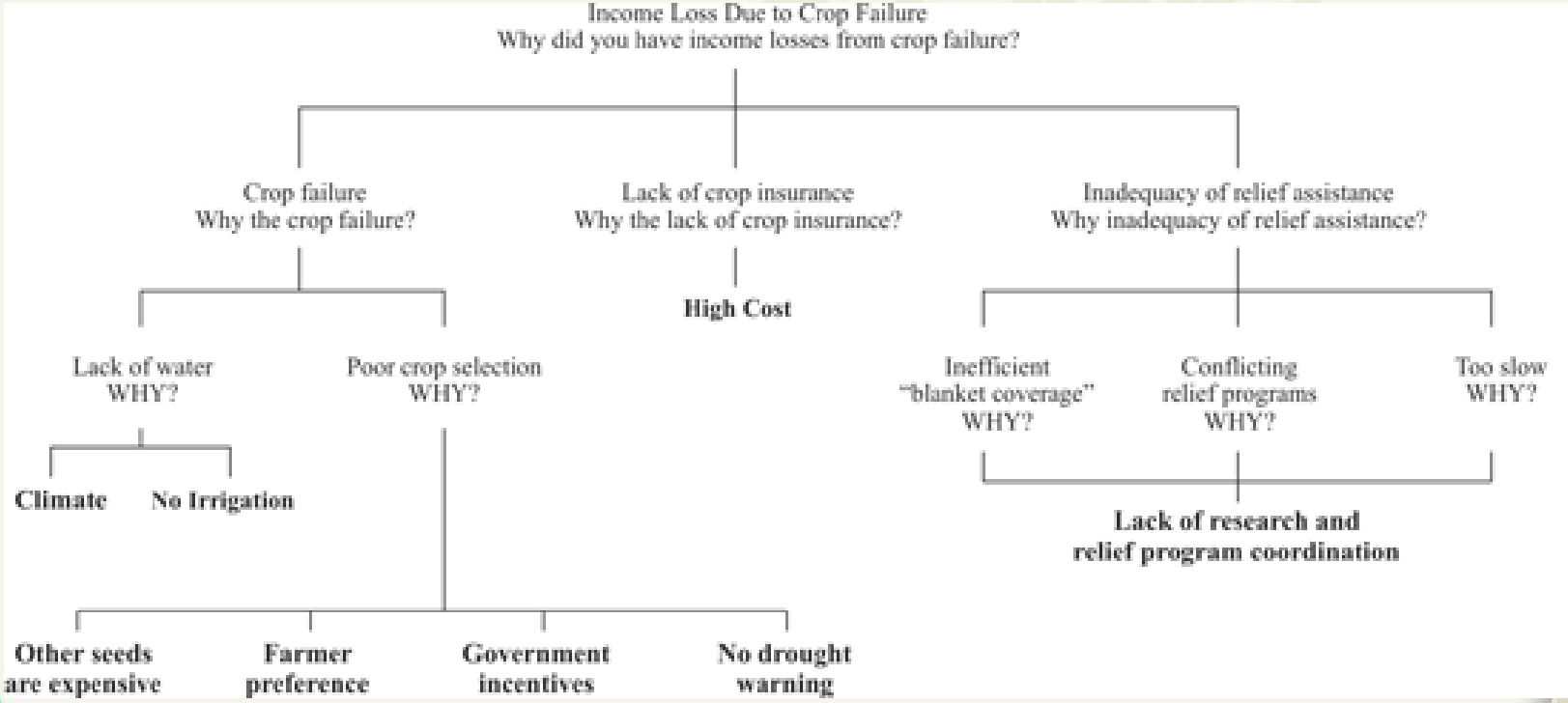
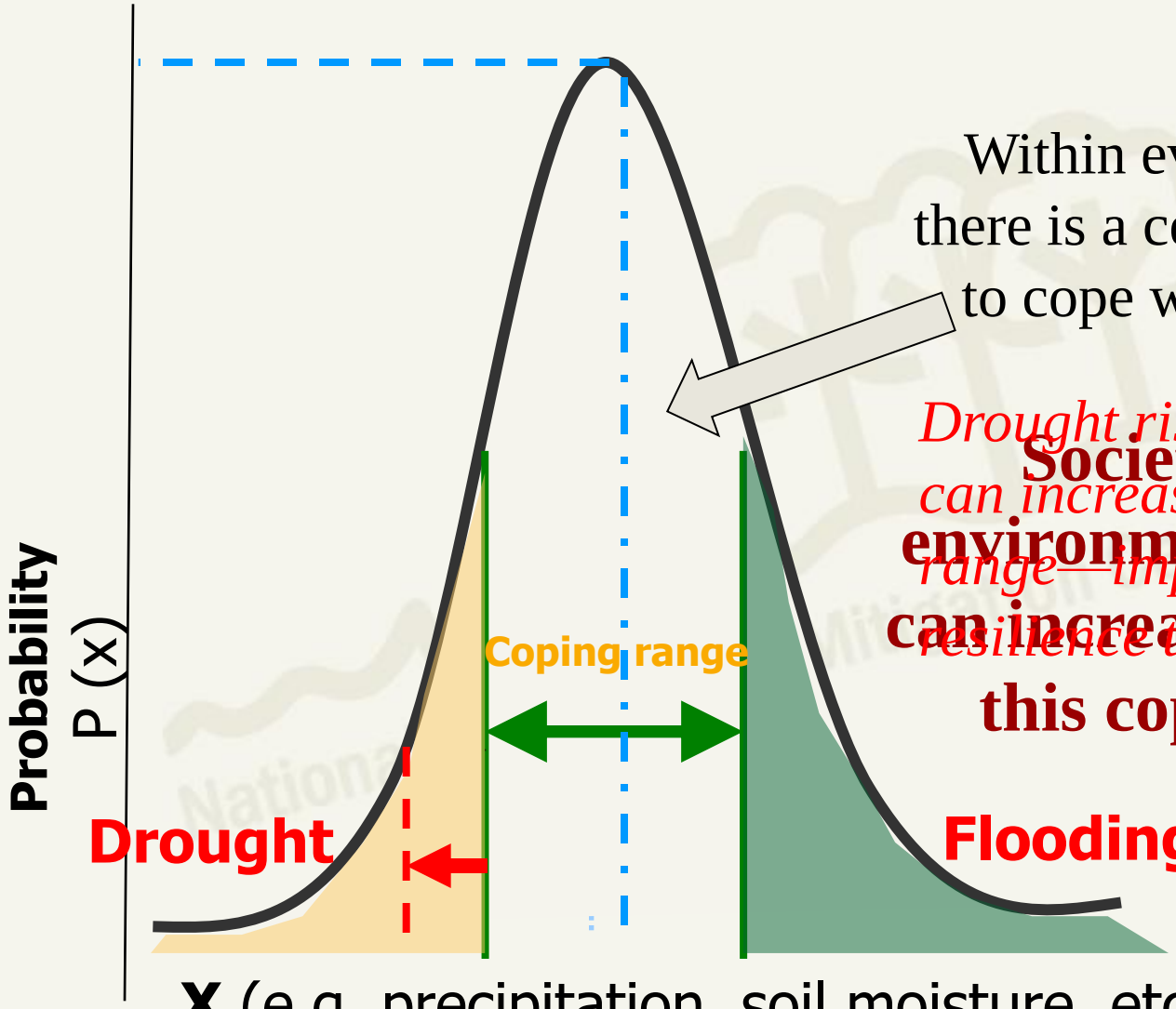
Vulnerability Analysis Methods

