



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





Topics

Select a topic of interest below to learn about climate-related risks and opportunities.



Coastal Flood Risk

- Sea Level Rise
- Coastal Erosion
- Storm Surges
- Tsunami
- Inland Flooding
- Shallow Coastal Flooding (Nuisance Flooding)
- Building Resilience in Coastal Communities



Ecosystem Vulnerability

- Fire Regimes
- Water Resources
- Carbon Balance
- Invasive Species
- Biodiversity Conservation
- Protecting and Enhancing the Resilience of Ecosystems



Food Resilience

- Food Production
- Food Distribution
- Food Safety and Nutrition
- International Food Security
- Building Food Resilience



Human Health

- Extreme Heat
- Severe Storms and Flooding
- Increased Levels of Air Pollutants
- Changing Ecosystems
- Altered Risk of Infectious Diseases
- Building Climate Resilience in the Health Sector



Find Out How People Are Building Resilience



Forests to Faucets
[Watch video >](#)



Building a Bridge to Reduce Risk
[Watch video >](#)



Dune Migration and Shoreline Protection
[Watch video >](#)



Louisiana's Front Line Defense from Storm and Surge
[Watch video >](#)

Climate Explorer



Climate Explorer lets you access map and data...

Site Overview



Featured Tools

CanVis

This downloadable photo-editing program gives you the power to generate "after" pictures illustrating possible futures. Use... [Read more >](#)

COMET-Farm

Taking Action

Filter by topic: ▼

Filter by steps to resilience: ▼

Filter by region: ▼

Communities and businesses are taking action to reduce their vulnerability to climate-related impacts and to build resilience to extreme events. The stories below illustrate the application of the process and tools featured in this Toolkit. Browse the stories, or filter by topic, step to resilience, and/or region in the boxes above. To expand your results, click the [Clear Filters](#) link.



Partnerships Promote Healthy Forests and Clean Water

Two major fires and subsequent flooding events wreaked havoc on a critical watershed and reservoir that supplies Denver, Colorado, with water. Now, a public-private partnership is working to ensure a clean, reliable water supply.

[Read more >](#)



Restoring Surfers' Point: Partnership's Persistence Pays Off

Coastal erosion has repeatedly damaged bike paths and parking lots near Ventura, California. It took local groups with varying viewpoints more than a decade to agree upon a strategy, but the first phase of their solution is now complete.

[Read more >](#)



Show Don't Tell: Visualizing Sea Level Rise to Set Planning Priorities

City officials in Tybee Island, Georgia, recognized sea level rise as a growing problem for their community. Visualizations from a sea level rise viewer helped them raise awareness of the city's vulnerabilities and set priorities for adaptation efforts.

[Read more >](#)



Climate Outlooks Increase Farmer's Odds for Success

From weeks-long dry spells to extreme precipitation events, farmers face significant challenges in bringing crops to market. Here's how one grower uses seasonal climate forecasts to increase his chances for success.

[Read more >](#)



Waterfront Restaurant Rebuilds to Remain Open Through Future Storms

Property owners in New Jersey can check their vulnerability to sea level rise and storm surge using an



Ranchers in Marin County Consider Carbon Credits

Ranchers are participating in a pilot project to improve carbon storage and reduce net greenhouse gas emissions. After quantifying their



Browser-Based Tools Show Current and Historical Crop Cover and Health

To manage their businesses successfully, farmers and food production companies need to



Quantifying Risk Shows Value of Replacing Highway

Louisiana's Highway 1 carries a significant fraction of the gas and oil that comes from the Gulf of Mexico to distribution points in the United

Taking Action

Communities and business illustrate the application of expand your results, click



Partnerships Promote Healthy Forests and Water

Two major fires and subsequent flooding events wreaked critical watershed and resupplies Denver, Colorado water. Now, a public-private partnership is working to clean, reliable water supply

[Read more >](#)



Waterfront Restaurant Rebuilds to Remain Open Through Future Storms

Property owners in New York check their vulnerability to rise and storm surge using an

Taking Action > Restoring Surfers' Point: Partnership's Persistence Pays Off >



Restoring Surfers' Point: Partnership's Persistence Pays Off

Coastal erosion has repeatedly damaged bike paths and parking lots near Ventura, California. It took local groups with varying viewpoints more than a decade to agree upon a strategy, but the first phase of their solution is now complete.

