

# USGS AND CLIMATE CHANGE

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CLIMATE CHANGE CONFERENCE  
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# CONCLUSIONS

- Climate change is part of the USGS science as stated in the new reorganization
- The USGS, in cooperation with other federal and state agencies will promote cooperative partnerships to address the challenges resulting from Climate Change
- In Puerto Rico and the U. S. Virgin Islands, the USGS will continue monitoring and conducting research to provide scientific information for decision making.

## Start with Science

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How do we make smart decisions about a changing world?

# Start with Science

*There are 7 billion people on Earth, and that number is increasing every day* — human influence on our planet is ever more apparent. Changes to the natural world combined with growing human demands threaten our health and safety, our national security, our economy and our quality of life.

## Help shape the future of USGS science!

*Offer your comments on our draft strategies.*

The USGS is focused on some of the most significant issues society faces, in which natural science can make a substantial contribution to the well-being of the Nation and the world. The USGS Science Strategy outlines the major societal issues that USGS science is poised to address. Now we're creating specific strategies for each of those areas to expand and advance the actions we can take in the next decade, and we need your help. [SHARE](#)

### Core Science Systems

**Climate and  
Land Use Change**

**Energy and Minerals**

**Environmental Health**

### Ecosystems

**Natural Hazards**

**Water**

## Learn more about what we are doing.

[The Science Strategy Planning Process](#)

[Our Science Strategy](#)

[Our Mission Areas](#)

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# CLIMATE AND LAND USE CHANGE

- The USGS undertakes scientific research, monitoring, remote sensing, modeling, synthesis, and forecasting to address the effects of climate and land use change on the Nation's resources. The resulting research and products are provided as the scientific foundation upon which policymakers, natural resource managers, and the public make informed decisions about the management of natural resources on which they and others depend.

## Climate and Land Use Change Programs

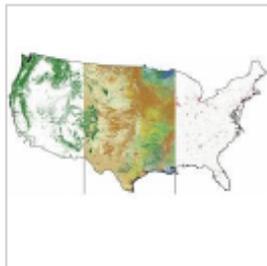
### Carbon Sequestration



Scientists at the U.S. Geological Survey (USGS) are working to assess both the potential capacities and the potential limitations of the various forms of carbon sequestration and to evaluate their geologic, hydrologic, and ecological consequences. In accordance with the Energy Independence and Security Act of 2007, the USGS has developed

scientifically based methods for assessment of biologic and geologic carbon sequestration.

### Geographic Analysis and Monitoring (GAM)



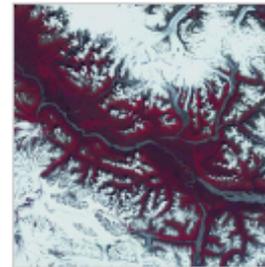
The goal of the USGS Geographic Analysis and Monitoring (GAM) Program is to understand the patterns, processes, and consequences of changes in land use, land condition, and land cover at multiple spatial and temporal scales, resulting from the interactions between human activities and natural systems.

### National Climate Change and Wildlife Science Center (NCCWSC)



The National Climate Change and Wildlife Science Center responds to the research and management needs of partners and provides science and technical support regarding the impacts of climate change on fish, wildlife and ecological process. The Center is taking the lead on establishing the Department of the Interior regional Climate Science Centers.

### Earth Resources Observation and Science Center (EROS)



The USGS Earth Resources Observation and Science Center (EROS) contributes to the Climate and Land Use Change Mission Area through research and operational activities that enable the understanding of local to global land change. The EROS multidisciplinary staff uses their unique expertise in remote sensing-based science and technologies to carry out basic and

applied research, data acquisition, systems engineering, information access and management, and archive preservation to address the Nation's most critical needs.

### Land Remote Sensing (LRS)



The Land Remote Sensing Program operates the Landsat satellites and provides the Nation's portal to the largest archive of remotely sensed land data in the world, supplying access to current and historical images. These images serve many purposes from assessing the impact of natural disasters to monitoring global agricultural production.