- discussions, tree diagrams, community capitals, scenario building, modeling, quantitative indicators



Drought *vulnerability* is a fluid variable



Adapted from work by Barry Smit, University of Guelph

Within every society, there is a certain capacity to cope with drought.

Drought risk management can increase this coping range—improving resilience to future events.

Societal and/or environmental changes can increase or decrease this coping range.

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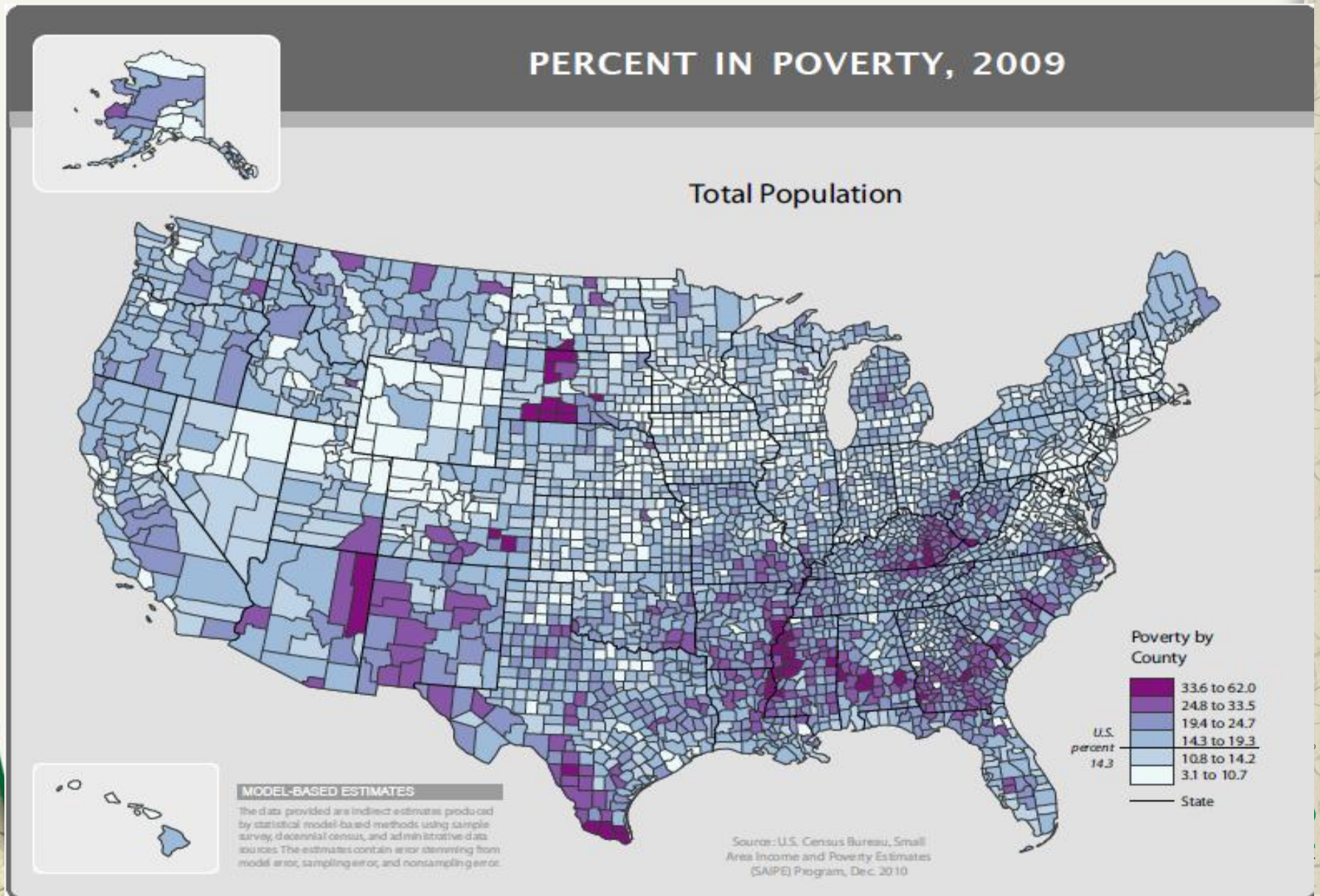
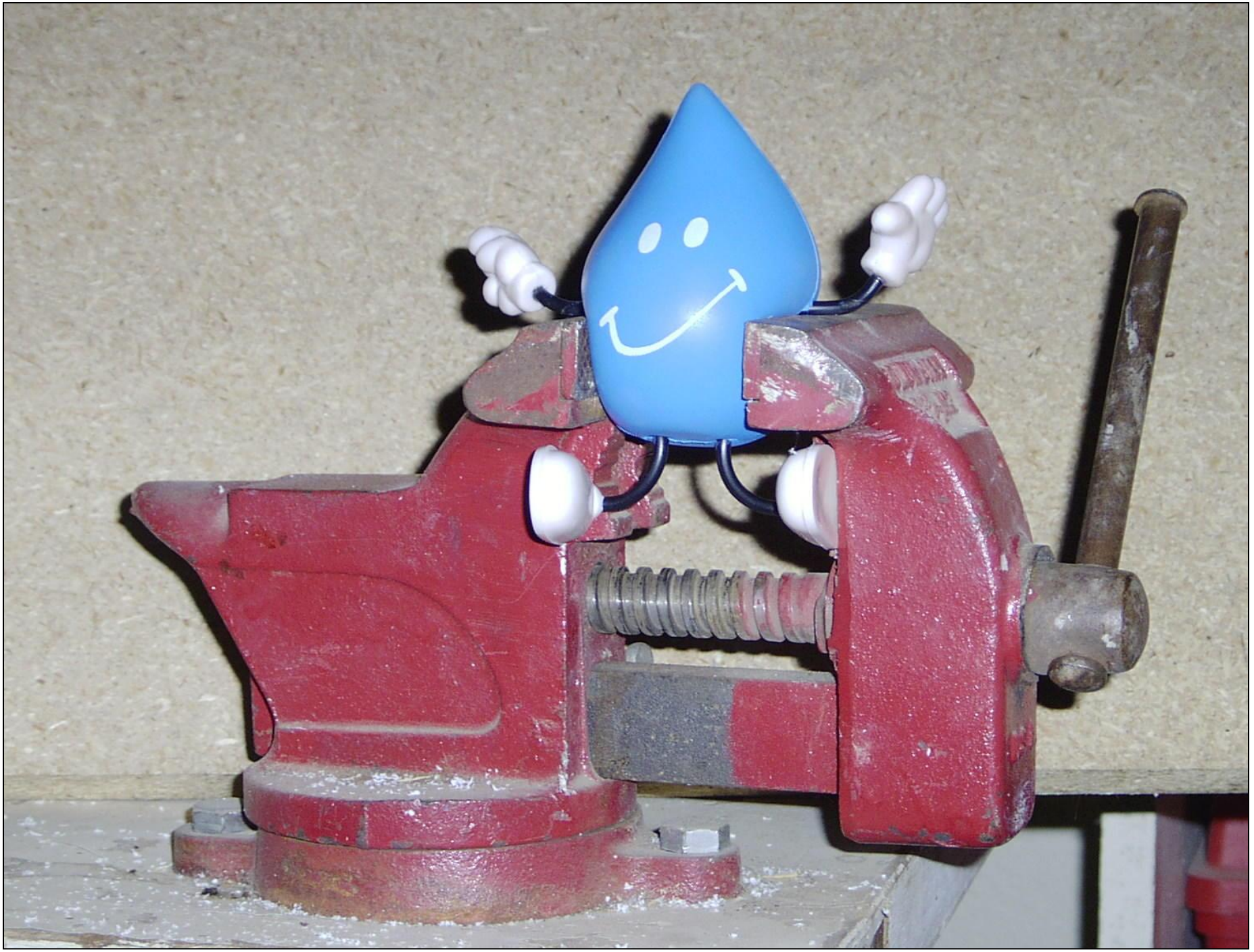
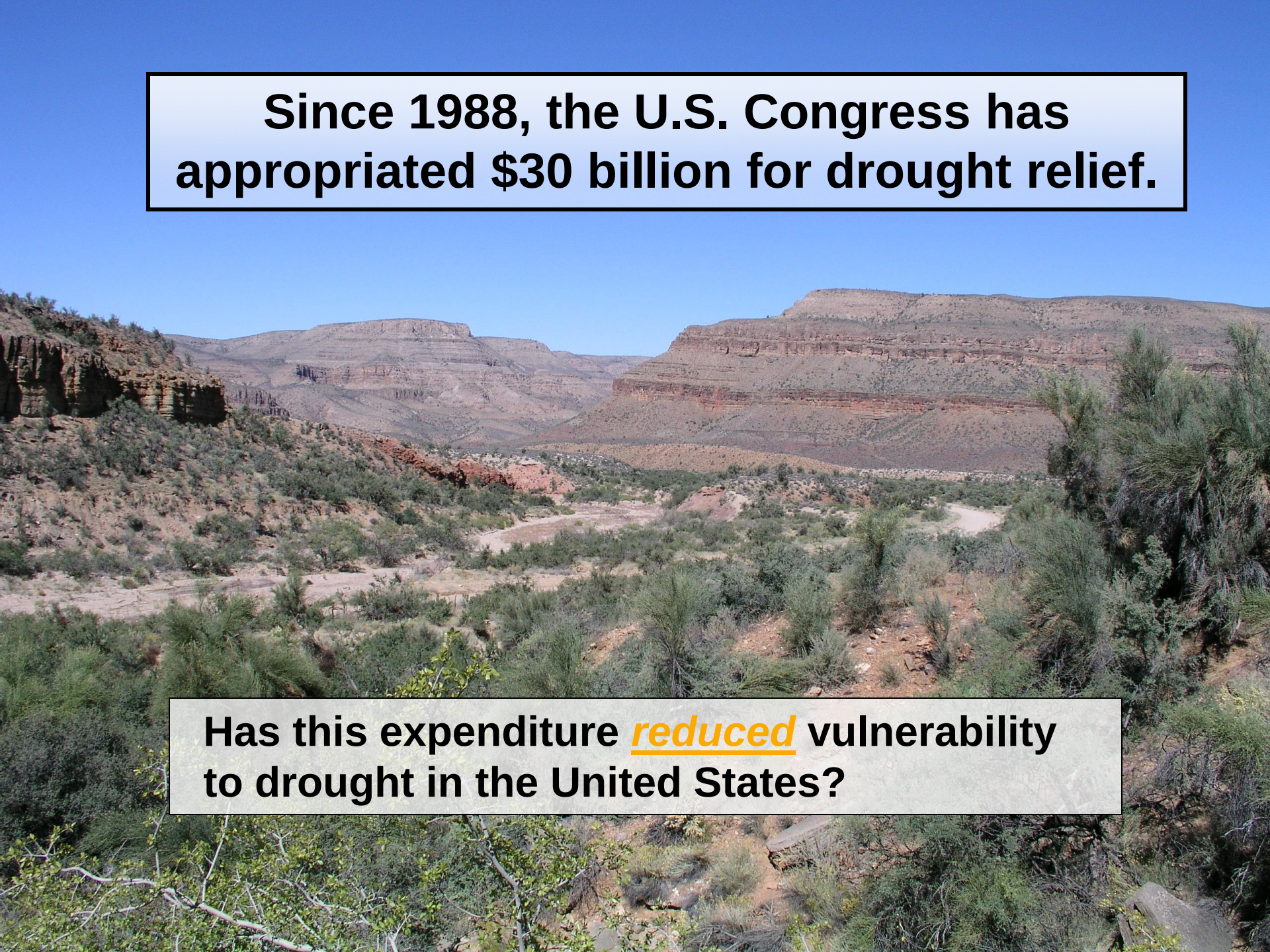
Vulnerability: Not all droughts and their impacts are created equal!