Stressors and impacts

In 1992, the City of Ventura, California, saw the return of a familiar problem: the recently re-constructed bike path along the beach at Surfers' Point was eroding away again. Coastal erosion eventually swallowed large portions of the bike path as well as the parking lot at the adjacent fairgrounds. Hasty efforts to preserve the area ultimately led to further damage. By 1997, crumbling asphalt, concrete barricades, and rusty chain-link fences erected to keep people from danger made the area a hazardous eyecore.

A long road to consensus

Paul Jenkin, Ventura Campaign Coordinator of the Surfrider Foundation, worked to engage residents to solve the contentious issue. He made numerous public presentations and encouraged groups to work toward a win-win solution. For years, city planners, the California Coastal Conservancy, the State Coastal Commission, the Ventura County Fairgrounds, the Surfrider Foundation, and other stakeholders considered and proposed various options for restoring the beach. The effort, ultimately called the Surfers' Point Managed Shoreline Retreat Project, was beset by conflicting ideas about the best strategy for addressing the problem, pressure to keep the area open for public recreation, and unwillingness of some stakeholders to compromise.



Working together at times, and at odds at other times, it took the groups more than a decade of discussion to come to consensus. They eventually agreed on a strategy that would restore the beach's recreational opportunities and uncluttered view.

Steps to Resilience:

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

Tools:

- [Sea Level Rise and Coastal Flooding Impacts Viewer >](#)
- [Coastal Change Hazards Portal >](#)

Topic:

- [Coastal Flood Risk >](#) [Coastal Erosion >](#)

Additional Resources:

- [Surfers' Point Managed Shoreline Retreat Project | Ventura, California >](#)
- [Ventura Beach Dune Restoration Work at Surfers' Point >](#)
- [Project Notes: 1997-2011 >](#)

Partners:

- [California Coastal Commission >](#)
- [California State Coastal Conservancy >](#)

Tools

Filter by parent topic: ▼

Filter by functionality: ▼

Tools are available to help you manage your climate-related risks and opportunities, and to help guide you in building resilience to extreme events. Browse the list below, or filter by topic and/or tool functionality in the boxes above. To expand your results, click the Clear Filters link.



Advanced Hydrologic Prediction Service

Individuals and communities consult this comprehensive suite of graphical forecast products to anticipate and plan for potential flooding or drought.

[Read more >](#)



Airborne LIDAR Data Processing and Analysis Tools

Spatial analysts can use this downloadable tool to extract desired information from airborne LIDAR data. The tool's filtering algorithms classify ground and non-ground measurements and auxiliary tools enable users to thin, tile, or grid data.

[Read more >](#)



Annual Greenhouse Gas Index (AGGI)

Compare the total warming effect of heat-trapping gases in Earth's atmosphere to their level in 1990.

[Read more >](#)

