



Identifying Vulnerabilities & Taking Action toward Climate Resilience

Presenters:

S. Beck, American Public Gardens Association

N. Gardiner, NOAA's Climate Program Office and the U.S. Climate Resilience Toolkit

T. Magellan, Montgomery Botanical Center



CHANGING PERSPECTIVES: **PLANTING FOR THE FUTURE**

2016 AMERICAN PUBLIC GARDENS ASSOCIATION ANNUAL CONFERENCE





Climate & Sustainability Alliance

AMERICAN PUBLIC GARDENS ASSOCIATION

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KEYWORD

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-SUSTAINABILITY INDEX

-CLIMATE RESOURCES

-CLIMATE RESEARCH AT GARDENS

-COMMUNICATING CLIMATE & CONSERVATION

-EDUCATION CURRICULUM

-SUPPORTING POLLINATORS

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Apply



US Drought Monitor

11/1/15

Current drought conditions, as well as forecasts, mapped out for the United States and Puerto Rico. Soil moisture, streamflow and precipitation conditions and outlooks are included.

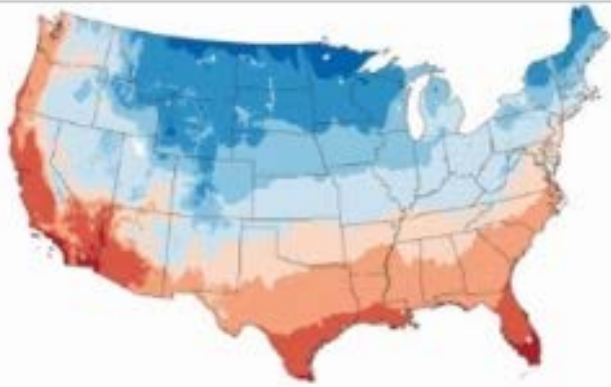


North America Drought Monitor

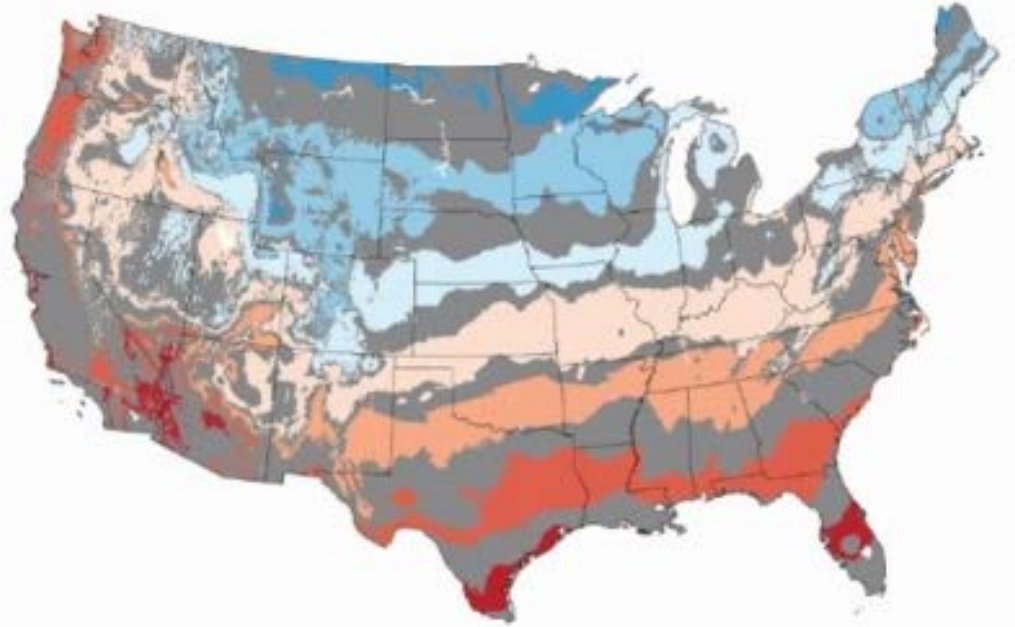
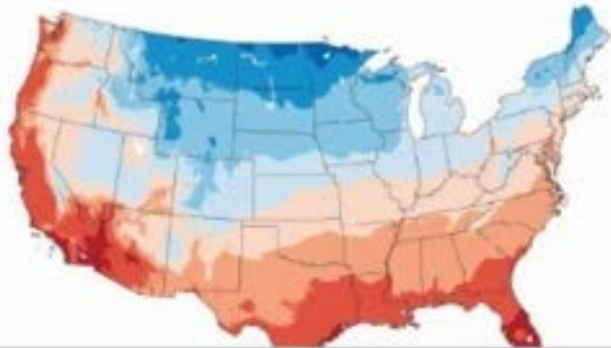
11/1/15

A collaboration between Canada, Mexico and the US, the North America Drought Monitor produces a monthly drought conditions map. Downloadable drought data are provided free to the public.





CLIMATE-RELATED PLANTING ZONES 2011–2040
Based on 1971-2010 trends.



Average Annual Minimum Temperature by Climate-Related Planting Zone



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NOAA tools will be accessible through Public Gardens Sustainability Index Phase 2:

ENVIRONMENTAL	SOCIAL	ECONOMIC
WATER Keep it plentiful & clean to support life	SUSTAINABLE COMMUNITY DEVELOPMENT Help the local community to better sustain itself	STRATEGIC PLANNING & GOVERNANCE Infuse sustainability into the garden DNA from the top down
ENERGY Use less to slow global warming	ENGAGEMENT, OUTREACH & EDUCATION Connect people to the garden's mission & diversify visitorship.	BUSINESS PLANNING & MANAGEMENT Reflect strategies in viable business plans & execution
MATERIALS Consume less, recycle & clean byproducts to reduce local waste load & impact	EMPLOYEE DEVELOPMENT & DIVERSITY Keep employee base happy, diverse & engaged	CLIMATE RISK MANAGEMENT & ADAPTATION Extend planning to anticipate climate change impacts
BIODIVERSITY Preserve species diversity for ecological resilience & domestic uses	HEALTH & WELL-BEING Help people take care of their minds & bodies	LOCAL/REGIONAL ECONOMIC HEALTH Support local businesses & diversity of residents to become great neighbors & advocates



Programs

Plant Collections Network

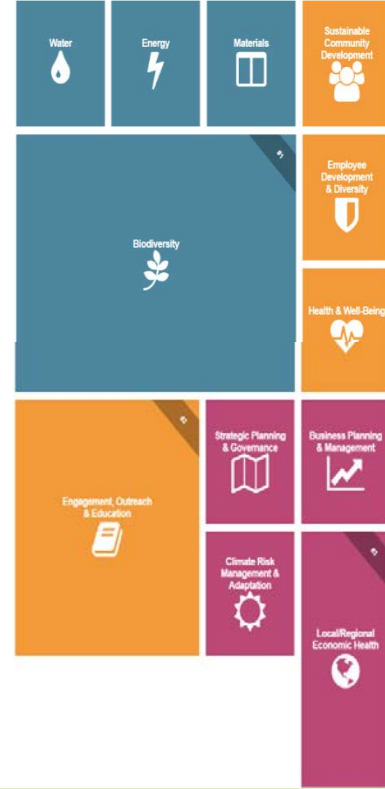
Program

City Alliance

Generation

Your Focus on the Attributes

Results
Based on what you have shared about your garden, the three largest icons below represent sustainability attributes your garden is well positioned to achieve.



***Environmental Sustainability
maintains Earth's capacity to support all life***



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Chicago Region Trees Initiative

The Chicago Region Trees Initiative was established in 2013 as a collaboration of Chicago region partners working together to develop and implement a strategy that builds a healthier and more diverse urban forest by 2040.

The strategy was developed based on findings from the Regional Tree Census produced in cooperation with the USDA Forest Service and The Morton Arboretum.



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Autumn Gold Ginkgo

American Linden

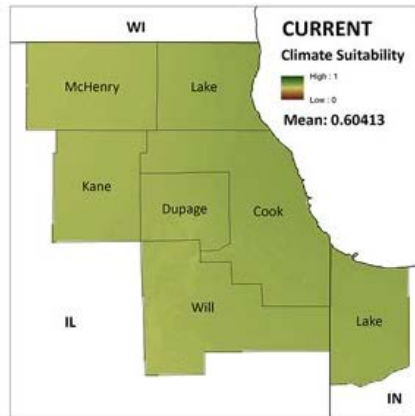
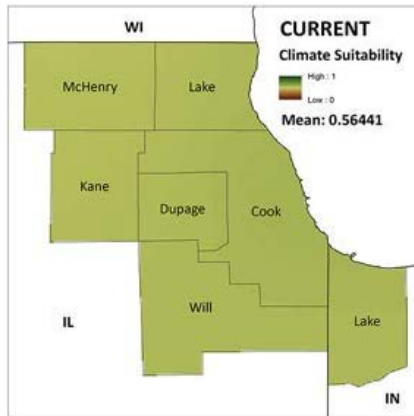


CHICAGO BOTANIC GARDEN






Trees for 2050

Many of the trees common to Chicago's urban forests will adapt to a steadily warming climate through 2050, according to a recent study led by Dr. Andrew Bell, curator of woody plants.