Understanding drought hazards and vulnerabilities forms the basis for developing ***informed*** risk management measures and drought resilient societies



Since 1988, the U.S. Congress has appropriated $30 billion for drought relief.

Has this expenditure *reduced* vulnerability to drought in the United States?

NO… In Fact….

- **Drought impacts are still devastating**
- **Impacts are becoming more complex**

  agriculture, energy production, transportation, tourism and recreation, forest and wildland fires, urban water supply, environment, and human health
- **Conflicts between water users increasing**
- **Drought vulnerability is increasing**

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Drought Mitigation

Mitigation: Actions and programs done before a drought that would reduce long-term vulnerability to future droughts. (referred to as “adaptation” in climate change vocabulary)

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Identify Risk Reduction Measures

Drought Mitigation

- long-term water demand reduction
- long-term water supply increase
- Best land management practices
- Flexible, diversified systems
- Stable financial systems

Drought Preparedness

- creating monitoring and early warning systems
- developing drought plans

Drought Response/Recovery

- short-term water demand reduction
- short-term water supply increase
- short-term management adjustments
- enhanced relief management
- rehabilitation

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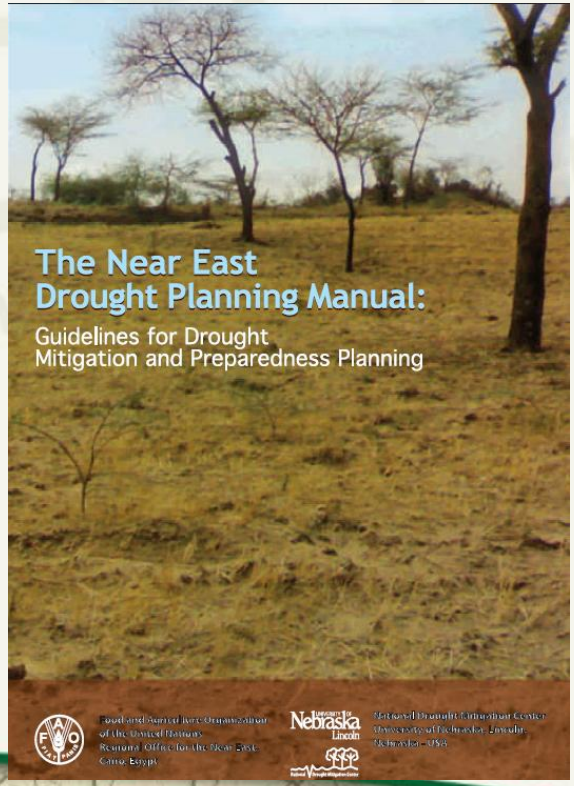
Drought Planning is defined as the identification of actions taken by individual citizens, industry, government, and others before drought occurs to mitigate impacts arising from drought.

