

PUTTING THE NATION ON A PATH FOR CLIMATE RESILIENCE AND PREPAREDNESS: NOAA'S INFORMATION AND EXPERTISE

Our climate is changing. We are seeing the impacts around the globe and in our own backyards, including:

- Warmer land and ocean temperatures;
- Sea level rise;
- Ocean acidification;
- Decreases in snow, glacier, and Arctic sea ice coverage;
- More frequent extreme weather events (i.e., heat waves, heavy downpours);
- Longer growing seasons; and
- Shifts in the ranges of plant, animal, and fish species, and the habitats that support them.

These impacts pose significant risk to communities, industries, and government in the short- and long-term. The cost of inaction will likely be more significant than the cost of taking steps now to prepare for extreme events in the coming years and to plan for resilience in the long term.

Information seekers can turn to NOAA personnel on the ground to access and apply available information to specific questions and needs. NOAA provides a wide range of climate information through monthly, seasonal and decade forecasts and data tailored to the specific needs of different sectors. NOAA uses this same information to take direct action to increase the resilience and facilitate adaptation of the nation's valuable marine and coastal resources and the people that depend on them.

Planning for long-term resilience

Access to NOAA climate data and tools

Climate.gov is a single point-of-entry for NOAA's climate information, data, products and services. This climate portal provides information about the impacts of climate on nearly every aspect of our lives from agriculture to energy to transportation. Highlights of the portal include an interactive "climate dashboard" that depicts a range of constantly updating climate datasets; news and features that highlight videos of and articles by scientists discussing recent climate research and findings; and an array of data products and educational resources. Climate.gov averages 160,000 unique visits per month and was recently nominated by the International Academy of the Digital Arts and Sciences for a Webby Award in the Government and Green categories.

Digital Coast provides tools, trainings, stories from the field, and information that allow users to incorporate updated climate data into coastal management decisions. One way NOAA delivers data is through the Sea Level Rise and Coastal Flooding Impacts Viewer. This tool allows inundation zones to be visualized on top of other community data so that managers can see what is at risk. For example, the

Digital Coast’s Social Vulnerability Index (SOVI) measures the social vulnerability of U.S. counties to environmental hazards. Using a wide range of human factors that affect people’s vulnerability to hazards—things like age, poverty, and single-parent households—this sub-community-level data helps policymakers and emergency response practitioners understand differences in capacity for preparedness and response and identify areas where more resources may be needed.

Industry Specific Information is provided through a wide array of products that put future climate changes in context for specific sectors of our economy. Some examples include:

- Residential Energy Demand Temperature Index is based on population-weighted heating and cooling data that is closely related to the demand for certain specific types of energy usage in the contiguous U.S., which help energy producers make business decisions based on projections of demand.
- Air Freezing Index helps builders understand how much insulation is needed to protect a building foundation from frost. These data lead to changes in foundation construction that resulted in annual building cost savings of \$330 million and energy cost savings of 586,000 megawatt-hours.
- The Crop Moisture Stress Index measures the effects of drought and catastrophic wetness on national crop yields for corn and soybeans, and helps farmers plan wisely for future growing seasons. Moisture stress affects U.S. average crop yield, particularly when moisture stress occurs in the most highly productive crop growing areas.
- The West Nile Virus Mosquito Crossover Dates Indicator provides estimates of the dates when the northern house mosquito—the primary suspect for transmission of the disease to humans—becomes the dominant species in a particular area. The peak infection rate in mosquitoes occurs about two to three weeks after the northern house mosquito becomes the dominant species, representing the period of greatest risk of transmission.

Climate Reports

Putting current data in a historical context, NOAA publishes the monthly ***State of the Climate Report*** that includes analyses of the Nation's recent climate conditions, their unusualness, and their rank within long-term trends. These data are combined into the yearly, peer-reviewed State of the Climate Report that serves as one of the world’s most comprehensive and reliable scorekeepers of changes and trends in climate science.

Using historical trends to generate future scenarios, NOAA runs the technical support unit for the ***National Climate Assessment*** that provides a range of likely future climate conditions. NOAA is also working on a web-based global change information system that will provide all the data sets used in the report for public access.

