



Early Warning of Fire Emergencies: Tools and Resources

Requested by
Rene Garcia, Caltrans Division of Maintenance

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The Caltrans Division of Research, Innovation and System Information (DRISI) receives and evaluates numerous research problem statements for funding every year. DRISI conducts Preliminary Investigations on these problem statements to better scope and prioritize the proposed research in light of existing credible work on the topics nationally and internationally. Online and print sources for Preliminary Investigations include the National Cooperative Highway Research Program (NCHRP) and other Transportation Research Board (TRB) programs, the American Association of State Highway and Transportation Officials (AASHTO), the research and practices of other transportation agencies, and related academic and industry research. The views and conclusions in cited works, while generally peer reviewed or published by authoritative sources, may not be accepted without qualification by all experts in the field.

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Executive Summary

Background

Every year, California deals with a fire season that can be catastrophic. Damage to the transportation system can be unpredictable due to the changing path of a fire. Knowing more about the potential for a fire and its expected path can help Caltrans better protect field staff and the traveling public, stage equipment and resources to prevent or minimize damage to roadways and structures on the state highway system, and manage needed operational changes (such as road closures). Advance notice of fire danger can also be used to predict areas where air quality may be dangerous.

Currently, Caltrans provides an early-morning notice to its staff of fire danger ratings (low, moderate, high, very high or extreme) collected from CAL FIRE units throughout the state. Caltrans would like to learn how other public agencies provide advance notice of potential fire emergencies and advise and assist staff in the field conducting daily activities during periods of heightened fire danger. Caltrans is especially interested in practices, tools, systems and models used to provide early warning and ongoing notice of fire emergencies that may impact transportation systems and operations.

To support this effort, this Preliminary Investigation gathered information on tools and resources employed by the following types of agencies to provide early warning and ongoing notice of fire emergencies:

- State departments of transportation (DOTs).
- Other California agencies, including the Governor's Office of Emergency Services and CAL FIRE.
- Other government agencies with responsibilities related to fire notification and management, such as the U.S. Forest Service, state fire agencies and forest services, and offices of emergency management.
- Other countries that have relevant experience with wildfires.

Summary of Findings

Through a literature search, we identified a variety of tools and other resources used to manage wildland fire incidents and keep fire responders and others working in the field advised of potential fire danger and active fires.

Incident Management Tools

We found three examples of incident management tools used by the wildfire response community. Developed with assistance from the California first responder community, Next-Generation Incident Command System, or NICS, is a web-based tool with an open standards platform that offers an easy-to-use space to gather, organize, create, collaborate and share information about small- and large-scale incidents such as wildfires. NICS users log in to a map-based environment accessible via a web browser. California and other states are also using another incident management tool—InciWeb—to create or update incident records, view maps and share other announcements via the web. Finally, WildWeb, an optional feature of WildCAD, a computer-aided dispatch system for wildland fire agencies, is another source of information about active and past fires.

Fire Mapping, Assessment and Warning Tools

California

The U.S. Forest Service, in collaboration with UCLA and San Diego Gas and Electric, recently launched the Santa Ana Wildfire Threat Index, a tool used to generate a six-day forecast of large fire potential in Southern California. Maps of current wildfires are available through the web sites of several California state agencies, including the Office of Emergency Services and CAL FIRE, and these web sites and others offer up-to-the-minute lists and details of current fires. Coordination centers in Northern and Southern California provide a focal point for mobilizing resources to deal with wildland fire and other incidents and provide a wealth of resources related to fire warning and management.

Other States

State and regional wildfire risk assessment portals (WRAPs) such as those serving Colorado and Texas are similar in their focus, providing public and professional “views” that offer varying degrees of complexity when viewing and mapping current fires. Web sites such as those supported for wildfire response in Arizona and New Mexico serve as clearinghouses for wildfire-related information and tools.

In Florida, a robust set of resources, including one of the first Internet-based fire mapping tools in the U.S., displays existing or active wildfires and uses forecasted weather data to model the potential impacts from a smoke plume. In Texas, the Texas Interagency Coordination Center supplements TxWRAP, the state’s wildfire risk assessment portal, by providing fire-related information that can be used in daily operations, such as fire weather forecasts, fire risk assessments and maps of current and recent fire activity.

The state DOT perspective is provided in a Colorado DOT presentation that describes lessons learned after a significant 2012 fire. Texas DOT staff take an active role in responding to wildfires, participating by clearing fire breaks and providing fuel. We located several publications and podcasts that describe Texas DOT staff responsibilities, best practices and training for staff responding during a wildfire.