Box 2. National Drought Plans

Researchers and policy makers in several Near East countries have already begun investigating the development of national drought mitigation and preparedness plans (FAO/NDMC, 2008). These countries include:

- Jordan
- Iran
- Syria
- Azerbaijan
- Kazakhstan
- Kyrgyz Republic
- Tajikistan
- Turkmenistan
- Uzbekistan

Several other countries around the world have also developed national drought plans such as Australia, South Africa, and Namibia (UN/ISDR, 2007).



Drought Planning Continuum

Response Plans → **Mitigation Plans**

Increasing need for timely and reliable climate/water supply assessments

Increasing need for higher resolution analysis for policy decision support

Increasing need for organizational structure and communication

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Drought Plan Components

- **Monitoring and early warning**
  - assess, communicate, and ***trigger*** action
  - ***Foundation*** of a drought mitigation plan
- **Vulnerability assessment**
  - Who and what is at ***risk*** and why?
- **Mitigation and response actions**
  - Actions/programs that ***reduce risk and impacts*** and enhance recovery

Most processes and plans in the past have primarily focused on monitoring and response...

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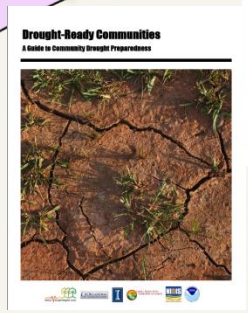
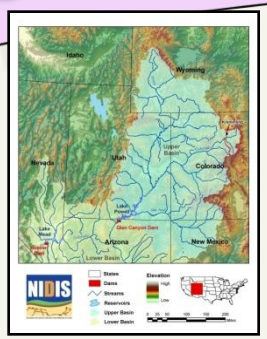
Tools for Planning: NDMC and NIDIS

- All droughts are “local”
- Planning is a “living” process
- Planning should start local
- Planning at all scales
- Now what?