His team analyzed 50 trees in the garden collection and found that 40 would continue to thrive under worst-case warming scenarios through mid-century.

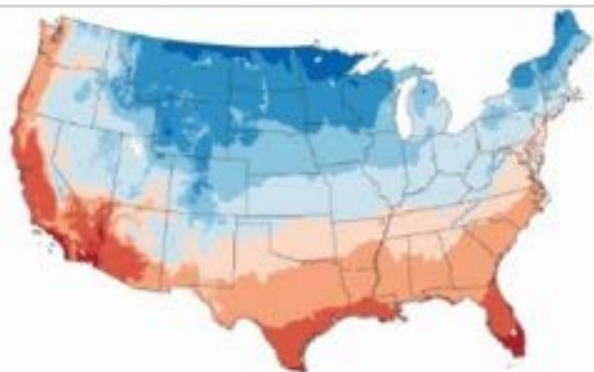


The trees were evaluated for their performance in three types of urban uses, sidewalk plantings, parks and residential settings, and public gardens and other “legacy” sites. Planting recommendations are presented in an interactive database.

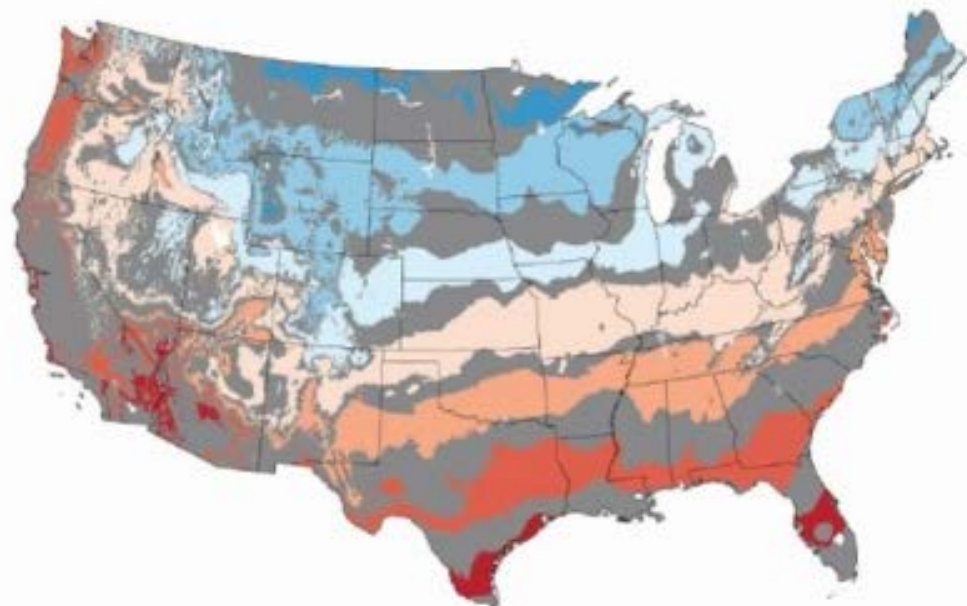
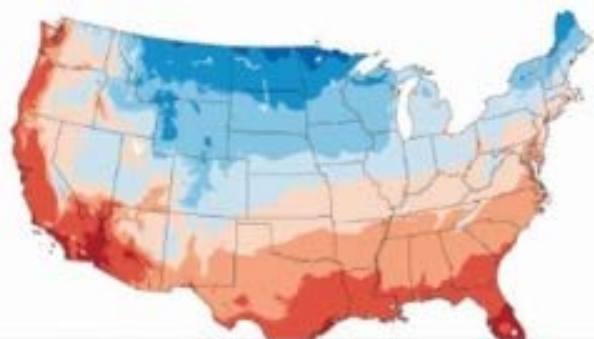
<u>Amur Maackia</u>	N/R +35 yrs	
<u>Autumn Blaze® Maple</u>	Park/Residential, Legacy	
<u>Autumn Brilliance Serviceberry</u>	Park/Residential	
<u>Autumn Gold Ginkgo</u>	Street, Park/Residential, Legacy	
<u>Baldcypress</u>	Street, Park/Residential	



NOAA Climate Resources

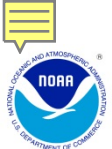


CLIMATE-RELATED PLANTING ZONES 2011-2040
Based on 1971-2010 trends.



Average Annual Minimum Temperature by Climate-Related Planting Zone





Maps, Data, and Tools

Parameter:

Time Scale:

Month:

Start Year:

End Year:

State/Region:

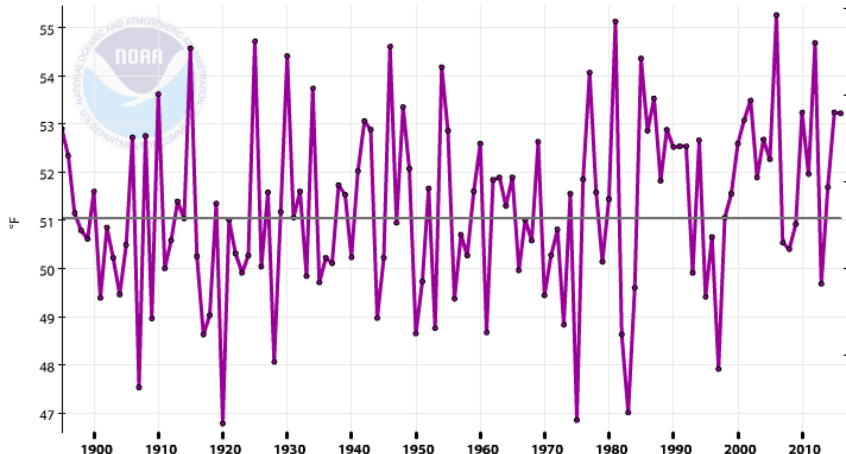
Climate Division/City:

Options

Display Base Period
Start: End:

Display Trend
 per Decade per Century
Start: End:

Smoothed Time Series
 Binomial Filter LOESS





science & information for a climate-smart nation

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Featured on Climate.gov 1 2 3 4 5



NOAA 2016 summer outlook: Where are the highest chances for a hot summer in the U.S.?

May 23, 2016

Filed in: News & Features

Most of the continental United States is facing elevated chances of well above average summer temperatures, according to the latest outlook from NOAA's Climate Prediction Center.

[read more](#)

Recent Topics



Get Involved: Climate Choices Issue Guide

May 17, 2016

Filed in:



U.S. Climate Resilience Toolkit

November 17, 2014

Filed in: Supporting Decisions



U.S. Federal Crowdsourcing and Citizen Science Toolkit

November 24, 2015

Filed in:



Exercise 1: Climate at a Glance

Have climate conditions affected you where you live?

Here is a method to find a tool that helps you visualize **at a glance** how **climate** conditions are changing in **your city/county/state**:

1. Go to the Climate Resilience Toolkit (toolkit.climate.gov) **Tools** section and, using the filter functions (top right), select the following:

Category » View Past/Current Conditions

Category » Analyze/Download Data

2. How many tools are left? Which one(s) best match your search criteria?
3. Select “Climate At A Glance.” Click to visit that website and explore its functionality.



South Carolina Botanical Garden

“We learned from what happened in 2013 and applied what we learned – and it worked. It really showed what happens when you do things right.”

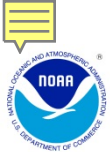
*-- Patrick McMillan,
Botanical Garden Director*



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Interagency Activities

GlobalChange.gov
U.S. Global Change Research Program

ABOUT USGCRP WHAT WE DO AGENCIES

National Climate Assessment

In May 2014, USGCRP released the Third National Climate Assessment, the authoritative and comprehensive report on climate change and its impacts in the United States.

[EXPLORE THE NCA](#) [DOWNLOAD THE NCA](#)

U.S. Climate Resilience Toolkit

About | Contact | Funding Opportunities | FAQ

Get Started Taking Action Tools Topics Expertise

Search

Meet the Challenges of a Changing Climate

The Climate Resilience Toolkit provides resources and a framework for understanding and addressing the climate issues that impact people and their communities.