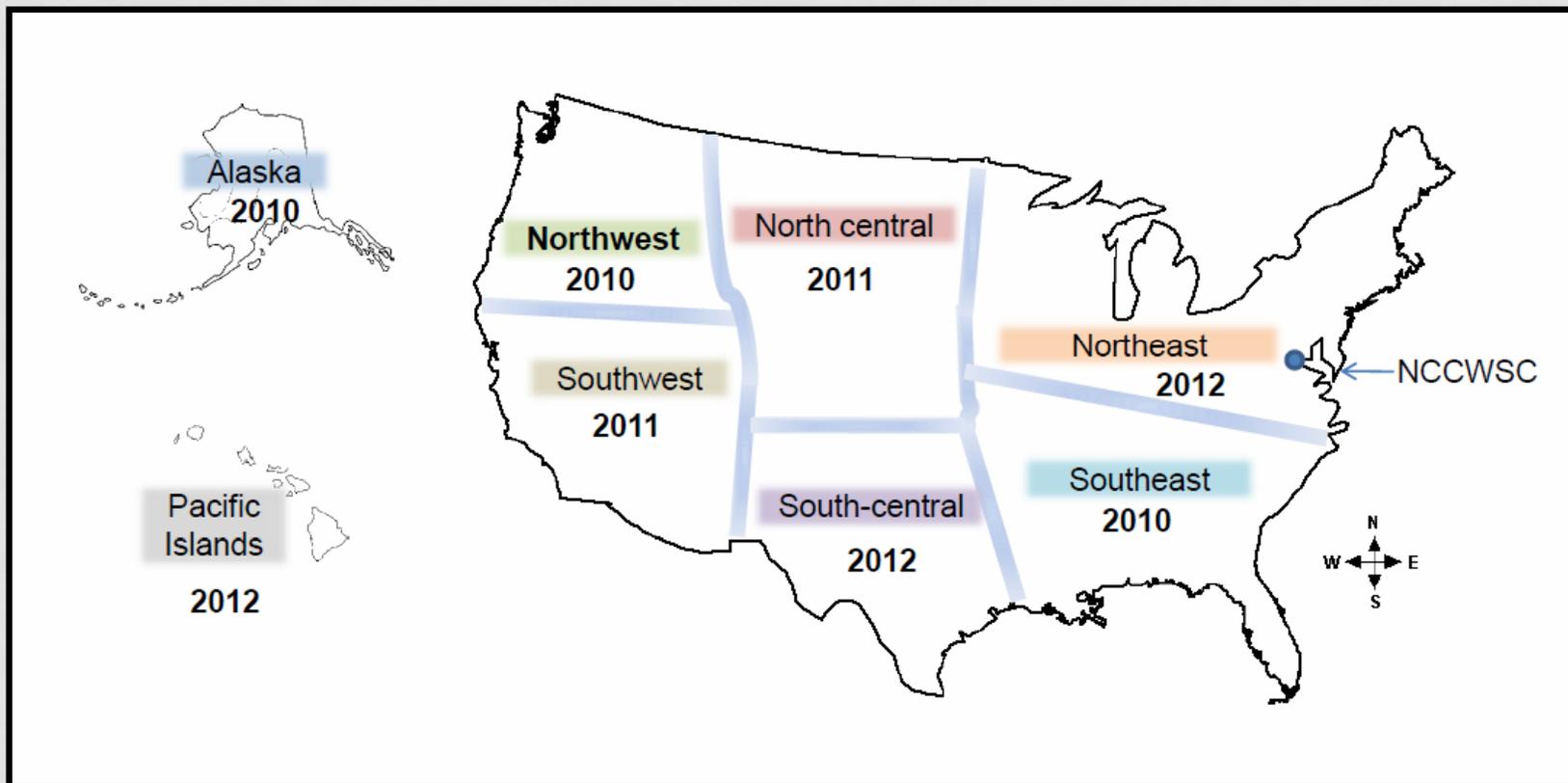
### Research and Development Program (R&D)



The USGS Global Change Research and Development Program supports fundamental scientific research to: 1) understand processes controlling Earth system responses to global change over broad temporal and spatial scales; and 2) understand and model impacts of climate and land-cover change on ecosystems and other natural resources.

