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Fire Weather: Background and NOAA's Role

Fire weather refers to conditions that influence whether a fire ignites, how it behaves, and how it can be contained. Record-breaking wildfires, especially in the western United States, have caused loss of life and property damages estimated in the billions of dollars per year. Congress continues to show interest in supporting fire weather forecasting, monitoring, communication, and research and may consider whether—and, if so, how—to alter federal agency roles, funding, and activities related to fire weather to further protect U.S. lives and property.

Congress has authorized the Secretary of Commerce, acting through the National Oceanic and Atmospheric Administration's (NOAA's) Administrator, to forecast weather and issue storm warnings (15 U.S.C. §313), including for fire weather. NOAA's fire weather activities span multiple subagencies or line offices, including the National Environmental Satellite, Data, and Information Service (NESDIS); National Weather Service (NWS); and Office of Oceanic and Atmospheric Research (OAR). These activities occur at headquarters, regional centers, and local weather forecast offices (WFOs). NOAA coordinates its wildfire activities through the intra-agency Fire Observation, Research, and Services Team (FOReST). Other entities also provide operational fire weather services, such as the National Interagency Coordination Center (NICC), an intergovernmental group focused on mobilizing wildfire resources. This In Focus provides information on NOAA's fire-weather-related activities and potential congressional considerations.

Before the Fire

Before a fire, NESDIS, NWS, and OAR activities focus on observations, prediction, and forecasting of variables that contribute to fire weather and wildfire, such as temperature, precipitation, wind speed, humidity, and weather patterns. These NOAA line offices also detect new and monitor existing wildfires and provide daily decision support services (forecast advice and interpretation) to land management and emergency response communities. NOAA researchers and meteorologists produce a range of fire-weather-related outlooks and forecasts, including

- annual to seasonal El Niño and La Niña outlooks (weather systems that influence drought conditions);
- seasonal to 6- to 10-day temperature and precipitation outlooks;
- seasonal to weekly drought outlooks;
- 1- to 8-day fire weather outlooks; and
- 1- to 4-day forecasts, which include fire weather alerts, watches, and warnings.

Some of the information in the outlooks and forecasts is incorporated into NICC monthly and weekly “significant

fire potential” outlooks, among other federal forecasts and decision support services.

During the Fire

As a wildfire evolves, NOAA forecasters continue to collect observations and issue fire weather forecasts. Public safety officials also can request *spot forecasts* for specific areas and timeframes. In some cases, NOAA deploys incident meteorologists (IMETs) to a fire command center to provide on-site weather and environmental information. NOAA also uses observational platforms and models to detect, monitor, and predict smoke and air quality associated with fires.

Communication

NOAA's criteria to issue fire weather-related watches and warnings consist of multiple environmental conditions, such as an ignition source (e.g., lightning), interaction between dry and moist air, strong winds, and very low relative humidity. The thresholds for each may differ depending on the geographic area (e.g., average environmental conditions in Los Angeles differ from those in Detroit). Forecasters issue *Red Flag Warnings* when they are highly confident “that weather and fuel conditions consistent with local Red Flag Event criteria will occur in 48 hours or less” or are already occurring. *Fuel* refers to vegetation and other materials that are available to burn in a fire. Forecasters issue *Fire Weather Watches* when there is a “high potential for the development” of a Red Flag Event, 18-96 hours before the expected onset of the Red Flag Warning criteria. For example, the Los Angeles/Oxnard, CA, WFO (**Figure 1**) issues a Red Flag Warning when there is dry fuel along with

- various combinations of (a) relative humidity of 15% or below and (b) sustained winds of 15 miles per hour (mph) or greater (or gusts at 25 mph or greater) over more than six hours or
- widespread (area covered) and/or significant (in terms of number of strikes) dry lightning.

Forecasters also have discretion to issue a Red Flag Warning outside of the specific criteria. In rare cases, the Red Flag Warning may designate an area as being in a “Particularly Dangerous Situation,” such as when warning criteria are greatly exceeded and/or near record levels (**Figure 1**).

