

New Jersey's Climate Change and Water Resource Policy Initiatives

NJ Clean Water Council

Annual Public Hearing

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Outline of Presentation

Climate Change Risk Assessment

- Framework for Risk Assessment
- Climate Change --Global Context
- Key Impacts of Climate Change
- Hydrology & Water Resources
- Northeast Climate Projections

Climate Change Response: Policy Initiatives for NJ

- Climate Change Response: Mitigation & Adaptation
- U.S./NJ Contribution to Global Warming/Climate Change
- NJ Response: Mitigation Policies & Programs including Water-related Measures
- NJ Response: Mitigation (Funding Mechanism)
- NJ Response: Adaptation Policies & Programs
- NJ Response: Draft Water Supply Plan
- Concluding Note

CLIMATE CHANGE RISK ASSESSMENT

Framework* for Climate Risk Assessment

- Present and Past Climatologies- current and historical climate trends, indicators, variability
- Climate Models- temperature, precipitation, sea-level rise; indicate climate uncertainty (IPCC AR4, 2007)
- Emission Scenarios- population, GDP, technology (IPCC, 2000)
- Regional Climate Scenarios- downscaled model- based probabilities characterize risks
- Extreme Events- frequency and intensity of heat waves, rainfall flooding, droughts and coastal storms
- High Impact Scenarios- Ice sheet melting and Arctic sea ice extent monitored and evaluated

*Adapted from Center for Climate Systems Research, Columbia University

Options for Dealing with Climate Change

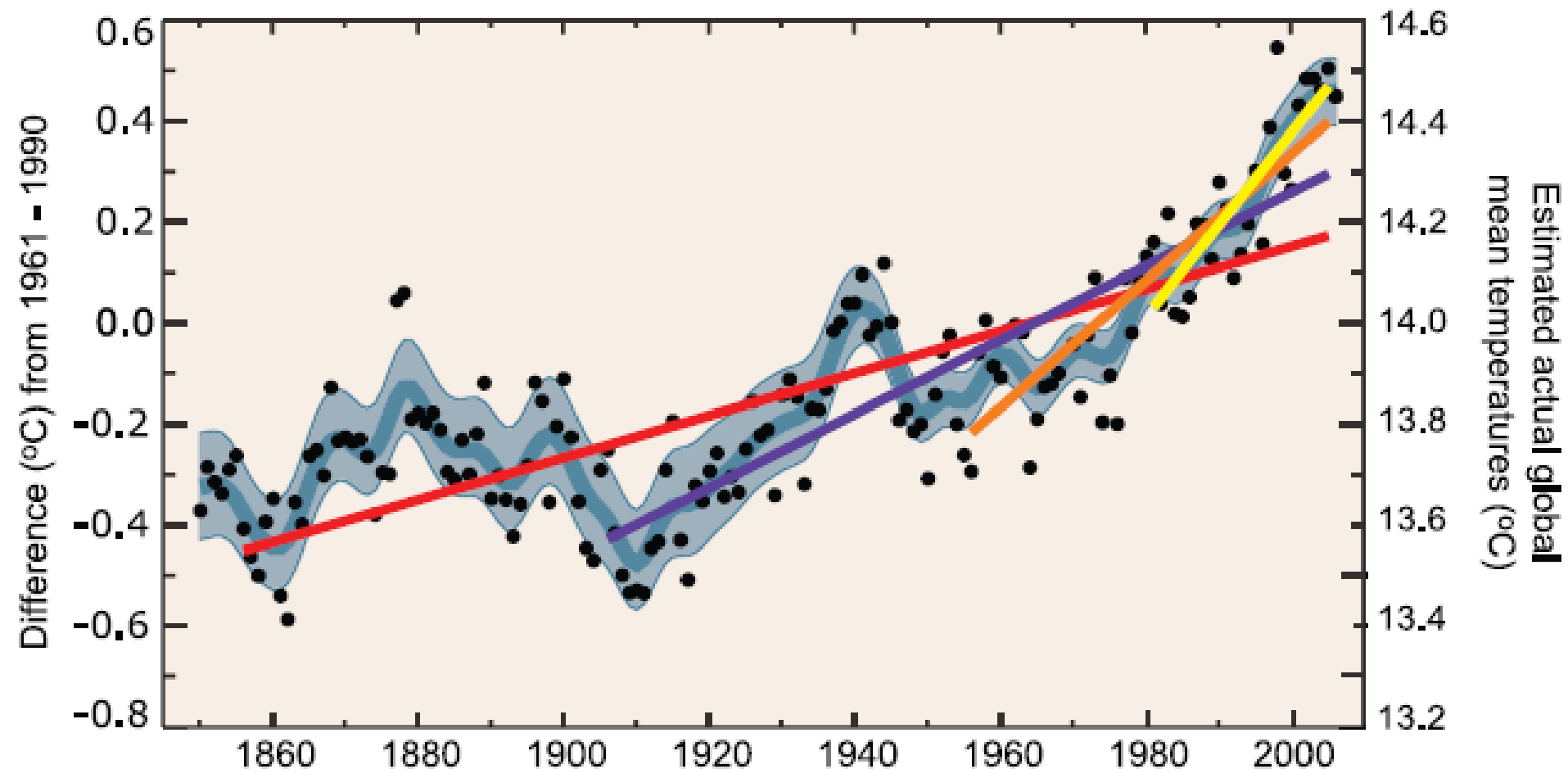
The optimal decision will depend on:

- Pattern and rate of climatic change
- Frequency, proximity and severity of extreme events
- The ‘potential impact’ of climate change for natural and human systems (exposure and sensitivity)
- Adaptive capacity of current systems and communities in the state
- Costs and timeframes associated with options for dealing with climate change

Climate Change – Global Context

- Enhanced GHG effect due to increased CO₂ concentrations (pre-industrial 275 ppm; now 390 ppm; stabilization level 450 ppm)
- Increase in temperature accompanied by changes in climate (cloud cover, precipitation, wind patterns, seasonal durations)
- Extreme weather events very likely (will be difficult and disruptive)

Global Mean Temperature



- Annual mean
- Smoothed series
- 5-95% decadal error bars

	Period	Rate
	Years	°C per decade
	25	0.177 ± 0.052
	50	0.128 ± 0.026
	100	0.074 ± 0.018
	150	0.045 ± 0.012

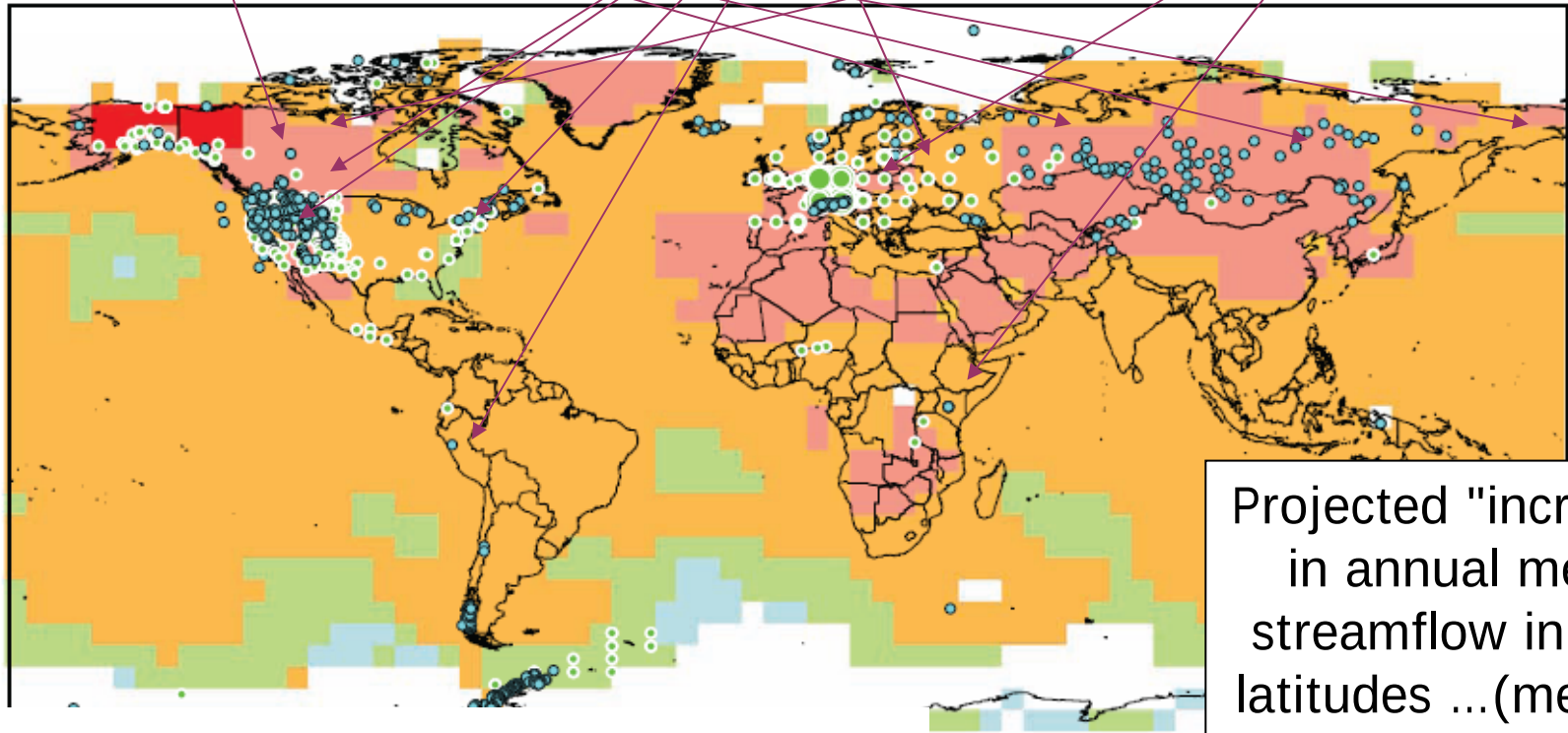
Key Impacts of Climate Change

- Water: Quantity and quality
- Human health: Changes in vector-borne diseases, heat/air quality-related mortality
- Ecosystems: Wildfire risk; loss of ecosystem services with decreases in biodiversity and populations of critical/endangered species
