Resources for Predicting and Mitigating Smoke Impacts of Wildland Fires

Introduction

Fire managers use prescribed fire and some wildfires to meet resource management objectives, like restoring and maintaining ecological processes, watershed function, and wildlife habitat, as well as to reduce fuels and mitigate the risk of severe wildfires. However, public concerns about smoke impacts are often a limiting factor for accomplishing fuels reduction and ecological restoration goals. It is imperative that agency land managers mitigate smoke impacts from wildland fire for the health and safety of the public. The Wildland Fire Air Quality Response Program (WFAQRP) has smoke impact assessment and forecast tools to assist agencies in managing fire incidents and mitigating smoke impacts to communities. New smoke modeling tools and technical specialists, called Air Resource Advisors (ARAs), can help inform fire management operations and provide important information to air quality, public health, public safety officials, and the public. This fact sheet describes how ARAs use smoke modeling and monitoring tools to build a toolkit for fire management operations and improved public communication.

Air Resource Advisors

Air Resource Advisors are technical experts in air quality and smoke dispersion science. They are trained in monitoring, data analysis, air quality, meteorology, computer simulation modeling and interpretation, and effective communication on the health and safety impacts of smoke. They are deployed nationwide during large wildfire events, often at the direct request of incident management team or agency administrators.

The Air Resource Advisor Toolkit: The Three "M"s

Air Resource Advisors use a number of tools to predict smoke impacts in order to help the public and professionals mitigate smoke effects. While technology and its applications are constantly evolving, there are three key elements ARAs use to accomplish their task — modeling, monitoring, and messaging (Figure 1).

SMOKE TRIANGLE

Figure 1. The three "M"s that ARAs utilize to predict and mitigate smoke impacts – modeling, monitoring, and messaging.

Modeling

One of the most commonly used smoke prediction tools by ARAs for wildfires and land management agency personnel on prescribed fires is known as the BlueSky modeling framework (www.airfire.org/bluesky). Air Resource Advisors are taught extensively in the use of the framework as well as other smoke modelling tools to determine where smoke will go and what surface-level smoke impacts will occur. BlueSky represents a highly complex modeling framework that maximizes the quality of the prediction, integrating different modeling fields such as fire information, fuel loadings, consumption modeling, emissions modeling, time rate of emissions modeling, plume height estimations, smoke trajectory, and dispersion modeling. BlueSky is accessible by ARAs, air resource managers, prescribed fire burn bosses and the public.

The 2011 Wallow Fire near Eagar, Arizona was the largest fire in state history. Extreme smoke impacts from the fire provided significant lessons regarding public and firefighter health and safety *Photo courtesy of ERI*

Monitoring

Smoke impacts are monitored through a variety of methods, from visual estimates based on how far one can see in low humidity areas to quantitative measuring devices. Air Resource Advisors set up air quality monitoring equipment on fires to determine whether air quality standards set by state and federal agencies are exceeded and to better understand the smoke impacts affecting a population in a given area. Air Resource Advisors and many air quality regulatory agencies use a program called Monitoring v4.0 (https://tools.airfire.org/monitoring/v4/) to analyze monitoring data and understand when smoke impacts peak and subside on a daily basis.

Messaging

Air Resource Advisors organize modeling and monitoring information into daily Smoke Outlooks, which are crucial for public communication and cooperator coordination. These daily reports illustrate smoke modeling projections and the potential smoke impacts for communities likely to experience ground-level concentrations of fine particulates in smoke. An ARA uses the daily reports to communicate smoke impacts to Public Information Officers, transportation safety agencies, health departments, and state, tribal, and local air quality regulatory agencies.

Management Implications

Ecologists and land managers understand that the increased use of prescribed fire and some wildfire is needed to improve ecosystem health and reduce the threat of catastrophic wildfire. However, the public, including regulators, place a high value on clean air and at times lack an understanding of the effective use of fire for land management. As land managers increase the use of fire to restore landscapes, public concern about smoke impacts will likely increase. Timely smoke impact information can address these concerns, as well as reduce the public's health and safety risk and improve public perception of fire and land management activities. The following recommendations can assist agencies in predicting, mitigating, and communicating smoke impacts to affected communities:

- Ordering an ARA can add much-needed capacity during larger wildfire incidents.
- For prescribed fire and smaller, less impacting wildfires, managers can use the ARA toolkit to build skills for predicting smoke impacts and then creating valuable public messages about smoke to mitigate impacts.
- In the absence of a certified ARA technical specialist, there are many training opportunities, tools, and resources, e.g., BlueSky, Monitoring v4.0, to build smoke management capacity.

This fact sheet summarizes information from the following ERI Working Paper:

Stotts, C., P. Lahm, and C. Standish. 2018. Resources for Predicting and Mitigating Smoke Impacts of Wildland Fires. ERI Working Paper No. 40. Ecological Restoration Institute, Northern Arizona University.