

Oklahoma Emergency Manager Use of Fire Weather Forecasts and Products

David Hogg^{1,2,3}, Holly Obermeier^{1,2}, Taylor Maciag^{1,2}, Makenzie Krocak^{2,3}, Kodi Berry², Anna Wanless³, Sam Stormer³, Todd Lindley⁴, Drew Daily⁵

¹Cooperative Institute for Severe and High-Impact Weather Research and Operations, The University of Oklahoma, Norman, Oklahoma

²NOAA/OAR/National Severe Storms Laboratory, Norman, Oklahoma

³Institute for Public Policy, Research, and Analysis, The University of Oklahoma, Norman, Oklahoma

⁴NOAA/NWS Norman, Oklahoma

⁵Oklahoma Forestry Service, Oklahoma Department of Agriculture, Food and Forestry, Oklahoma City, Oklahoma

ABSTRACT

During the spring of 2023, two large wildfires occurred in Oklahoma in or near populated areas. On 31 March, the Simpson Road Fire occurred in the heavily populated area of the northern Oklahoma City metropolitan area. On 4 April, the Route 66 Fire occurred near the town of Weatherford. Both wildfires caused significant damage, but no fatalities. During these events, the Norman, OK, National Weather Service forecast office initiated what is known as the “integrated team fire warning process” in which forecasters detected potentially dangerous fires via GOES-16 satellite imagery. Following the detections, forecasters then worked alongside both Oklahoma Forestry Services (OFS) and local emergency management, who then requested that NWS Norman disseminate polygon-based Fire Warnings. These events highlighted that though NWS Norman had quickly and accurately detected the fires and coordinated the issuance of Fire Warnings with OFS through an Integrated Warning Team approach, less is known about how the Fire Warnings (and fire weather products in general) are understood, communicated, and used, particularly among other emergency managers. Thus, researchers developed and distributed a survey to emergency managers in Oklahoma to obtain a baseline knowledge of their understanding and use of fire weather information and products, operational procedures during fire weather conditions and ongoing fires, and how Fire Warnings were received and disseminated. Survey results indicate that emergency managers in Oklahoma recognize wildfires as a significant risk for their jurisdictions, with 70% rating the risk wildfires pose to their jurisdiction as “High” or “Very High.” Due to this level of threat awareness, emergency managers reported seeking out or receiving fire weather forecast information from a number of sources, including their local National Weather Service Forecast Office and Oklahoma Forestry Service.

1. Introduction

a. Background/Motivation

In the event of wildland fire, emergency managers provide vital information to communities and manage crucial resources at local scales and beyond. As many National Weather Service (NWS) local forecast offices seek to strengthen their partnerships during fire weather events, and as forecasters transition to a “science first responder” role, thoroughly understanding emergency managers’ role in response to wildfires is paramount. During the spring of 2023, two large wildfires occurred in Oklahoma in wildland urban interface zones (U.S. Fire Administration 2024) . On 31 March, the Simpson Road Fire occurred in the northern Oklahoma City metropolitan area. On 4 April, the Route 66 Fire occurred near the town of Weatherford, OK. Both wildfires caused significant damage, but no fatalities occurred related to the wildfire incidents. In response to these destructive wildfires, the Norman, OK NWS forecast office issued official Fire Warnings to help warn and evacuate the public. The office used a novel integrated warning team fire procedure, in which forecasters initially sent a “potentially dangerous wildfire detected” hotspot notification (ascertained by GOES-16 satellite imagery) to Oklahoma Forestry Services (Lindley et al. 2016). Upon receiving notification, OFS confirmed the threats to values at risk associated with the wildfires, coordinated with local emergency management/incident commanders, and then requested the dissemination of the Fire Warnings by the NWS. Under this procedure, evacuations occurred successfully and no lives were lost in either wildfire. However, questions remain following the fires, such as exactly how the Fire Warnings were received, communicated and acted upon, particularly by partners in local-level emergency management and incident command. For example, researchers and practitioners were curious if emergency managers understood the process utilized by the NWS for issuing Fire Warnings.

To address these questions and learn more about how partners generally use NWS wildfire forecasts and products, researchers at the OU Cooperative Institute for Severe and High-Impact Weather Research and Operations (CIWRO) and the NOAA National Severe Storms Laboratory (NSSL) developed a survey to specifically ask how emergency managers perceive wildfire risk and prepare and respond to wildfires. Other survey topics included fire weather forecasting sources, active wildfire operations, and usefulness of NWS products for preparation and risk communication. The survey consisted of multiple choice, Likert scale and open-ended qualitative questions. Researchers distributed the surveys to partners in Oklahoma during the fall and winter of 2023-24.

b. Sampling and recruitment

Survey distribution specifically targeted emergency managers across Oklahoma, representing a variety of jurisdiction types and sizes. The survey instrument was shared with representatives from the Oklahoma Emergency Management Association (OEMA) professional organization to be distributed to the organization’s active membership.

Regional leadership used existing contact lists to share a link to the online survey platform, along with language explaining the purpose and expected outcomes of the survey results. Individual survey respondents were asked questions about their jurisdiction type and organizational structure, but no identifiable information was collected. A total of 44 survey responses were collected during the period when the survey tool was open.

To ensure the protection of survey respondents, the questions and the survey protocol were approved by the University of Oklahoma Institutional Review Board (IRB #16492). Average (median) completion time was 15 minutes. Decisions to participate were entirely voluntary.

2. Results and survey instrument

Below is a reproduction of the survey instrument with frequencies or measures of central tendencies for questions with numeric responses, or lists of general themes for questions with verbatim responses.

a. Emergency manager roles

job_title: What is your job title (include any non-emergency management job titles as well; please do not include the name of your jurisdiction)? [VERBATIM]

Job Title	Count*
Emergency Manager	39
Safety Director/Officer	5
Police/Fire/EMS/911	14
Floodplain Manager	4
Other	6

*Note: Many have more than one title.

jurisdiction: What type of jurisdiction does your emergency management agency represent?

1 - County [45.5%, n=20]

2 - City [36.4%, n=16]

3 - Tribal [11.4%, n=5]

4 - State [4.5%, n=2]

5 - Other (please elaborate) [VERBATIM] [2.3%, n=1]

Other responses: "Town"

em_org: How is your local emergency management office organized within your jurisdiction?

1 - Emergency management is part of a local fire department. [9.1%, n=4]

- 2 - Emergency management is part of a local law enforcement agency. [2.3%, n=1]
- 3 - Emergency management is a standalone agency that reports directly to local officials (i.e. county commissioners, city manager, etc.) [72.7%, n=32]
- 4 - Other [VERBATIM] [15.9%, n=7]

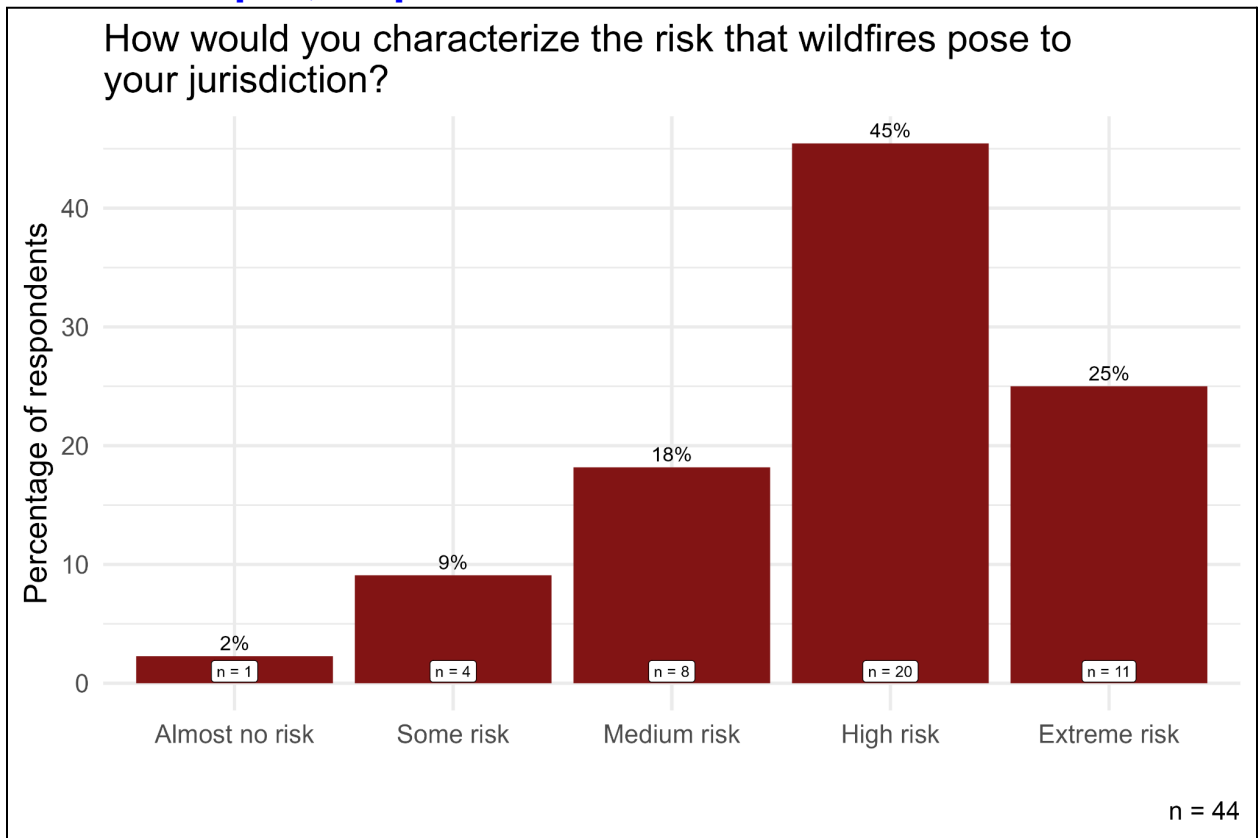
WFO: What is your local National Weather Service Forecast Office? Check all that apply:

- 1 - Amarillo [6.8%, n=3]
- 2 - Norman [79.5%, n=35]
- 3 - Shreveport [2.3%, n=1]
- 4 - Tulsa [25%, n=11]

b. Characterization of Wildfire Risk

fire_risk: How would you characterize the risk that wildfires pose to your jurisdiction? [see graphic below for results]

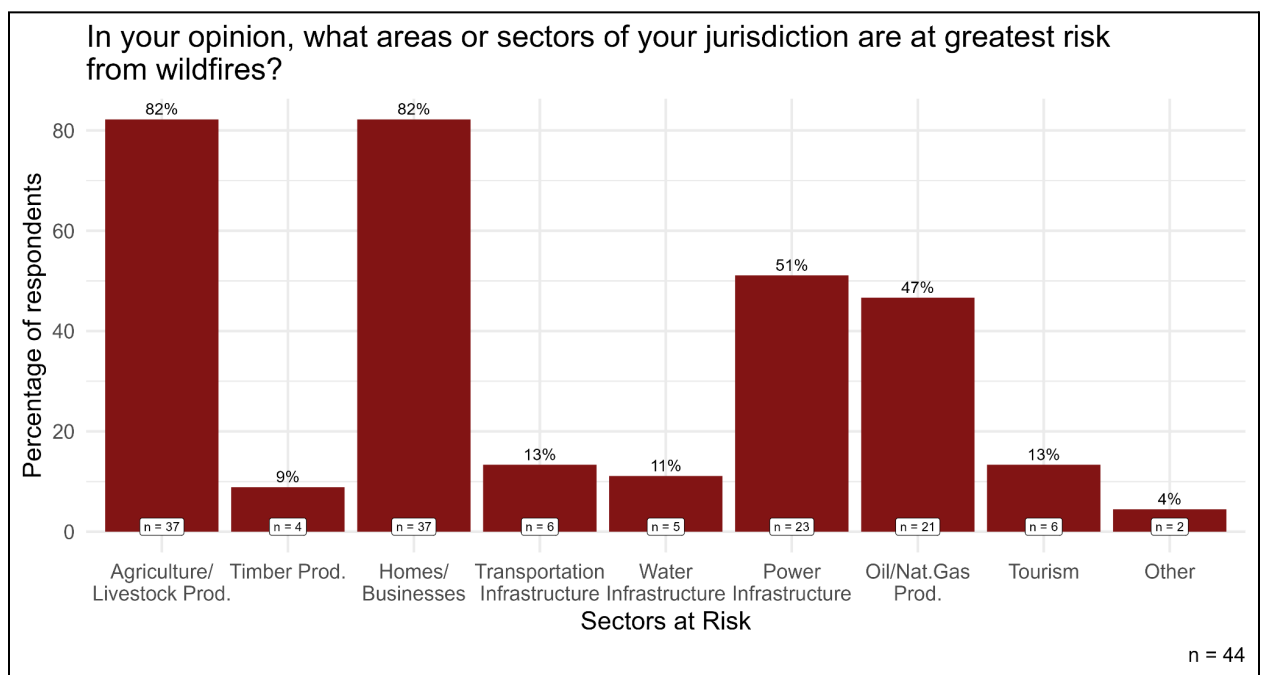
- 1 - Almost no risk [2%, n=1]
- 2 - Some risk [9%, n=4]
- 3 - Medium risk [18%, n=8]
- 4 - High risk [45%, n=20]
- 5 - Extreme risk [25%, n=11]



fire_sector_risk: In your opinion, what areas or sectors of your jurisdiction are at greatest risk from wildfires? Check all that apply:

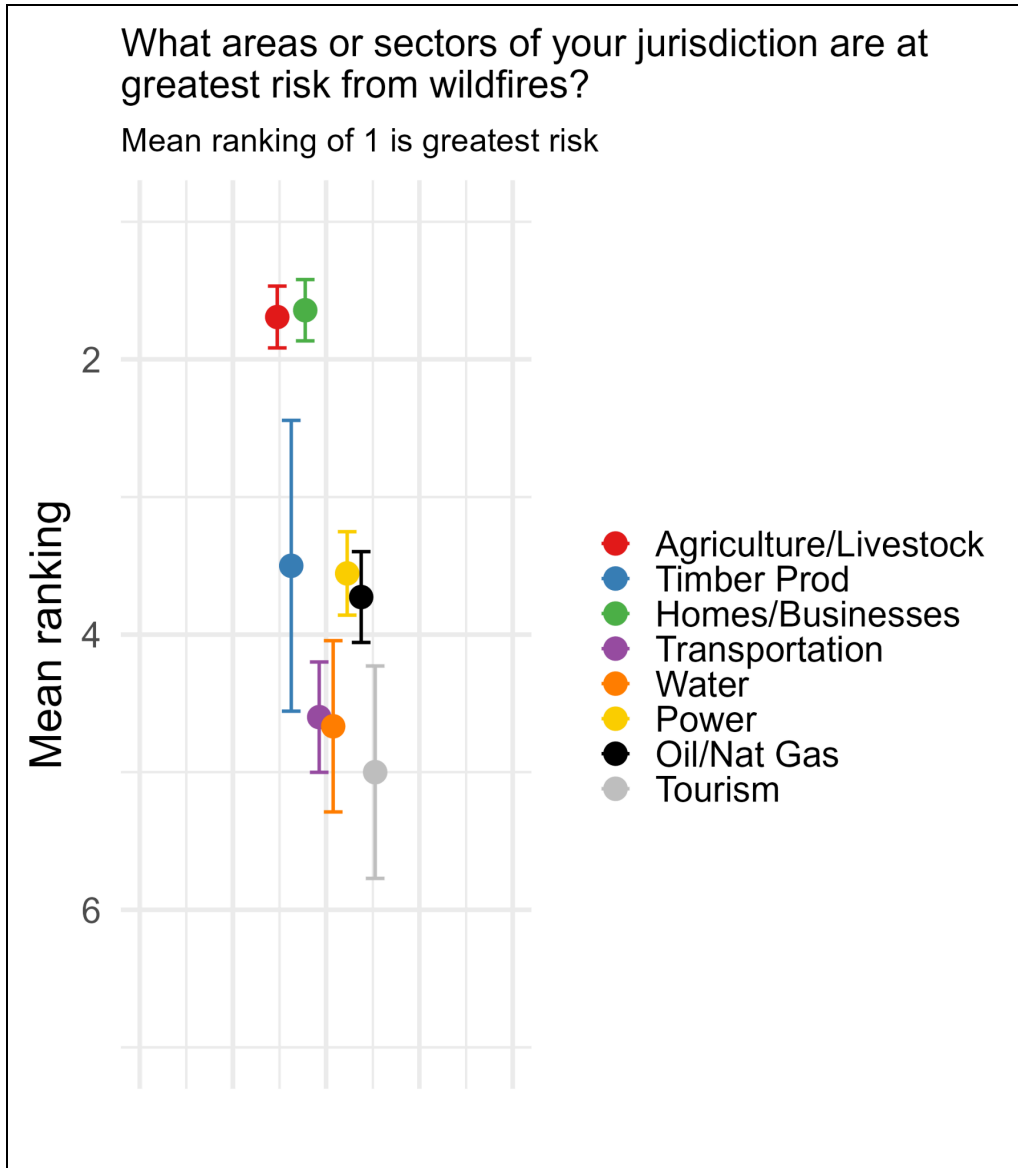
- 1 - Agriculture/Livestock Production [82%, n=37]
- 2 - Timber Production [9%, n=4]
- 3 - Homes/Businesses [82%, n=37]
- 4 - Transportation Infrastructure [13%, n=6]
- 5 - Water Infrastructure [11%, n=5]
- 6 - Power Infrastructure [51%, n=23]
- 7 - Oil/Natural Gas Production [47%, n=21]
- 8 - Tourism [13%, n=6]
- 0 - Other [VERBATIM] [4%, n=2]

Other responses: "Wildlife Refuges, State Park", "...restricted Indian land"



sector_[ag:oth]_rank: Based on the answers you provided in the last question, please rank your choices from greatest risk to lowest risk by dragging and dropping each selection into your preferred order. Values closer to 1/8 indicate greatest/lowest risk.

