



@SJ_Program
#SustainableStateNJ

Ready, Set, Adapt!

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2015 NEW JERSEY SUSTAINABILITY SUMMIT

Exploring New Jersey Climate Variability and Change

Sustainable Jersey Summit

The College of New Jersey

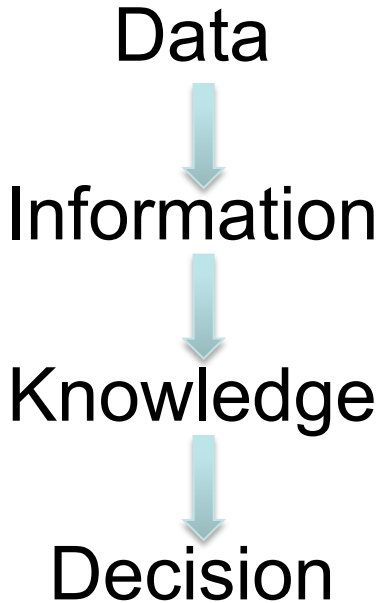
Dr. David A. Robinson
Professor, Department of Geography
& New Jersey State Climatologist
Rutgers University

June 10, 2015



Landing Lane, Piscataway, NJ
1 May 2014 (M. Gerbush)

Office of the NJ State Climatologist



ONJSC

at Rutgers University

RUTGERS

New Jersey Agricultural
Experiment Station

Office of the New Jersey State Climatologist · Rutgers University · 54 Joyce Kilmer Avenue · Lucy Stone Hall B224 · Piscataway, NJ 08854

Home

Quick Links

- NJWxNet
- New Jersey Forecast
- National Forecast
- NOAA Climate Watch

NJ

- Current Conditions
- Current Forecasts
- Climate Information

US

- Current Conditions
- Current Forecasts
- Climate Information

Other

- Coastal Observations
- El Niño/La Niña
- Hurricanes

ONJSC

- Outreach
- About ONJSC
- Research
- Staff

Partners

Latest from the NJWxNet

Temperature
Wed Apr 22 03:05 PM EDT
Copyright 2014 Rutgers

Latest temperatures across NJ appear in the above map. Click on the map or here, the [New Jersey Weather and Climate Network](#), for much more information.

Frequently Updated Climate Data

- [Winter 2014-2015 Snow Event Totals](#)
- [Monthly and Annual Statewide \(1895-Present\)](#)
- [Monthly Station](#)
- [Monthly Maps](#)

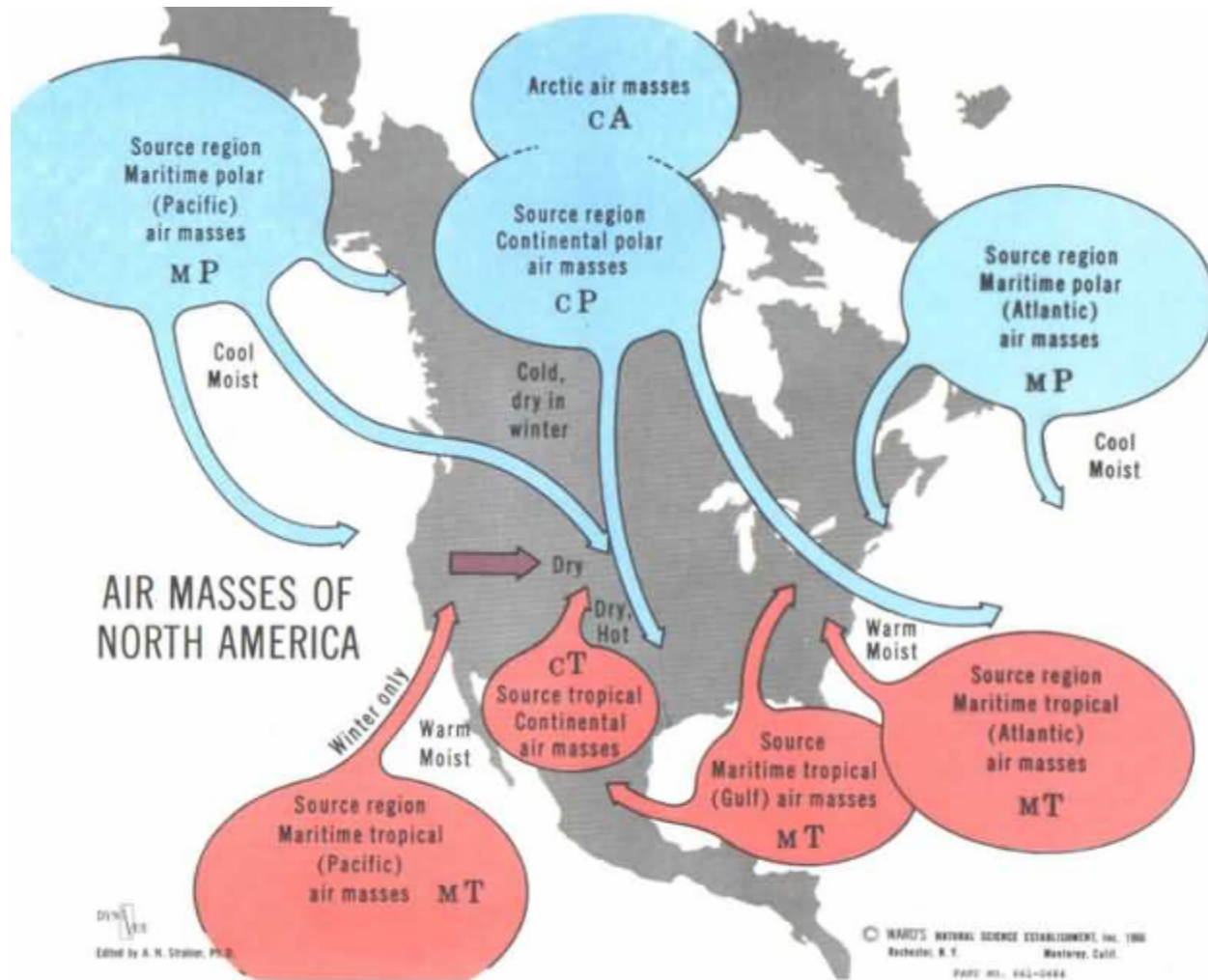
Latest News

A snowy Six Mile Run along the Millstone River in Franklin Twp (Somerset County) on March 5th. Photo by Dave Robinson.

For Second Consecutive Year, Winter is Slow to Relinquish Its Grip: March 2015 Recap