NOAA published, for the first time in 2012, a ***Sea Level Rise Report*** that estimates global mean sea level rise over the next century based on a comprehensive synthesis of existing scientific literature.

Access to NOAA expertise and information

Regional Integrated Science and Assessments supports research teams that help expand and build the nation's capacity to prepare for and adapt to climate variability and change. There are currently 11 active RISA projects across the country. These teams create lasting relationships with decision makers from the public and private sectors including local, regional, and state governments, federal agencies, tribal governments, utilities, the business community, and national and international non-profit organizations. RISAs integrate climate science with interdisciplinary knowledge to assess impacts, vulnerability, and risks and to inform and evaluate adaptive response options and trade-offs. For more information, see

<http://cpo.noaa.gov/ClimatePrograms/ClimateandSocietalInteractions/RISAProgram.aspx>.

Regional Climate Services Directors work on-the-ground in six regions across the U.S. to connect people to actionable and trusted climate information by integrating and transforming data into regional products and services, and promoting access to climate information through robust partnership networks. The RCSDs assess regional climate information needs across sectors to inform NOAA's priorities and better serve the nation. They also work to build and sustain regional partnerships and networks to deliver timely and relevant climate information. Critical links in the Regional Climate Services partnership are the NOAA's Regional Climate Centers, a contract under the National Climatic Data Center to operationally produce and deliver NOAA's observational climate data, information, and knowledge for decision makers at the local, state, and regional scales. For more information, see

<http://www.ncdc.noaa.gov/customer-support/partnerships/regional-climate-centers>.

NOAA Coastal Services Center and Office of Coastal Resource Management provides the technology, information, and management strategies used by local, state, and national organizations to address complex coastal issues. The Coastal Services Center has offices and staff members in all six regions of the U.S. coastal zone, and helps local and state governments to address the challenges associated with flooding, hurricanes, sea level rise, and other coastal hazards, by providing data and the technical expertise in how to use that data to make decisions. The Office of Coastal Resource Management provides national leadership to state and territory coastal programs and estuarine research reserves to keep America's coasts healthy and resilient. For more information, see <http://www.csc.noaa.gov/> and <http://coastalmanagement.noaa.gov/>.

Climate Prediction Center provides climate monitoring, diagnostics, forecasts, and verification products in regional, national, and global scales on sub-seasonal, seasonal, and inter-annual timescales. Expert discussions are conducted weekly and monthly. For more information, see

<http://www.cpc.ncep.noaa.gov/>.

NOAA Fisheries Science Centers provide state-of-the-art regional observations, research and modeling to track, understand and project climate-related impacts on U.S. marine ecosystems, living marine resources (e.g., fisheries, protected species) and the people, communities and businesses that depend on them. The six Centers provide regional information for fisheries management, protected species conservation, and habitat conservation. For information on each Center, see

<http://www.nmfs.noaa.gov/science.htm>. For more information on NOAA Fisheries Service activities related to climate and marine ecosystems, see

http://www.nmfs.noaa.gov/stories/2014/03/climate_portal.html.

National Sea Grant Program focuses on helping communities understand climate science and how they can adapt to the opportunities and challenges of a changing climate. As a dynamic link between scientific information providers and information users, Sea Grant leads innovative research and outreach programs that further the effectiveness of our federal, state, and local partners. Located within the communities it serves, Sea Grant is an integral and trusted resource for coastal residents and decision makers. For more information, see <http://seagrant.noaa.gov/>.

National Climatic Data Center engages users in the agriculture, civil infrastructure, coastal hazards, energy, health, insurance, litigation, marine and coastal ecosystems, tourism, transportation, and water resources sectors. Activities within each sector include the development of sectoral fact sheets, hosting or co-hosting sectoral workshops, participating at sectoral conferences, and partnering on research activities. For more information, see <http://www.ncdc.noaa.gov/>

National Integrated Drought Information System is an interagency partnership led by NOAA which provides drought information and early warnings throughout the nation. Through the drought portal and other venues, it provides the right information to the people who needed it most. Staff conduct calls and webinars with partners to provide outlook and mitigation information to farmers, water utilities, wildlife managers, and others experiencing and suffering from drought. NIDIS has also developed the Regional Drought Early Warning Systems to explore and demonstrate a variety of early warning and drought risk reduction strategies for federal, state, regional, and local agencies. For more information, see <http://www.drought.gov/>.