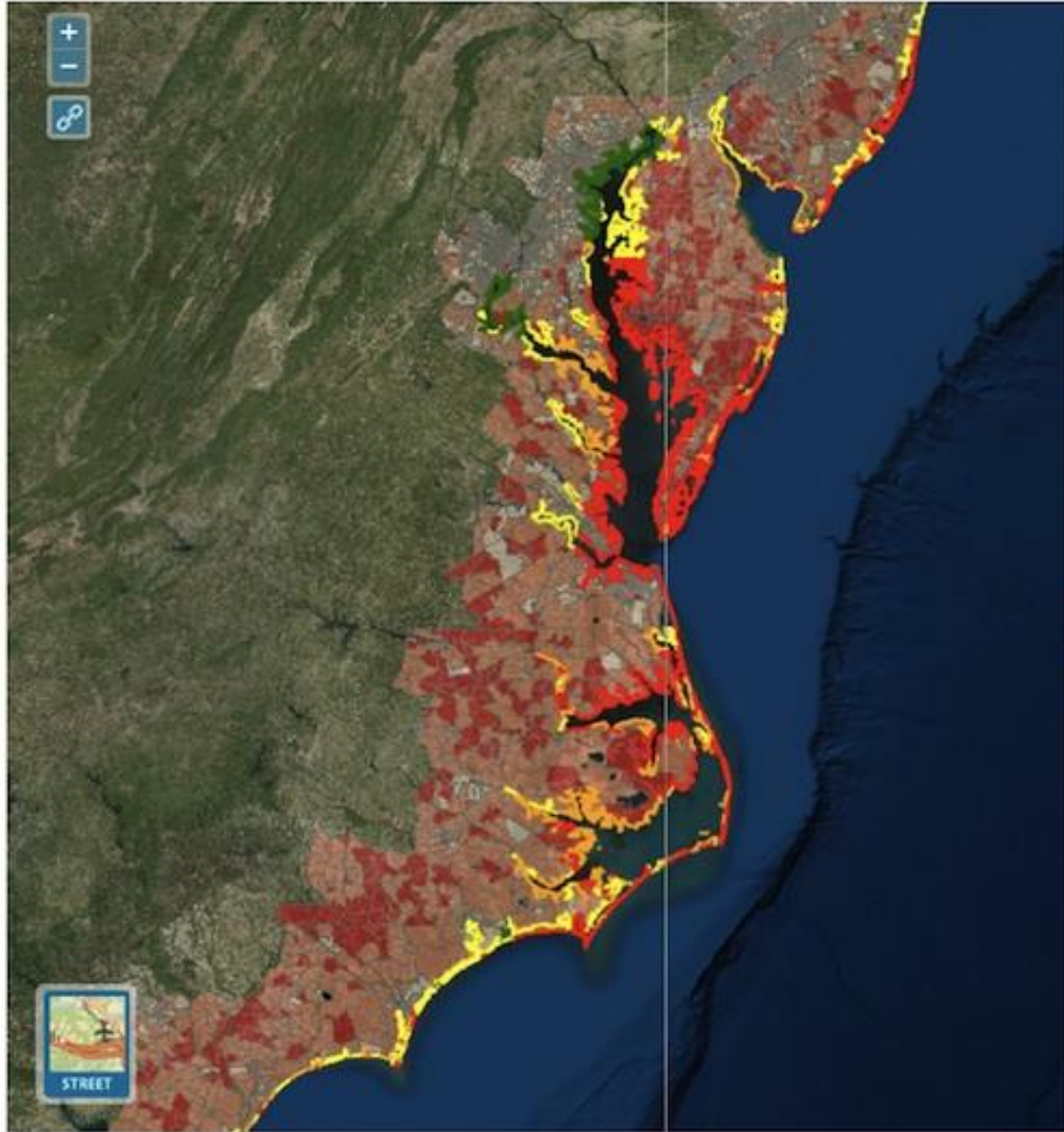


Beach-fx

Coastal managers considering shore protection projects can download Beach-fx software and use it model and measure the costs and benefits of protecting existing infrastructure against erosion, inundation, and wave attack damages.

[Read more >](#)





TOPICS:

Coastal Flood Risk

Climate Stressors

- Inundation from Sea Level Rise (1ft) i
- Inundation from Sea Level Rise (2ft) i
- Inundation from Sea Level Rise (3ft) i