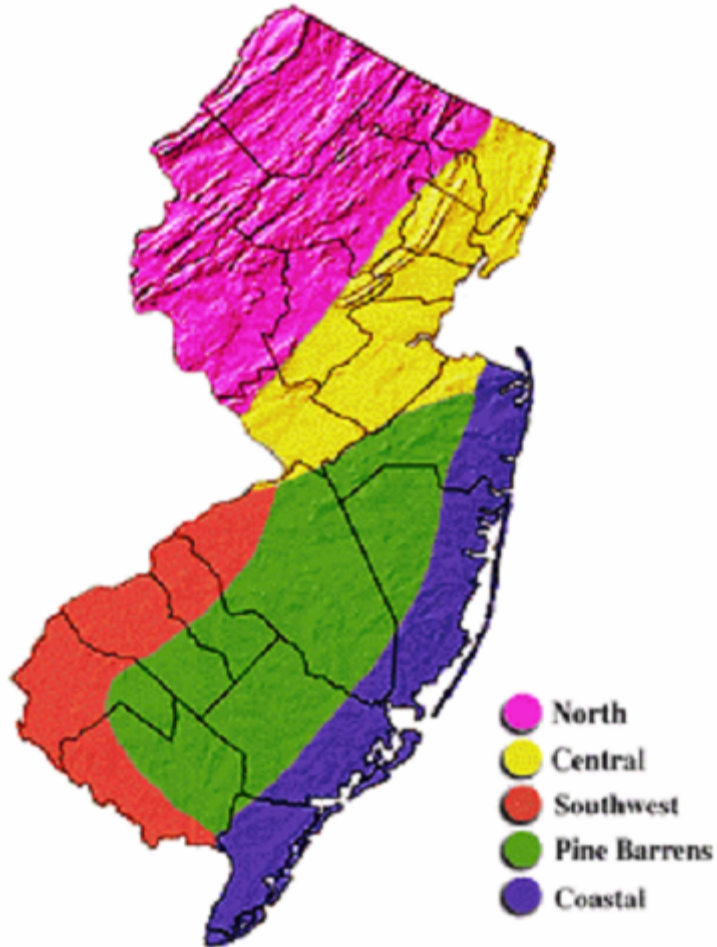
NJclimate.org

The big picture: a NJ squeeze play



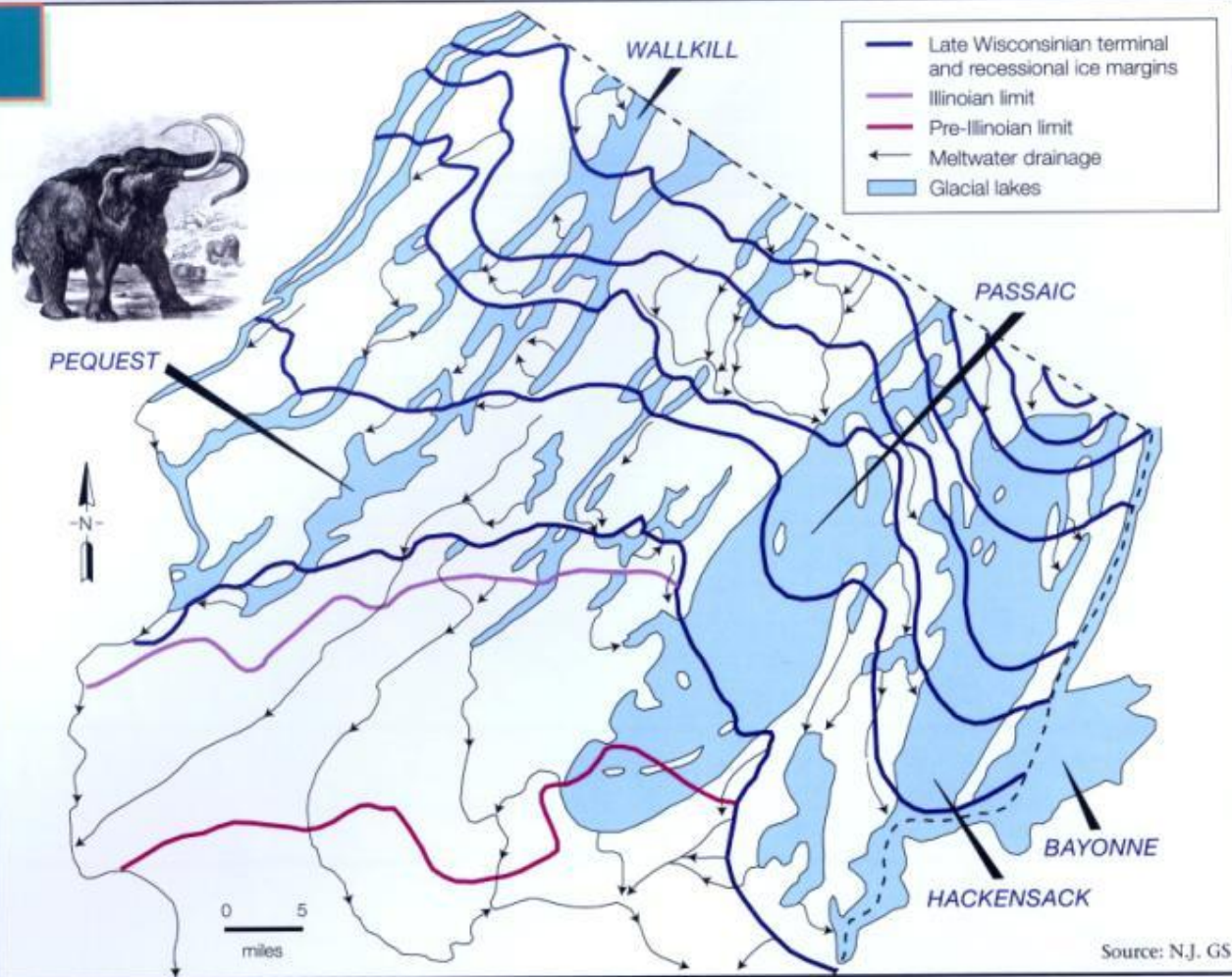
Diversity at home

New Jersey Climate Zones



Altitude
Latitude
Surface Conditions
Land-Water Contrasts

The Ice Age



Ice sheets expanded to and retreated from northern New Jersey at least three times during the last Ice Age. Glaciers scoured valleys, shaped hills, and left behind significant deposits, including some of the state's best sources of drinking water. The oldest of the glacial deposits, the pre-Illinoian, were laid down more than 800,000 years ago. During the Illinoian stage, about 150,000 years ago, an ice sheet again covered northern New Jersey. The most recent glaciation was during the late Wisconsinian substage, about 21,000 years ago.