- 1 Identify the Problem
- 2 Determine Vulnerabilities
- 3 Investigate Options
- 4 Evaluate Risks & Costs
- 5 Take Action





Exercise 2: Extreme Precipitation

Access the Taking Action case studies. Use search filters to find

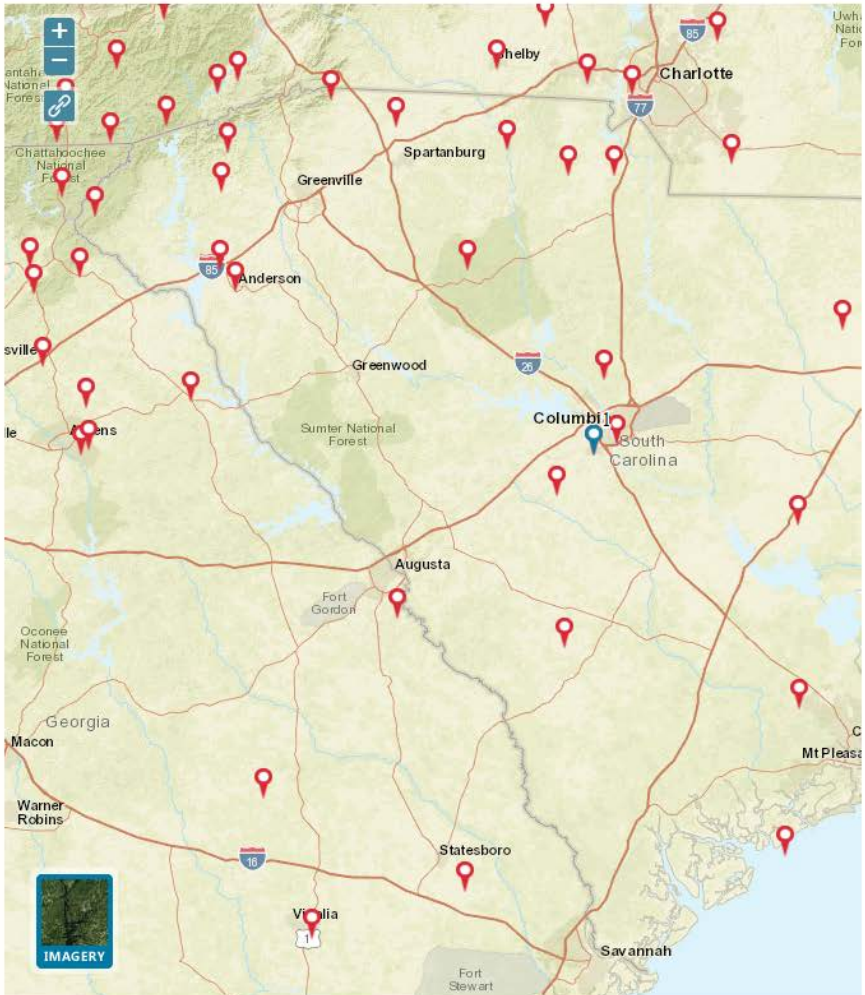
- How many of studies address extreme precipitation?
- How many get all the way to “Step 4: Evaluate Risks & Costs”?
- How many of those are situated in the Northeast U.S.?

Select and read the case study focused on culvert sizing in Columbia County, NY and entitled “Extreme Rainfall Analyses Can Point to Right Size for Culverts.”

Extreme Rainfall Analyses Can Point to Right Size for Culverts

Across most of the United States, the heaviest rainfall events have become heavier and more frequent. New tools can help decision makers choose culverts with appropriate capacities for the future.





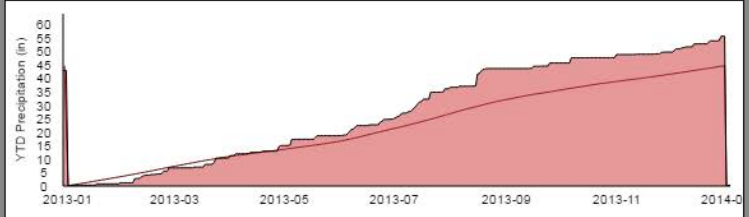
STATION DETAIL:

TEMPERATURE

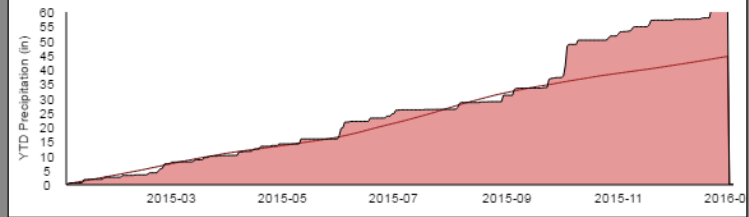
PRECIPITATION

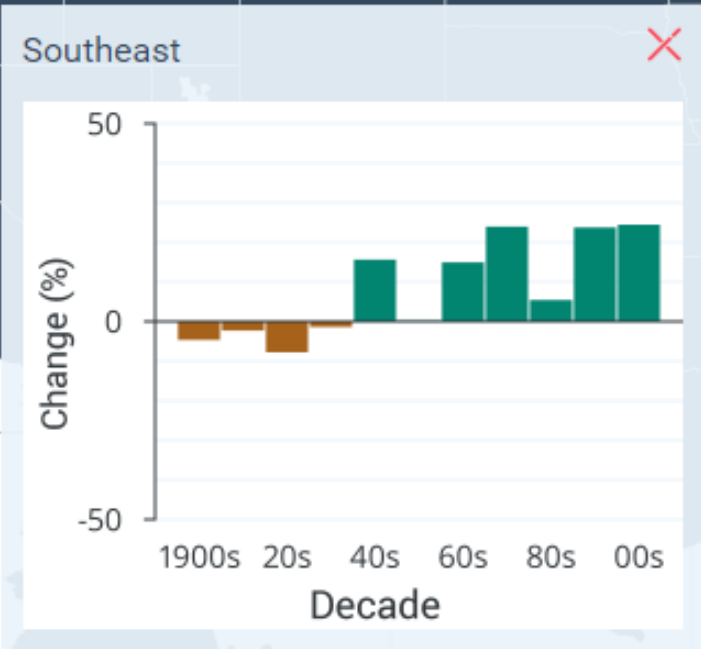
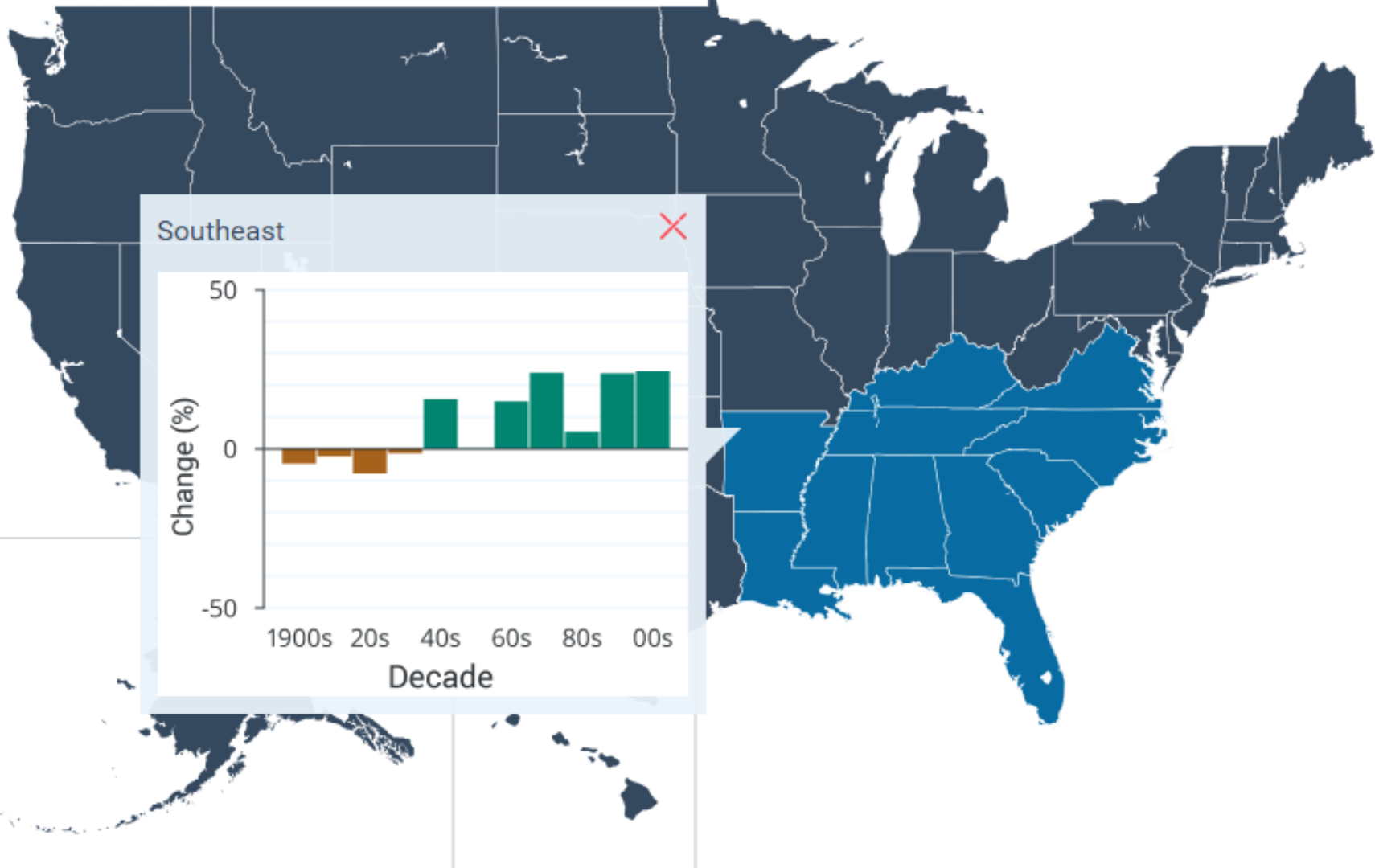
(1) COLUMBIA SC