- 1 - Agriculture/Livestock Production [mean=1.7]
- 2 - Timber Production [mean=3.5]
- 3 - Homes/Businesses [mean=1.6]
- 4 - Transportation Infrastructure [mean=4.6]
- 5 - Water Infrastructure [mean=4.7]
- 6 - Power Infrastructure [mean=3.6]
- 7 - Oil/Natural Gas Production [mean=3.7]
- 8 - Tourism [mean=5.0]
- 0 - Other [VERBATIM] none ranked

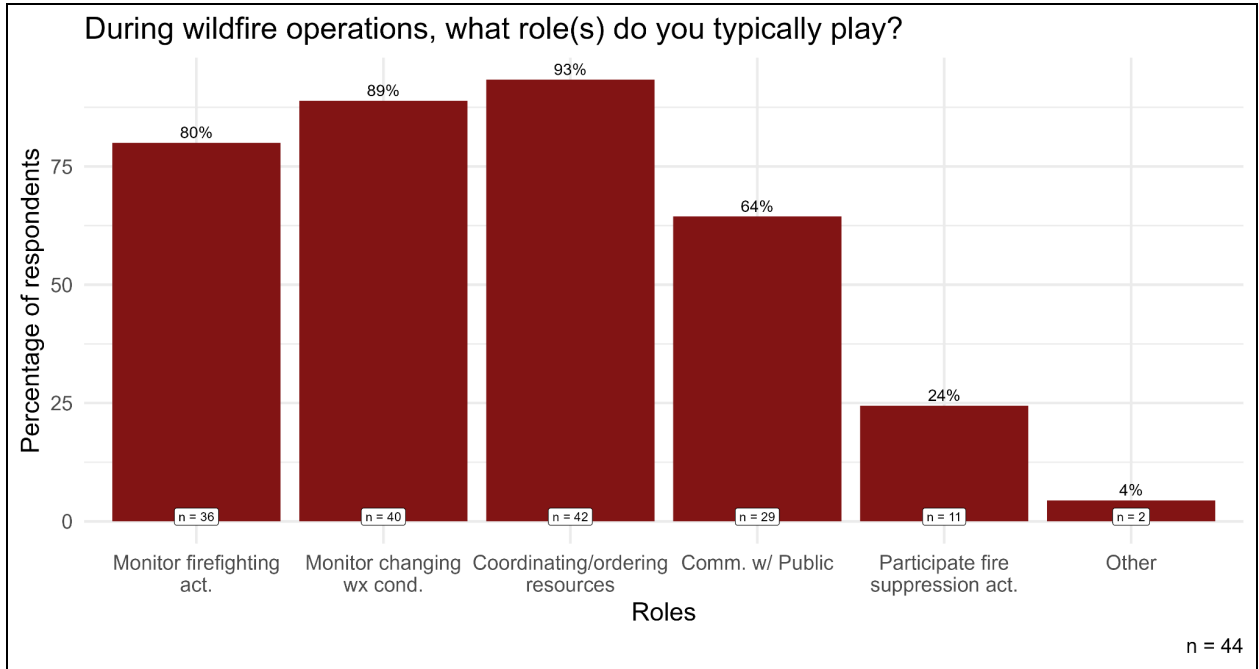


c. *Typical Wildfire Operations*

fire_role: During wildfire operations, what role do you typically play? Check all that apply.

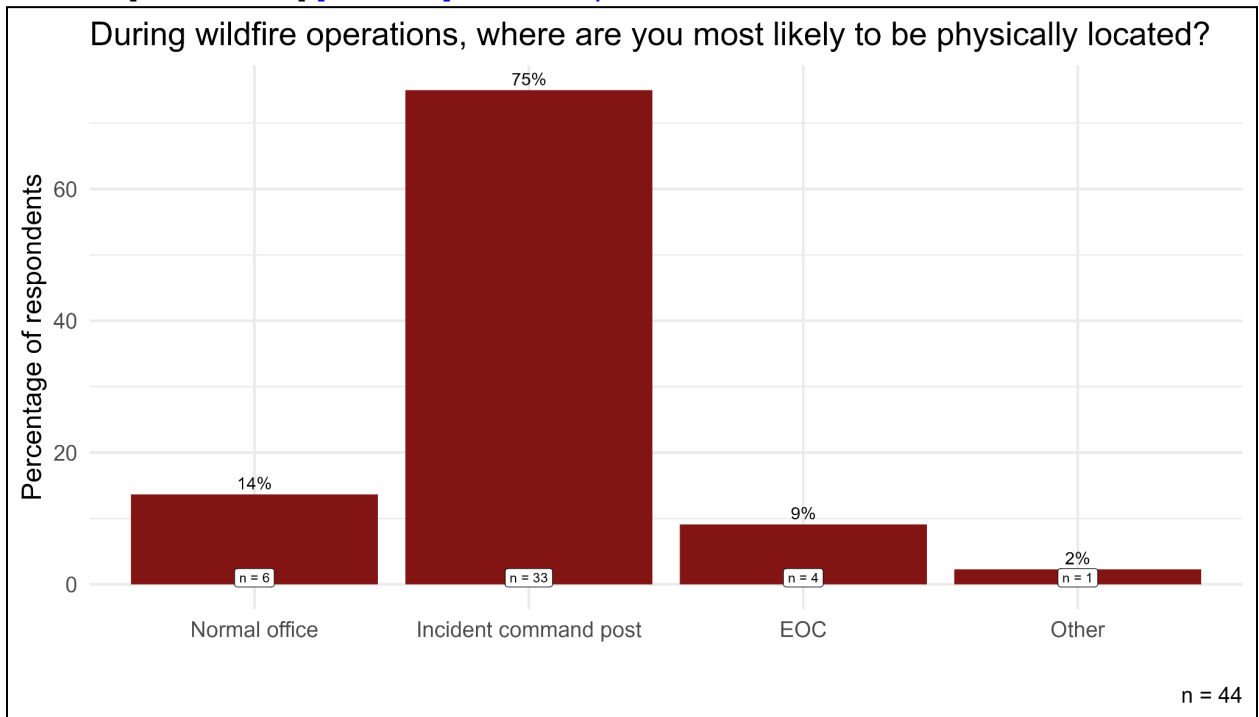
- 1- Monitoring firefighting activities [80%, n=36]
- 2- Monitoring changing weather conditions [89%, n=40]
- 3- Coordinating or ordering resources [93%, n=42]
- 4- Communicating with the public [64%, n=29]
- 5- Actively participating in fire suppression activities [24%, n=11]
- 6- Other [VERBATIM] [4%, n=2]

Other responses: assisting or participating in incident command



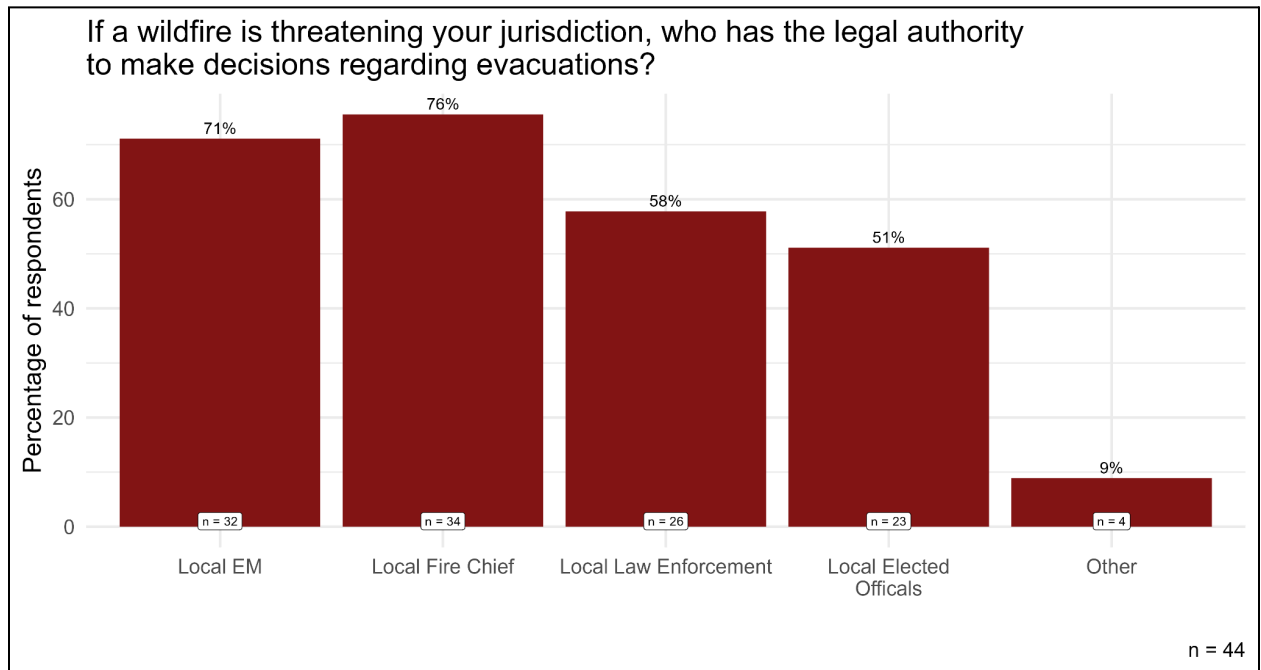
fire_located: During wildfire operations, where are you most likely to be physically located?