Mapping NJ, 2009

RUTGERS

NJclimate.org

Floyd:
16 September 1999



Bound Brook



New Brunswick





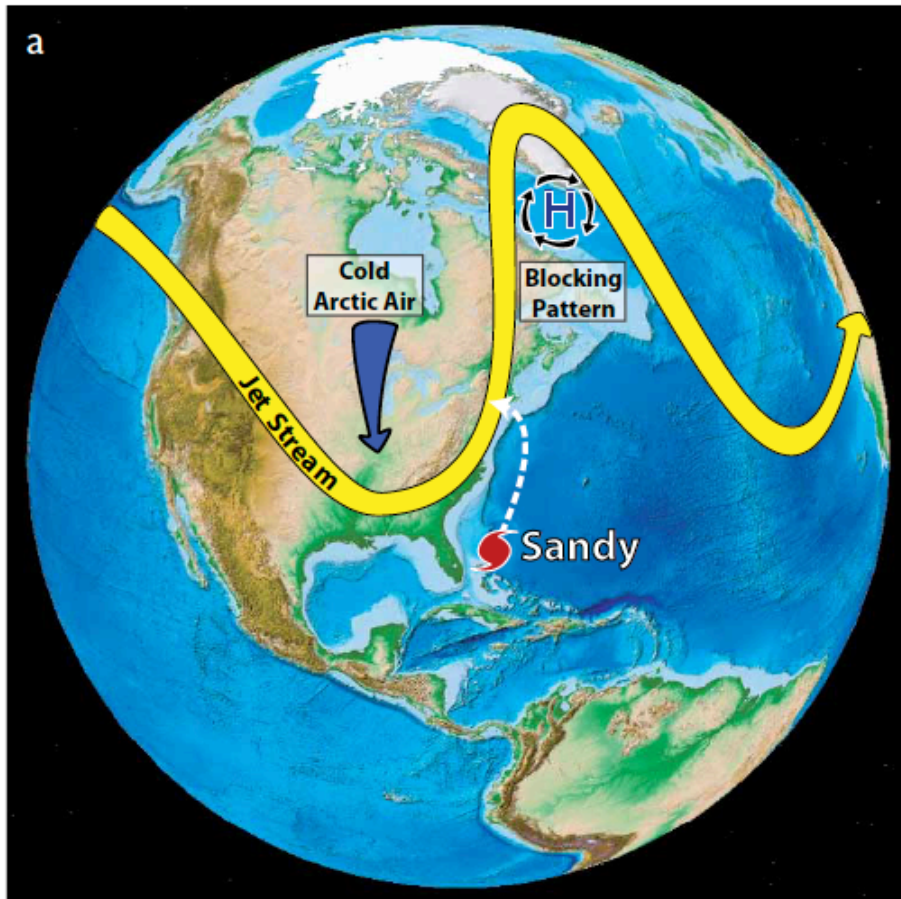
Irene 29 August 2011



Manville

Sandy: 29 October 2012

A unique recipe for disaster

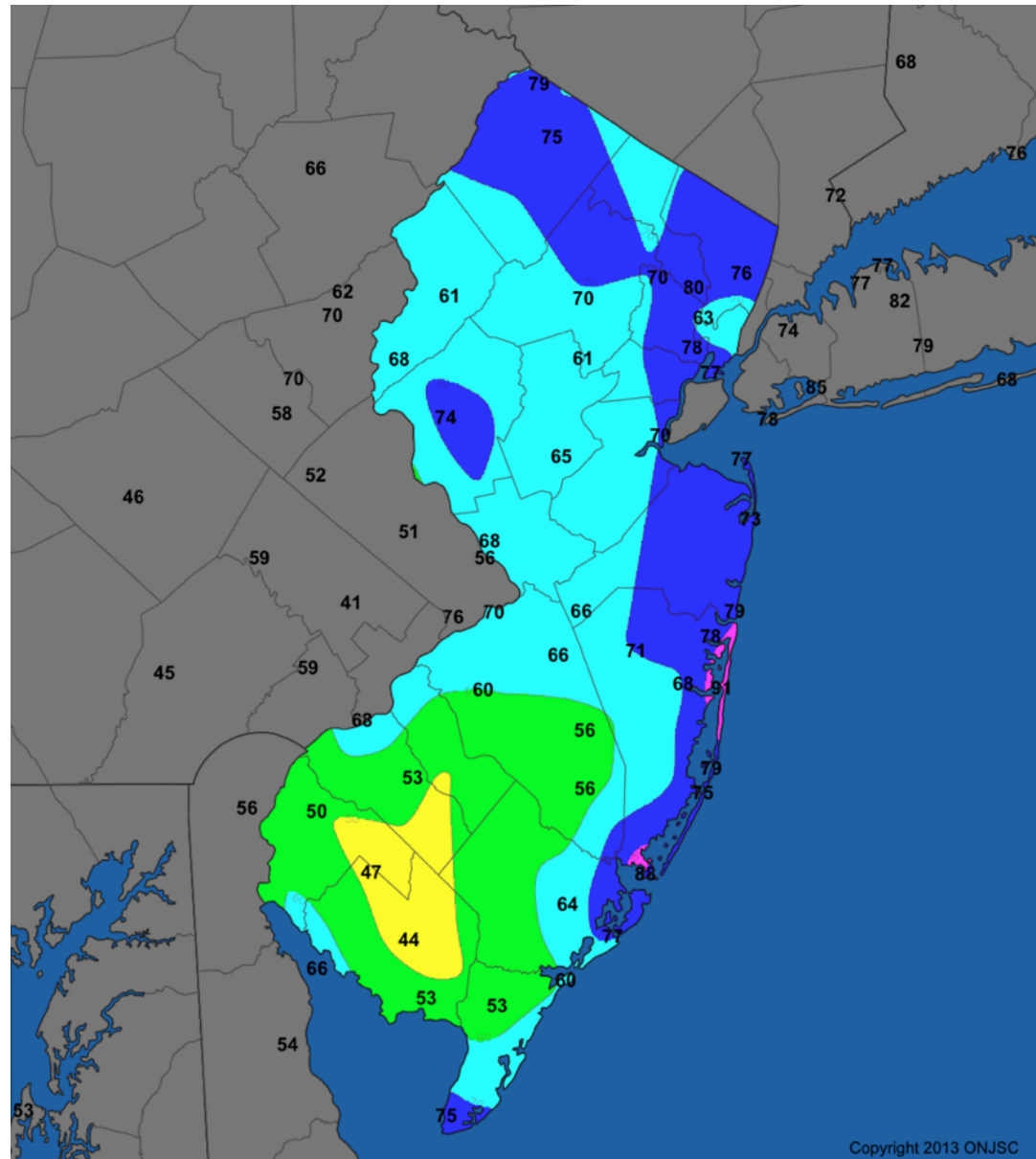


Ingredients

1. Sandy
2. Wavy jet stream
3. Blocking high
4. Deep trough

Greene, C.H., J.A. Francis, and B.C. Monger. 2013. Superstorm Sandy: A series of unfortunate events? *Oceanography* 26(1):8–9, <http://dx.doi.org/10.5670/oceanog.2013.11>.

**Sandy
Maximum
Wind Gusts
Oct 29-30, 2012**





Hoboken



Holgate

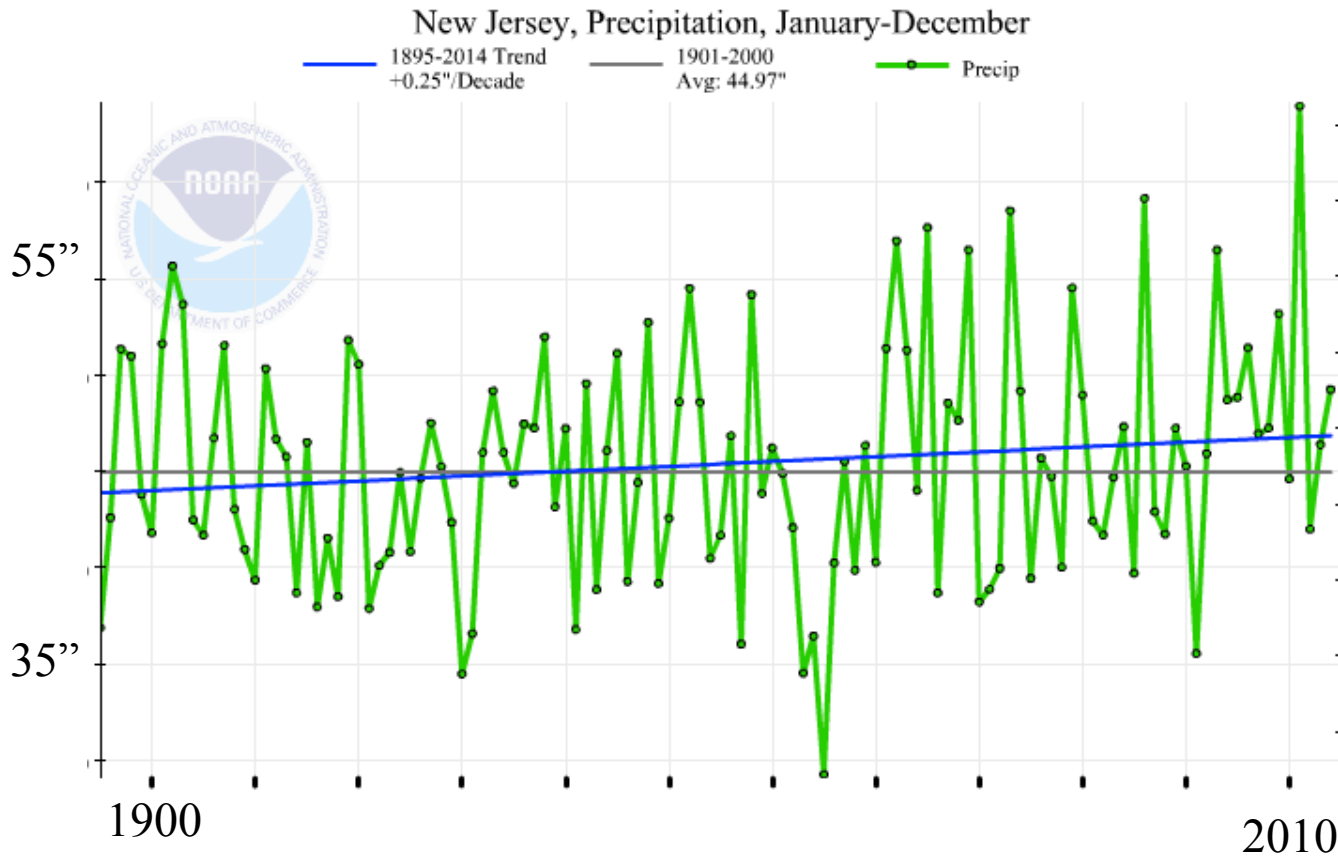


Photo: Will Randall-Goodwin

Hundreds of thousands of trees down.....