People and Assets Impacted

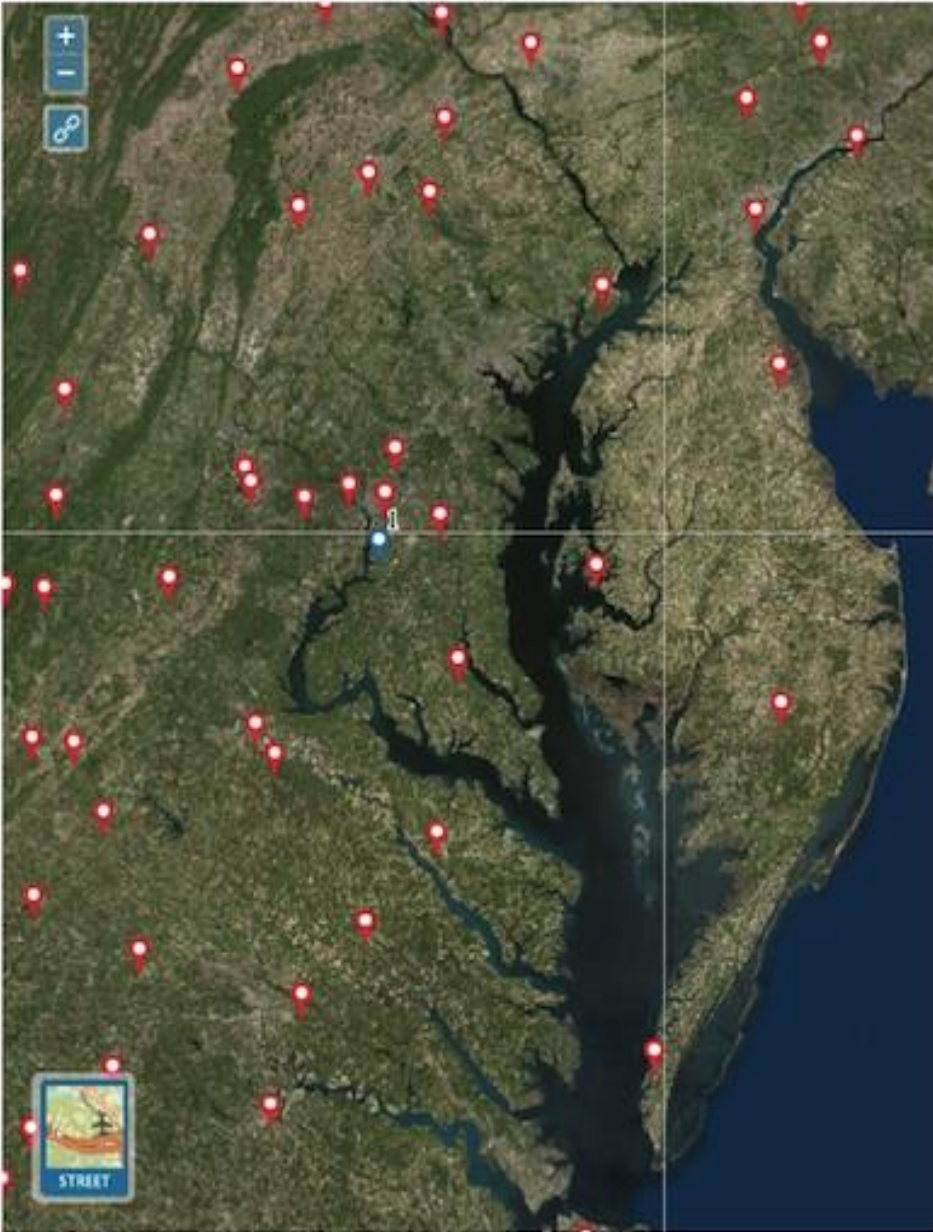
- Population Density (2000) i
- Coastal Vulnerability to Sea Level Rise i 100%
- Social Vulnerability Index i 55%

LAYER INFORMATION

Coastal Vulnerability to Sea Level Rise
Source: [USGS](#)

Relative susceptibility to sea-level rise based on topography, bathymetry, and tidal range.





