CLIMATE CHANGE RESEARCH – STATUS AND FINDINGS OF KEY PROJECTS

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Overview

- Water Related Impacts of Climate Change
- Impacts on Water Resources
- Climate Change Strategic Initiative
- Climate Change Clearinghouse
- Selected Climate Change Projects
- Conclusions

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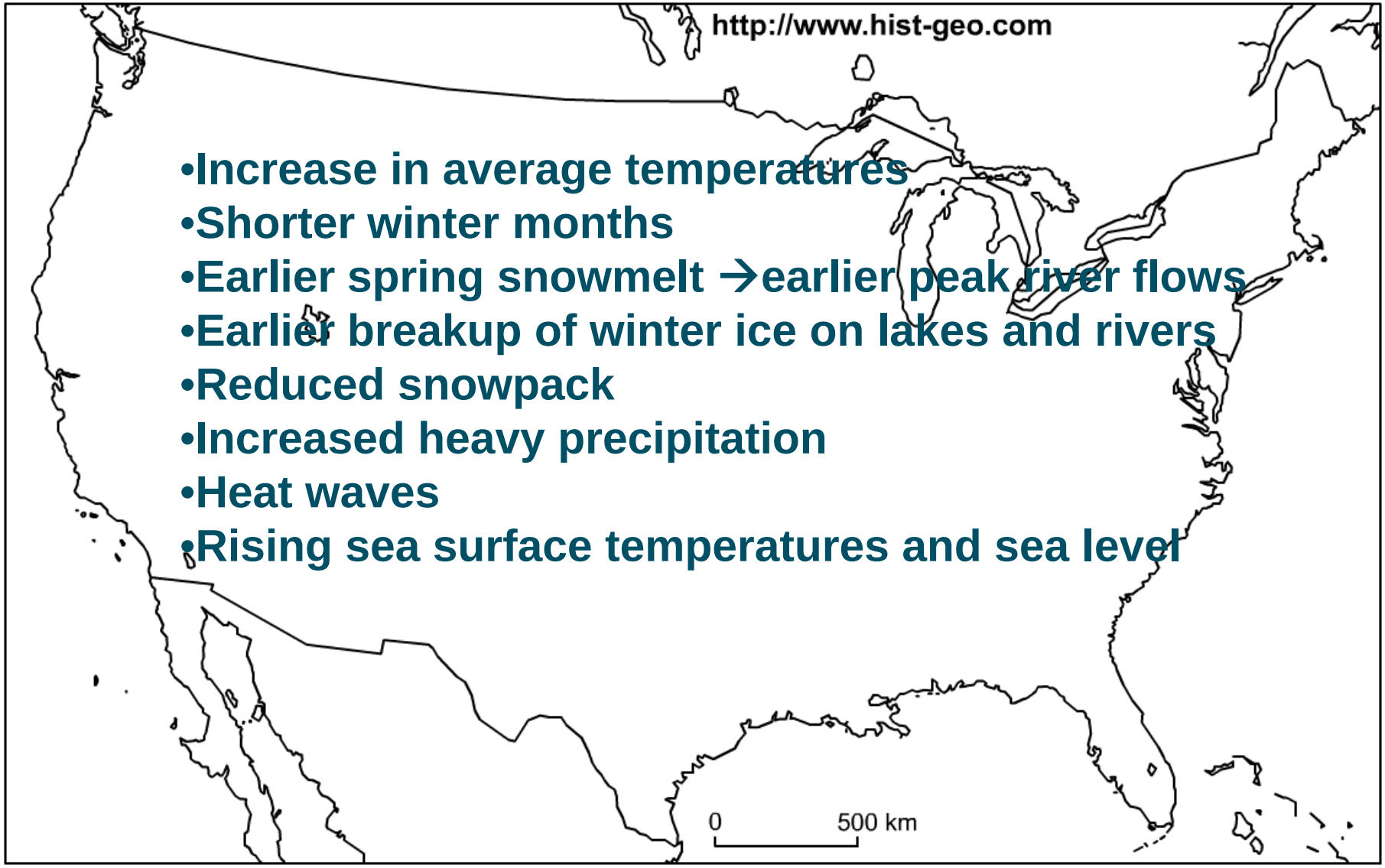
Potential Impacts of Climate Change on Water Resources