Trends in annual mean New Jersey precipitation: 1895-2014



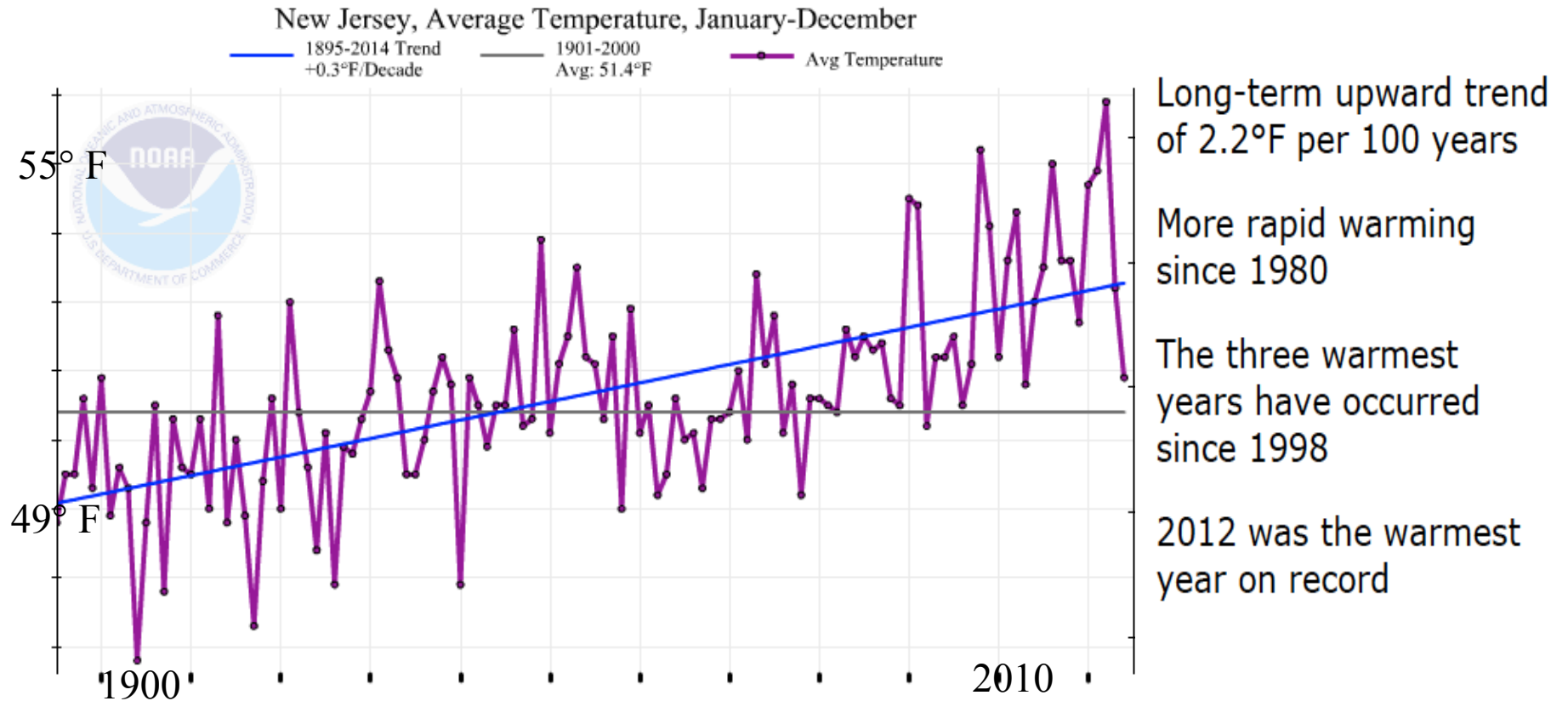
Long-term upward trend of 4.1" per 100 years

Large decadal variability (early 1960s drought, wet 1970s, very wet in last decade)

Most of the upward trend comes from changes in spring and fall

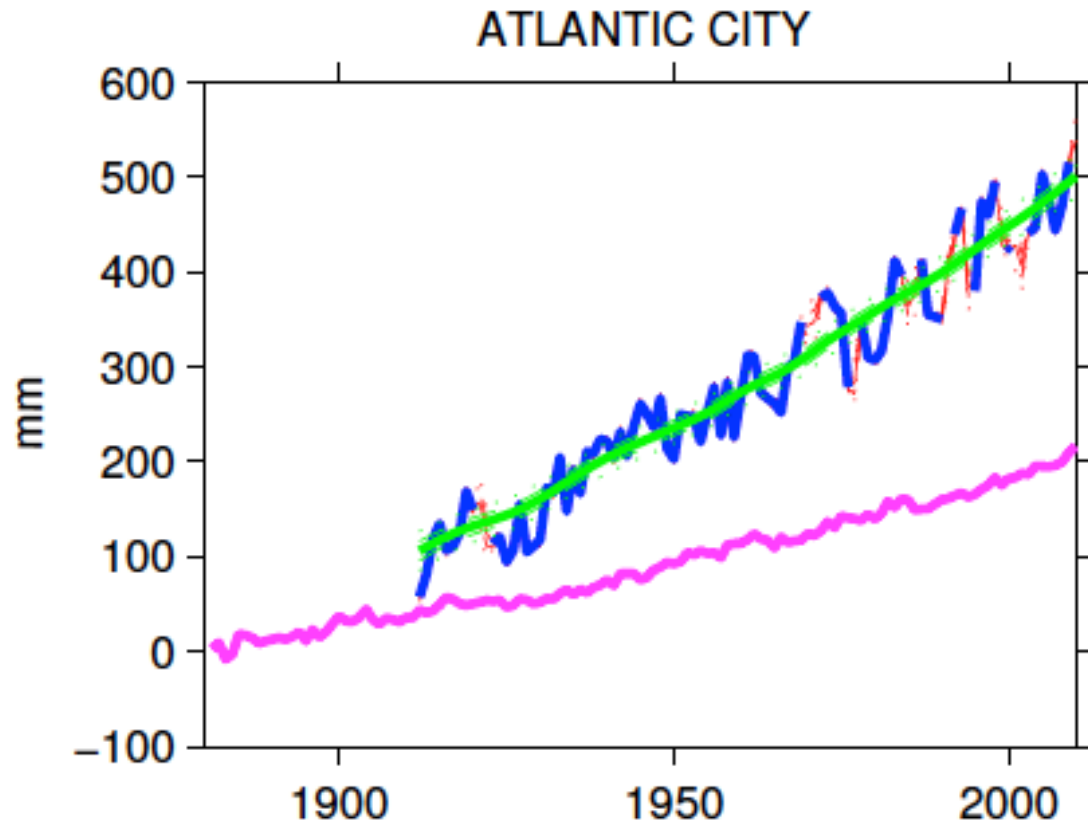
data source: National Climatic Data Center

Trends in annual mean New Jersey temperature; 1895-2014



data source: National Climatic Data Center

Sea level rise: global and regional: 1880-present



- Local sea level rise along the NJ coast has been more rapid than the global rise due to land subsidence (combination of post-glacial movement of earth's crust and compaction of coastal plain sediments)

Purple: Church & White (2011) GSL
Blue: Tide gauge data
Green: Long-term sea-level signal

~1.3 mm/y GIA 1.7 mm/y NJ
An additional ~1 mm/y on the shore

Is climate presently changing in NJ & elsewhere?