- Infrastructure and Energy: Changes in severe weather events, possibly including tropical storms
- Concomitant and Indirect Impacts: (e.g., economics, industry, agriculture, human health)

Increased Streamflow

Earlier Stream Flow

Warming Lakes



Projected "increases in annual mean streamflow in high latitudes ... (medium confidence)" TAR

Hydrology and Water Resources

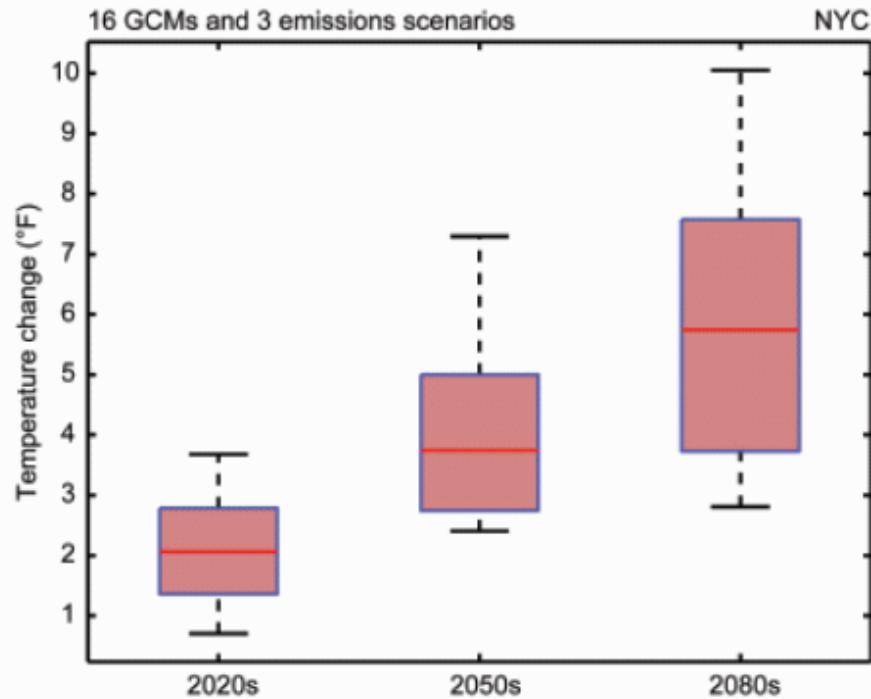
Increased runoff and earlier spring discharge from snow melt and glacial melt, Warming lakes and rivers

Northeast Climate Projections (NECIA, 2007)

- More frequent days with temperatures above 90°F (NCAR* projects record highs could outnumber record lows 20 to 1 by the end of the century)
- Longer growing season
- Increased heavy precipitation (20-30% late 21st c.)
- Winter ppt falling more as rain rather than snow; reduced snowpack; earlier breakup of ice on lakes and rivers; earlier spring snowmelt resulting in earlier peak river flows
- Rising sea surface temperatures and sea level (10-23 in.); the latter may result in saltwater intrusion into estuaries and aquifers, inundate polluted sites, compromise coastal ecosystems (including loss of wetlands and their water filtration functions)