# DOI CLIMATE SCIENCE CENTERS

- 8 Centers collocated with Universities

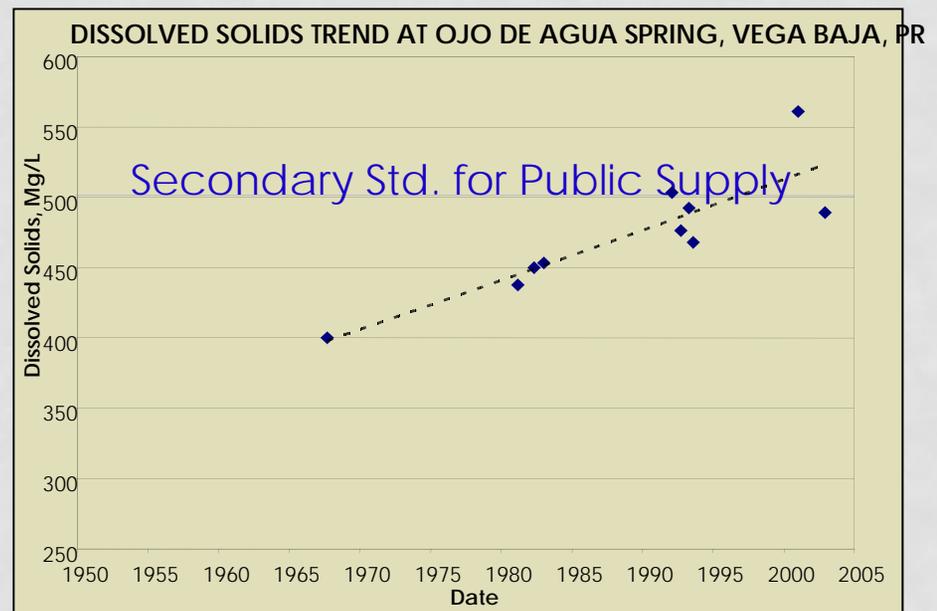


# DOI CLIMATE SCIENCE CENTERS

- CSCs will deliver basic climate change impact science.
- CSCs will prioritize fundamental science, data and decision-support activities.
- CSCs will partner with and help facilitate the coordination of fundamental climate science capabilities across their regions of responsibility.
- CSCs will synthesize, integrate, and communicate existing climate change impact data.
- CSCs will partner with resource managers at pertinent LCCs to assist development of science-based adaptation strategies.

# PRIORITIES AT USGS-CWSC

- Work with Caribbean Landscape Conservation Cooperative, other federal and state agencies, and stakeholders
- Support to the Southeast Climate Science Center
- Continue monitoring and research