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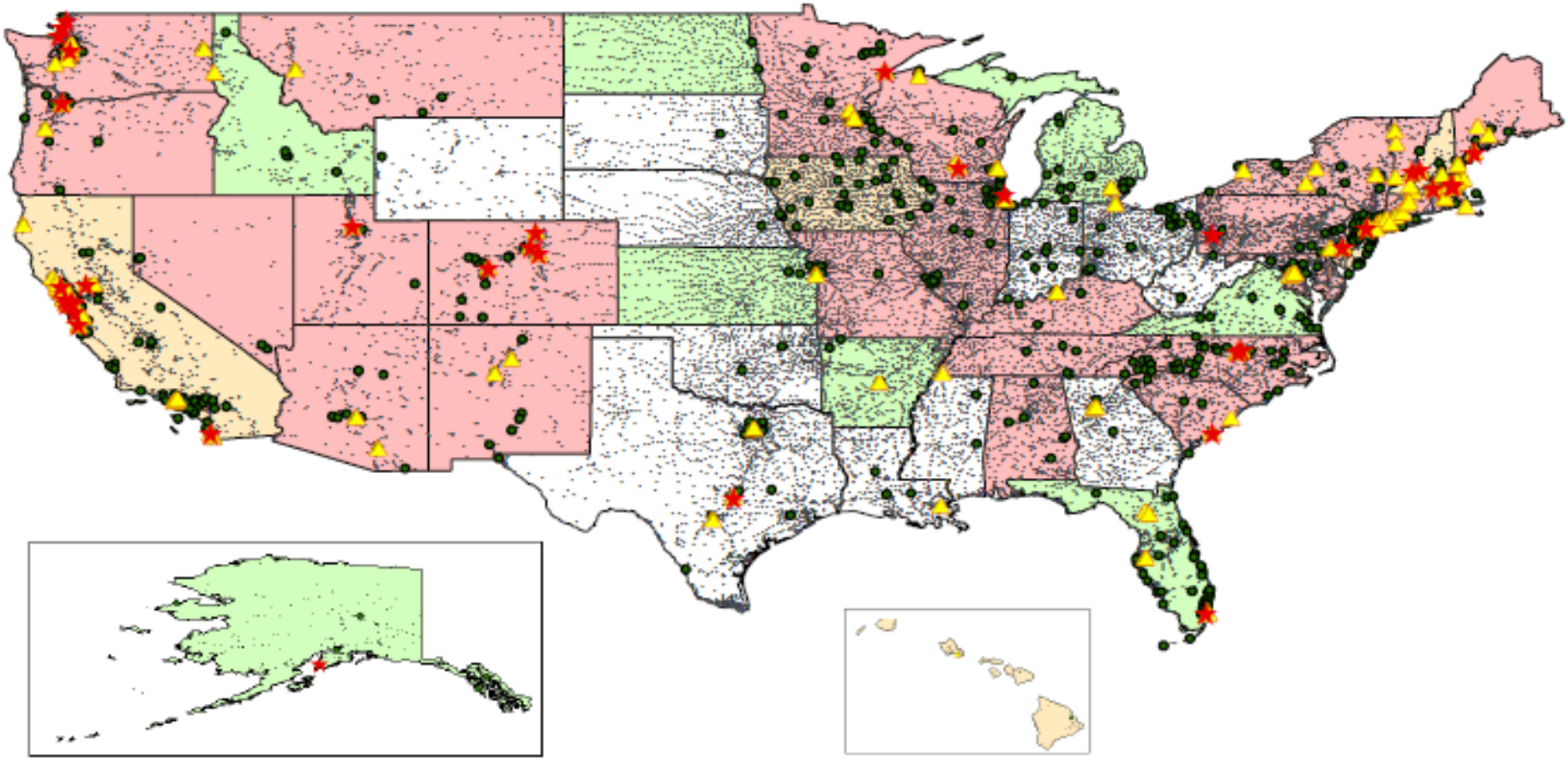
U.S. Climate Change Action Map



Legend

- States Completed Climate Action Plans
- States in Revision of Climate Change Plans
- States in Progress of Climate Action Plans
- States DO NOT Have Climate Action Plans
- Jurisdictions with Local Climate Action Plans
- Jurisdictions Joined the Cities for Climate Protection (CCP) Campaign
- Jurisdictions Signed the Mayors Climate Protection Agreement
- Jurisdictions DO NOT Have Any Actions

Date of this Map:
September 18, 2008

Created by
Dr. Zhenghong Tang

17085 0 170 Miles

Global Drought Preparedness Network

Individually, many nations will be unable to improve their drought coping capacity.

Collectively, through global, regional, and national **partnerships**, we can share information and experiences to reduce the impacts of drought.