Preponderance of evidence suggests climate change is occurring and humans are responsible for a significant portion of recent changes

1. theory
2. observations
3. models

New Jersey's future climate

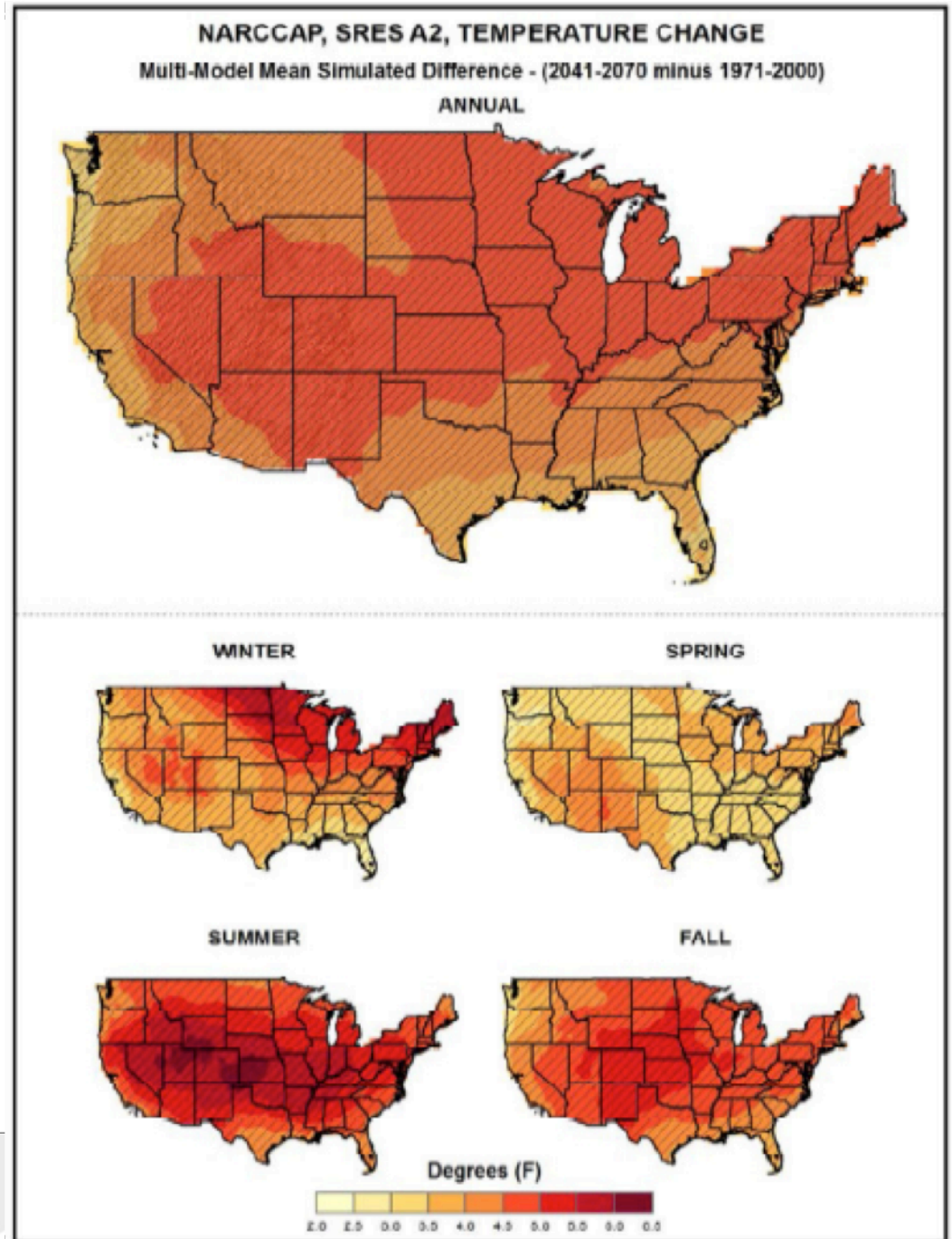
- Rising temperatures
- Steady or increasing precipitation
- Increasing variability and extremes
 - storms, flood, drought, heat.....
- Rising sea level