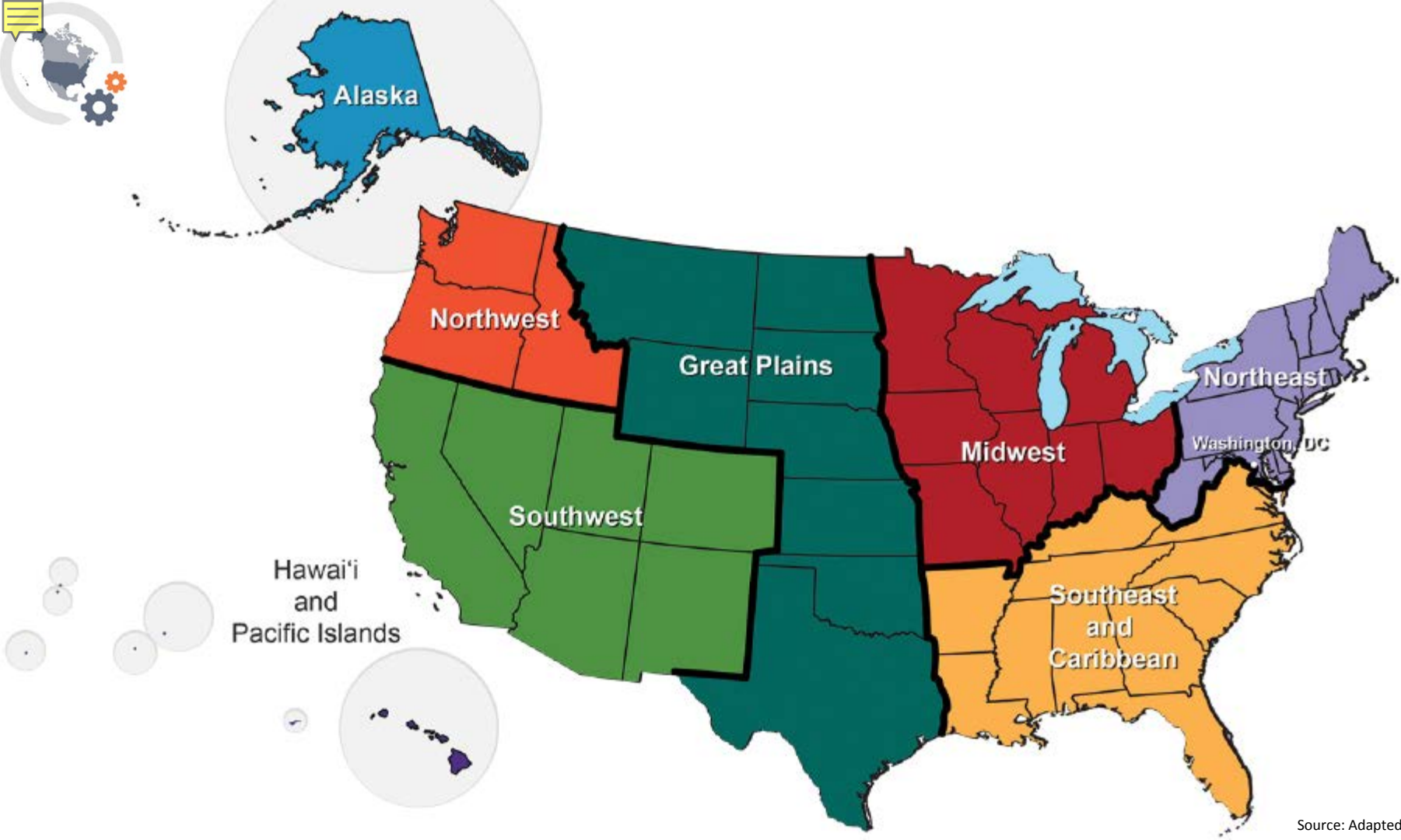
PRECIPITATION

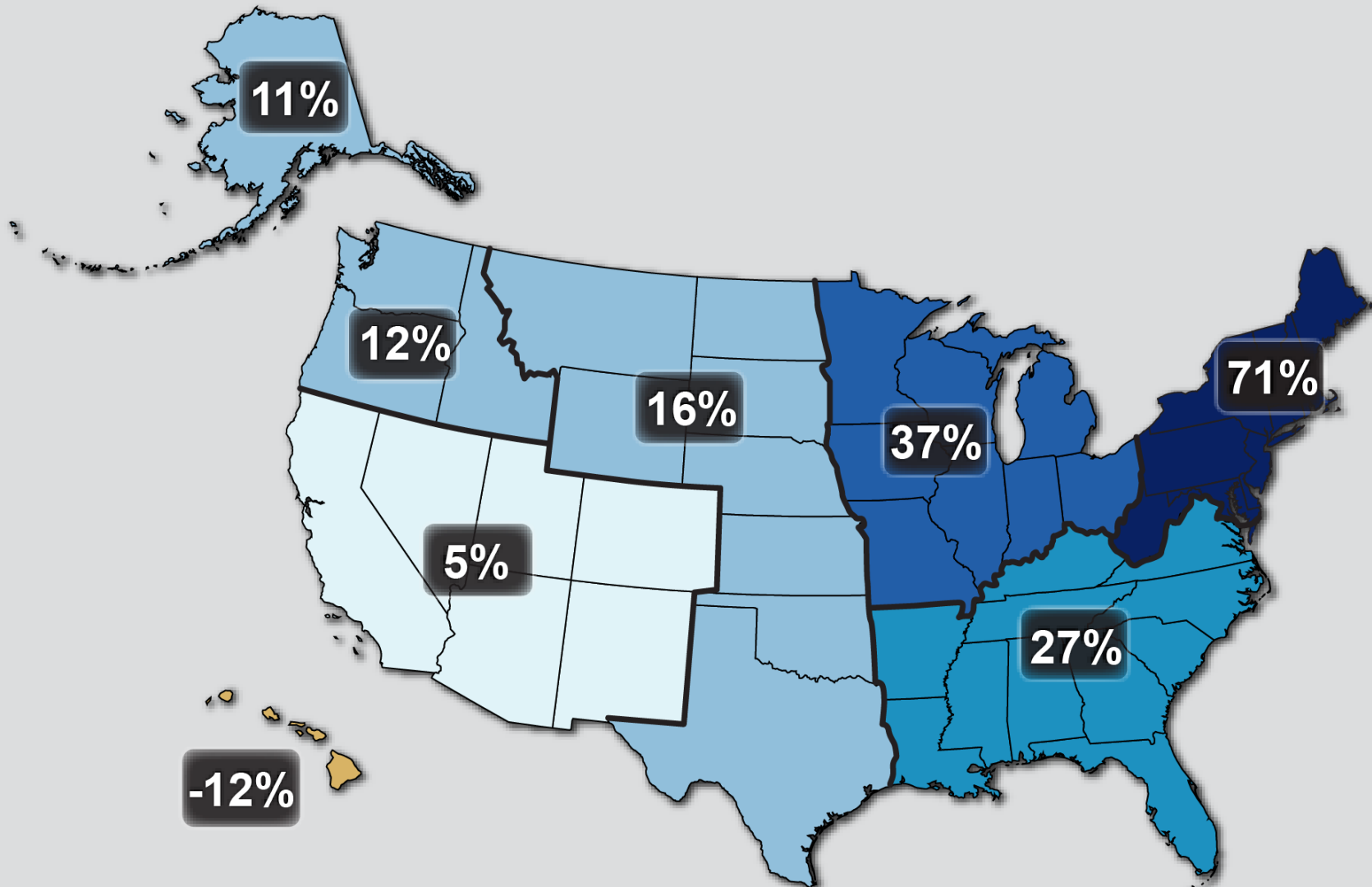


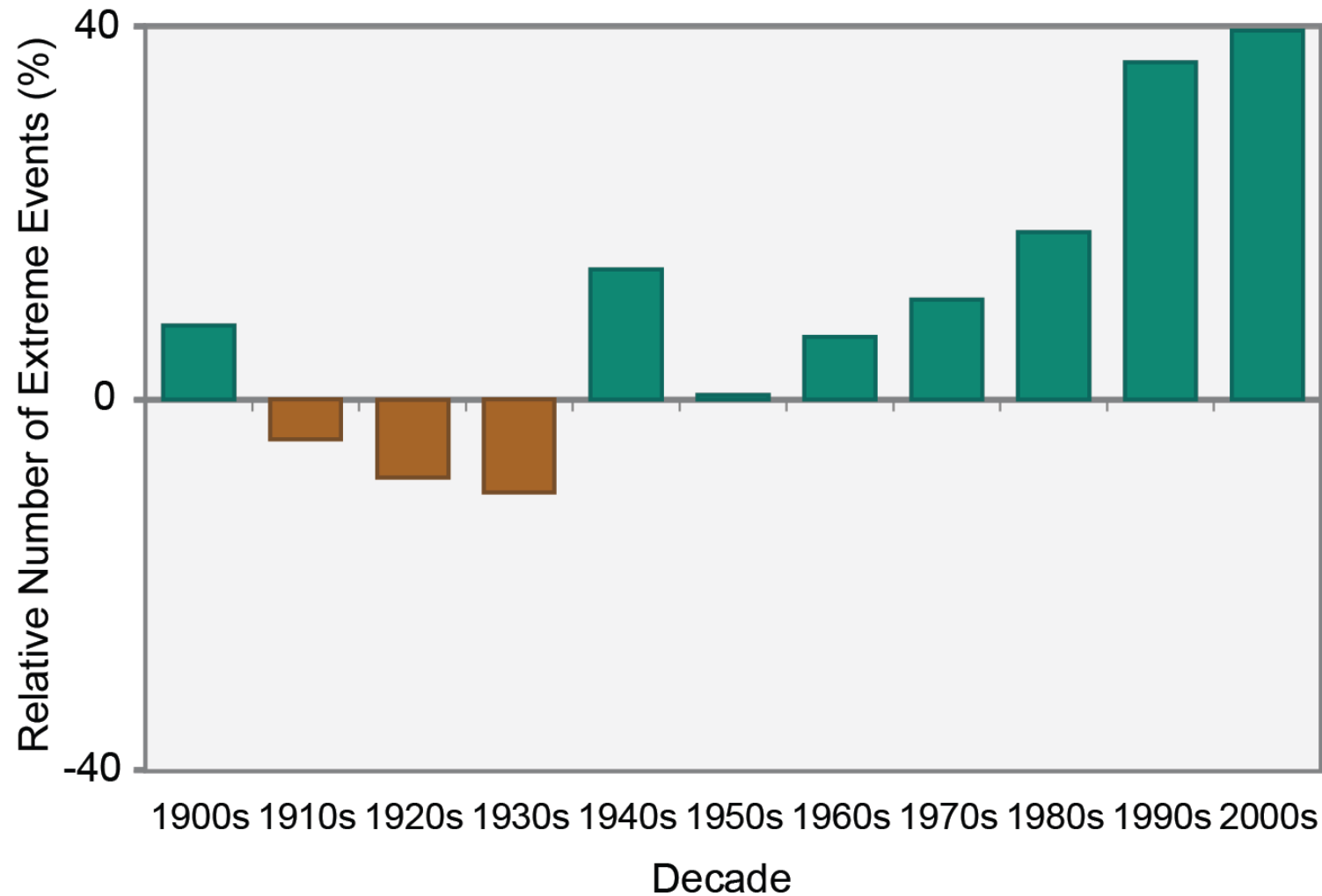
PRECIPITATION













Topics

Select a topic of interest below to learn about climate-related



Arctic

Arctic Oceans, Sea Ice, and Coasts

Melting Glaciers, Snow, and Ice

Arctic Weather and Extreme Events

Permafrost and Arctic Landscapes

Arctic Development and Transport

Arctic Peoples and Ecosystems



Coastal

Sea Level Rise

Coastal Erosion

Storm Surge

Tsunami

Inland Flooding

Shallow Coastal Flooding (Nuisance Flooding)

Building Resilience in Coastal Communities



Water Resources

Municipal Water Supply

Flooding

Drought

Ecosystems

Water Resources Dashboard

Vulnerability

Adaptation

Protecting and Enhancing the Resilience of Ecosystems



Energy Supply and Use

Energy Consumption

Energy Production

Energy Facilities

Building Resilience in Energy Supply and Use

Economic Sustainability

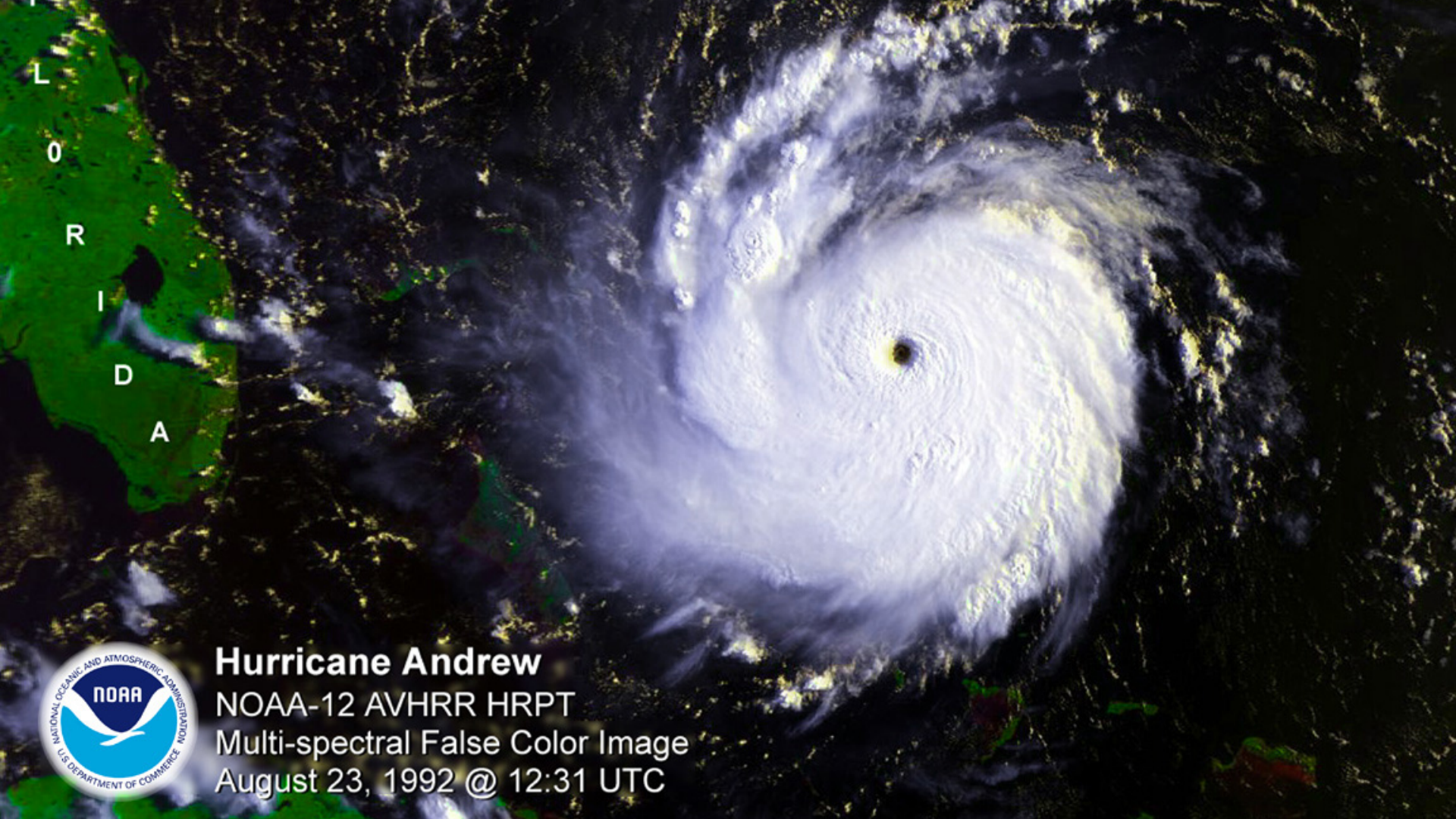
*prosperity through efficient management of
natural and human resources.*



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Hurricane Andrew
NOAA-12 AVHRR HRPT
Multi-spectral False Color Image
August 23, 1992 @ 12:31 UTC



Biggest disaster at MBC

Hurricane Andrew, 1992



Hurricane Andrew, 1992



Hurricane Andrew, 1992

Memorandum

Date: 01 June 2005
To: Laurie, Christina, Christine, Jody, Laura, Harvey
CC: Lee, Larry, Arantza, Patrick
From: Barb Bohnsack, CD Manager/Dicot Biologist
Re: Responsibilities and tasks following a natural disaster: Hurricane Season 2005

Following a natural disaster requiring evaluation to the collections, the assessment teams in the field will be as follows:

Palms

Palm Horticulturist
Field Supervisor
On call: Imaging Specialist