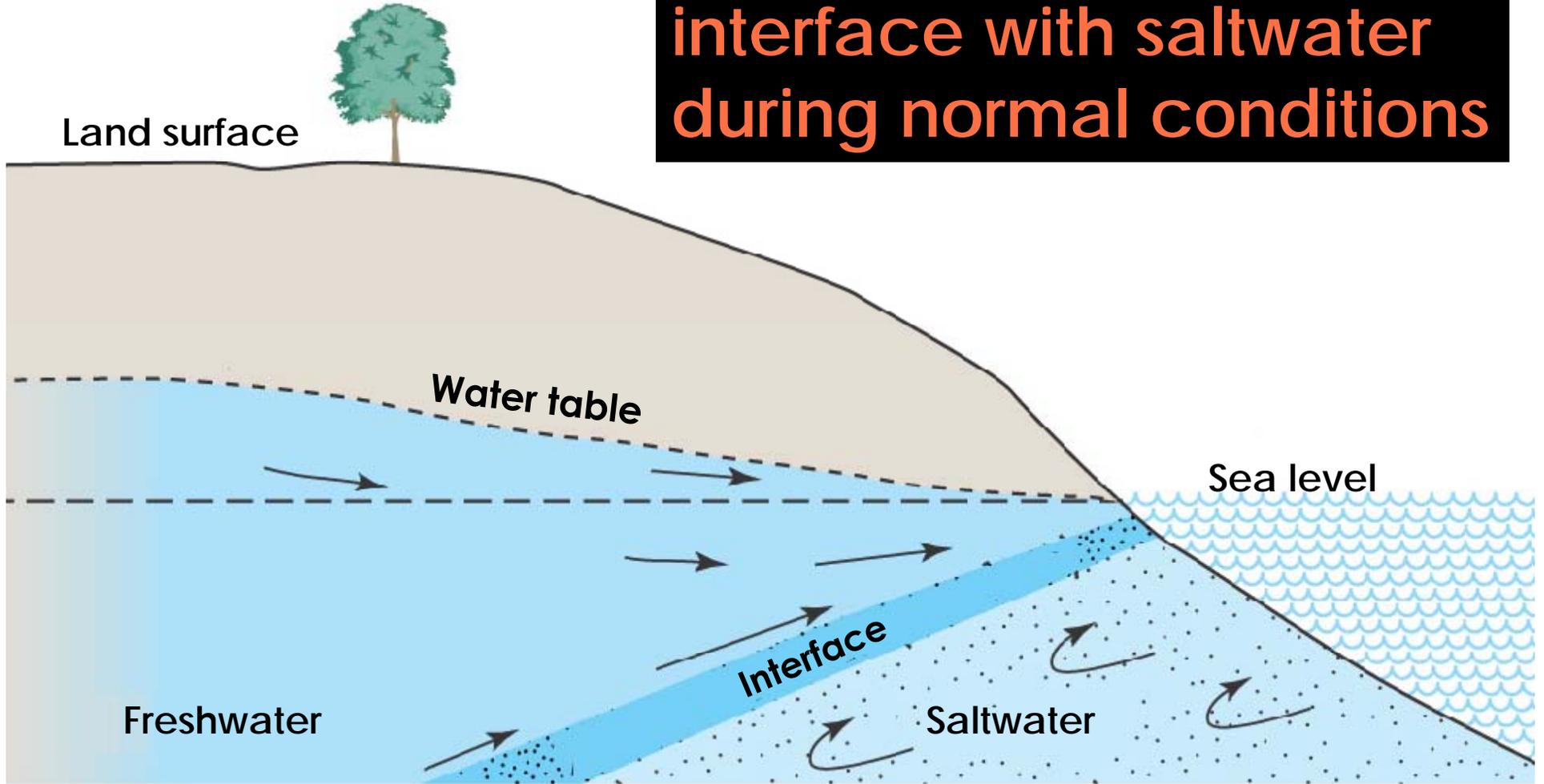


# CLIMATE CHANGE AND SEA LEVEL RISE

- Loss/displacement of coastal habitats
  - Biota, fauna, fresh and saltwater systems
- Loss of coastal infrastructure
  - Ports, roads, houses, etc.
- Possible loss of groundwater resources
  - Models predict a sea level rise of up to 0.47 meters by year 2100.
  - All wells with depths close to existing salt/freshwater interface will turn brackish or saline.