- Increase in average temperatures
- Shorter winter months
- Earlier spring snowmelt →earlier peak river flows
- Earlier breakup of winter ice on lakes and rivers
- Reduced snowpack
- Increased heavy precipitation
- Heat waves
- Rising sea surface temperatures and sea level

Potential Impacts of Climate Change on Water Resources

Warmer Temperatures	Heavy Precipitation	Drought	Sea Level Rise
• ↓ Snowpack • ↑ Flashiness of stream flows • ↓ DO • ↑ algae blooms • ↑ algal toxins • Changes in vegetation of watershed → changes in runoff quality / quantity	• ↑Flooding • ↓Groundwater recharge • ↑Contaminants and sediments • ↑ Rate of change of water quality • ↓ Water quality	• ↓ Base flows → ↑ pollutant concentrations • ↑ Salinity • ↑ Wildfire risk→ changes in runoff quality & quantity	• ↑ Coastal flooding • ↑Salt water intrusion • ↑ Coastal erosion

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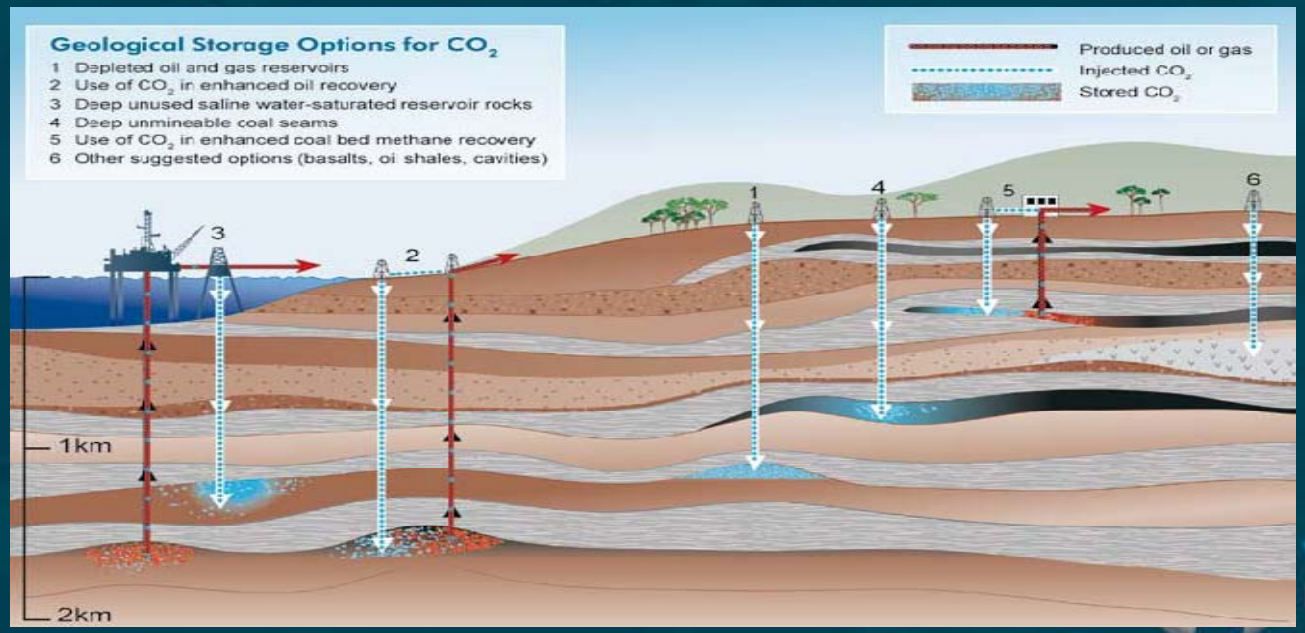
Potential Impacts of Climate Change on Water Resources