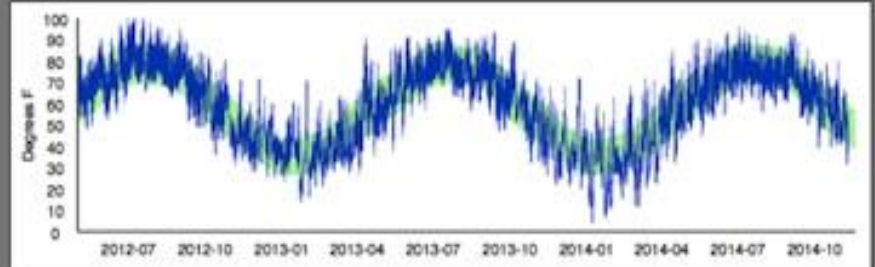
STATION DETAIL:

TEMPERATURE

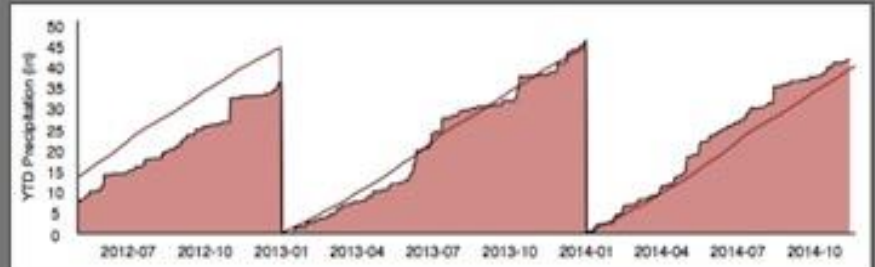
PRECIPITATION

(1) OXON HILL MD

TEMPERATURE



PRECIPITATION



Tools > Coastal Resilience 2.0 >



Users have access to interactive tools to visualize future flood risks from sea level rise and storm surge. Other tools can help users identify areas and populations at risk from coastal hazards and gain a better understanding of ecological, social, and economic impacts. This information is particularly helpful for officials involved in coastal planning, zoning, and land acquisition who must take rising sea levels and increased storm intensity and frequency into consideration.

The Coastal Resilience approach includes four critical elements:

- **Assess Risk and Vulnerability** to coastal hazards through community input and tools that include alternative scenarios for current and future storms and sea level rise.
- **Identify Solutions** for reducing vulnerability that focus on collaborative efforts across social, economic, and ecological systems.
- **Take Action** help communities develop and implement solutions.
- **Measure Effectiveness** of efforts to reduce disaster risks and apply ecosystem-based adaptation.

Topic:

- Coastal Flood Risk > **Sea Level Rise** >
- Coastal Flood Risk > **Coastal Erosion** >
- Ecosystem Vulnerability > **Biodiversity Conservation** >

Taking Action:

[Climate Preparedness Workshops Provide a Head Start toward Resilience](#) >

URL:

<http://maps.coastalresilience.org/network/> >

Webpage:

[Coastal Resilience Website](#) >

Training/Tutorials:

[Coastal Inundation Mapping](#) >

This two-day instructor-led course offers a combination of lectures and hands-on exercises to give students a better understanding of coastal inundation issues and mapping methods using a geographic information system (GIS).

Tools > Downscaled CMIP3 and CMIP5 Climate and Hydrology Projections >



Important Notice for Using Climate Projections

The inherent complexities of climate models make it easy to misinterpret or misuse their results. When examining projection data, be aware of the following points:

- Climate projections are not predictions.
- The location and timing of extreme weather events cannot be deduced from climate model projections.
- Projections vary from model to model: the best projection dataset for one location and purpose may not be the best for other situations.
- Some climate projection datasets contain daily or weekly projections; other datasets contain only monthly averages.
- The increased spatial resolution of statistically downscaled projections available for temperature and precipitation may not be available for all parameters.
- Climate model simulations can't predict the timing of natural climate patterns.

For high-risk decisions involving climate model projections, you may want to consider seeking expertise.

This archive contains high-resolution translations of climate projections for the contiguous United States. Archive content is based on global climate projections from the World Climate Research Programme's Coupled Model Intercomparison Projects, Phase 3 (CMIP3) and Phase 5 (CMIP5) of these experiments informed the Intergovernmental Panel on Climate Change's Fourth Assessment Report and Fifth Assessment Report, respectively.