Cycads

Cycad Horticulturist
Cycad Biologist
On call: Imaging Specialist

Dicots/Others

Dicot Horticulturist
Collections Manager/Dicot Biologist
On call: Imaging Specialist

Field teams: assemble in the Collections Development office for instructions and distribution of the On-Site Evaluation of Damage to Collection forms. [Packets of forms and instructions for completing them are located in the blue Natural Disasters folder in the right side file drawer of my desk, all the way in the back. Clipboards and pens are available in the Collections Development Office. Flagging tape is located in the metal cabinet in Nell's House west garage.]

Each field team evaluates all impacted plants in their specialty group in all areas of the property. Horticulturists are responsible for: 1) determining the condition of each impacted plant (good, fair, poor); 2) assessing plant damage (specific descriptions requested); 3) specifying tasks required to deal with the assessed damage (i.e., chemical treatment, staking, trimming, removal, etc.). [See attached memo for details.] 4) attaching flagging tape to each assessed plant as required. [See attached memo for details.] Collections Development personnel are responsible for the following tasks: 1) Collections Development forms. The Imaging Specialist is responsible for the following tasks: 1) Collections Development forms as well as

Early 2005:
living collections
hurricane protocol:

summary:

1. quick inspection for emergencies
2. entire team evaluate plants
3. then, entire team "save plants"

Simple. Linear. Straightforward.



Hurricane Katrina, late August 2005



Hurricane Katrina, 2005



Hurricane Katrina, 2005

Damage assessment, next morning





damage assessment:
systematic, organized, *thorough*.