- Changes in population / migration / demands
- Changes in risks & reliability of infrastructure
- Increased use of mitigation & adaptation strategies (e.g., carbon sequestration)



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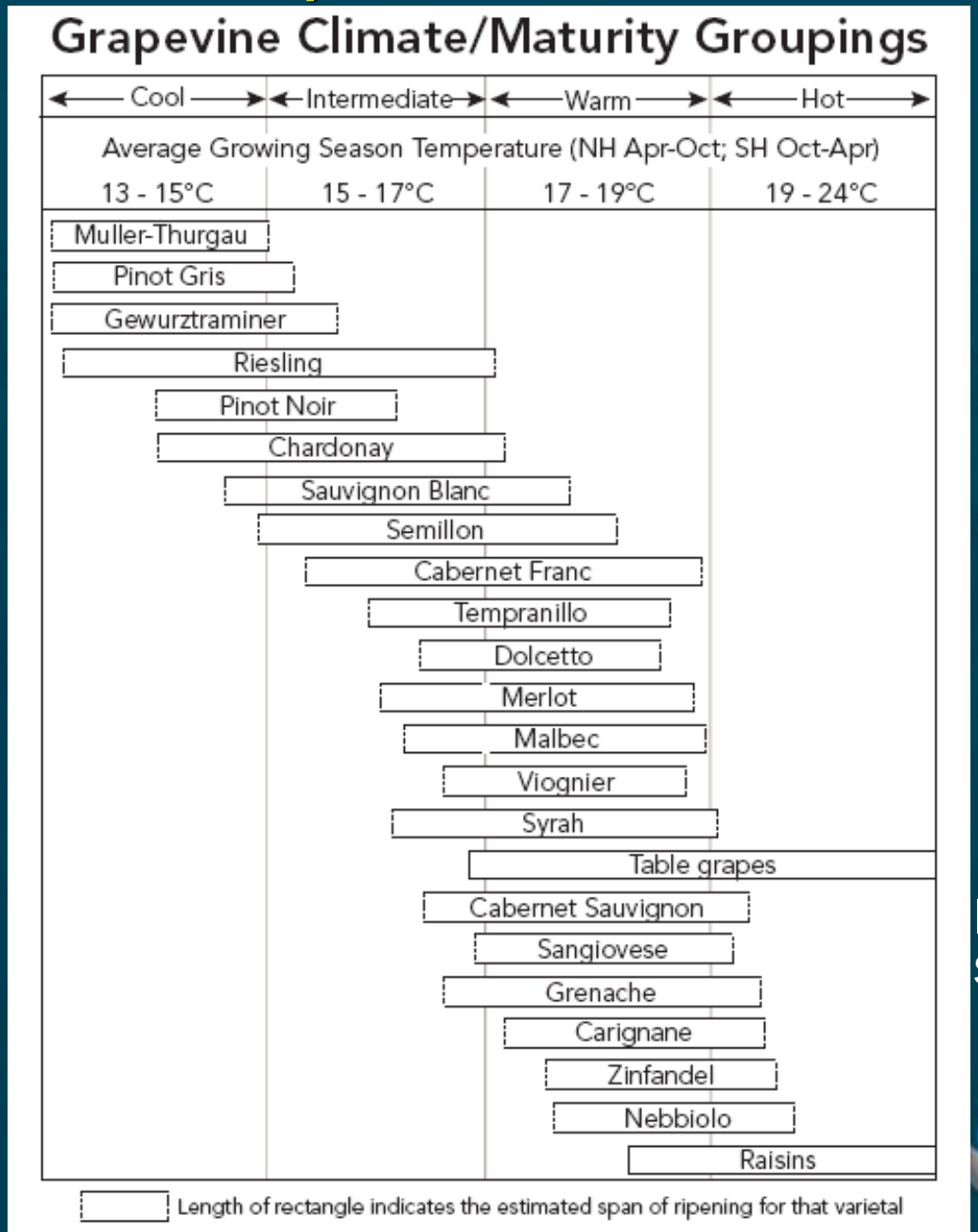
Potential Impacts of Climate Change