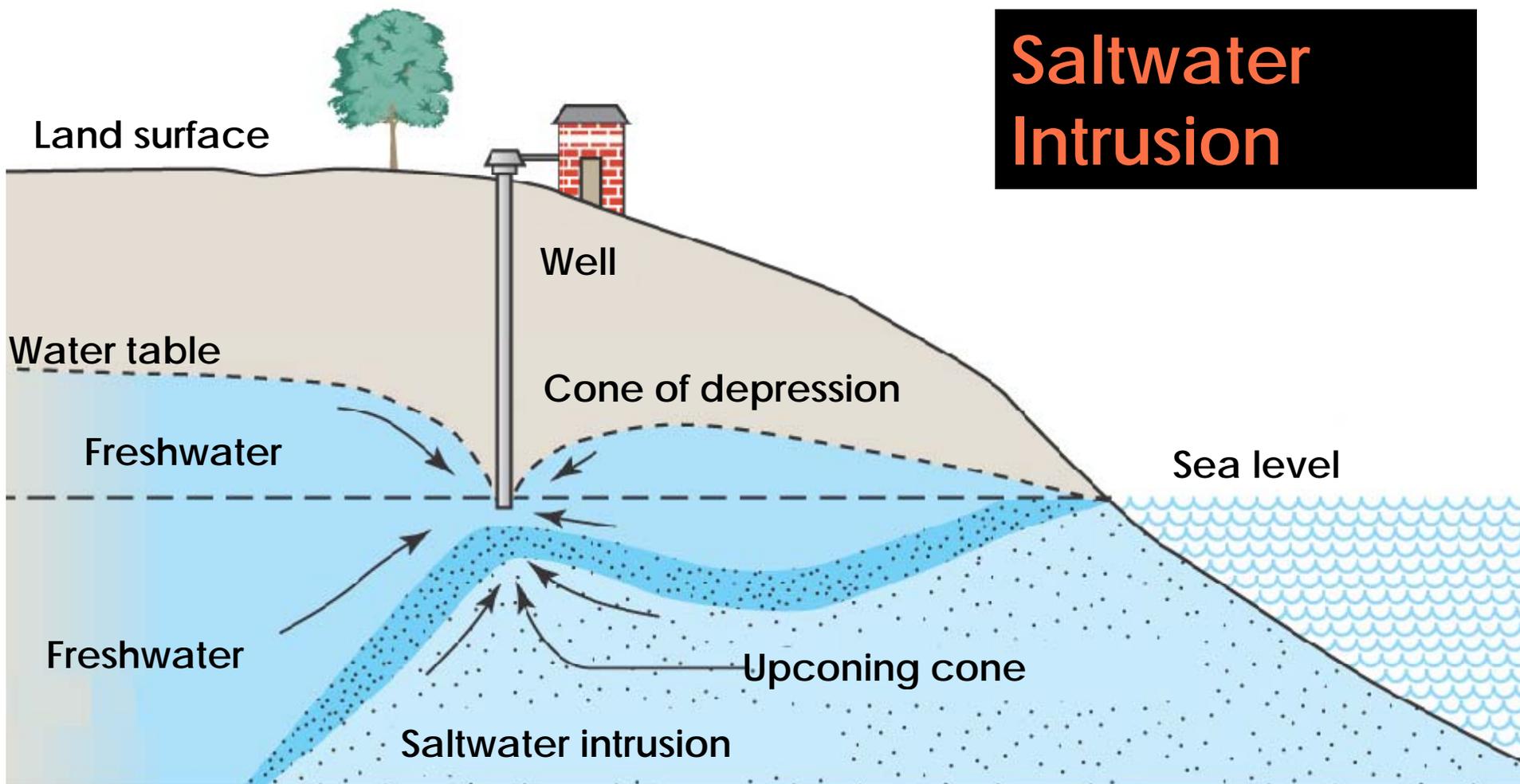


# Groundwater flow and interface with saltwater during normal conditions



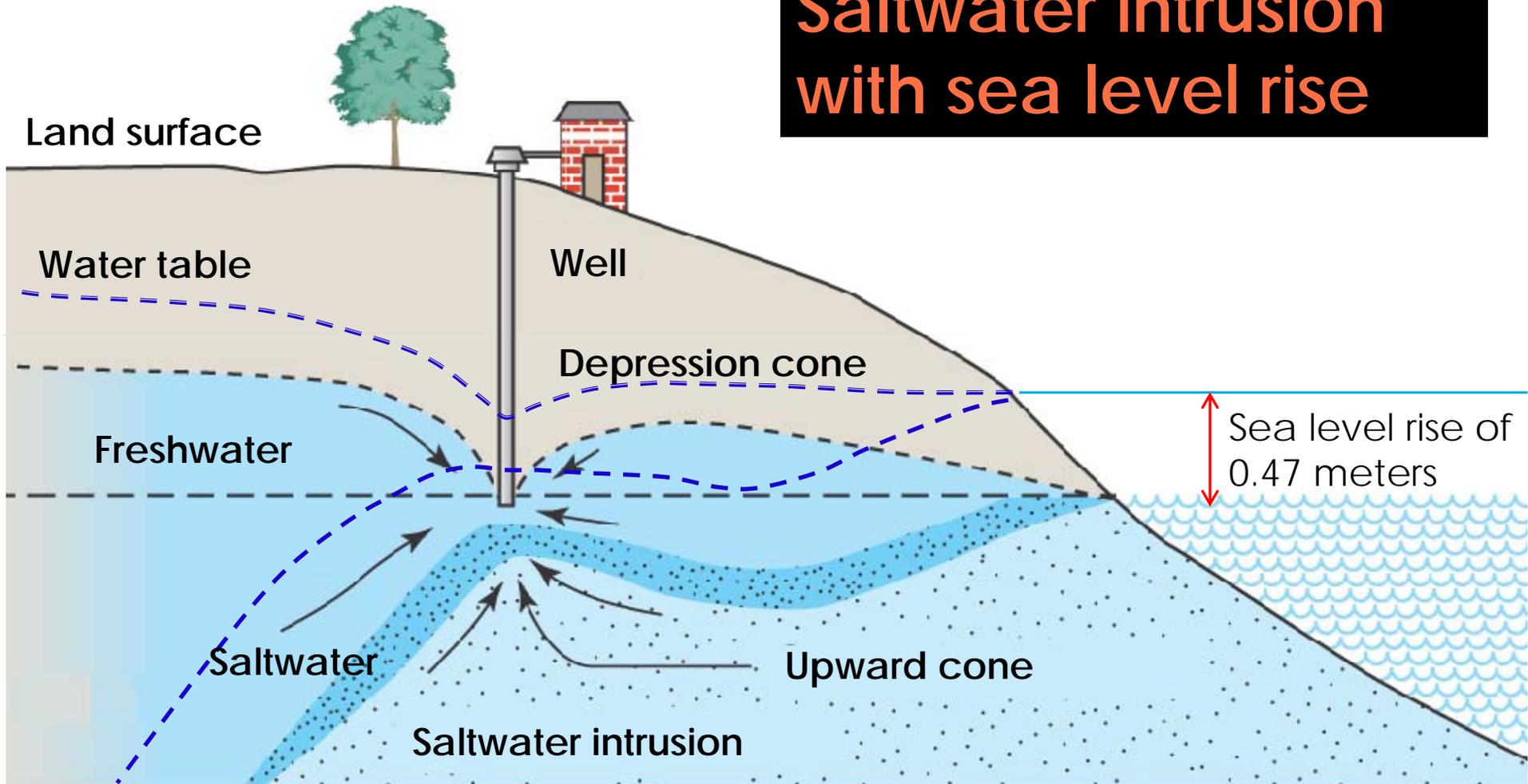
(a)