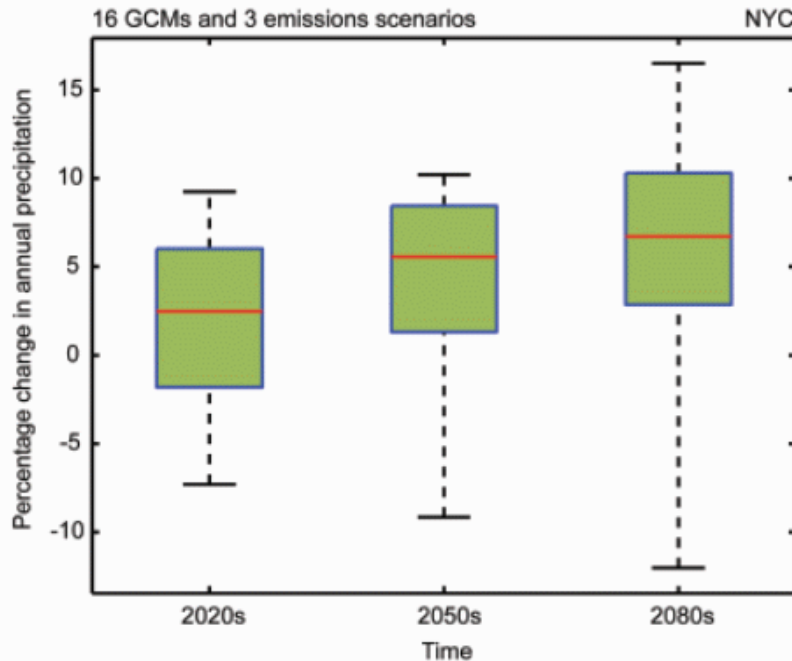
*National Center for Atmospheric Research

Temperature Impacts on Water Sector



- Longer growing season
- More evaporation
- Less runoff
- More demand for lawn irrigation.