Ref: G. Jones
Southern Oregon Univ

Water Research Foundation and Climate Change

- First climate change project funded in 2003
  - Climate Change and Water Resources: A Primer for Municipal Water Providers (Published in 2006)
  - Al Gore's An Inconvenient Truth premiered in 2006
- Between 2003 – 2008, five projects funded through Tailored Collaboration or Partnership
- In 2008 - established Climate Change Strategic Initiative
- Since 2008 - 11 climate change projects funded
- In 2009 - developed and launched climate change clearinghouse website
- Since late 1990s, the Foundation funded over 130 projects relevant to climate change

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Climate Change Strategic Initiative

- To develop & implement a research program focused on impacts of climate change on water supplies
- Water Research Foundation commits up to $1 million per year
- The target timeframe of 5-7 years

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Climate Change Strategic Initiative

Objectives:

- Enhance and improve water industry awareness of climate change issues, impacts
- Provide water utilities with tools to identify and assess vulnerabilities & develop effective adaptation strategies
- Provide water utilities with tools to assess and minimize carbon footprint
- Communicate with internal & external stakeholders

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Climate Change Strategic Initiative Expert Panel Members

- Andrew F. DeGraca - Chair, San Francisco Public Utilities Commission
- Paul Fleming, Seattle Public Utilities
- Lorraine L. Janus, NYC Department of Environmental Protection
- Mark Knudson, Tualatin Valley Water District
- Hal Reed, American Water
- Brad Udall, CU-NOAA
- Douglas Yoder, Miami-Dade Water and Sewer Department
- Steve Whipp, United Utilities

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Climate Change Clearinghouse Website

www.theclimatechangeclearinghouse.org

- Offers the water community access to useful information on
  - Climate change science relevant to water utilities
  - Impacts climate change can have on water resources
  - Guidance on planning and adaptation strategies
  - Water Research Foundation research
- Site is regularly updated with new information, case studies, and links … twitter feed
- Project currently underway to enhance & expand site

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Climate Change Research
By The Water Research Foundation

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Algal Research

- 25 projects valued at $8.5 Million
- Topics covered
  - Algae Detection and Removal Strategies
  - Algal Toxins
  - Early Warning Systems

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Algal Research

- Project 4016 - International Guidance Manual For The Management Of Toxic Cyanobacteria (PI: Gayle Newcombe)
  - Partnership with GWRC; international manual
  - Understand the importance of cyanobacteria and the toxins they produce
- Project 4904- Alternative and Innovative Methods for Source Water Management of Algae and Cynobacteria (PI: Michael Burch)
  - Partnership project with Australian Water Quality Center
  - Will evaluate a range of alternative and innovative techniques for control of algae and cynobacteria

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Vegetation Change in Watersheds