10,859 plants


Three days of assessment work



Table 1. Collections damage assessment summary

	Destroyed	Damaged	Toppled
Cycads	0		
Palms	48	22	63
Dicots	85	899	207
Total	133	296	124
		1,217	394



A satellite image of Hurricane Wilma, showing a well-defined eye and a dense, swirling cloud structure. The hurricane is positioned over the Gulf of Mexico, with the Gulf Coast of the United States visible on the left. The surrounding ocean is a deep blue, and the landmasses are a mix of green and brown. In the top right corner, there is a circular logo with a white stylized bird or wing design on a blue background.

Hurricane Wilma, October
2005

two months after
Hurricane Katrina



Hurricane Wilma, 2005



Hurricane Wilma, 2005



Hurricane Wilma, 2005

containers easily become airborne



Hurricane Katrina, 2005

containers easily become airborne

tips:

group containers like this

label container and tag

add extra tag below medium

Hurricane Wilma, 2005



threats



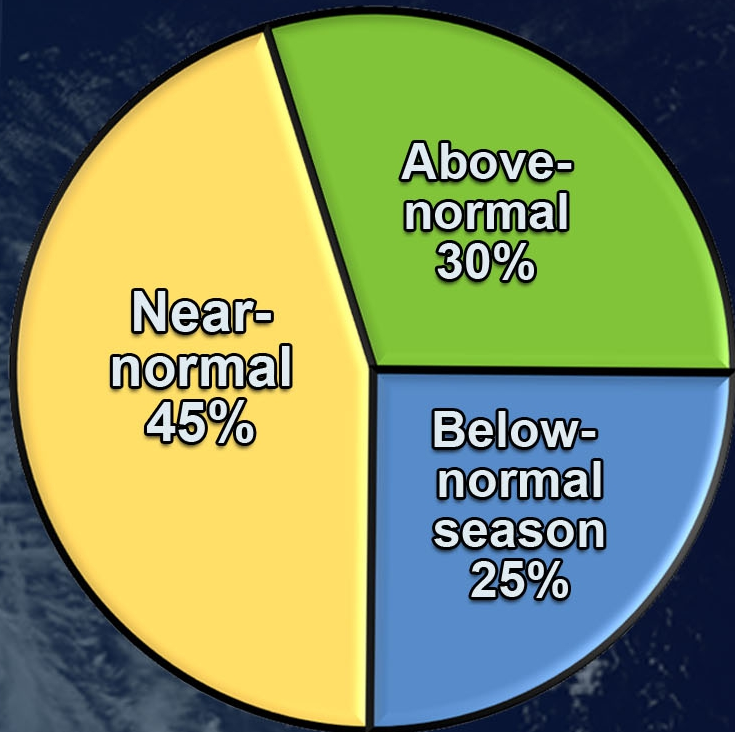
2016 Atlantic Hurricane Season Outlook

Named storms: 10 - 16

Hurricanes: 4 - 8

Major hurricanes: 1 - 4

Outlook
probability



Be prepared: Visit hurricanes.gov

and follow @NWS and @NHC_Atlantic on Twitter



assets





Historical Hurricane Tracks



Search Hurricanes By

Location Name/Year Ocean Basin

2005

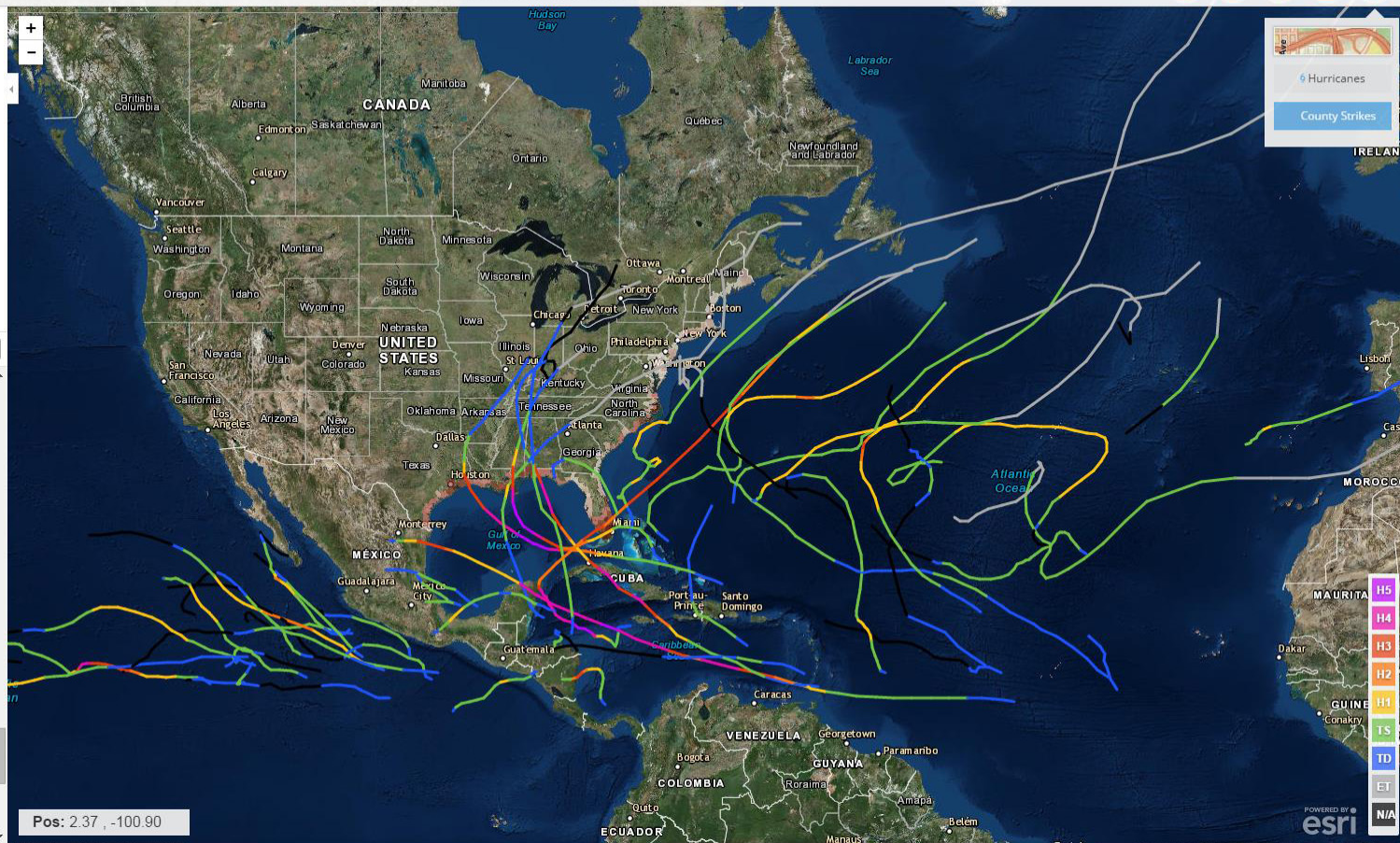
Refine Search

Search through the storms below

Results (116) Selected My Storms (0)

Clear Sort By Year (Asc)

+	TD1007 2005	Oct 06, 2005 to Oct 06, 2005
+	TWENTY-TWO 2005	Oct 08, 2005 to Oct 14, 2005
+	VINCE 2005	Oct 08, 2005 to Oct 11, 2005
+	KIROGI 2005	Oct 09, 2005 to Oct 19, 2005
+	NOT NAMED 2005	Oct 13, 2005 to Oct 17, 2005
+	SIXTEEN 2005	Oct 15, 2005 to Oct 21, 2005
+	WILMA 2005	Oct 15, 2005 to Oct 26, 2005
+	ALPHA 2005	Oct 22, 2005 to Oct 24, 2005
+	NOT NAMED 2005	Oct 25, 2005 to Oct 29, 2005
+	BETA 2005	Oct 26, 2005 to Oct 31, 2005
+	KAI-TAK 2005	Oct 27, 2005 to Nov 02, 2005
+	NOT NAMED 2005	Nov 04, 2005 to Nov 08, 2005
+	TEMBIN 2005	Nov 06, 2005 to Nov 12, 2005
+	BOLAVEN 2005	Nov 12, 2005 to Nov 20, 2005
+	GAMMA 2005	Nov 14, 2005 to Nov 22, 2005



Pos: 2.37, -100.90

United States Department of Commerce | National Oceanic and Atmospheric Administration | National Ocean Service

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Hurricane Hazel: 60th Anniversary