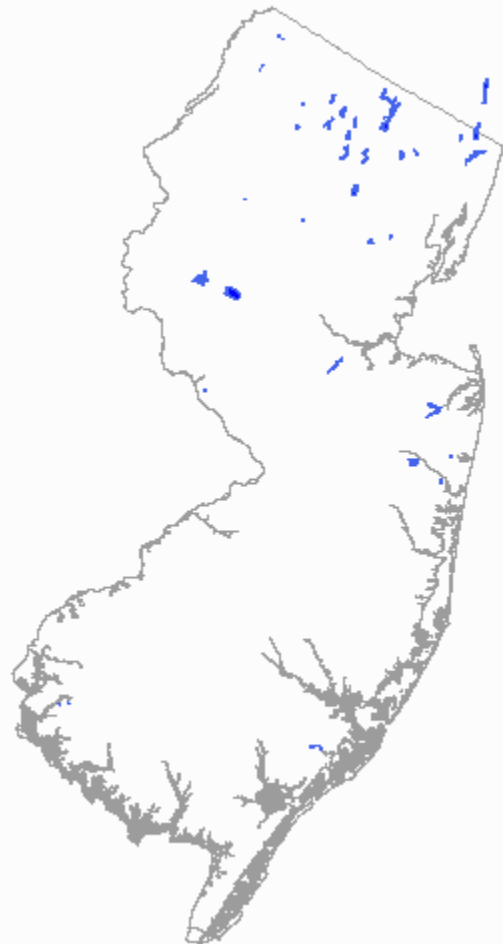
Precipitation Impacts on Water Sector



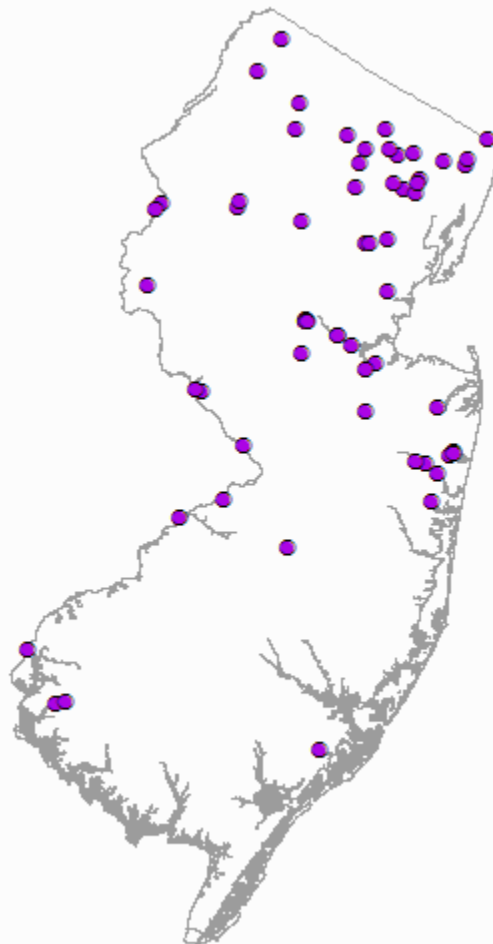
More extremes (storms & droughts) means more storage is needed.

Public Water Supplies in NJ

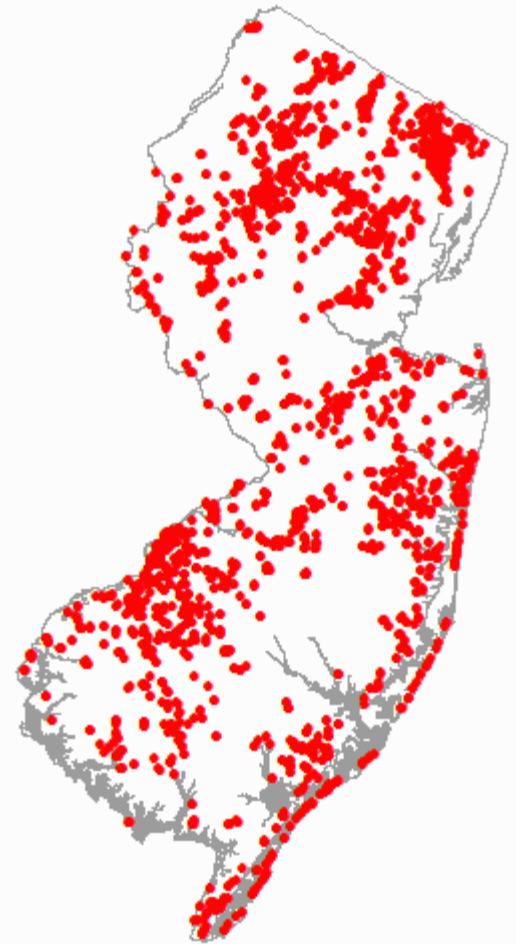
reservoirs



intakes



wells



Sea Level Rise Impacts

- Infrastructure, residential and commercial assets are all at risk to SLR and more frequent coastal flooding
- Inland flooding from rainfall will be more destructive due to drainage problems
- Saltwater will intrude into estuaries and aquifers, and inundate polluted sites
- Coastal ecosystems will be compromised
- Northeast coasts face increases in the extent and frequency of storm surge, coastal flooding, erosion and wetland loss (along with their water filtration)