National

Mapping resources such as the U.S. Forest Service’s Active Fire Mapping Program, NASA’s Web Fire Mapper and U.S. Geological Survey’s GeoMac provide near real-time views of current wildland fires. The Active Fire Mapping program provides active fire detection and monitoring for all 50 states as well as Canada; Web Fire Mapper provides global interactive maps with a choice of GIS layers. Assessment and warning resources are available from the National Weather Service, which provides a map with active watches, warnings and advisories (“Red Flag Warnings”).

Incident management situation reports and other current fire information are available from the National Interagency Fire Center. Two U.S. Forest Service tools—the Wildland Fire Assessment System and Wildland Fire Decision Support System—offer a range of tools and support for the wildfire response community, including a fire danger point forecast tool that produces seven-day fire danger forecasts, and a web-based application for sharing fire-related analyses and reports. Finally, an air quality tools portal provided by the U.S. Forest Service offers smoke guidance point forecasts and regional maps, and maps of current air quality conditions.

International

Fire mapping and warning resources available for those outside the U.S. include the Global Fire Monitoring Center, which serves as a global portal for wildland fire documentation, information and monitoring. The European Forest Fire Information System provides maps of hotspots and fire perimeters that are updated daily, and the Canadian Wildland Fire Information System offers situation reports in addition to national maps of current and archived forest fire conditions. In South Australia and New Zealand, web sites provide residents with warnings and alerts (but not fire mapping).

Gaps in Findings

While resources such as maps and incident reporting systems are readily available for identifying the potential for wildfire and tracking active fires once they occur, we did not find it to be a common practice among state agencies to publish procedures about the provision of early warning and ongoing notice of fire emergencies. We found limited information from Colorado and Texas DOTs about best practices for staff in responding to wildland fires, and we identified a Florida emergency management plan that describes a notification process for active wildfires. However, we did not find other documentation that specifically identifies the tools, resources or practices used to supply state DOT or other government agency staff with early fire warning or ongoing notification of fire movement for staff already in the field.

Next Steps

Moving forward, Caltrans could consider:

- Learning more about how incident management tools such as NICS and InciWeb are being used throughout California to keep those in potential danger from active fires informed and prepared to respond appropriately.
- Contacting Texas DOT staff to learn more about how staff are kept abreast of fire danger while serving in the field.
- Contacting Colorado DOT to gather more information about their employee notification process in the event of wildfires.
- Reviewing the training materials developed by Texas DOT to identify content that could be applied by Caltrans in preparing its staff to work in the field during fire season.
- Examining the forecasting and mapping tools available from regional and national providers to identify the tools that best meet Caltrans' needs in keeping staff in the office and those in the field abreast of current and changing fire danger.

Detailed Findings

Incident Management Tools

Incident management tools are used during major incidents such as wildfires to share information in real time and keep fire responders and others working in the field informed about current fire danger. Presented below are three systems that can enhance situational awareness for staff in the field while wildfires are active.

Next-Generation Incident Command System (NICS), Massachusetts Institute of Technology Lincoln Laboratory.

NICS help site: <https://public.nics.ll.mit.edu/nicshelp/>

NICS is a web-based command and control environment for small- to large-scale incidents that allows for effective collaboration among a range of response partners. NICS was developed with assistance from the California first responder community.

Highlights from the NICS help site include:

- The tool is free for responder organizations. All funding has been provided by the government, and no vendor has proprietary rights to NICS.
- Incident data is displayed using a web-based, open standards platform that allows users to log in to a map-based environment.
- Georeferenced virtual whiteboards allow for dynamic interagency collaboration.
- The NICS Desktop is designed to provide users with an easy-to-use space to gather, organize, create, collaborate and share information.
- Responders can quickly form teams, send messages to one another, and remotely share maps and drawings that enhance the management of the incident.
- Map base layers include streets, satellite view, topography, physical relief/elevation, and sectional aeronautical charts.
- Users include all CAL FIRE regional units, the California Emergency Management Agency and all CAL FIRE Incident Management Teams.

Related Resources:

“New Communication Tool Enhances Incident Management and Situational Awareness,” Bill Gabbert, *Wildfire Today*, February 10, 2014.

<http://wildfiretoday.com/2014/02/10/new-communication-tool-enhances-incident-management/>

Highlights from the article:

- At least 255 emergency management agencies in California and a few other areas have used or tested this tool.
- NICS can be hosted anywhere using a minimum of hardware (a well-equipped laptop can be used).

- NICS is technology-neutral and can be used on computers as well as tablets and handheld devices. It is compatible with Windows, iOS, Linux, Android, and the web browsers Chrome, Firefox, Safari and later versions of Internet Explorer.
- Maps can be created by firefighters on scene in a matter of minutes. The maps are then immediately viewable by anyone who has access to that incident on a computer or handheld device.
- The maps can show an incident perimeter, staging areas, evacuation zones, road blocks, division breaks and symbology commonly used on incident maps.
- One agency chief put it this way: “We are able to compress the time of developing our situational awareness from 12 hours to 12 minutes.”