# Saltwater Intrusion



(b)

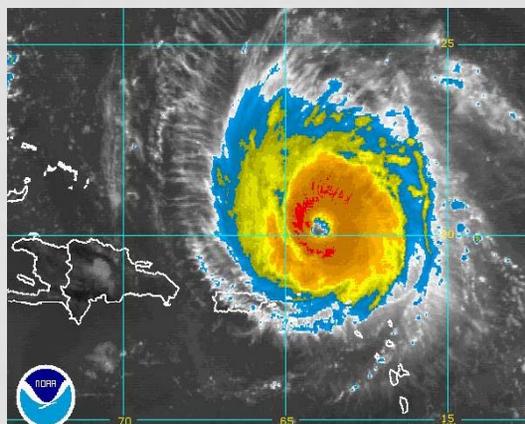
# Saltwater intrusion with sea level rise



(C)

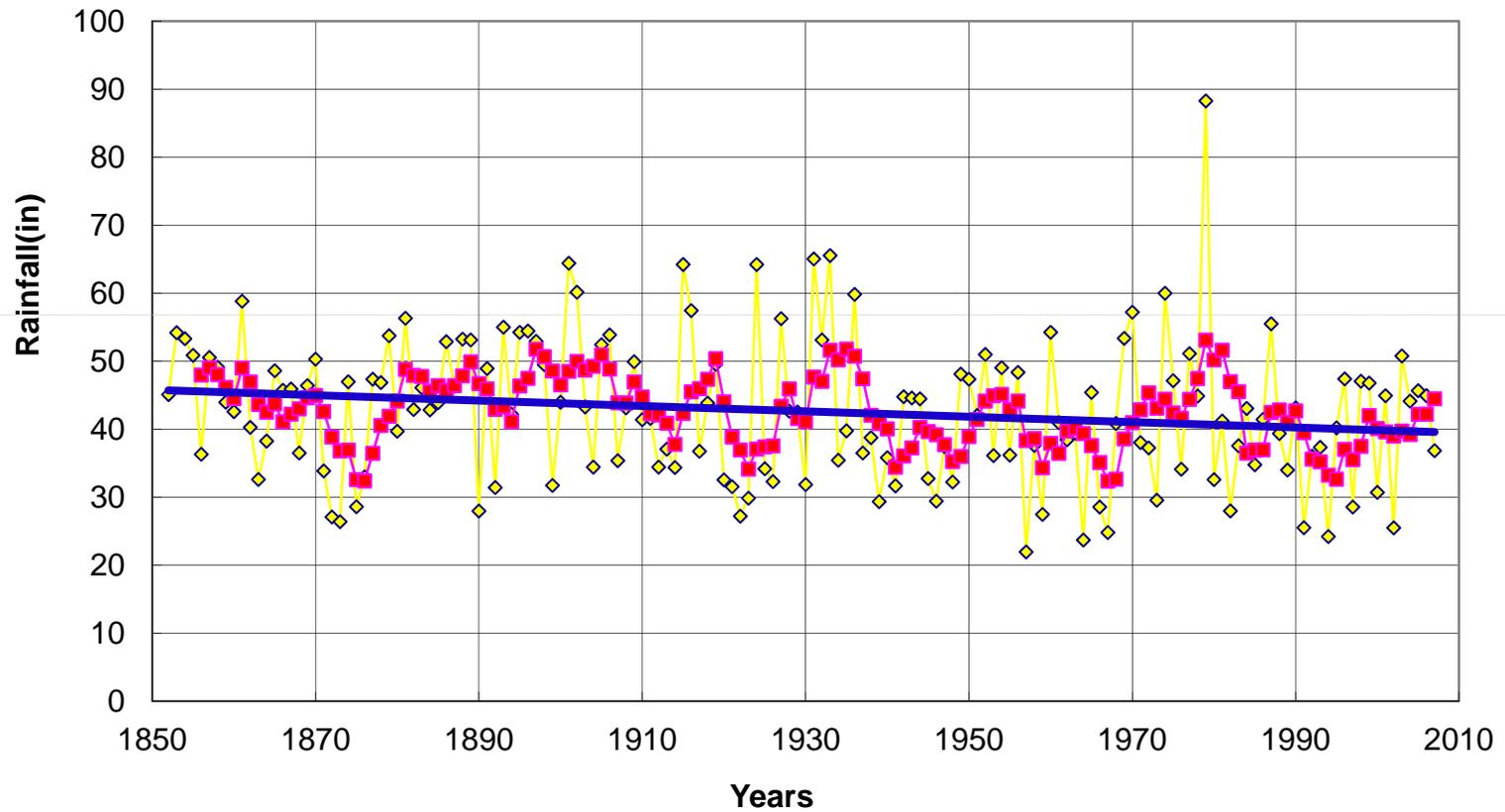
# CLIMATE CHANGE AND RAINFALL

- Predicted increased in short duration but intense precipitation events
  - Increased hurricanes
  - Increased runoff and sediment loads
  - Increased evapotranspiration rates
  - Increased floods and droughts
  - Overall, decrease in groundwater recharge



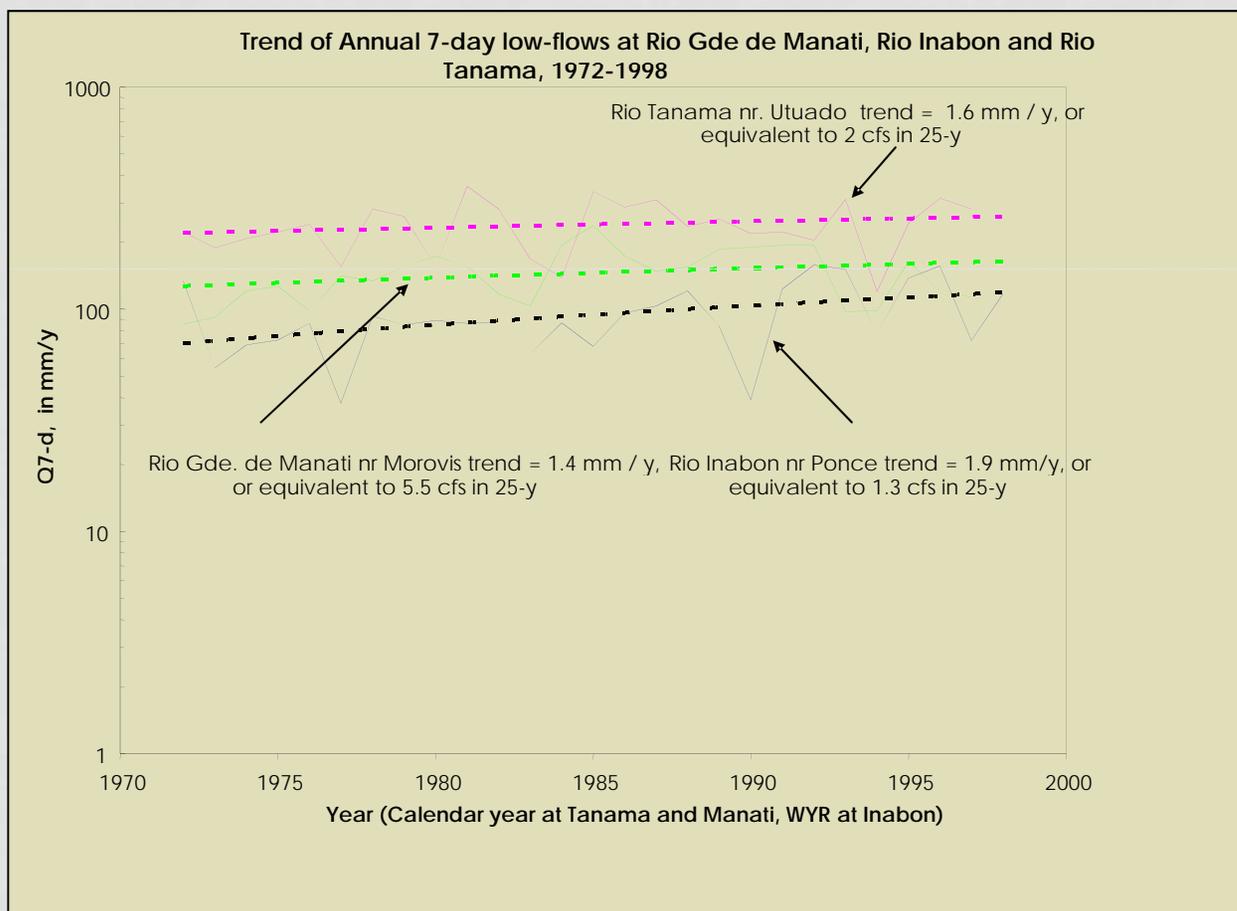
### St Croix, USVI Long Term Rainfall Record

[sources: Danish records 1852 to 1967; corrected records from 1960 to 1967, D. Jordan, and NOAA records from 1968 to 2007; Meteorological Station Christiansted Fort]



Projected decrease in rainfall of **3.95 inches per century**.  
Notice that this trends includes the effects of hurricanes (outliers) in estimating the mean annual rainfall, particularly in 1979 when three hurricanes passed within 2 degrees or over St. Croix.