- 1- At my normal office or workspace [14%, n=6]
- 2- At a dedicated jurisdictional EOC [9%, n=4]
- 3- At an on-scene incident command post [75%, n=33]
- 4- On a fire apparatus [0%, n=0]
- 5- Other [VERBATIM] [2%, n=1] Other response: in a truck



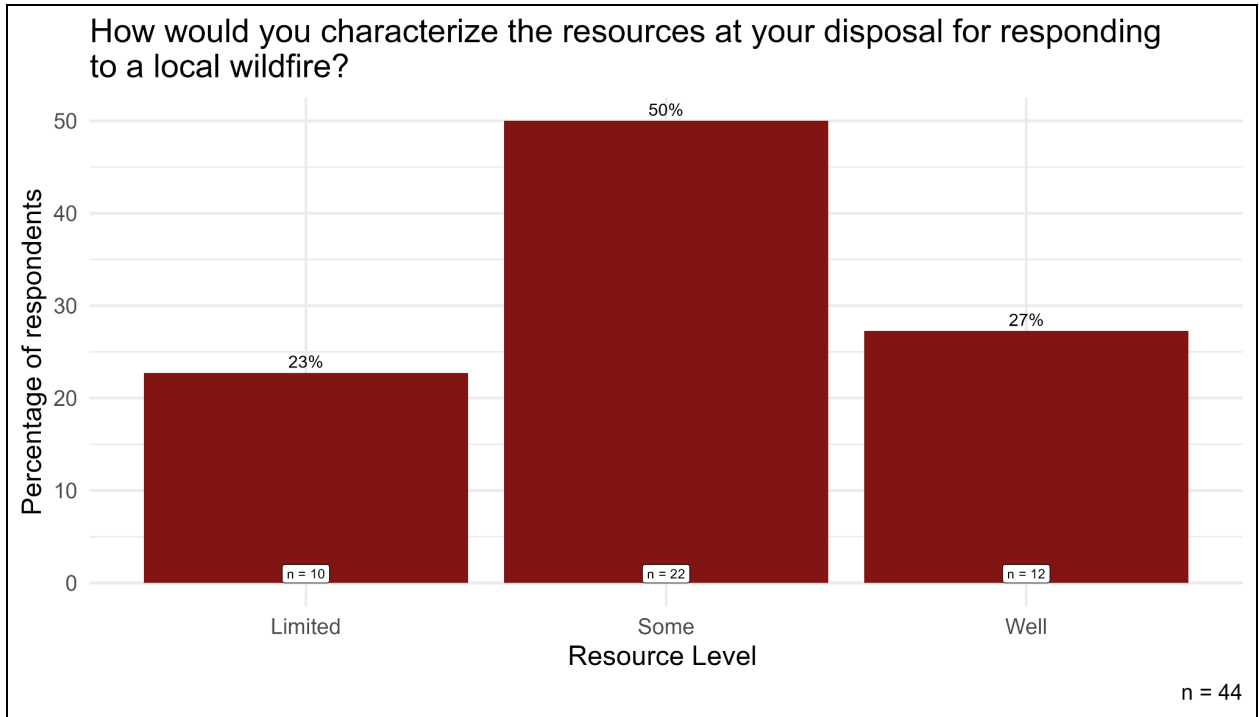
evac_dec: If a wildfire is impacting or threatening your jurisdiction, who has the legal authority to make decisions regarding evacuations? Check all that apply:

- 1- Local Emergency Manager [71%, n=32]
- 2- Local Fire Chief [76%, n=34]
- 3- Local Law Enforcement [58%, n=26]
- 4- Local Elected Officials [51%, n=23]
- 5- Other [VERBATIM] [9%, n=4]



fire_resource: How would you characterize the resources at your disposal for responding to a local wildfire?

- 1- Almost no resources (always request mutual aid) [0%, n=0]
- 2- Limited resources (almost always request mutual aid) [23%, n=10]
- 3- Some resources (frequently request mutual aid) [50%, n=22]
- 4- Well resourced (rarely request mutual aid) [27%, n=12]
- 5- Fully resourced (never request mutual aid) [0%, n=0]

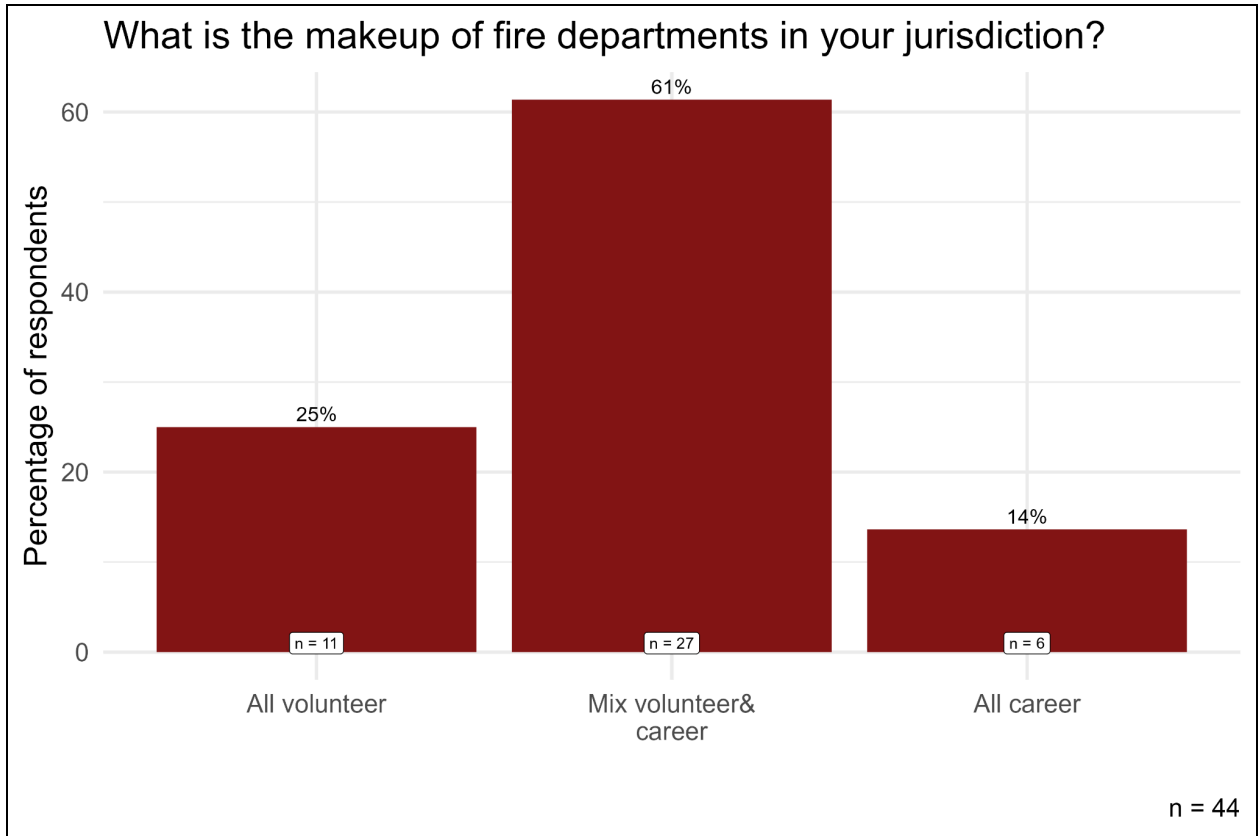


fire_dept: What is the makeup of fire departments in your jurisdiction?

1- All volunteer firefighters [25%, n=11]

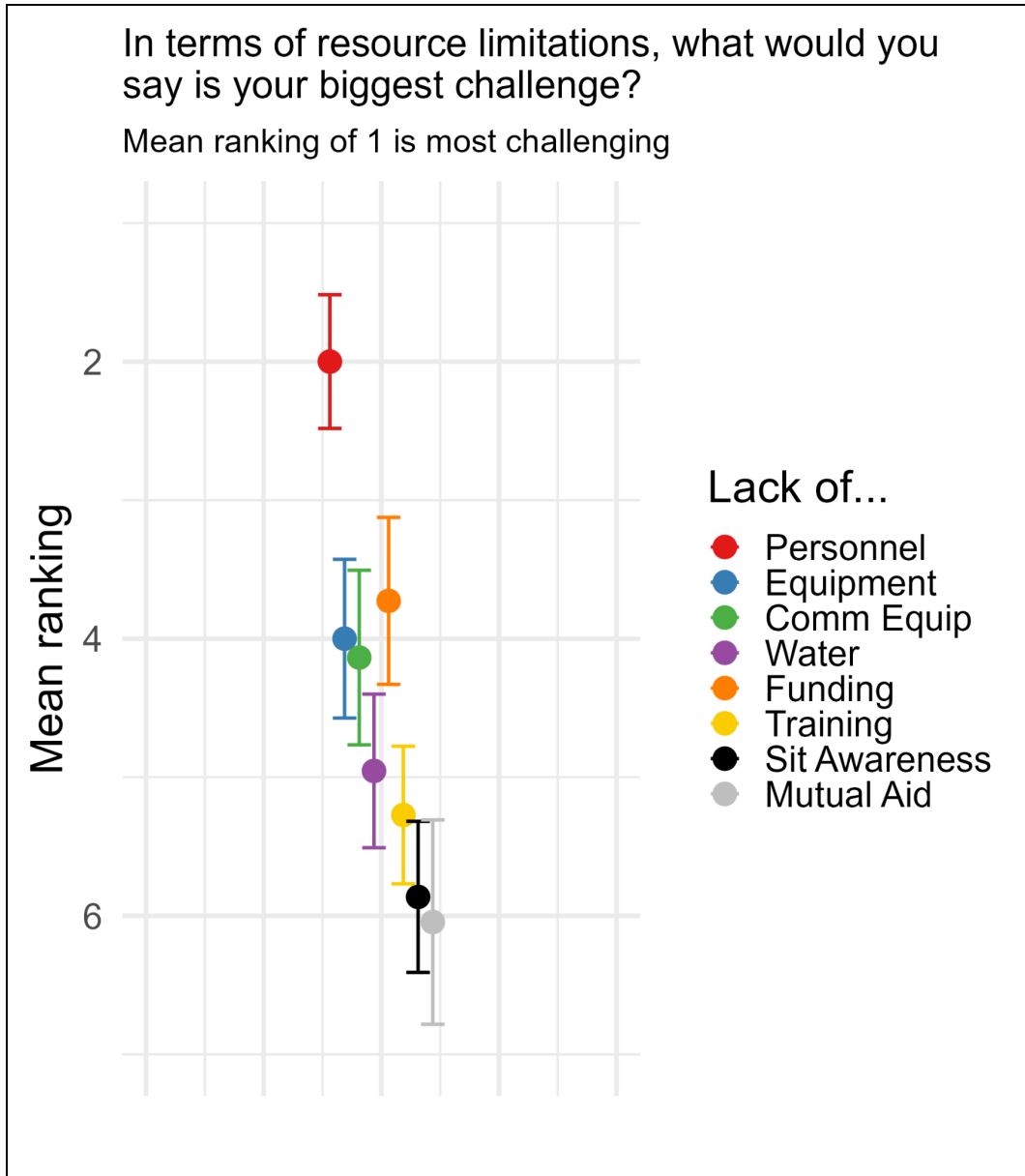
2- A mix of volunteer and career firefighters [61%, n=27]