“Next-Generation Incident Command System,” *Tech Notes*, Massachusetts Institute of Technology Lincoln Laboratory, 2011.

http://www.ll.mit.edu/publications/technotes/TechNote_NICS.pdf

This document describes the use of NICS by CAL FIRE in Riverside and San Diego counties in the agency’s day-to-day operations to train personnel and to respond to incidents such as wildland fires.

InciWeb, National Wildfire Coordinating Group and partner agencies.

<http://inciweb.nwcg.gov/>

InciWeb is an incident information management system available for use by federal, state and local government agencies to post and provide information about wildfires and other incidents. The system was developed to provide the public with a single source of incident-related information and serve as a standardized reporting tool for the public affairs community. From the site’s home page, select a state to see incidents, announcements, closures, news, photographs and maps.

Related Resources:

InciWeb, PIO Bulletin Board, National Interagency Fire Center.

http://www.nifc.gov/PIO_bb/inciweb.html

This page links to information about how to use InciWeb.

InciWeb User’s Manual: Using the Interagency Incident Information Website, Version 2.4.

http://www.nifc.gov/PIO_bb/InciWeb/InciWebManual.pdf

This manual is designed for PIOs and others responsible for communicating incident information to the public.

Accessing InciWeb Cheat Sheet, National Interagency Fire Center.

http://www.nifc.gov/PIO_bb/InciWeb/InciWebAccess040813.docx

As this cheat sheet notes, “InciWeb is designed to serve the long-term communication needs of the unit with jurisdiction over the land that an incident occurs on (i.e., National Forest, State Department of Forestry, County, etc.).”

WildCAD, Version 5.0, Bighorn Information Systems, March 2013.

User guide:

http://gacc.nifc.gov/swcc/dc/nmadc/management_admin/software/user_guides/WildCAD_User_Guide_5.0.pdf

WildCAD is a GIS-based computer-aided dispatch system developed by Bighorn Information Systems for wildland fire agencies.

Related Resource:

WildWeb, Bighorn Information Systems.

<http://www.wildcad.net/WildCADWeb.asp>

WildWeb is an optional feature included with WildCAD that provides information about vegetation fires. On the web site, participating states and centers appear in an alphabetized list. Click on a "Recent Veg Fires" link to see details for a particular center, including recent and open incidents, incidents by type ("Wildfire" appears first in the list of incident types), resource status, and an incident map.

California Fire Mapping, Assessment and Warning Tools

Below we summarize some of the tools and resources currently available to forecast, map, provide warning for or respond to wildfires in California.

Santa Ana Wildfire Threat Index (SAWTI), Predictive Services Program, U.S. Forest Service, U.S. Department of Agriculture.

<http://psgeodata.fs.fed.us/sawti/>

From the web site: The Santa Ana Wildfire Threat Index (SAWTI) categorizes Santa Ana winds based on anticipated fire potential. The index uses a comprehensive, state-of-the-art predictive model that includes dead fuel moisture, live fuel moisture, and the greenness of annual grasses to create a detailed daily assessment of the fuel conditions across Southern California. This information is coupled with calibrated weather model output (comprised of wind speed and atmospheric moisture) to generate a six-day forecast of Large Fire Potential. The Large Fire Potential output is then compared to climatological data and historical fire occurrence to establish the index rating. This product is produced by the USDA Forest Service and Predictive Services.

Related Resource:

“UCLA Scientists Play Key Role in Developing New Santa Ana Wildfire Threat Index,” *UCLA Newsroom*, September 17, 2014.

<http://newsroom.ucla.edu/releases/ucla-scientists-play-key-role-in-developing-new-santa-ana-wildfire-threat-index>

From the article: UCLA atmospheric scientists were instrumental in the creation of the Santa Ana Wildfire Threat Index—a new tool to classify the fire threat potential of the powerful, hot, dry Santa Ana wind, which can turn a spark into an inferno. The index was introduced Sept. 17 by the U.S. Forest Service, in collaboration with UCLA and San Diego Gas and Electric. ... The threat index has four levels of increasingly severe fire potential:

- Marginal: Upon ignition, fires may grow rapidly.
- Moderate: Upon ignition, fires will grow rapidly and will be difficult to control.
- High: Upon ignition, fires will grow very rapidly, will burn intensely and will be very difficult to control.
- Extreme: Upon ignition, fires will have explosive growth, will burn very intensely and will be uncontrollable.

Each level includes recommended actions that escalate in accordance with the possible severity of the fire.