Changing Annual and Seasonal Temperatures

2041-2070
minus
1971-2000

North American Regional
Climate Change Assessment
Program

Kunkel et al. NOAA Tech.
Report NESDIS 142-9, 2013

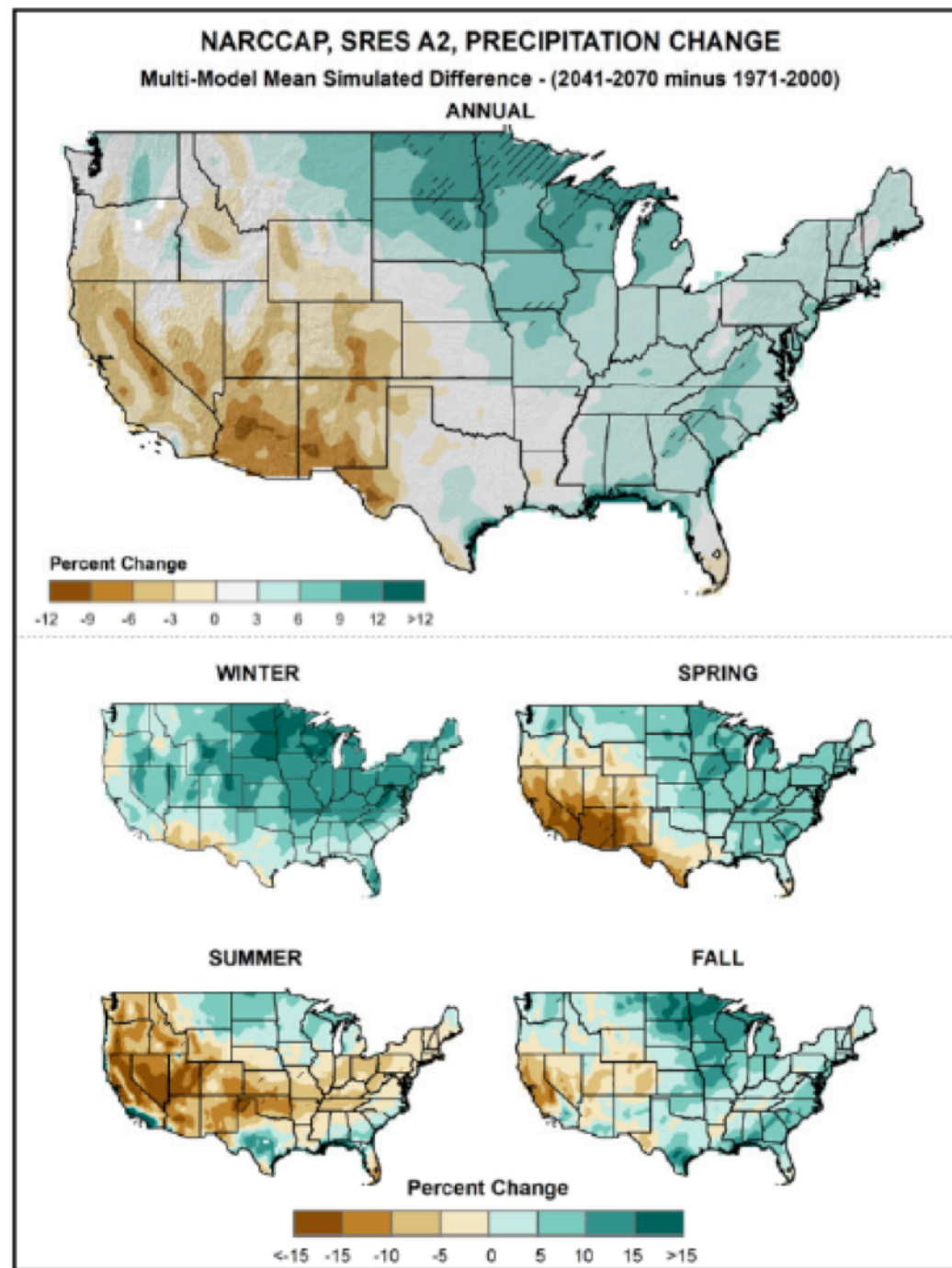


Changing Annual and Seasonal Precipitation

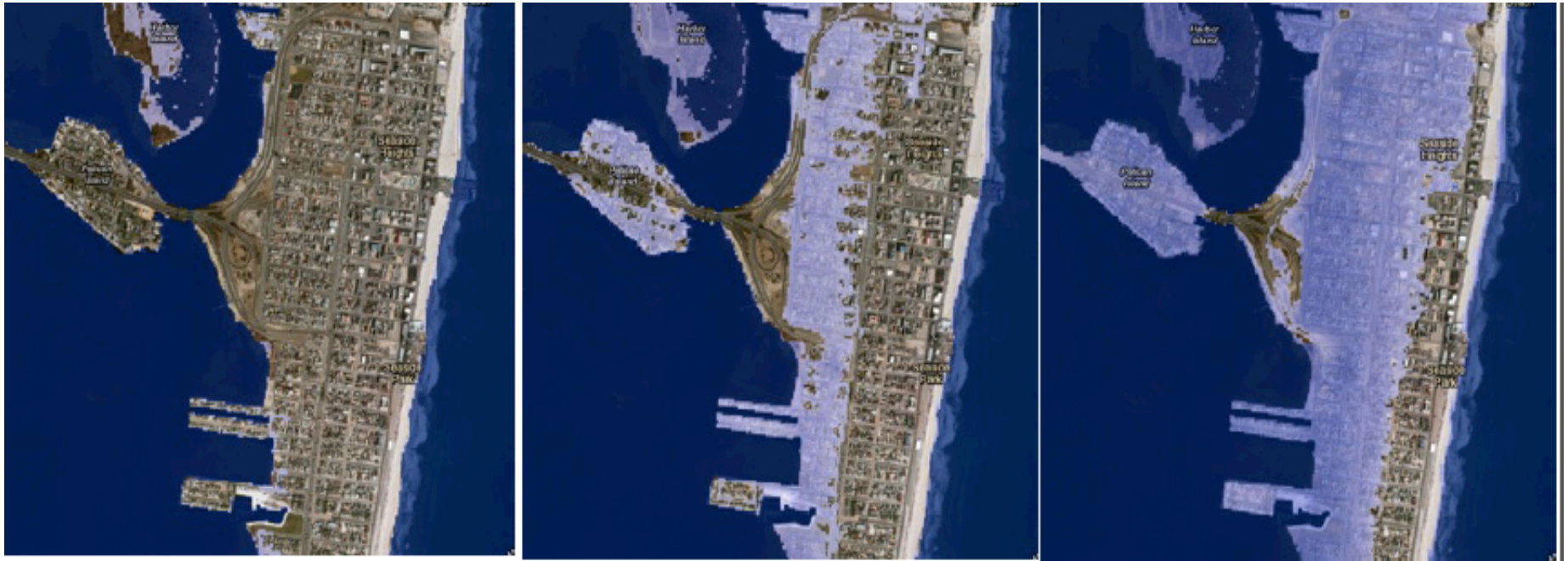
2041-2070
minus
1971-2000

North American Regional
Climate Change Assessment
Program

Kunkel et al. NOAA Tech.
Report NESDIS 142-9, 2013



Seaside Heights



1 foot
(likely by ~2040)

3 feet
(likely by 2090s)

6 feet
(~5% chance by
2100)

Maps available from <http://slrviewer.rutgers.edu/> and <http://sealevel.climatecentral.org/>

Vulnerable Sectors in New Jersey

Impacts:

- Precipitation
- Storm Surge
- Temperature
- Sea Level Rise
- Drought
- Heat Waves

Sectors:

Built Infrastructure

- Energy
- Transportation (roads, railways, ports, freight)
- Telecommunications
- Parks & Preserved Lands

Water Resources

- Drinking water quantity
- Water quality
- Inland flooding
- Infrastructure (drinking water, wastewater, stormwater)
- Ecosystem Impacts

Public Health and Society

- Emergency Preparedness
- Heat Emergencies
- Vector Borne Disease
- Allergies
- Cardiovascular conditions

Agriculture

- Food Supply
- NJ commodities

Coastal

- Ecosystem services
- Tourism
- Residential and commercial structures

The Natural Environment

- Coastal & freshwater wetlands
- Back bays
- Forests
- Habitats, native species (flora, fauna)

A dilemma



Passaic flooding: March 2011



Thanks

david.robinson@rutgers.edu

NJclimate.org

Sustainable Jersey

Climate Adaptation: Flooding Risk

Climate Adaptation: Flooding Risk 20 Points Bronze Priority Silver Priority

Who should lead and be involved with this action?

Timeframe

Project costs and resource needs

Why is it Important?

What to do and How to do it ("How to")

What to Submit to Get Credit/Points

Spotlight

Resources

Appendix A: Example Scenarios for the NJ Flood Mapper

[Print Action Description](#)

[Download PDF Version](#)

New Action for January 2014

This Sustainable Jersey action, under the category of "Climate Adaptation," is designed to help communities identify: 1) your community's vulnerability to flooding impacts (both coastal and inland) and 2) ways to improve your community's overall resiliency. This action focuses on the various causes of flooding that could impact a community, either now or in the future, including increased precipitation, increased frequency of heavy precipitation events, sea level rise and storm surge¹.

Completion of this action item will count for a total of 20 points and will serve as a prerequisite for future companion Sustainable Jersey actions related to flooding and resiliency.

To be awarded 20 points for this action, towns must complete the following three steps **from within 3.5 years of the June submission deadline:**

1. Form a team capable of and dedicated to addressing this action. This team could be the town's Green Team, but more likely will include representatives from the various local agencies that deal with planning, zoning and emergency management. This team will be responsible for the following two steps.
2. Utilizing the *NJ Flood Mapper Tool* to visually assess your community's vulnerability;
3. Completing the on-line *Getting to Resilience: Community Planning Evaluation Tool* (hereafter referred to as the GTR Tool), which assesses a town's readiness to deal with flooding situations.

Riverine Future Projection

The IMPACT of CLIMATE CHANGE and Population Growth

on the National Flood Insurance Program
through 2100

prepared for

Federal Insurance and Mitigation Administration
Federal Emergency Management Agency

prepared by

AECOM

in association with

Michael Baker Jr., Inc.