3- All career firefighters [14%, n=6]



fire_chal_[per:mut]: In terms of resource limitations, what would you say is your biggest challenge? Please rank the following options from Most Challenging to Least Challenging by clicking and dragging the options into your preferred order. **Mean values closer to 1/8 indicate most/least challenging.**

- 1- Lack of personnel [mean=2.0]
- 2- Lack of fire suppression equipment [mean=4.0]
- 3- Lack of interoperable communication equipment [mean=4.1]
- 4- Lack of access to water [mean=5.0]
- 5- Lack of funding [mean=3.7]
- 6- Lack of training [mean=5.3]
- 7- Lack of situational awareness [mean=5.9]
- 8- Lack of timely resource support from mutual aid or state resources [mean=6.1]



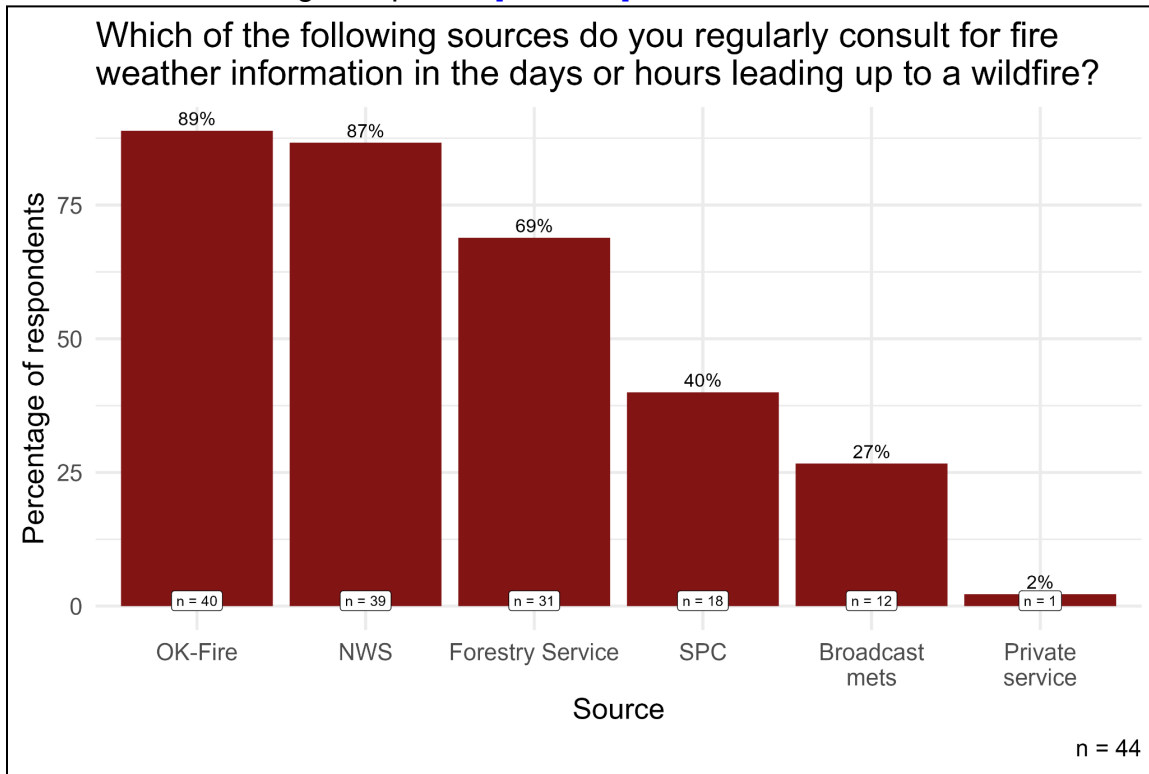
c. *Fire Weather Forecast Information Sources*

Next we would like to know more about weather information you may utilize in fire weather preparedness and operations, with an emphasis on the days and hours leading up to a wildfire.

weather_source: Which of the following sources do you regularly consult for fire weather information in the days or hours leading up to a wildfire? Check all that apply:

- 1- Local National Weather Service Forecast Office [87%, n=39]
- 2- Oklahoma Mesonet/OK-FIRE [89%, n=40]
- 3- Oklahoma Forestry Service [69%, n=31]

- 4- Storm Prediction Center [40%, n=18]
- 5- Local Broadcast Meteorologists [27%, n=12]
- 6- Private Forecasting Companies [2%, n=1]



nws_source: How do you typically receive fire weather forecast information from your local NWS Forecast Office? Check all that apply.

- 1- Email [64%, n=29]
- 2- Social Media [40%, n=18]
- 3- Agency Website [53%, n=24]
- 4- Webinar [62%, n=28]
- 5- Other [VERBATIM] [7%, n=3]

okfire_source: How do you typically receive fire weather forecast information from the Oklahoma Mesonet/OK-FIRE? Check all that apply.

- 1- Email [40%, n=18]
- 2- Social Media [38%, n=17]
- 3- Agency Website [62%, n=28]
- 4- Webinar [31%, n=14]
- 5- Other [VERBATIM] [0%, n=0]

forest_source: How do you typically receive fire weather forecast information from the Oklahoma Forestry Service? Check all that apply.

- 1- Email [56%, n=16]
- 2- Social Media [20%, n=9]
- 3- Agency Website [36%, n=16]

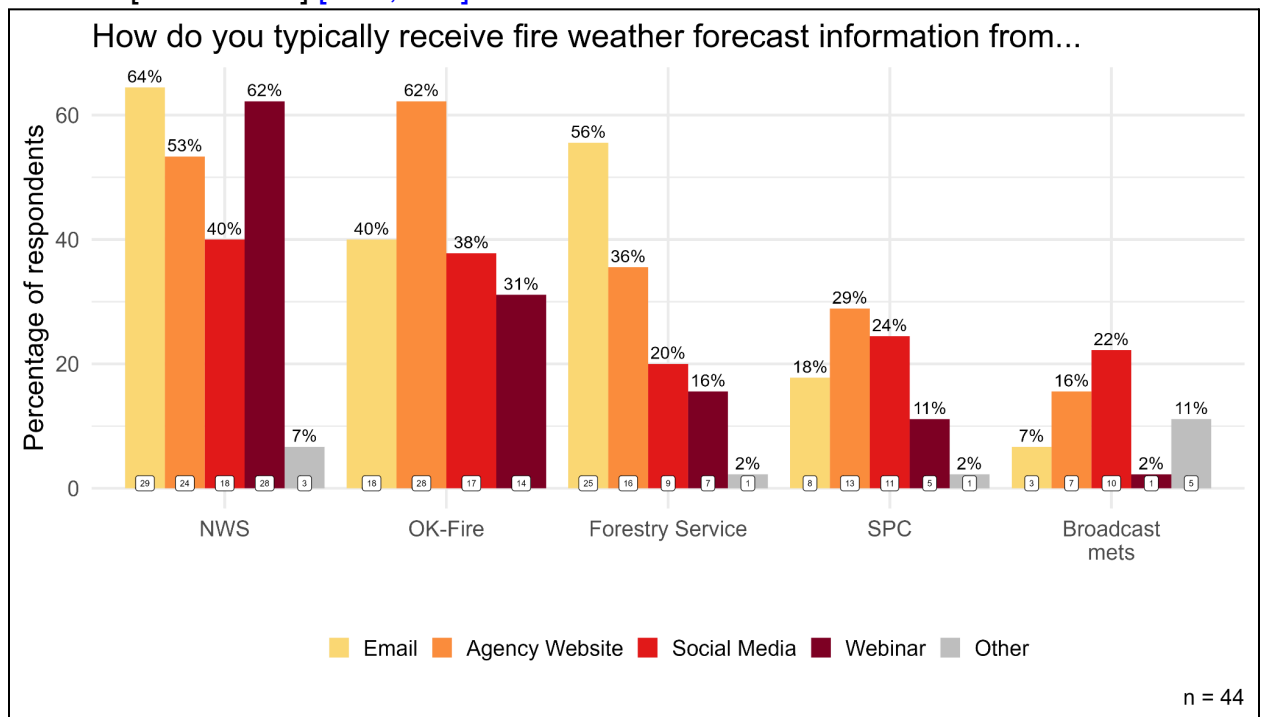
- 4- Webinar [16%, n=7]
- 5- Other [VERBATIM] [2%, n=1]

spc_source: How do you typically receive fire weather forecast information from the Storm Prediction Center? Check all that apply.