Current Fire Information, Incident Information, California Department of Forestry and Fire Protection (CAL FIRE), State of California.

http://cdfdata.fire.ca.gov/incidents/incidents_current

This site provides a list of the major fire incidents for 2014. The location of each incident can be viewed on the California Statewide Fire Map, available at

<http://www.calfire.ca.gov/general/firemaps.php>. Icons on the map link to more information about the incident, if available.

Fire & Rescue, Governor's Office of Emergency Services, State of California.

<http://www.calema.ca.gov/FireandRescue/Pages/Fire-and-Rescue.aspx>

This site includes links to fire-related resources, including California fire weather and a map of current wildland fires in California (click on "Current Wildland Fires"), with options to select from different layers and maps.

Fire and Resource Assessment Program (FRAP), California Department of Forestry and Fire Protection (CAL FIRE), State of California.

<http://frap.fire.ca.gov/>

FRAP "assesses the amount and extent of California's forests and rangelands, analyzes their conditions and identifies alternative management and policy guidelines." The site includes links to maps, GIS data and viewers.

Related Resource:

CAL FIRE Tools for ARCGIS 10, State of California.

http://frap.fire.ca.gov/tools/calfiretools-incident_mapping2.php

CAL FIRE developed a set of Geographic Information System (GIS) tools for use in fire incident mapping and daily GIS work.

PreventWildfireCA.org, California Wildland Fire Coordinating Group.

<http://www.preventwildfireca.org/>

This web site provides current fire information, including an up-to-the-minute list of current minor and major CAL FIRE wildfire incidents (see <http://www.preventwildfireca.org/Current-Fire-Information/>). The site also includes a page on wildfire risk forecasting tools.

Geographic Area Coordination Centers (GACC), National Interagency Fire Center.

<http://gacc.nifc.gov/>

GACC divides the U.S. into 11 geographic areas for incident management and mobilization of resources to address wildland fires. The centers' primary mission is to serve federal and state wildland fire agencies and provide logistical coordination; some of the centers also have programs in predictive services, intelligence and fire information.

Related Resources:

Northern California Geographic Area Coordination Center

<http://gacc.nifc.gov/oncc>

Located in Redding, the Northern California Geographic Area Coordination Center is the focal point for coordinating the mobilization of resources for wildland fire and other incidents throughout Northern California. The "Intelligence" page of the site (<http://gacc.nifc.gov/oncc/predictive/intelligence/index.htm>) includes links to situation reports, maps, news and more.

Southern California Geographic Area Coordination Center

<http://gacc.nifc.gov/oscc>

Located in Riverside, the Southern California Geographic Area Coordination Center provides the same types of information and services as the coordination center serving Northern California. On both California coordination center web pages, the "Incident Information" link goes to the InciWeb web site (see page 6 of this Preliminary Investigation for more information about InciWeb).

Other States' Fire Mapping, Assessment and Warning Tools

This section includes some of the fire mapping, risk assessment and early warning tools available to serve specific states or regions of the U.S. outside of California. We also include publications that address best practices for Colorado and Texas DOTs in responding to wildfires.

Regional

Southern Wildfire Risk Assessment Portal (SouthWRAP), Southern Group of State Foresters.

<http://www.southernwildfirerisk.com/>

The Southern Wildfire Risk Assessment (SWRA) is considered the first successful regional wildfire risk assessment in the nation. Sponsored by the Southern Group of State Foresters, managed by Texas A&M Forest Service and completed in 2006 for the 13 southern states, SWRA provides the baseline for fire protection planning in the South.

The site offers public and professional applications. The web site says this about the professional version:

The Professional Viewer is a web mapping application designed to support community wildfire protection planning needs of government officials, fire planners and hazard mitigation planners. The application contains advanced capabilities and additional map themes compared to the Public Viewer. The key features of the application include the capability to define a project area, generate a detailed risk summary report, generate quick maps, and export and download the wildfire risk GIS data.

Southwest Coordination Center

<http://gacc.nifc.gov/swcc/index.htm>

Located in Albuquerque, NM, the Southwest Coordination Center (SWCC) is an interagency office that coordinates resources for wildland fire, prescribed fire and other incidents within the southwest area (including Arizona, New Mexico, and western Oklahoma and Texas). The SWCC also provides predictive services and intelligence-related products such as maps, documentation of incidents, and outlooks.

Arizona

Arizona Interagency Wildfire Prevention, State of Arizona.

<http://www.wildlandfire.az.gov/default.asp>

This interagency effort by federal and state agencies in Arizona provides fire-related news, information and maps. Information for this site is taken from the most recent data available from the Southwest Coordination Center (see citation above) and includes fire weather, fire potential outlook and Arizona InciWeb updates.

Colorado

Assessment Tools

Colorado Wildfire Risk Assessment Portal (WRAP), Colorado State Forest Service.