URL:

http://gdo-dcp.ucllnl.org/downscaled_cmip_projections/ >

Webpage:

[Overview](#) >

Documentation:

[About the Data](#) >

Training/Tutorials:

[Tutorials](#) >

Partners:

[Climate Analytics Group](#) >

[Climate Central](#) >

[Lawrence Livermore National Laboratory](#) >

[NCAR Research Applications Laboratory](#) >

[Santa Clara University](#) >

[Scripps Institute of Oceanography | California-Nevada Climate Applications Program](#) >

Training Courses

The training courses here can help you acquire the tools, skills, and knowledge you need to take action on climate change and opportunities. All courses are free of charge, and are offered in at least one of three formats: online audio-visual presentations ("On-Demand", "On-Demand Lecture Series"), training webinars ("Online, Scheduled Lecture Series"), and residence training courses ("Onsite, Instructor-Led"). Many courses include a test to help you evaluate your knowledge. These courses feature scientific information adapted from authoritative sources and are often developed in partnership with other experts. The courses have been pilot tested with users and other subject matter experts and may be updated periodically.

Filter by category: ▲

Filter by type of training: ▼

Filter by difficulty scale: ▼

- Climate Products (16)
- Climate Change (11)
- Climate Variability (8)
- Climate 101 (6)
- Climate Adaptation & Mitigation (5)
- Communication (5)
- Climate Attribution & Extreme Events (1)
- Strategic Planning (1)

Advanced Climate Variability and Change Course

This three-day residence training course provides advanced knowledge in climate variability and change, and approaches and tools for developing local climate studies.

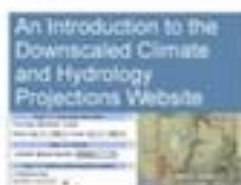


Category:
Climate Variability, Climate Change, Climate Products,
Climate Attribution & Extreme Events
Type of Training: Onsite, Instructor-Led
Difficulty scale: Advanced

Source:
[National Weather Service](#)

An Introduction to the Downscaled Climate and Hydrology Projections Website

These two videos serve as an introduction to the Downscaled Climate and Hydrology Projections website. This website, the result of a collaboration between several federal and non-federal partners, provides access to downscaled climate and hydrology projections for the contiguous United States and parts of Canada and Mexico, derived from contemporary global climate models. In the first video, a hydrologic engineer at the Bureau of Reclamation's Technical Service Center, in Denver, introduces the website and provides an overview of the MetEd lesson: Preparing Hydro-climate Inputs for Climate Change in Water Resources Planning. This lesson provides background information needed to use the projections site effectively to retrieve climate and hydrology projections data for impacts analysis. In the second video, another lecturer steps through the process of retrieving projections data using the website.