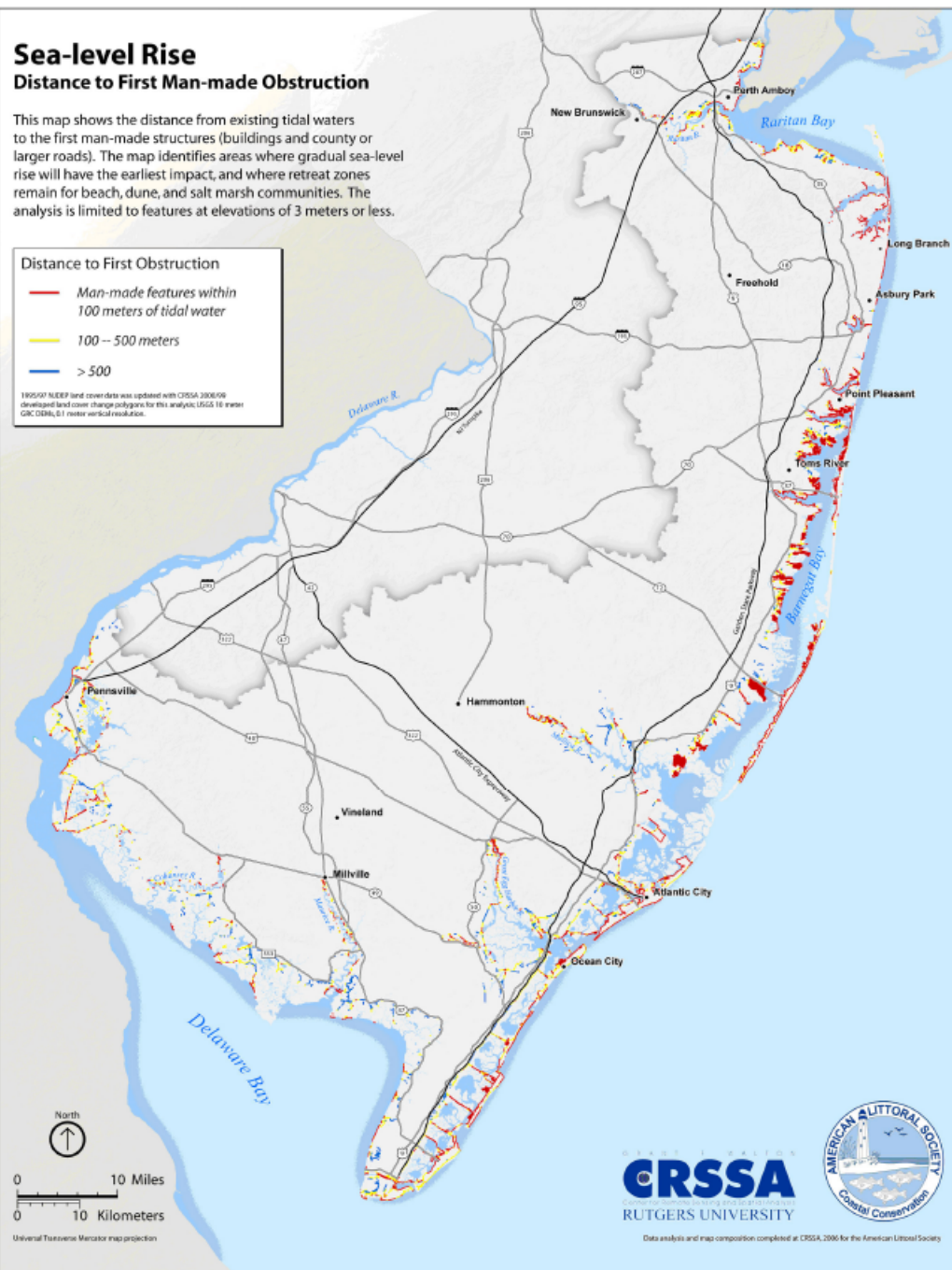
Sea-level Rise Distance to First Man-made Obstruction

This map shows the distance from existing tidal waters to the first man-made structures (buildings and county or larger roads). The map identifies areas where gradual sea-level rise will have the earliest impact, and where retreat zones remain for beach, dune, and salt marsh communities. The analysis is limited to features at elevations of 3 meters or less.

Distance to First Obstruction

- Man-made features within 100 meters of tidal water
- 100 -- 500 meters
- > 500

1995/97 NEDP land cover data was updated with CRSSA 2006/06 developed land cover change polygons for this analysis, USGS 10 meter GNC DEM, 0.1 meter vertical resolution.



CRSSA
RUTGERS UNIVERSITY

Data analysis and map composition completed at CRSSA, 2006 for the American Littoral Society



Aquatic Ecosystem Impacts

- Ecosystem health is an element of water quality standards
- Ecological communities and wildlife depend on adequate stream flow
- In the Northeast conditions of low stream flow are projected to last roughly a month longer by late century under higher GHG emissions scenario
- For communities dependent on streams and rivers for their water supply, this trend is cause for concern
- Biological indicators of water quality will be affected (e.g., hydrologic sensitivity)