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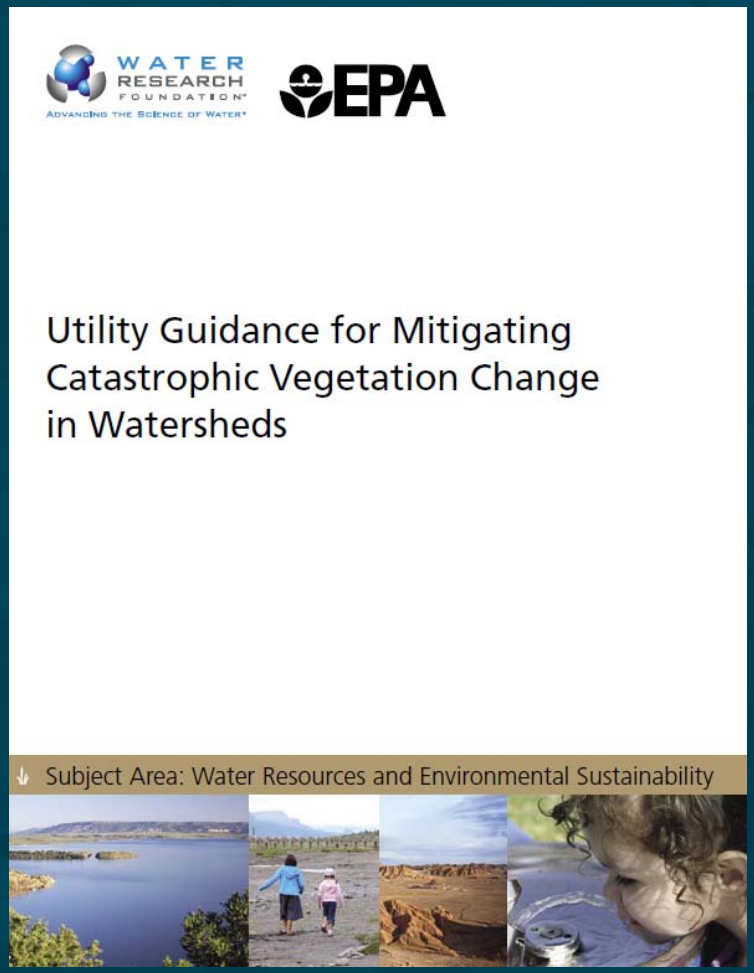
Watershed Research

- Project 4009 (PI: Elizabeth Strange)
  - Focuses on vegetation change due to: wildfire, storms, urbanization, drought etc.
  - Provides information on the changes in water quality and quantity
  - Provides information on potential management strategies



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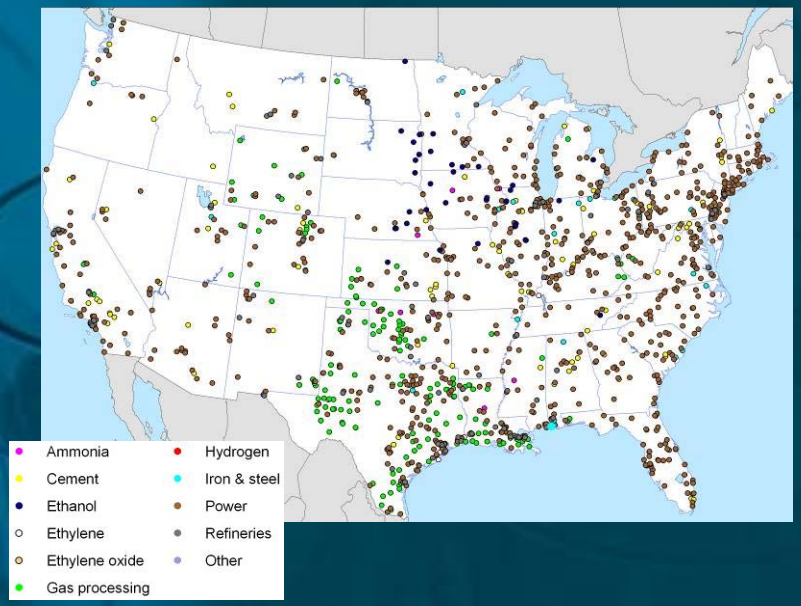
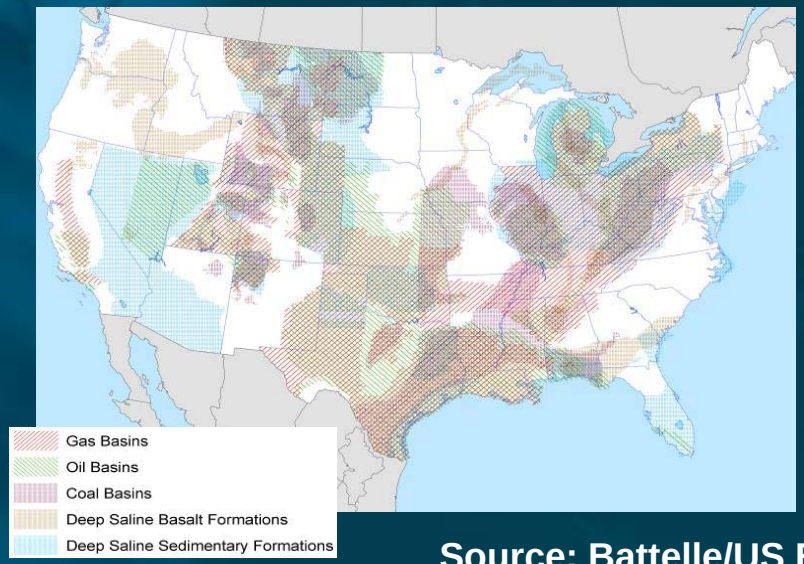
Carbon Sequestration