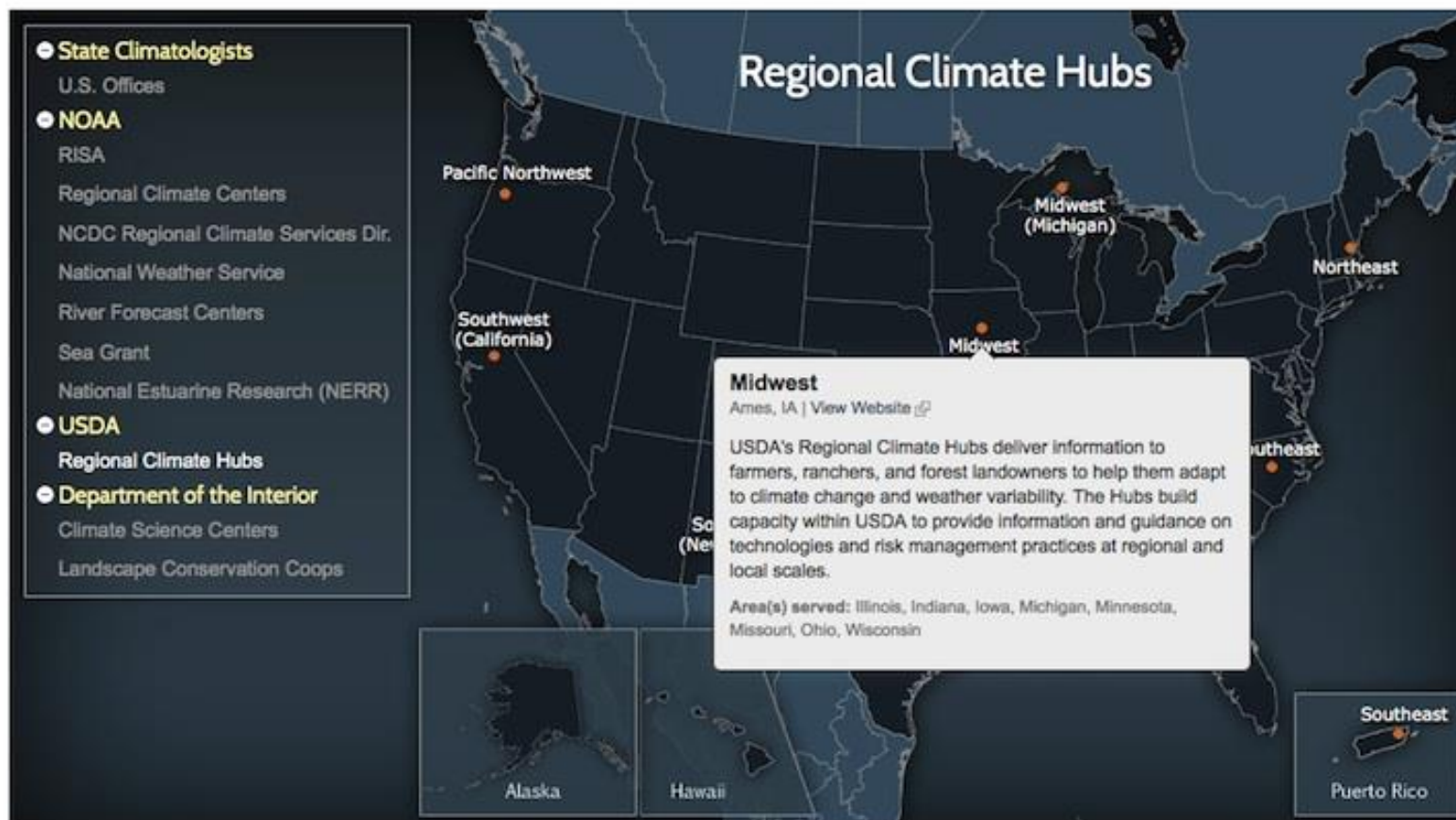
Category: Climate Change
Type of Training: Online, Self-Guided
Difficulty scale: Intermediate
Module time (hr:min): 0:25

Source:
[MetEd LICAR
Registration](#)

[Help](#) > [Find Experts](#) >

Find Experts

Regional and locally-focused centers across the nation are available to help you build resilience to climate-related changes and impacts in your community. Browse the maps below, then click on an orange marker to see that office's location, the services it provides, and other information.



- State Climatologists**
 - U.S. Offices
- NOAA**
 - RISA
 - Regional Climate Centers
 - NCDC Regional Climate Services Dir.
 - National Weather Service
 - River Forecast Centers
 - Sea Grant
 - National Estuarine Research (NERR)
- USDA**
 - Regional Climate Hubs
- Department of the Interior**
 - Climate Science Centers
 - Landscape Conservation Coops

Midwest
 Ames, IA | [View Website](#)

USDA's Regional Climate Hubs deliver information to farmers, ranchers, and forest landowners to help them adapt to climate change and weather variability. The Hubs build capacity within USDA to provide information and guidance on technologies and risk management practices at regional and local scales.

Area(s) served: Illinois, Indiana, Iowa, Michigan, Minnesota, Missouri, Ohio, Wisconsin



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From the makers of **NOAA's Climate.gov**

- production
- design
- evaluation
- strategy