CLIMATE CHANGE RESPONSE: POLICY INITIATIVES FOR NJ

Climate Change Response: Mitigation, Sequestration, Adaptation

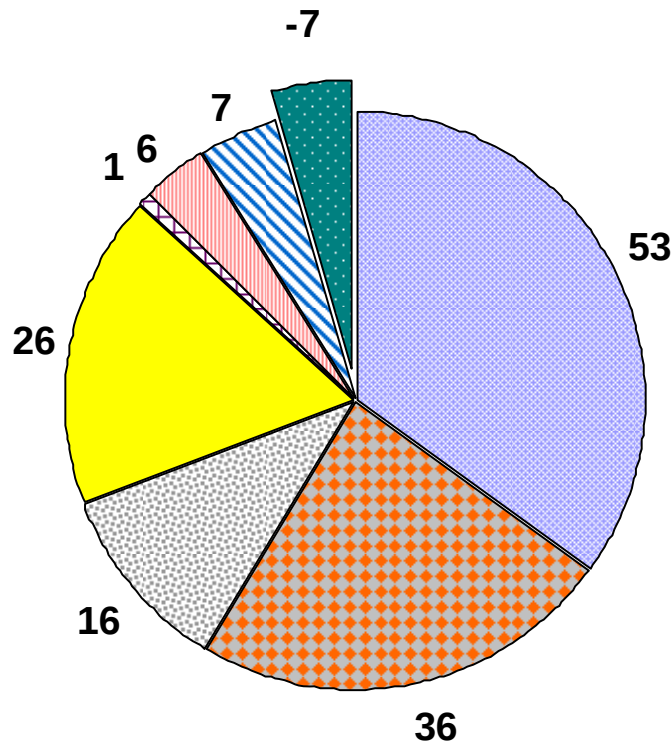
- Limiting Future Impacts – **Mitigation** (*reduced CO₂ emissions* through energy efficiency, renewable energy, carbon capture and storage and *reduced CH₄ emissions*) and **Sequestration** (enhanced CO₂ uptake by natural systems through improved land-use management)
- Response to Existing Impacts – **Adaptation** (“*climate proofing*, i.e., ensuring development of *climate-resilient* human and ecological communities)

U.S. and NJ Contribution to Global Warming/Climate Change

- U.S. emits 20% of the world's GHG emissions
- NJ emits approximately 137 MMTCO₂ annually (2007) which is 2% of U.S. emissions and 0.4% of global emissions
- U.S. needs to cut emissions 30% by 2030 and 80% by 2050 to meet stabilization goal of 450 ppm CO₂ in the atmosphere
- NJ goal is to stabilize its emissions to 1990 level (123 MMTCO₂) by 2020 & reduce emissions 80% below 2006 level by 2050 (i.e., 25.5 MMTCO₂)

GHG Emissions by Sector; New Jersey, 2007

Millions of Metric Tons CO₂ equivalent



- Transportation (~38% of total)
- Electric Generation (~26% of total)
- Industrial (~12% of total)
- Residential/Commercial (~19% of total)
- Other (~1% of total)
- Waste Management (~4% of total)
- Other Highly Warming Gases (~3% of total)
- Terrestrial Carbon Sequestration (offsets ~5% of total)

NJ Response: Policies & Programs (Mitigation)

- Executive Order 54 (2/13/2007) and Global Warming Response Act (7/6/2007) set statewide GHG limits
- Draft Global Warming Response Act 2020 Recommendations Report (12/15/2008)
- Three ‘Core’ actions in GWRA: 1) Regional Greenhouse Gas Initiative (RGGI), 2) Energy Master Plan (EMP) and 3) Low Emission Vehicle (LEV) program, all 3 designed to meet 2020 GHG limits
- Beyond core actions, there are a host of other recommendations & related actions in key sectors including terrestrial sequestration and water

NJ Response- (Mitigation: Water-related Measures in Draft GWRA Report)

- Outdoor water consumption: mandatory statewide watering limits applied to all water users
- Green buildings: state guidelines/programs including measures to improve water conservation & decrease storm water run-off)
- Waste management: financial incentives to reduce carbon footprint of public water supply & POTWs

NJ Response: Policies & Programs

(Mitigation: Funding Mechanism)

- Global Warming Solutions Fund Act (N.J.S.A. 26:2C-45 *et seq*) allocates proceeds from the auction of NJ RGGI CO₂ allowances (\$51 million to date)
- 60% to EDA for end-use energy efficiency and new state-of-the-art electric generation in commercial, institutional, industrial sectors; 20% to BPU to reduce electricity demand & costs for residential low and moderate income electricity customers; and 20% to DEP (10% to support local government GHG efforts and 10% to enhance stewardship & restoration of State forests and tidal wetlands [CO₂ storage & co-benefits, e.g., water filtration])

NJ Response: Policies & Programs (Adaptation)

- Draft Global Warming Response Act 2020
Recommendations Report commits the State to developing Comprehensive Adaptation Plan; lays out framework for the impacts to be addressed
- State currently in early stages of plan formulation and expects a coordinated process integrating other on-going efforts (e.g., Water Supply Plan)