NOAA uses its own channels (e.g., NWSChat) and the Federal Emergency Management Agency-operated Integrated Public Alert and Warning System (IPAWS) to communicate warnings to the public. IPAWS sends messages to local television and radio stations via the Emergency Alert System, to mobile phones using Wireless

Emergency Alerts, and on NOAA Weather Radio All Hazards (NWR), a nationwide network of radio stations continuously broadcasting weather information directly from the nearest WFO. For more about IPAWS, see CRS Report R48363, *The Integrated Public Alert and Warning System (IPAWS): Primer and Issues for Congress*.

Figure 1. Red Flag Warnings in Los Angeles, CA
January 14, 2025



Source: CRS adapted from NOAA NWS, Los Angeles, CA, Weather Forecast Office, "Red Flag Warnings," January 14, 2025.

Research

NOAA programs, primarily within NESDIS and OAR, focus on fire weather research to improve observations, detection, modeling, forecasting, communications, and instrument development, among other activities. NESDIS activities include training and calibrating fire weather prediction models, detecting fire via weather satellites, optimizing satellite information for forecasting, and long-term monitoring. OAR activities include field studies, data collection, and monitoring; understanding connections between climate and wildfire; advancing forecast systems and decision support services; and improving air quality and fire weather modeling. NOAA's Fire Weather Testbed (FWT), a collaboration between OAR, NWS, and NESDIS and the broader fire weather community, aims to accelerate the development and delivery of products, technologies, and communication strategies to users, including forecasters and emergency responders.

NOAA collaborates with federal land management agencies (e.g., U.S. Forest Service) and science agencies (e.g., National Aeronautics and Space Administration) on fire weather research through interagency groups (e.g., National Interagency Fire Center) and memoranda of understanding.

Congressional Considerations

The funding for and specifics of fire-weather-related activities at NOAA are currently unclear. Typically, NOAA has funded its fire-weather-related activities as part of its broader programs, rather than as a specific fire weather budget line item. Congress also has provided direction and funding specifically for fire weather. For example, in the explanatory statement accompanying the FY2023 appropriations act (P.L. 117-328), Congress provided OAR with funding to develop a collaborative and integrated fire

weather research program, including an FWT. Congress requested that the agency continue those efforts in FY2024, among other things. Congress also had appropriated funding to NOAA for FY2022 through FY2026 for wildfire prediction, detection, observation, modeling, forecasting, and communication through the Infrastructure Investment and Jobs Act (IIJA; P.L. 117-58). In 2025, the Trump Administration ceased funding disbursements from IIJA. The Administration also proposed to terminate OAR and its programs and shift some weather-related research to NWS. The impact of these changes, as well as agency staff reductions, on fire weather activities is uncertain. Congress signaled its continued support for the collaborative and integrated fire weather research program, noted above, and for retaining OAR as a line office in congressional reports accompanying proposed FY2026 appropriations bills. The 119th Congress could continue to provide NOAA with the discretion to fund most of its fire weather activities under broader budget line items or establish an OAR-specific or NOAA-wide fire weather program with its own budget line item, among other potential actions.

Legislation introduced in the 119th Congress would authorize new or codify existing NOAA fire-weather-related activities. For example, one bill (S. 306) would establish in statute NOAA fire weather services, an FWT, IMETs, interagency and advisory groups focused on wildfire-related topics, a fire weather rating system, and an authorization of appropriations, among other provisions. Another bill (H.R. 4075) would require some of these activities, as well as research on wildfire communication and information dissemination. Provisions in other bills focus more narrowly on observation techniques (S. 322) and community weather research modeling systems (H.R. 3816) for fire-weather-related uses. Fire-weather-related bills often cross the jurisdictions of multiple congressional authorizing committees, potentially complicating bill consideration and passage.

Multiple groups (e.g., NOAA Science Advisory Board, Federation of American Scientists, and Wildland Fire Mitigation and Management Commission) have recommended actions that NOAA and/or Congress could take to improve NOAA's fire weather services. While NOAA has stated that FOReST is developing a strategic plan related to its fire weather activities (personal correspondence, August 2025), it remains challenging to track NOAA's progress in implementing external recommendations. Options for Congress in this area could include mandating that NOAA develop and implement a fire weather strategic plan, directing NOAA to publicly report on its progress, and requiring an assessment of NOAA's actions, among other initiatives. A strategic plan or progress report could further provide Congress with insight on fire-weather activities and funding within NOAA and could possibly assist Congress in assessing the effectiveness of NOAA's fire-weather activities in protecting U.S. lives and property.

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