# LAND COVER CHANGES IN LOW-FLOWS



(abandonement of farmland or increase in number of high-intensity rainfall events?)

# LAND COVER CHANGES IN LOW-FLOWS

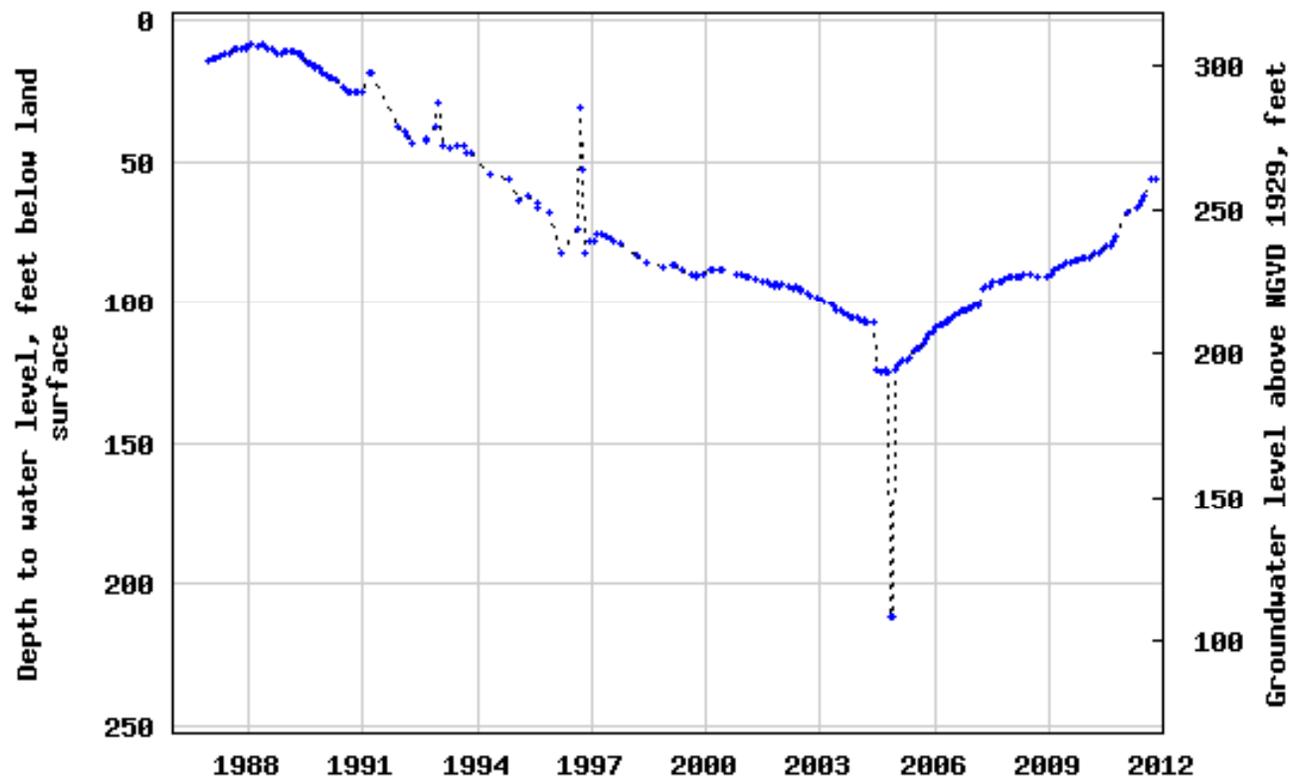
- The Effects of Forest Cover on Baseflow Characteristics in the Mountainous Interior of Puerto Rico
  - Temporal and spatial variability of rainfall infiltration and recharge
  - Contribution to stream baseflow from local and regional groundwater flow systems
  - Difference in storage and hydraulic properties



# GROUNDWATER LEVELS



USGS 182544066341500 CRUCE DAVILA NC-5 WELL, BARCELONETA, PR



----- Provisional Data Subject to Revision -----