1,715 Large Sources (100+ $ktCO_2$/yr) with Total Annual Emissions = 2.9 $GtCO_2$

- 1,053 electric power plants
- 259 natural gas processing facilities
- 126 petroleum refineries
- 44 iron & steel foundries
- 105 cement kilns
- 38 ethylene plants
- 30 hydrogen production
- 19 ammonia refineries
- 34 ethanol plants
- 7 ethylene oxide plants



230 Reservoirs with 3,900+ $GtCO_2$ Capacity

- Oil and gas reservoirs
- Deep saline formations
- Deep coal seams

Source: Battelle/US EPA

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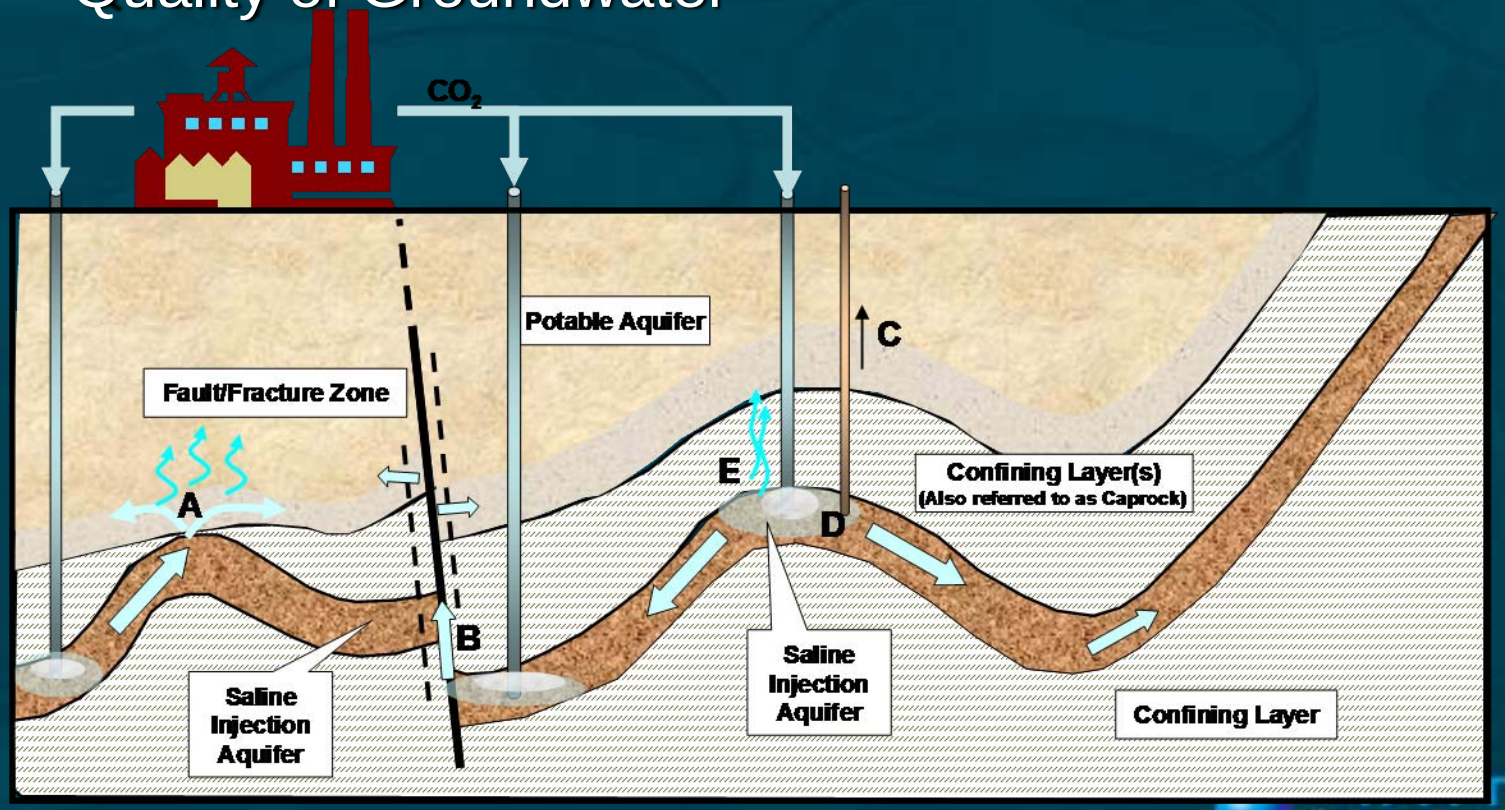
Carbon Sequestration Research