- 1- Email [18%, n=8]
- 2- Social Media [24%, n=11]
- 3- Agency Website [29%, n=13]
- 4- Webinar [11%, n=5]
- 5- Other [VERBATIM] [2%, n=1]

bm_source: How do you typically receive fire weather forecast information from local broadcast meteorologists? Check all that apply.

- 1- Email [7%, n=3]
- 2- Social Media [22%, n=10]
- 3- Agency Website [16%, n=7]
- 4- Webinar [2%, n=1]
- 5- Other [VERBATIM] [11%, n=5]



nws_crit: How critical is the information provided by your local NWS Forecast Office to your operations?

- 1- Not at all critical [0%, n=0]
- 2- Somewhat critical [18%, n=7]
- 3- Very critical [41%, n=16]
- 4- Extremely critical [41%, n=16]

okfire_crit: How critical is the information provided by the Oklahoma Mesonet/OK-FIRE to your operations?

- 1- Not at all critical [2%, n=1]
- 2- Somewhat critical [8%, n=3]
- 3- Very critical [57%, n=23]
- 4- Extremely critical [32%, n=13]

forest_crit: How critical is the information provided by the Oklahoma Forestry Service to your operations?

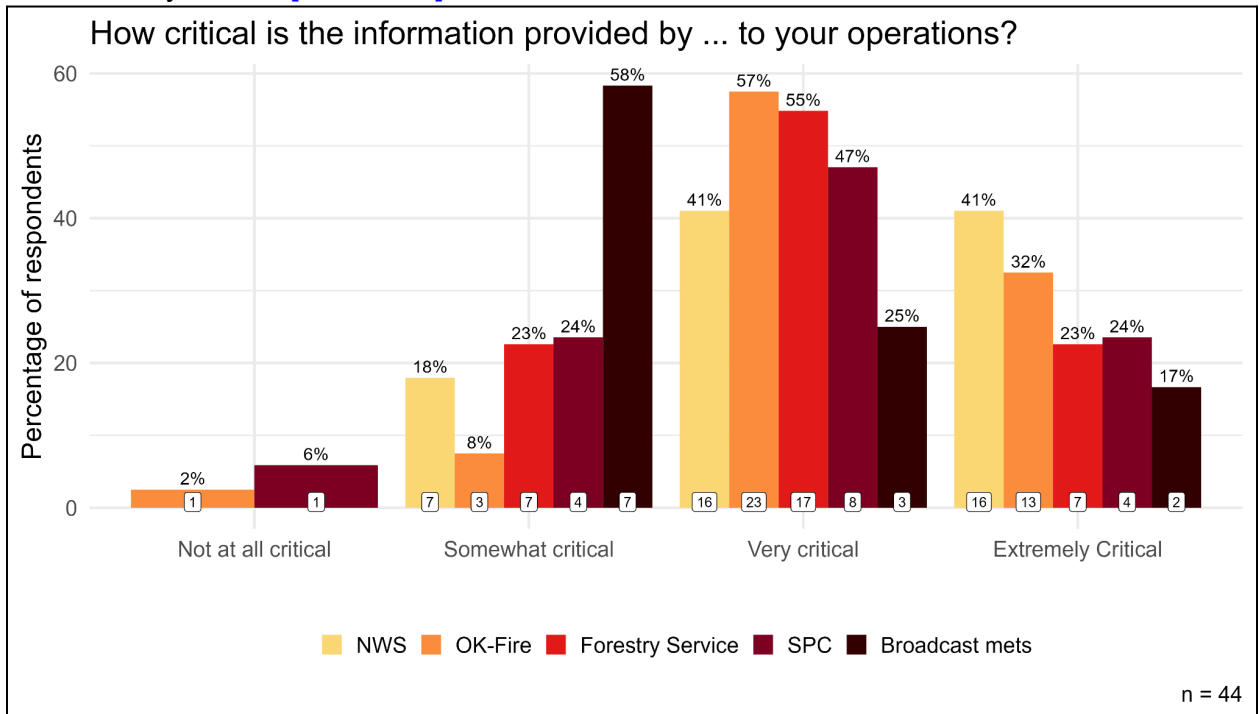
- 1- Not at all critical [0%, n=0]
- 2- Somewhat critical [23%, n=7]
- 3- Very critical [55%, n=17]
- 4- Extremely critical [23%, n=7]

spc_crit: How critical is the information provided by the Storm Prediction Center to your operations?

- 1- Not at all critical [6%, n=1]
- 2- Somewhat critical [24%, n=4]
- 3- Very critical [47%, n=8]
- 4- Extremely critical [24%, n=4]

bm_crit: How critical is the information provided by local broadcast meteorologists to your operations?

- 1- Not at all critical [0%, n=0]
- 2- Somewhat critical [58%, n=7]
- 3- Very critical [25%, n=3]
- 4- Extremely critical [17%, n=2]



nws_share_regular: Do you regularly share fire weather forecasting information from your local NWS Forecast Office?

1- Yes [92%, n=36]

2- No [8%, n=3]

okfire_share_regular: Do you regularly share fire weather forecasting information from the Oklahoma Mesonet/OK-FIRE?

1- Yes [82%, n=33]

2- No [18%, n=7]

forest_share_regular: Do you regularly share fire weather forecasting information from the Oklahoma Forestry Service?

1- Yes [74%, n=23]

2- No [26%, n=8]

spc_share_regular: Do you regularly share fire weather forecasting information from the Storm Prediction Center?

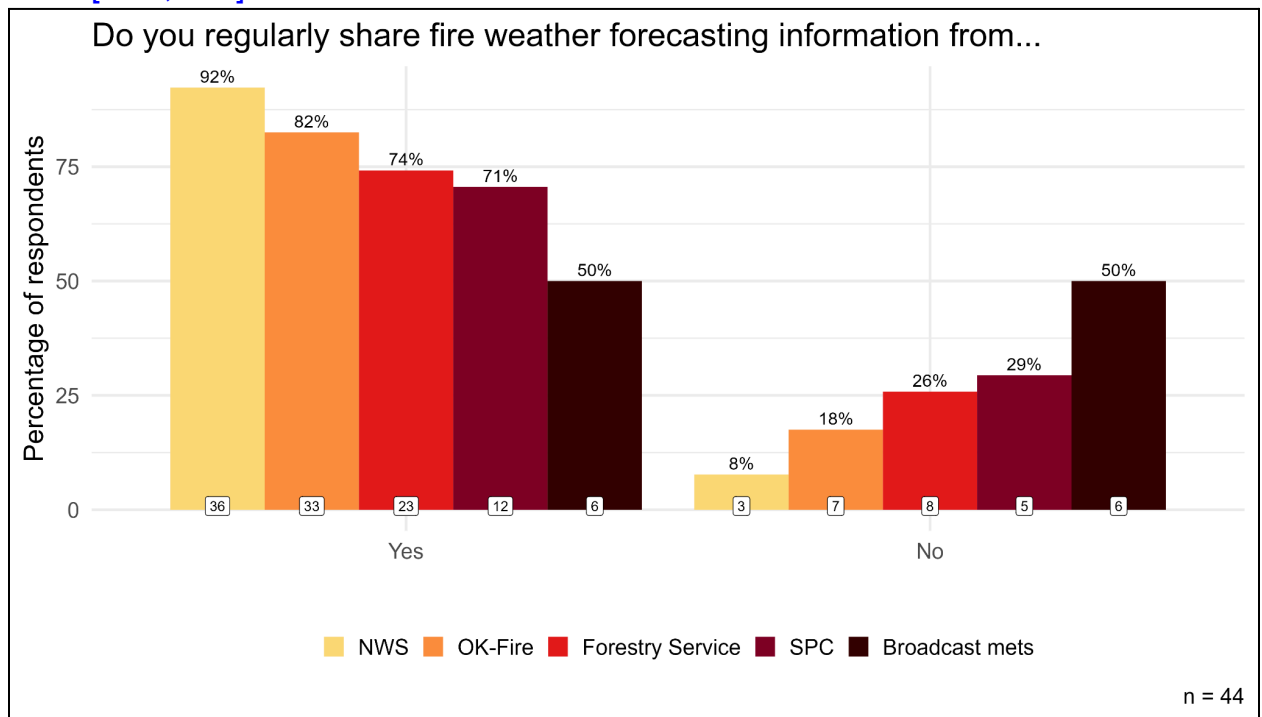
1- Yes [71%, n=12]

2- No [29%, n=5]

bm_share_regular: Do you regularly share fire weather forecasting information from local broadcast meteorologists?

1- Yes [50%, n=6]

2- No [50%, n=6]



nws_share_who: Who do you regularly share fire weather forecasting information from your local NWS Forecast Office with? Check all that apply.