<http://www.coloradowildfirerisk.com/>

Colorado WRAP is a web mapping tool with two viewers: a public viewer to “identify your risk” and a professional viewer to “support your fire protection plans.” Colorado WRAP is a suite of applications that provide the baseline information needed by state and local government planners to support fire mitigation and prevention efforts across the state.

DOT Responsibilities and Best Practices

“**2012 Waldo Canyon Fire, Colorado Springs, CO,**” David Watt, Colorado DOT, *AASHTO Extreme Weather Event Symposium*, May 21, 2013.

http://environment.transportation.org/pdf/2013_symposium/1_4_watt_aashto_waldo_canyon_presentation_dmw_1.pdf

This presentation highlights Colorado DOT’s response to the 2012 Waldo Canyon Fire during and after the fire. See slides 10 and 11 for lessons learned, including the need to find opportunities to integrate CDOT into the community command.

Florida

Assessment Tools

Fire Management Information System (FMIS) Mapping Tool, Florida Forest Service, Florida Department of Agriculture and Consumer Services.

<http://www.freshfromflorida.com/Divisions-Offices/Florida-Forest-Service/Wildland-Fire/Resources/Fire-Tools-and-Downloads/Fire-Management-Information-System-FMIS-Mapping-Tool>

From the web site: The Florida Forest Service was one of the first in the nation to offer an Internet-based mapping tool that allows the general public to access information concerning fire management activity on a statewide basis from one location. This tool is available to assist Florida Forest Service cooperators as well as the public at large in assessing what their local concerns might be at any time relating to forest/brush fires in Florida. Using this tool, it is possible to see where all existing/active wildfires are in Florida, where all open burn authorizations are or are planned to be on any particular day, and other incidents that the Florida Forest Service has responsibility for resolving. These data are real-time. The map will update as incidents occur.

Related Resource:

Fire Management Information Systems (FMIS) Mapping System, Florida Forest Service, Florida Department of Agriculture and Consumer Services.

<http://tlhfor013.doacs.state.fl.us/fmisdataviewer/>

This link provides direct access to the mapping system, which offers a range of options for map overlays. A mobile version is available at

<http://tlhfor013.doacs.state.fl.us/mobilefire/>.

Florida's Wildland Fire Risk Assessment System (FRAS), Florida Forest Service, Florida Department of Agriculture and Consumer Services.

<http://www.freshfromflorida.com/Divisions-Offices/Florida-Forest-Service/Wildland-Fire/Resources/Fire-Tools-and-Downloads/Florida-s-Wildland-Fire-Risk-Assessment-System-FRAS>

Similar to the wildfire risk assessment tools described above, this GIS tool helps Florida stakeholders become familiar with wildland fire areas of concern and select mitigation practices. The software required to run the application includes ESRI's ArcGIS Desktop 9.3; Spatial Analyst extension (not required to view data but necessary for editing); and FlamMap, a publicly available fire behavior mapping and analysis program that computes potential fire behavior characteristics (spread rate, flame length, fireline intensity, etc.). For more on FlamMap, see <http://www.firelab.org/project/flammap>.

Smoke Screening Tool, Florida Forest Service, Florida Department of Agriculture and Consumer Services.

<http://www.freshfromflorida.com/Divisions-Offices/Florida-Forest-Service/Wildland-Fire/Resources/Fire-Tools-and-Downloads/Smoke-Screening-Tool>

This web-based tool uses forecasted weather data to create a view of the potential impacts from a smoke plume. While primarily designed to allow individuals who are planning on conducting a planned burn to view a predicted smoke plume for the burn, the tool can be used by anyone.

Wildland Fire, Florida Forest Service, Florida Department of Agriculture and Consumer Services.

<http://www.freshfromflorida.com/Divisions-Offices/Florida-Forest-Service/Wildland-Fire>

In addition to the specific tools described above, this web page offers links and resources that provide current information on wildfires in Florida.

DOT Responsibilities and Best Practices

The State of Florida Wildfire Operations Annex to the State of Florida Comprehensive Emergency Management Plan, Florida State Emergency Response Team, February 2012.

<http://floridadisaster.org/documents/CEMP/2012/2012%20Wildfire%20Annex%20to%20the%20CEMP.pdf>

Chapter 5 of this plan (see page 19 of the PDF) discusses the notification process for active wildfires, the coordination of situation reports and incident action plans. Key points in the process:

- The Florida Forest Service (FFS) State Officer-in-Charge will notify the State Watch Office (SWO) of any significant fires that develop.
- The SWO will contact the FFS State Officer-in-Charge about any significant fires that are reported to the State outside of those reported by FFS.
- FFS will continue to produce a daily wildfire summary, which is available on its web site. The Forest Protection Bureau can be contacted to clarify the raw data on the summary.
- The Florida Division of Emergency Management will extract pertinent information from that site for its situation reports, which will be completed as deemed appropriate for the event.