Local Meteorologists are experts serving in NOAA's 122 Weather Forecast Offices throughout the country. They regularly interact with their local communities to communicate probability and risks of extreme weather and provide actions communities and individuals can take to be more prepared. In particular, the NOAA StormReady program helps arm America's communities with the communication and safety skills needed to save lives and property—before and during events. The StormReady program provides emergency managers with clear-cut guidelines on how to improve advanced planning, education, and awareness. To date, NOAA has partnered with 2050 communities and counties to promote preparedness to extreme events. For more information, see <http://www.stormready.noaa.gov/>.

Individual Events

NOAA hosts workshops, webinars, roundtables, and other interactive events to help end users better understand what information the agency has to offer, and works directly with them to apply the information.

NOAA workshops bring together business leaders, decision makers, entrepreneurs, innovators, and scientists to discuss climate data, applications of the data, and future uses of climate information. Through this collaborative discussion, we hope to uncover innovative opportunities for the market and research needs of the scientific and academic communities.

The Climate Services Division of the National Weather Service hosts a Seminar Series featuring speakers discussing the most recent advances in climate science and services for NOAA staff, stakeholders, and users. The Seminar Series covers a broad scope of climate topics, including new discoveries in understanding climate variability and change, tools for climate-sensitive decision support, and climate information communication practices. The seminars are conducted monthly and are recorded.

Increasing resilience & preparedness

Access to NOAA seasonal information

Quarterly Regional Climate Impacts and Outlook Reports synthesize NOAA's climate information on regional scales. The outlooks contain a map of significant events over the past season, a section of regional highlights, an examination of departures from normal temperature and precipitation over the past season, a section on observed impacts, and a collection of outlooks into the next season. For more information, see <http://www.ncdc.noaa.gov/news/latest-regional-climate-impacts-and-outlooks>.

Seasonal Outlooks provide forecasts on several timescales: 8-10 day, 30-day, and 3-month (seasonal). Regular reports are issued for El Niño/La Niña, and hurricanes as well as temperature, precipitation, and drought/flooding on a seasonal basis. These climate outlooks are used by agricultural, coastal, and flood-prone communities to take protective action before conditions develop. For example, farmers can adapt what type of crop to grow based on expected temperatures and precipitation. For more information, see <http://www.cpcpara.ncep.noaa.gov/>.

Drought.gov and U.S. Drought Monitor and Outlooks features a weekly updated U.S. Drought Monitor that provides the status of existing drought conditions and summarizes impacts. Monthly and seasonal drought outlooks are also updated on a monthly basis. Outlooks are forecasts that predict whether drought will emerge, stay the same, or get better in the next one to three months. The U.S. Drought Portal centralizes drought information in an unprecedented manner and has led to better community response in the form of smarter water management, such as implementing water restrictions or increasing reservoir reserves. For more information, see <http://www.drought.gov/>.

River Forecasts are issued by NOAA's 13 River Forecast Centers and make predictions about water across the country on time scales from hours to years into the future. Some of these forecasts and supporting information such as precipitation analyses are available online at water.weather.gov. In 2010 and 2011, NOAA issued early warning flood outlooks for emergency managers, dam operators, farmers, and local, state and tribal governments throughout the Northern Plains during record floods years. These outlooks—issued months in advance—helped communities prepare early and respond more quickly. For more information, see <http://water.weather.gov/ahps/rfc/rfc.php>.

Human Health Risk Assessments are the product of a partnership with the Centers for Disease Control to inform how extreme events impact human health. NOAA generates the 8-10 day heat outlook that provides advanced warning of possible upcoming heat stress events, and uses information from the Centers for Disease Control to layer health information into storm warnings. For example, Weather Forecast Offices disseminated health information in special weather statements during and immediately after Sandy made landfall, elevating awareness of threats such as carbon monoxide poisoning and harmful mold exposure. For more information, see http://www.cdc.gov/climateandhealth/technical_assistance.htm.