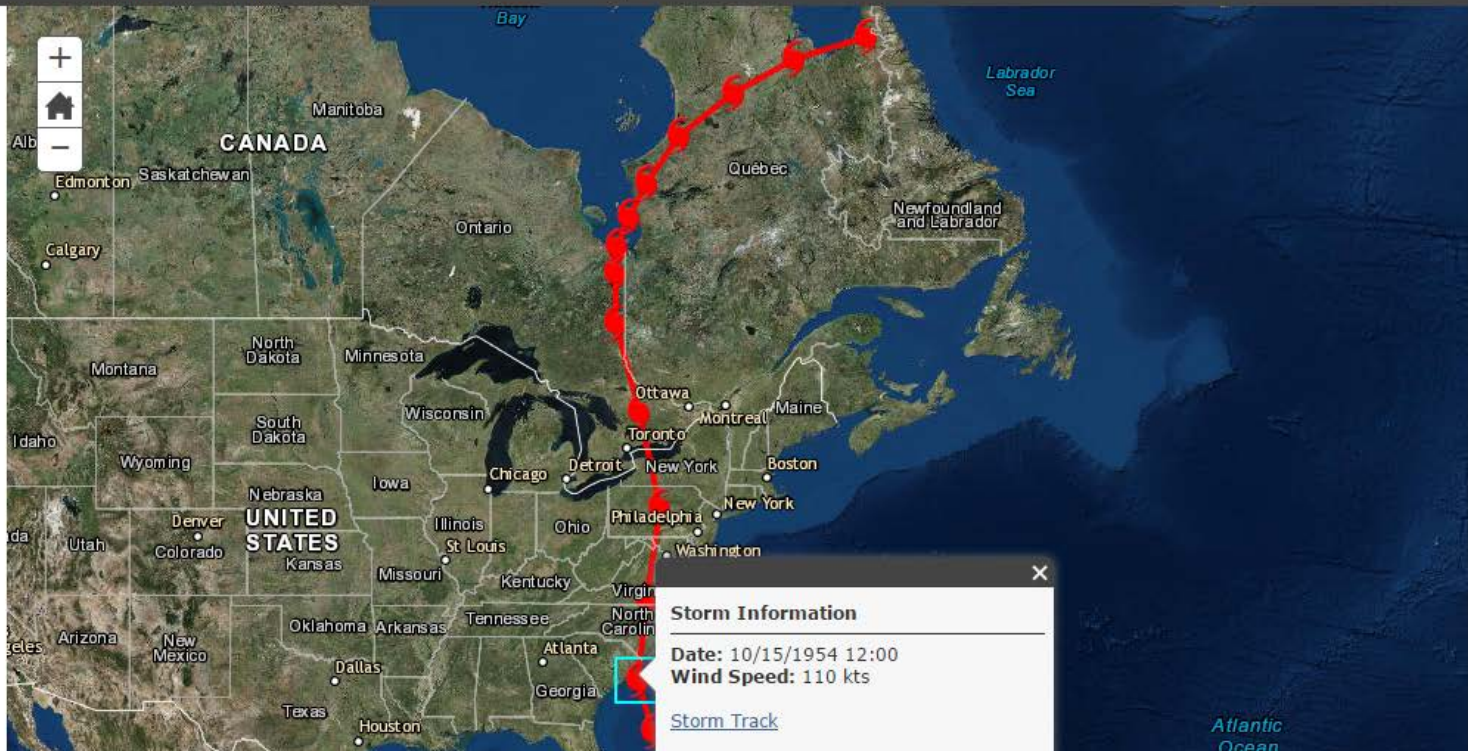
- Path
- Impacts
- In the Carolinas
- Storm Surge

Hazel's Path

Hurricane Hazel first developed on October 5, 1954, and moved westward through the Caribbean without striking land. Instead of continuing its predicted track towards Jamaica, Hazel made a sharp turn north, striking Haiti. Forecasters believed that the storm would lose power over the cooler waters north of Florida and drift eastward into the Atlantic. Again, contrary to predictions, Hazel turned northward to make landfall in the Carolinas as a Category 4 hurricane and then traveled up the East Coast into Canada. Hazel finally moved offshore on October 18.

Click the hurricane icons to get information on the storm track.

[More Historical Hurricane Tracks](#)



Storm Information

Date: 10/15/1954 12:00
 Wind Speed: 110 kts

[Storm Track](#)

Hurricane Hazel: 60th Anniversary



Path

Impacts

In the Carolinas

Storm Surge

What would the extent of Hazel's storm surge be today?

The damage inflicted by Hazel was made worse by the timing of the hurricane strike. Landfall coincided with the full moon of October, the highest lunar tide of the year, resulting in intensified storm surges. Surges of over 12 feet inundated a large area of coastline and reached as high as 18 feet at Calabash, North Carolina, producing severe coastal damage.

The map shows the effects of Hazel's storm surge on today's landscape. The Sea, Lake, and Overland Surges from Hurricanes, or *SLOSH*, model used current topography with the known parameters of the 1954 storm.

Darker blues indicate greater inundation depth while lighter blues indicate less inundation.

[More information on the SLOSH model](#)

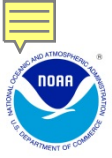




Emory Griffin-Noyes, a biologist working with the New England Wildflower Society collects spicebush seeds

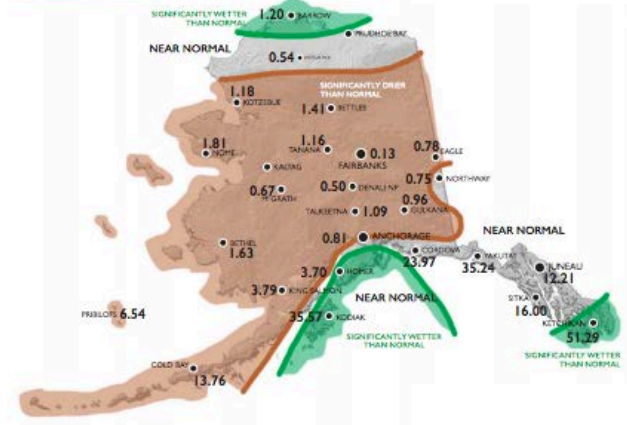
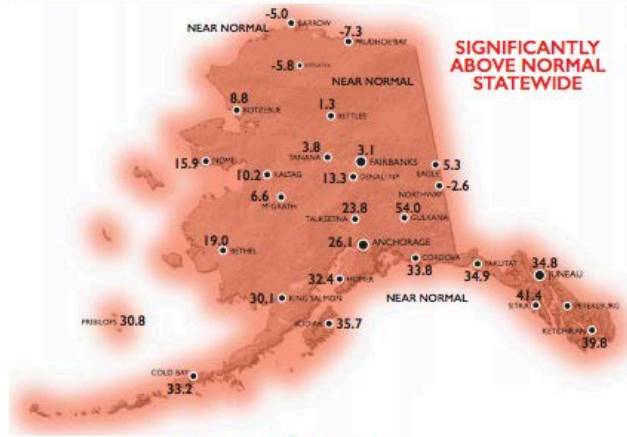
Over two years, the New England Wild Flower Society and its partners, North Carolina Botanic Garden and Mid-Atlantic Regional Seed Bank (part of New York City Department of Parks and Recreation), are undertaking the first large-scale, coordinated seed banking effort in the eastern United States.



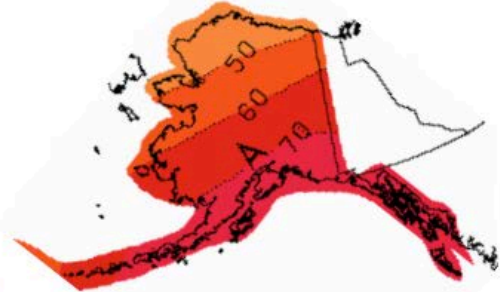


Regional Tools

TEMPERATURE & PRECIPITATION ANOMALIES



OUTLOOKS: APRIL-JUNE 2016



TEMPERATURE The April-June outlook from the Climate Prediction Center shows dramatically increased chances for significantly above-normal temperatures over most of Alaska, as the lingering effect of El Niño, above-normal sea surface temperatures and unusually low sea ice conspire to boost the chances of warmer than normal temperatures.



PRECIPITATION The same factors influence the precipitation outlook. With showers becoming the typical kind of precipitation over most of the state during May and June, there is much less confidence with precipitation outlooks.