New Mexico

New Mexico Fire Information

<http://nmfireinfo.com/>

Users of this web site, an interagency effort by federal and state agencies in New Mexico, can register to receive email updates when new information about wildfires is added and email updates from the New Mexico State Forestry's wildfire email alert service. The latter updates are about wildfires on state or private land, not fires burning on federal land such as national forests.

Texas

Assessment Tools

Wildfire Risk Assessment Portal (TxWRAP), Texas A&M Forest Service.

<http://www.texaswildfirerisk.com/>

TxWRAP offers a suite of web-based mapping applications that includes Public and Professional Viewers—the same types of tools available in the Southern Wildfire Risk Assessment and Colorado Wildfire Risk Assessment Portals—as well as a Fire Occurrence Explorer and Community Editor. As with the other assessment portals, the Professional Viewer offers advanced mapping functionality.

Related Resource:

Texas Wildfire Risk Assessment Portal (TxWRAP) User Manual, Texas A&M Forest Service, October 2012.

http://www.texaswildfirerisk.com/help/txwrap_user_manual.pdf

This manual includes detailed instructions for using the Public and Professional Viewers, Fire Occurrence Explorer (a web-based mapping application designed to analyze historical wildfire occurrence data from 2005 to 2009) and the Community Editor (a web-based mapping application that allows approved users to create and manage wildfire assessments at the community level).

Texas Interagency Coordination Center

<http://ticc.tamu.edu/Response/FireActivity/>

This web site is designed to provide the Texas fire community with fire-related information that can be used in daily operations. The site offers fire weather forecasts, fire risk assessments, drought indices and maps of fire activity (current and seven-day). An online fire reporting tool (the Texas Forest Service Fire Reporting Web Application; see <https://tfsfrp.tamu.edu/tfsreporting/>) allows authorized users to enter and view fire reports submitted for Texas Forest Service offices.

DOT Responsibilities and Best Practices

Best Practices for TxDOT on Handling Wildfires, Phillip T. Nash, Sanjaya Senadheera, Micah Beierle, Wesley Kumfer and Dannia Wilson, Texas DOT, August 2012.

<http://www.depts.ttu.edu/techmrtweb/Reports/Complete%20Reports/0-6735-1.pdf>

This report documents lessons learned during recent wildfire events. Staff from 10 TxDOT districts were interviewed along with other stakeholders in the Texas wildfire response community. Data from the research were used to develop regional workshops for TxDOT staff that address the safety and effectiveness of TxDOT personnel in an effort to improve response to future wildfires.

Each district's interview responses appear separately. Questions related to early warning or communication in general include:

- What is the chain of command for wildfire-related action within your district?
- If a wildfire event includes more than one district, how do you handle coordination efforts between districts?
- What are TxDOT's responsibilities in notifying the general public regarding wildfire events? Who is involved in preparing and delivering such notifications?

TxDOT Wildland Fire Management Training, Phillip T. Nash, Sanjaya Senadheera, Micah Beierle and Wesley Kumfer, Texas DOT, September 2013.

<http://www.depts.ttu.edu/techmrtweb/Reports/Products/0-6735-P1%20Final.pdf>

From the abstract: This document consists of slides from a Wildland Fire Management Training workshop aimed at directors of operations/maintenance, area engineers, maintenance managers, maintenance supervisors, assistants and crew chiefs. The workshop was divided into six learning modules, including organization and communication, resources and equipment, safety, documentation and data collection, and training programs.

“Casteel on TxDOT’s Wildfire Response: ‘This Is What We Do’,” TxDOT Statewide Podcast, September 16, 2011.

<http://ftp.dot.state.tx.us/pub/txdot-info/podcasts/statewide/casteel2011wildfires.mp3>

This podcast features David Casteel, TxDOT’s Assistant Executive Director for Field and District Operations, who addresses TxDOT’s role in responding to statewide emergencies, including wildfires.

“Fueling Texas Wildfire Efforts,” TxDOT Statewide Podcast, April 29, 2011.

<http://ftp.dot.state.tx.us/pub/txdot-info/podcasts/statewide/bazewildfireassistance.mp3>

This podcast addresses TxDOT’s role in 2011’s firefighting effort with Carla Baze, TxDOT’s Emergency Management Coordinator. TxDOT is part of the Emergency Management Council and participates in the response to wildfires by clearing fire breaks and providing fuel.

National Fire Mapping, Assessment and Warning Tools

Below we highlight web-based mapping programs available through the U.S. Forest Service, NASA and the U.S. Geological Survey that provide near real-time views of current wildland fires. Also included are maps and other tools or resources used to provide forecasts or early warning of the potential for wildland fires.

Fire Mapping

Active Fire Mapping Program, Remote Sensing Applications Center, U.S. Forest Service, U.S. Department of Agriculture.