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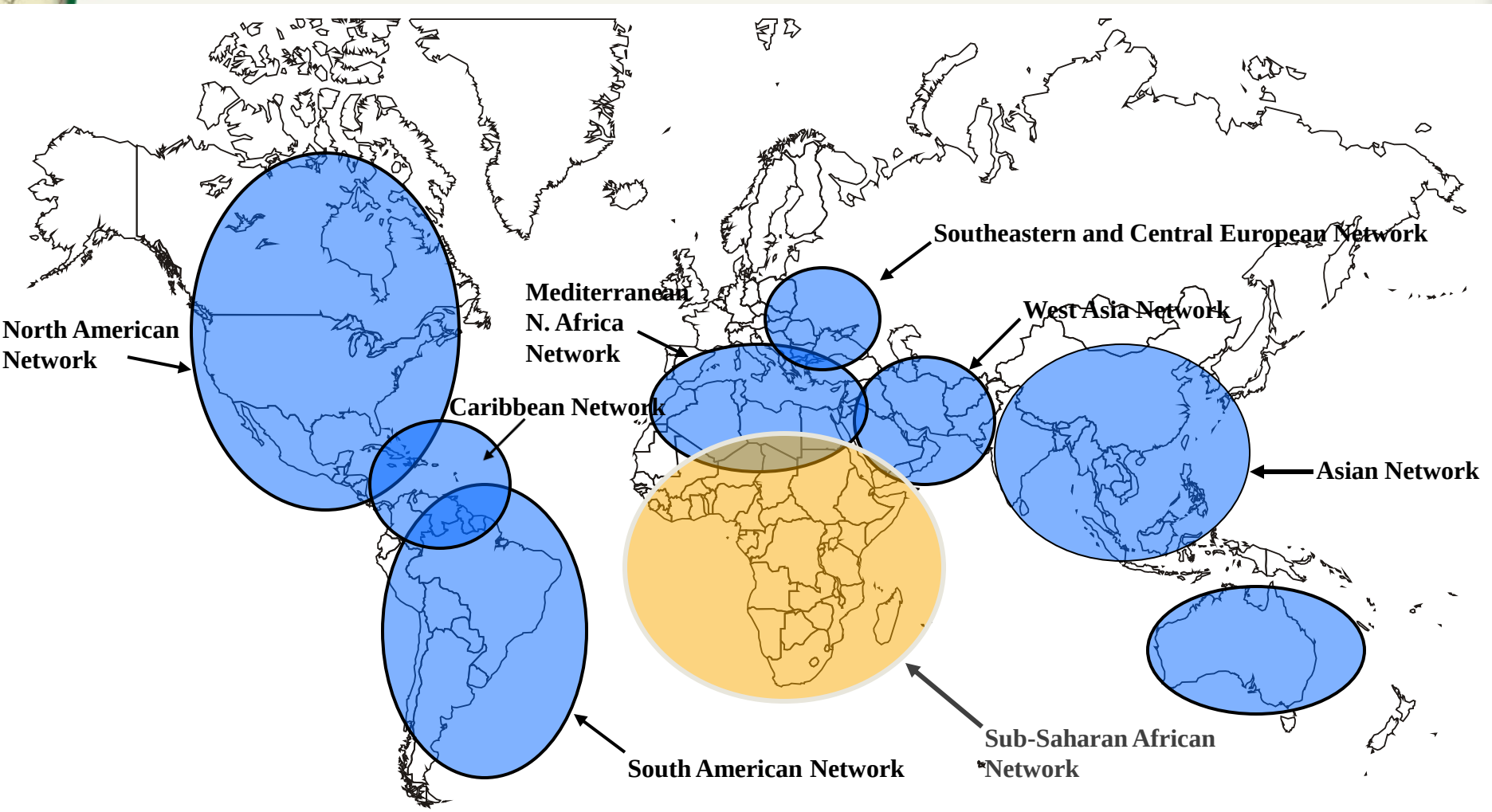
Potential Regional Networks



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World Meteorological Organization
Working together in weather, climate and water

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GEO GROUP ON EARTH OBSERVATIONS

- ✓ The growing problem of drought and its impact on long-term sustainability of Earth's water resources has been recognized for many years. At a 2007 GEO Ministerial Summit, the event concluded with a U.S. proposal that technical representatives from participating countries build upon existing programs to work toward establishing a Global Drought Early Warning System (GDEWS) within the coming decade to provide:
  - A system of systems for data & information sharing, communication, & capacity building to take on the growing worldwide threat of drought
  - Regular drought warning assessments issued as frequently as possible with increased frequency during a crisis

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JRC
EUROPEAN COMMISSION

TU WIEN
VIENNA UNIVERSITY OF TECHNOLOGY
INSTITUTE OF PHOTOGRAMMETRY AND REMOTE SENSING

NOAA
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
U.S. DEPARTMENT OF COMMERCE

Richard Heim 2011

Lessons Learned

- Crisis management ***discourages self reliance*** and promotes dependence on government and donors
- Risk Management ***increases self reliance*** and ***Reduces the likelihood*** of people and the environment being affected by drought
- ***Monitoring is the foundation*** of risk management planning
  - One can not manage what is not monitored
- Drought needs to be ***placed into the broader context of the issues*** surrounding us: climate change, water and food security, sustainability, and all natural hazards

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Takeaway Thoughts on Drought Risk Management

- All droughts are ***LOCAL***
  - Optimal to ***monitor at all scales*** (local/regional/national/global) (bottom-up or top-down or a combination of both)
  - Need to ***plan at all levels*** (local/basin/regional/national) rely on this operational/real-time monitoring information system and delivery
- ***Collaboration is key***
  - Leverage resources
  - Leverage skills/products
  - Data sharing—real time (derivative and/or joint products)

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Thanks!

Contact information:

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