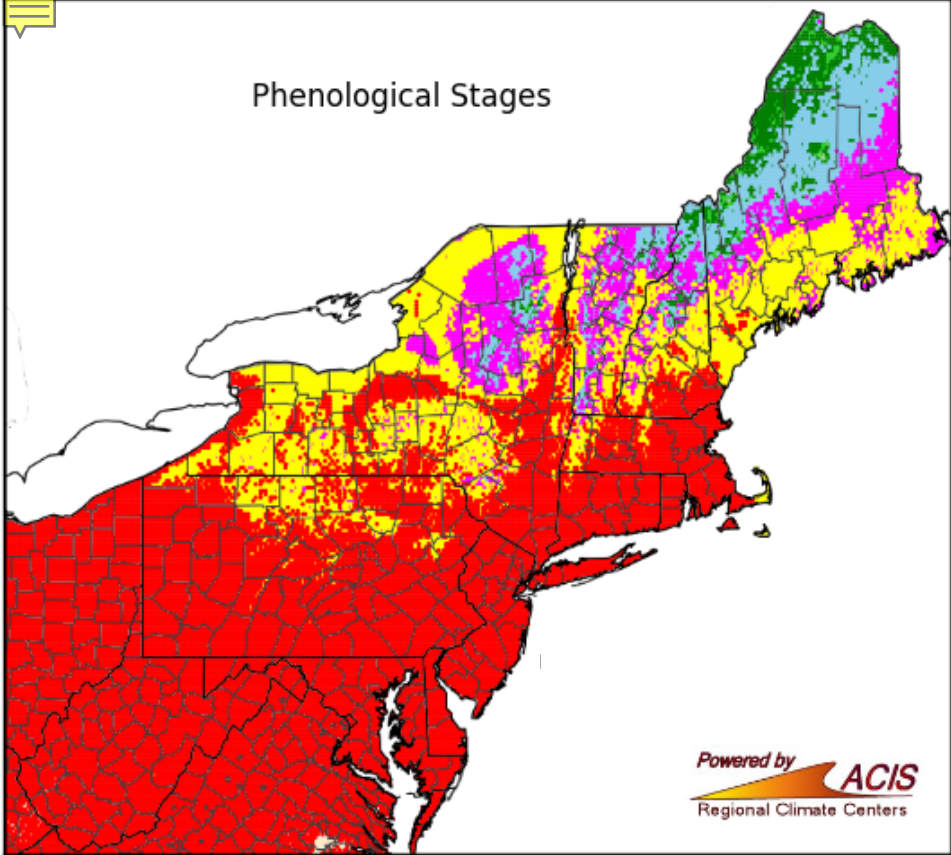


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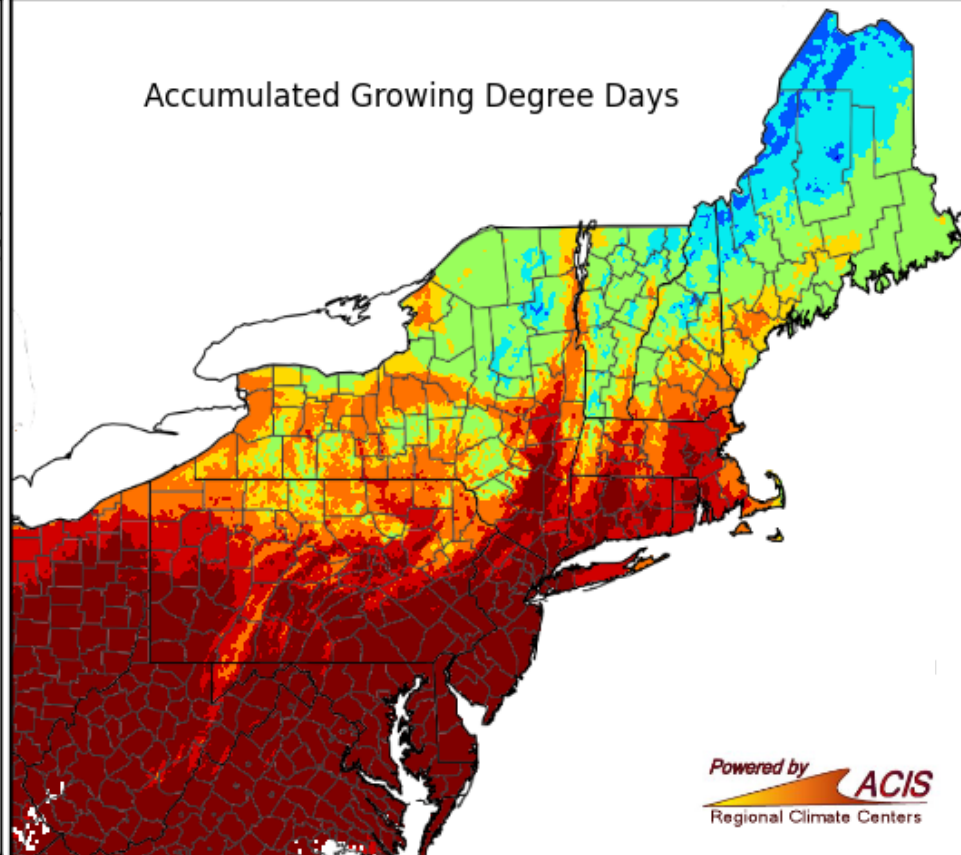
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Phenological Stages



Accumulated Growing Degree Days



Dormant **Silver Tip** **Green Tip** **1/2" Green** **Tight Cluster** **Pink Bud** **Bloom** **Petal Fall**

25 125 225 325 475 525 625 725



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Social Sustainability

social cohesion, equity, justice and wellbeing



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How can the humanities help address sea level rise?



The National Endowment for the Humanities (NEH) has chosen FIU's History Department as recipient of a Humanities in the Public Square grant.

A total of seven events will feature literary and religious studies experts, historians, philosophers, geographers and other scholars sharing their perspectives on risk, fear, hope and resilience, among other themes related to sea level rise and climate change.



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The Kampong is working with FIU to host events for the Ecohumanities for Cities in Crisis program.

The Kampong also includes staff from FIU's climate change and sea level research teams in our annual high school teacher enrichment programs.



Regional Climate Centers

State Climatologists

U.S. Offices

NOAA

RISA

Regional Climate Centers

NCEI Regional Climate Services Dir.

National Weather Service

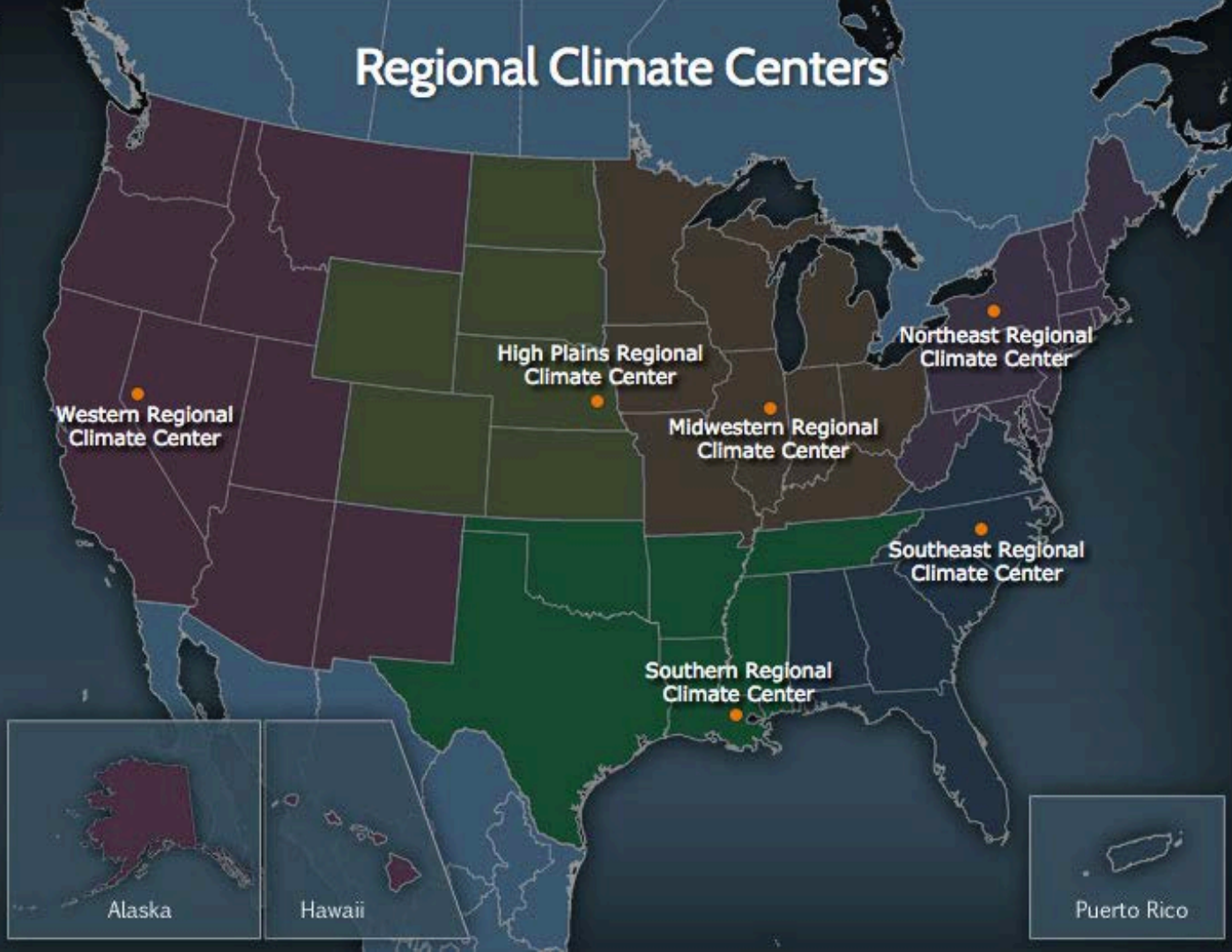
River Forecast Centers

Sea Grant

National Estuarine Research (NERR)

USDA

Department of the Interior



Alaska

Hawaii

Puerto Rico



Climate.gov

Lisa Auermiller

Jacques Cousteau National
Estuarine Research Reserve



Resilience is at the Heart of NOAA's Mission



Science:
Understand and predict changes in climate, weather, oceans, and coasts



Service: Share that knowledge and information with others



Stewardship:
Conserve and manage coastal and marine ecosystems and resources



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NOAA and Federal Climate Resources

- Data and Tools to understand our Environment
- Services to support our Economy
- Experts nearby to support Society