- 1- With fire departments in my jurisdiction [73%, n=33]
- 2- With elected officials [62%, n=28]
- 3- With other response partners [49%, n=22]
- 4- With the public [67%, n=30]

okfire_share_who: Who do you regularly share fire weather forecasting information the Oklahoma Mesonet/OK-FIRE with? Check all that apply.

- 1- With fire departments in my jurisdiction [69%, n=31]
- 2- With elected officials [49%, n=22]
- 3- With other response partners [47%, n=21]
- 4- With the public [53%, n=24]

forest_share_who: Who do you regularly share fire weather forecasting information the Oklahoma Forestry Service with? Check all that apply.

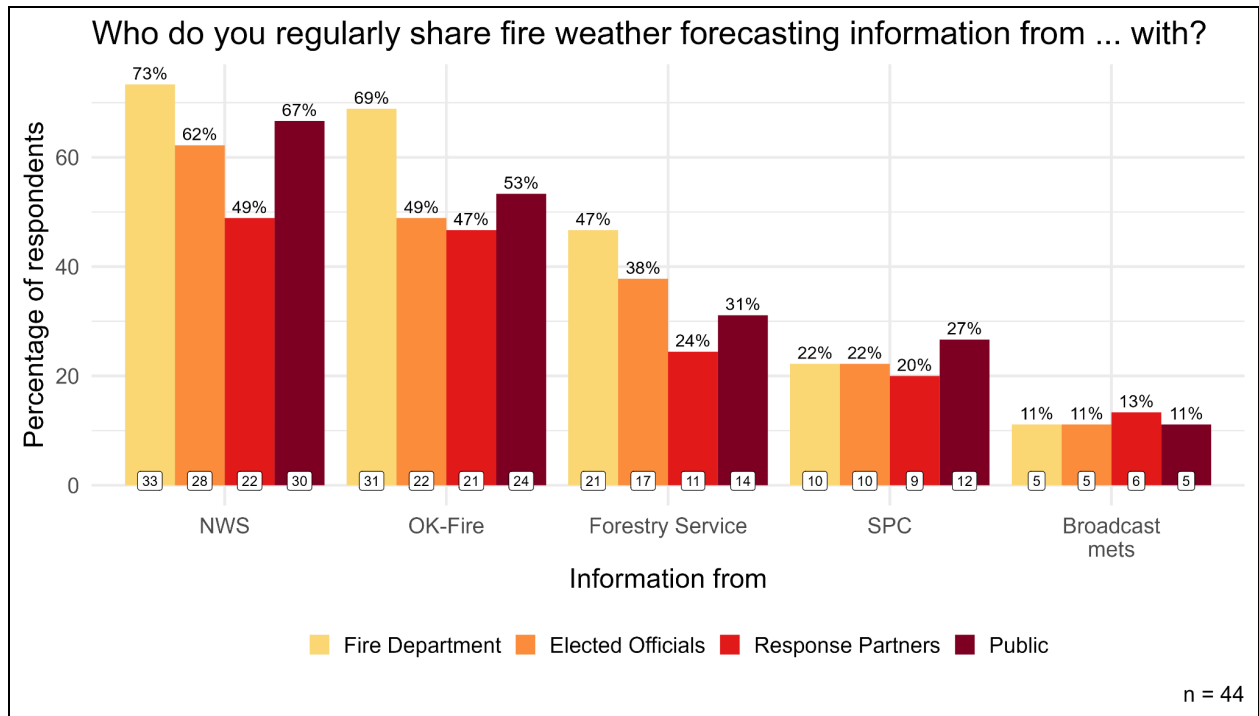
- 1- With fire departments in my jurisdiction [47%, n=21]
- 2- With elected officials [38%, n=17]
- 3- With other response partners [24%, n=11]
- 4- With the public [31%, n=14]

spc_share_who: Who do you regularly share fire weather forecasting information the Storm Prediction Center with? Check all that apply.

- 1- With fire departments in my jurisdiction [22%, n=10]
- 2- With elected officials [22%, n=10]
- 3- With other response partners [20%, n=9]
- 4- With the public [27%, n=12]

bm_share_who: Who do you regularly share fire weather forecasting information local broadcast meteorologists with? Check all that apply.

- 1- With fire departments in my jurisdiction [11%, n=5]
- 2- With elected officials [11%, n=5]
- 3- With other response partners [13%, n=6]
- 4- With the public [11%, n=5]



nws_share_how: How do you typically share fire weather forecast information that you may receive from your local NWS Forecast Office? Check all that apply:

- 1- Email [53%, n=24]
- 2- Social Media [62%, n=28]
- 3- Phone Call [24%, n=11]
- 4- In person briefing [31%, n=14]
- 5- Webinar or video [11%, n=5]
- 6- Mass notification system [40%, n=18]
- 7- Other [VERBATIM] [7%, n=3]

okfire_share_how: How do you typically share fire weather forecast information that you may receive from the Oklahoma Mesonet/OK-FIRE? Check all that apply.

- 1- Email [42%, n=19]
- 2- Social Media [44%, n=20]
- 3- Phone Call [27%, n=12]
- 4- In person briefing [20%, n=9]
- 5- Webinar or video [4%, n=2]
- 6- Mass notification system [31%, n=14]
- 7- Other [VERBATIM] [7%, n=3]

forest_share_how: How do you typically share fire weather forecast information that you may receive from the Oklahoma Forestry Service? Check all that apply.

- 1- Email [36%, n=16]
- 2- Social Media [27%, n=12]
- 3- Phone Call [11%, n=5]
- 4- In person briefing [18%, n=8]

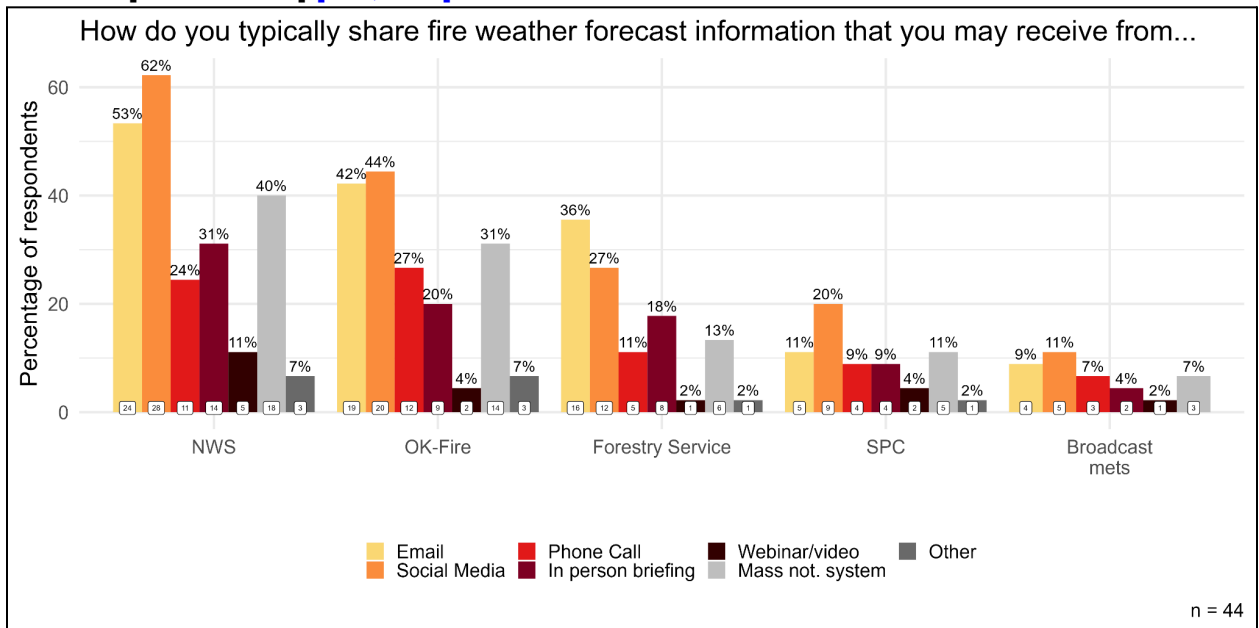
- 5- Webinar or video [2%, n=1]
- 6- Mass notification system [13%, n=6]
- 7- Other [VERBATIM] [2%, n=1]

spc_share_how: How do you typically share fire weather forecast information that you may receive from the Storm Prediction Center? Check all that apply.