<http://activefiremaps.fs.fed.us/>

The Forest Service's MODIS (MODerate Resolution Imaging Spectroradiometer) Active Fire Mapping Program "provides a near real-time geospatial overview of the current wildland fire situation at regional and national scales. Locations of current fires and the extent of previous fire activity are ascertained using satellite imagery acquired by the MODIS sensor. These fire data are integrated with various sources of contextual spatial data and information in a suite of geospatial data and mapping products. This information is utilized by fire managers to assess the current fire situation and serves as a decision support tool in strategic decisions regarding fire suppression resource allocation."

The mapping program provides active fire detection and monitoring for all 50 states and Canada. MODIS data are processed within one hour of acquisition and made available on the web site immediately following processing. Maps are available as a PDF plot or JPEG image. Fire detection GIS data is available for the most recent seven-day period.

Fire Information for Resource Management System (FIRMS), Earth Observing System Data and Information System, National Aeronautics and Space Administration (NASA).

<https://earthdata.nasa.gov/data/near-real-time-data/firms>

This web site offers a range of resources to identify hotspots and fire locations using near real-time data. For data older than the last seven days, the site provides an Archive Download Tool to extract fire locations. Active fire data can be downloaded as shape files; other file types supported by FIRMS include Keyhole Markup Language, Open GIS Consortium standard Web Map Service interface, and text files.

Other resources available through FIRMS:

- Email alerts. Receive notification of fires in an area of interest through email alerts that can be delivered in near real time or as daily or weekly summaries.
- Web Fire Mapper (see <https://firms.modaps.eosdis.nasa.gov/firemap/>). Interactively browse daily global MODIS fire locations and monthly burned areas through Web Fire Mapper. For selected regions and countries, users can view an interactive map showing active fires for a specified time period, combined with a choice of GIS layers and satellite imagery. The tool also provides information on temperature and certainty and monthly burned area information, but does not provide forecast-related products.

Related Resource:

“Fire Information for Resource Management System (FIRMS),” Diane Davies, Chris Justice, Jacques Descloitres, John Latham and John Musinsky, Department of Geography, University of Maryland, SSAI/NASA Goddard Space Flight Center, United Nations Food and Agricultural Organization, Conservation International, undated.

<http://www.oas.org/dsd/AAPAD2/Workshops/Amazonas/Diane%20Davies.pdf>

This presentation provides an introduction to FIRMS, a project funded by NASA to deliver satellite-derived fire information in easy-to-use formats; an introduction to the MODIS sensor (active fire information is derived from the MODIS sensor onboard NASA’s Aqua and Terra satellites); a discussion of FIRMS products; and next steps.

Geospatial Multi-Agency Coordination (GeoMAC), Wildland Fire Support, U.S. Geological Survey, U.S. Department of the Interior.

<http://www.geomac.gov/>

GeoMAC is a web-based mapping application that provides access to online maps of current fire locations and perimeters using standard web browsers. From the web site:

How GeoMAC Works

In order to give fire managers near real-time information, fire perimeter data is updated daily based upon input from incident intelligence sources, GPS data, and infrared (IR) imagery from fixed wing and satellite platforms. The GeoMAC web site allows users in remote locations to manipulate map information displays, zoom in and out to display fire information at various scales and detail, and print hard copy maps for use in fire information and media briefings, dispatch offices and coordination centers. The fire maps also have relational databases in which the user can display information on individual fires such as current acreage and other fire status information.

Assessment and Warning

National Weather Hazards, National Weather Service, National Oceanic and Atmospheric Administration.

<http://www.nws.noaa.gov/largemap.php>

The map on this web page displays active watches, warnings, advisories and short-term forecasts in the lower 48 states. The page automatically refreshes every five minutes. See the locations of “Red Flag Warnings” to identify areas of wildfire threat. The site’s definition of “Red Flag Warnings”:

A Red Flag Warning means that critical fire weather conditions are either occurring now, or will shortly. A combination of strong winds, low relative humidity, and warm temperatures will create explosive fire potential.

Related Resource:

iNWS (Interactive NWS), National Weather Service Mobile Decision Support Services, National Weather Service, National Oceanic and Atmospheric Administration.

<http://inws.wrh.noaa.gov/>

This experimental service permits National Weather Service core partners (including emergency managers, community leaders and other government agencies) to register for an iNWS account to receive customized alerts for NWS products by phone and email. Available alerts include those related to Fire Weather (Red Flag and Rangeland Fire Danger).

National Interagency Fire Center (NIFC)

www.nifc.gov

Located in Boise, ID, the National Interagency Fire Center is “the nation’s primary logistical support center for wildland fire suppression.” NIFC works with state and local agencies to provide a national response to wildfire and other emergencies and serve as a focal point for wildland fire information and technology.