Median Projected % Change in $Q_{1\%}$ for 2100 Over Current Conditions

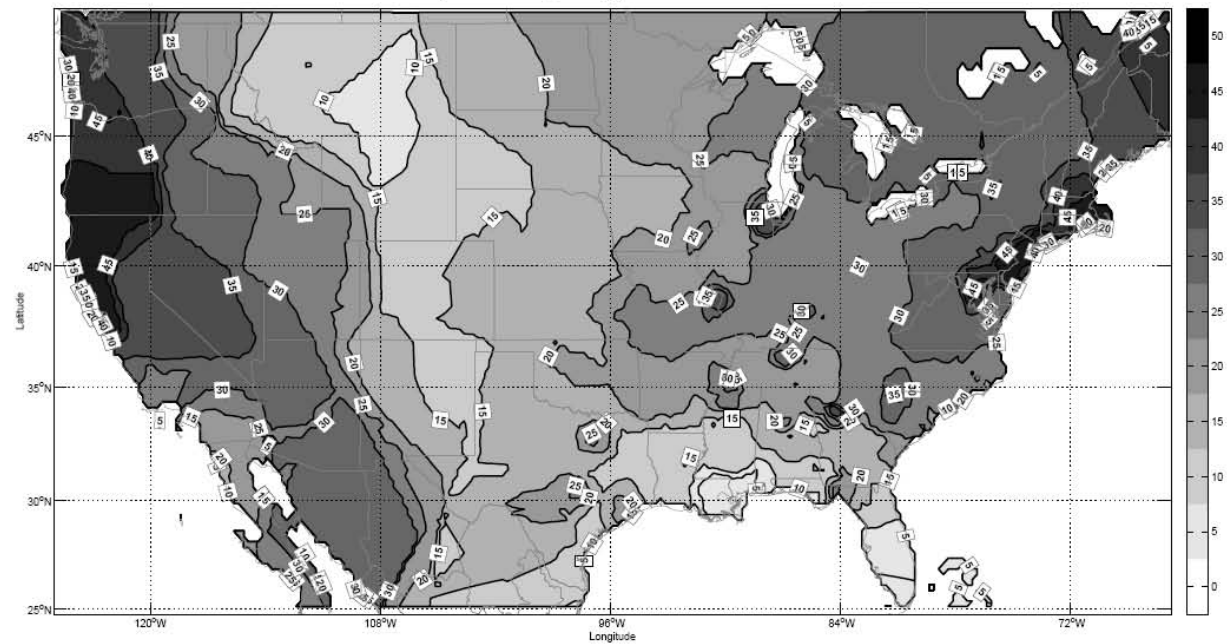
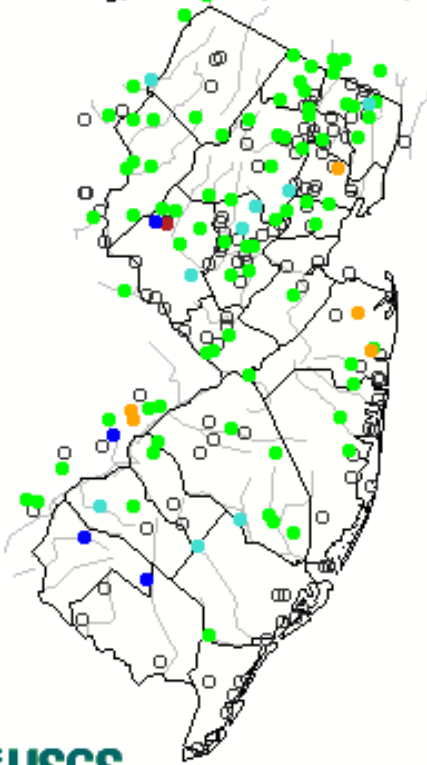


Figure 2. Median projected percent increase in the 1-percent-annual-chance discharge over current conditions.

Wednesday, June 10, 2015 12:00ET



National Weather Service
Advanced Hydrologic Prediction Service

Home News Organization Search for: [] NWS All NOAA Go

National Observations WFO Observations

Weather Forecast Office Philadelphia/Mount Holly, NJ Middle Atlantic River Forecast Center

River Observations River Forecasts Experimental Long-Range Flood Risk Precipitation Download Other Information

Auto Refresh is OFF [Refresh Icon]

403 total gauges 0 gauges in flood

Hydrograph Available
Probability and Hydrograph Available
Major Flooding
Moderate Flooding
Minor Flooding
Near Flood Stage
No Flooding
Observations Are Not Current
Out of Service
Flood Category Not Defined
At or Below Low Water Threshold

Last map update: 06/10/2015 at 12:21:17 pm EDT
06/10/2015 16:21:17 UTC
What is UTC time?
Disclaimer

USGS FLOODSMART.GOV

Climate Adaptation: Flooding Risk

Location	DA (sq miles)	1% Annual Flow	1% Annual Stage	0.2% Annual Flow	0.2% Annual Stage	Future 1% Annual Flow	Future 1% Annual Stage	Stage Increase	Historical Crest	Future to Historical
USGS 01405030 Lawrence Brook at Westons Mills NJ	44.9	5,590	19.58	9,360	beyond limit	8,106	20.39	0.81	18.88	1.51
USGS 01403060 Raritan River below Calco Dam at Bound Brook NJ	785	47,000	36.55	61,000	39.16	68,150	40.32	3.77	42.13	(1.81)
USGS 01405400 Manalapan Brook at Spotswood NJ	40.7	2,210	20.26	3,370	20.90	3,205	20.82	0.56	22.22	(1.40)
USGS 01403900 Bound Brook at Middlesex NJ	48.4	10,500	18.82	14,400	beyond limit	15,225	beyond limit	N/A	14.01	N/A
USGS 01403600 Green Brook at Rock Avenue at Plainfield NJ	18.2	7,900	12.41	15,200	beyond limit	11,455	beyond limit	N/A	13.5	N/A
USGS 01399500 Lamington (Black) River near Pottersville NJ	32.8	3,631	5.26	5,646	5.91	5,265	5.80	0.54	5.94	(0.14)
USGS 01402540 Millstone River at Weston NJ	271.0	22,900	unavailable	34,400	unavailable	33,205	unavailable	N/A	none	N/A
USGS 01402500 Millstone River at Millstone NJ	264.0	22,500	19.69	33,900	23.6	32,625	23.22	3.53	16.8	6.42
USGS 01400010 North Branch Raritan River at South Branch NJ	190.0	32,200	unavailable	48,000	unavailable	46,690	unavailable	N/A	18.98	N/A
USGS 01400000 North Branch Raritan River near Raritan NJ	190.0	32,100	19.05	47,800	22.45	46,545	22.21	3.16	18.98	3.23
USGS 01397420 SB Raritan R at Black Point Rd at Neshanic Sta NJ	190.0	21,500	unavailable	32,100	unavailable	31,175	unavailable	N/A	22.18	N/A
USGS 01399780 Lamington River at Burnt Mills NJ	100.0	12,000	unavailable	16,500	unavailable	17,400	unavailable	N/A	13.06	N/A
USGS 01398000 Neshanic River at Reaville NJ	25.7	16,800	beyond limit	27,200	beyond limit	24,360	beyond limit	N/A	15.33	N/A
USGS 01396500 South Branch Raritan River near High Bridge NJ	65.3	6,230	12.68	8,990	beyond limit	9,034	beyond limit	N/A	14.26	N/A
USGS 01462000 Delaware River at Lambertville NJ	6680.0	278,672	21.54	368,903	26.00	404,074	27.57	6.03	24.16	3.41