- Project 4203 and 4265 - Impacts of Underground Carbon Geologic Sequestration on the Water Quality of Groundwater



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Water Resources Research

- Project 3132- Incorporating Climate Change Information in Water Utility Planning: A Collaborative, Decision Analytic Approach
- Project 4205 - Joint Front Range Climate Change Vulnerability Study
- Project 4262 – Vulnerability Assessment and Risk Management Tools for Climate Change: Assessing Potential Impacts and Identifying Adaptation Options
- Project 4263 – Analysis of Changes in Water Use Under Regional Climate Change Scenarios

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Sea Level Rise Research

- Project 4285 – Assessing the Impact of Salt-Water Intrusion in the Carolinas under Future Climatic and Sea-Level Conditions
- Project 4228 - Water Utilities and Climate Change: A Research Workshop on Effective System Adaptation

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Infrastructure Research

- Project 4154 - Evaluating Effects of Climate Change on Water Quality Planning Criteria and Design Standards (PI: Ed Means)
- Project 4264 - Changing Mindsets to Promote Design of “Sustainable Infrastructure” (PI: John Cromwell)

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2010 Projects

- 4 new RFPs
  - Drinking Water Pump Station Design and Operation for Maximum Life Cycle Energy Efficiency
  - Water Quality Impacts of Extreme Weather-Related Events
  - Analysis of Reservoir Operations Under Climate Change
  - Ground Water Sustainability Under Climate Change

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Conclusions

- Climate change will directly impact water quality, quantity and water-related infrastructure
- Drinking water utilities are keenly aware of climate change issues and are seeking answers
- Water Research Foundation climate change research has laid the foundation but much work remains to be done
- Relevant adaptation strategies being developed
- Implementing adaptive strategies may be expensive but necessary to secure supplies

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Questions?

For more information on

Water Research Foundation's Climate Change Program, visit

www.theclimatechangeclearinghouse.org

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Thanks!

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