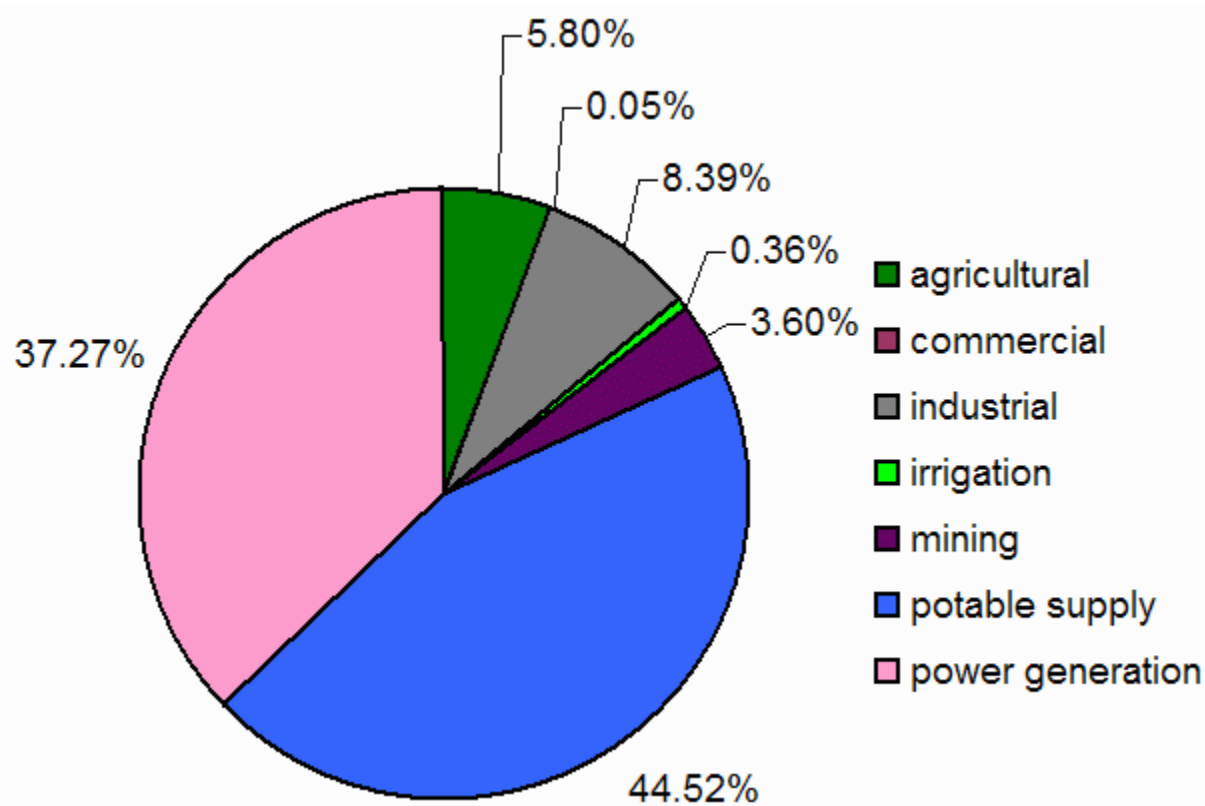
NJ Response: Policies & Programs (Mitigation and Adaptation: Work in Progress)

- A number of working groups set up to address adaptation research, planning & implementation concerns including collaboration with DEP programs, regional and federal initiatives
- Basic research questions (e.g., scale issues) being considered with regard to use of climate models with implications on water supply planning, TMDL, aquatic ecosystem indicators, and other applications relevant not only to water but other key sectors as well
- Example is determining probabilities of changes in occurrence and seasonality of temperature, precipitation and solar radiation over different timescales (20, 25, 50, 75, 100 years)

NJ Response: Draft 2009 Water Supply Plan (NJWSP)

- Includes acknowledgement of climate change as part of future management challenge for water supply in NJ
- Recognizes the importance of maximizing water efficiency as an effective form of adapting to the potential water related impacts of climate change. Demand management is also key feature of the draft NJWSP
- DEP coordinating with USEPA & other state agencies in developing cooperative strategies to address climate change impacts on a statewide & regional basis

Average NJ Water Use, 1990's (944 billion gallons/year)



Conclusion: Challenge of Climate Change

- Climate change will alter the distribution, quantity, and quality of water by affecting precipitation, air, and water temperature, and snow melt.
- Climate change will drive *adaptation* of the state's water supply infrastructure and allocations to meet the needs of its population.
- Cost of inaction > costs of mitigation & adaptation