The web site provides current fire information, which includes daily incident management situation reports (see <http://www.nifc.gov/nicc/sitreprt.pdf> for an example), National Weather Service fire weather forecasts, national fire news, and information about and links to cooperating agencies. The Geographic Area Coordination Centers, or GACCs, are part of NIFC; see page 9 of this Preliminary Investigation for more information about GACCs.

Wildland Fire Assessment System (WFAS), U.S. Forest Service.

<http://www.wfas.net/>

Tools available from this web site include:

- Fire danger point forecast tool. A simple point forecast interface that produces seven-day fire danger forecasts.
- Google Earth map data. Point-based map data in a Google Earth-compatible format. The files are updated daily and include current weather, fire danger and fuel moisture observations as well as forecast weather conditions when available.
- Fire danger forecasts. WFAS developers use seven-day forecasts from the National Weather Service to estimate future fire danger. These fire danger forecasts are produced at 6 a.m. Mountain Time each day for the current day and the next six days.

Wildland Fire Decision Support System (WFDSS), U.S. Department of Interior.

<http://www.doi.gov/pmb/owf/wfdss.cfm>

(Users log in from http://wfdss.usgs.gov/wfdss/WFDSS_Home.shtml.)

WFDSS combines desktop applications for fire modeling into a web-based system for easier data acquisition and sharing of analyses and reports across all levels of the federal wildland fire response.

Related Resource:

Wildland Fire Air Quality Tools Portal, U.S. Forest Service AirFire Research Team, Wildland Fire Decision Support System, Desert Research Institute's Center for Fire Ecological Applications, Sonoma Technology, Inc.

<http://firesmoke.us/wfdss/>

Developed to be a one-stop portal for air quality tools, this site connects the tools available on the site with the WFDSS to eliminate duplication of data entry. Tools available through the site include:

- Smoke guidance point forecast.
- Smoke guidance regional maps.
- Current air quality conditions map.
- Fire information and smoke trajectories.

International Fire Mapping, Assessment and Warning Tools

This section presents selected tools or methods for assessing fire danger, mapping active fires or providing warning of potential fire danger for users outside the U.S.

Fire Mapping

Global

Global Fire Monitoring Center

<http://www.fire.uni-freiburg.de/>

This web-based global portal provides wildland fire documentation, information and monitoring. Regularly updated national to global wildland fire products are generated by a worldwide network of cooperating institutions. The online and offline products include early warning of fire danger and near-real time monitoring of fire events.

Canada

Canadian Wildland Fire Information System (CWFIS), Natural Resources Canada, Government of Canada.

<http://cwfis.cfs.nrcan.gc.ca/home>

From the web site: The Canadian Wildland Fire Information System is a computer-based fire management information system that monitors fire danger conditions across Canada. Daily weather conditions are collected from across Canada and used to produce fire weather and fire behavior maps. In addition, satellites are used to detect fires.

Available from the site:

- Fire Weather and Fire Behavior show national maps of current and archived forest fire conditions.
- Fire M3 Hotspots shows fires detected by remote sensing, featuring near-real time imagery.

The site also includes the National Wildland Fire Situation Report and the CWFIS datamart, which includes point data for the national fire and large fire databases that can be viewed, mapped and downloaded.

Europe

European Forest Fire Information System, Joint Research Centre-Forest Action, European Commission.

<http://forest.jrc.ec.europa.eu/effis/>

This site includes “the most up-to-date information on the current fire season in Europe and in the Mediterranean area. This includes today’s meteorological fire danger maps and forecasts up to 6 days, and daily updated maps of hot spots and fire perimeters.”

Assessment and Warning

Australia

South Australian Country Fire Service, Government of South Australia.

http://www.cfs.sa.gov.au/site/warnings_and_incidents.jsp

Information on this web site includes bans and ratings, warnings and incidents, and maps with layer options that include wind, safer places, fire ban districts, last resort, and safer settlement.

Canada

Canadian Interagency Forest Fire Centre

www.cifffc.ca/

From the web site: The Canadian Interagency Forest Fire Centre (CIFFC) provides operational fire-control services, as well as management and information services to its member agencies. In addition to coordinating services for all of the provinces and territories of Canada, CIFFC often coordinates the sharing of resources with the United States and other countries. The CIFFC Web site provides the public with information about the centre and its activities. It also contains a link to *FireWire*, CIFFC's online fire reporting system, which provides up-to-the-minute bulletins, situation reports, and other data, as well as other online information, publications lists, and an event calendar.

New Zealand

National Rural Fire Authority, New Zealand.

<http://www.nrfa.org.nz/Pages/default.aspx>

This site provides weather forecasts, forecasts of daily fire danger and monthly severity comparisons.