Riverine Future Projection

Sustainable Jersey's 2015 Sustainability Summit

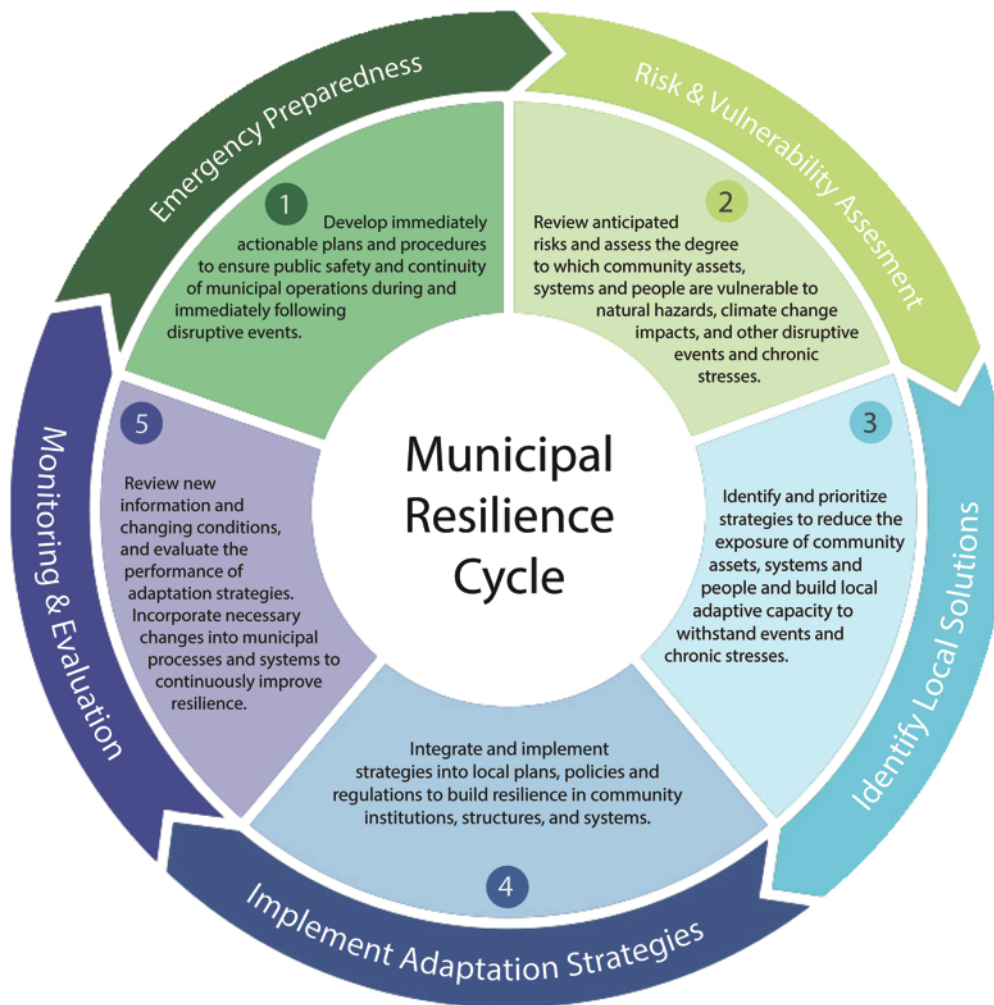
Ready, Set, Adapt

John A. Miller, P.E., CFM, CSM
Legislative Committee Chair
NJAFM.org
@jamiller45





Municipal Resilience Cycle



Municipal resilience is the ability of a community to adapt and thrive in the face of extreme events and stresses.



Resiliency Actions – Existing & Pending

Flood Risk Action

- Local multi-disciplinary team
- Self-assessment tool – “Getting to Resilience”
- Evaluates plans & policies for emergency preparedness and flood management
- Reviews sea level rise projections





Resiliency Actions – Existing & Pending

Coastal Vulnerability Assessment Action (in 2015)



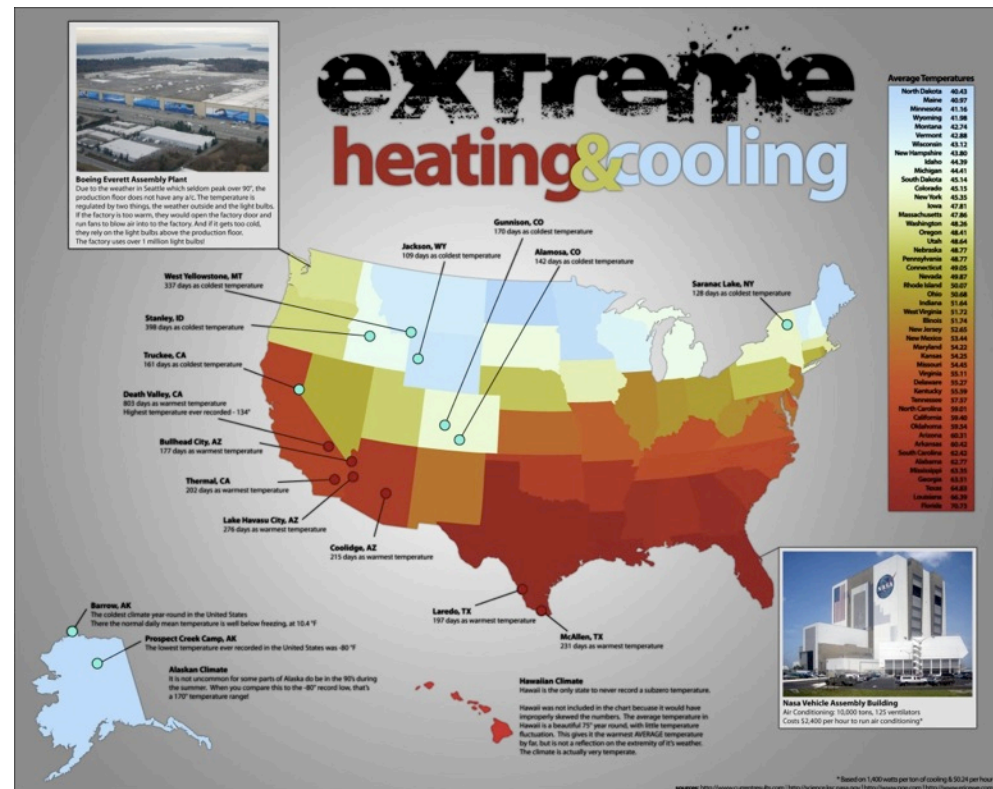
- Reviews multiple future flood scenarios, include sea level rise and hurricane storm surge
- Evaluates the vulnerability of community assets – their exposure to flooding and ability to function
- Introduces adaptation strategies and mitigation measures



Resiliency Actions – Existing & Pending

Extreme Temperature Action (in 2015)

- Defines local extreme temperature events
- Identifies process to alert community
- Includes steps to provide protection, e.g. cooling centers, emergency care, etc.
- Suggests a monitoring process





Resiliency Actions – Existing & Pending

Fire Protection – a Suite of Actions (in 2015)



Ready-Set Go Fire Company

Community Wildfire
Protection Plans

Wildfire Safety Council

Firewise Community
Recognition

Fire Adapted Municipalities



Resiliency Actions – Existing & Pending

Emergency Communications Actions (in 2015)

Municipal Emergency and
Disaster Warning &
Communications Strategy

Emergency Community
Outreach Plan





Resiliency Actions – Existing & Pending

Energy Resiliency Suite of Actions (2014-2015)

Climate, Planning & Efficiency	Renewable Energy & Advanced-Infrastructure	Alternative Vehicles
<p>Municipal Carbon Footprint Hi Performance Buildings Community Carbon Footprint Climate Action Plan</p>	<p>Wind Ordinance Renewable GEA Program (NEW) Make Town Solar-Friendly (NEW) Purchase Renewable Energy (NEW)</p>	<p>Fleet Actions Procurement Actions Town EV Friendly (NEW) Public EV Chargers (NEW)</p>



Resiliency Actions – Under Consideration

Pending 2016 or Under Consideration

Nature-Based Mitigation Strategies

Drought Event Plan

Food Security





Resiliency Actions – What’s Missing?

What other **key steps** should municipalities be taking to strengthen resiliency?