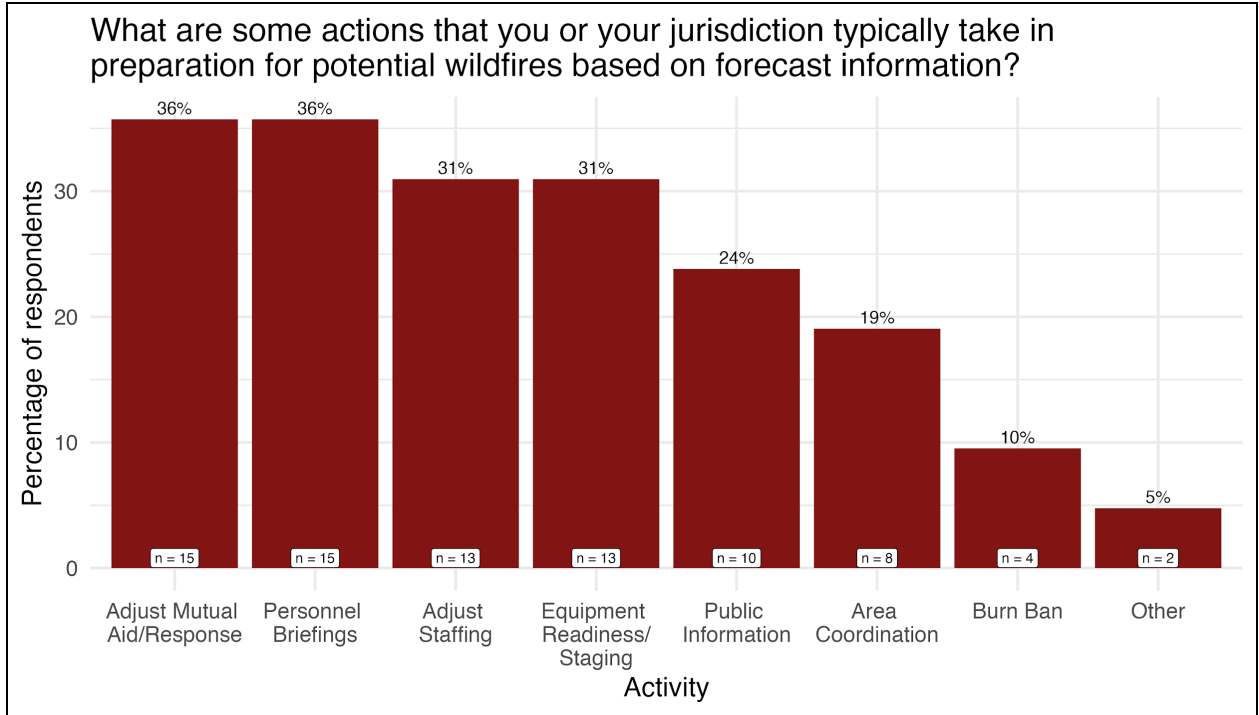
- 1- Email [11%, n=5]
- 2- Social Media [20%, n=9]
- 3- Phone Call [9%, n=4]
- 4- In person briefing [9%, n=4]
- 5- Webinar or video [4%, n=2]
- 6- Mass notification system [11%, n=5]
- 7- Other [VERBATIM] [2%, n=1]

bm_share_how: How do you typically share fire weather forecast information that you may receive from local broadcast meteorologists? Check all that apply.

- 1- Email [9%, n=4]
- 2- Social Media [11%, n=5]
- 3- Phone Call [7%, n=3]
- 4- In person briefing [4%, n=2]
- 5- Webinar or video [2%, n=1]
- 6- Mass notification system [7%, n=3]
- 7- Other [VERBATIM] [0%, n=0]



fire_prep: What are some actions that you or your jurisdiction typically take in preparation for potential wildfires based on forecast information? Please provide examples: [VERBATIM]



d. Active Wildfire Operations

Next, we would like to know more about how you utilize weather information during active wildfire operations.

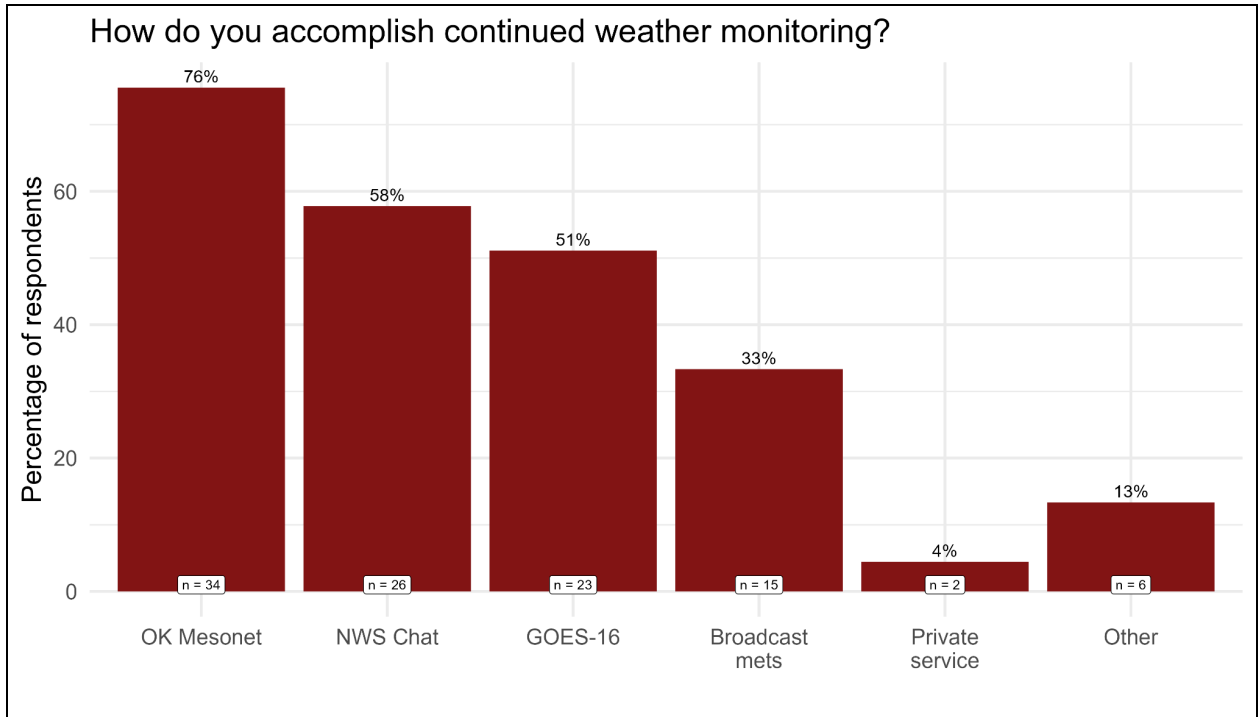
fire_active_monitor: Once fires are actively impacting your jurisdiction, or nearby areas, do you continue to monitor weather conditions?

- 1- Yes [92.9%, n=39]
- 2- No [7.1%, n=3]

fire_active_monitor_how: How do you accomplish continued weather monitoring?

Check all that apply:

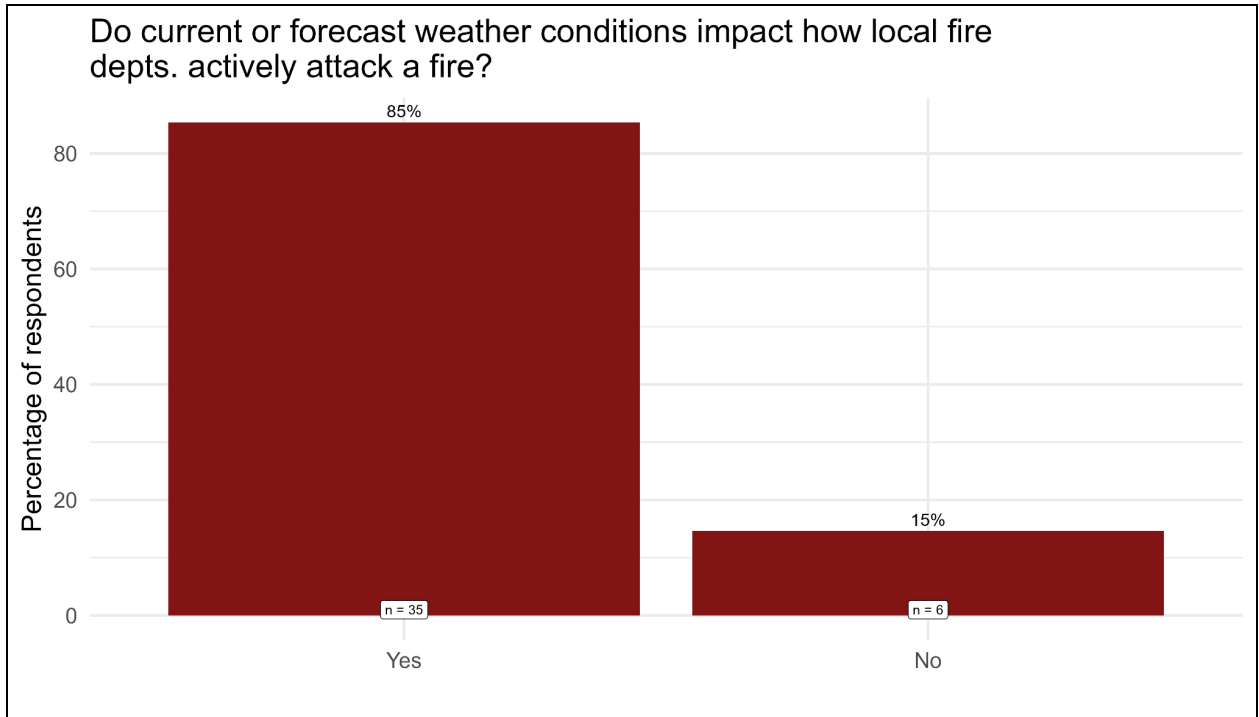
- 1- OK Mesonet/OK FIRE [76%, n=34]
- 2- NWS Chat [56%, n=26]
- 3- GOES-16 Infrared Satellite [51%, n=23]
- 4- Broadcast Media [33%, n=15]
- 5- Private or commercial weather service [4%, n=2]
- 6- Other [VERBATIM] [13%, n=6]



fire_active_fight: Do current or forecast weather conditions impact how local fire departments actively attack a fire? For example if a recommendation is made by OFS to not attack a fire head-on due to expected weather conditions, are local fire departments likely to change their tactics?

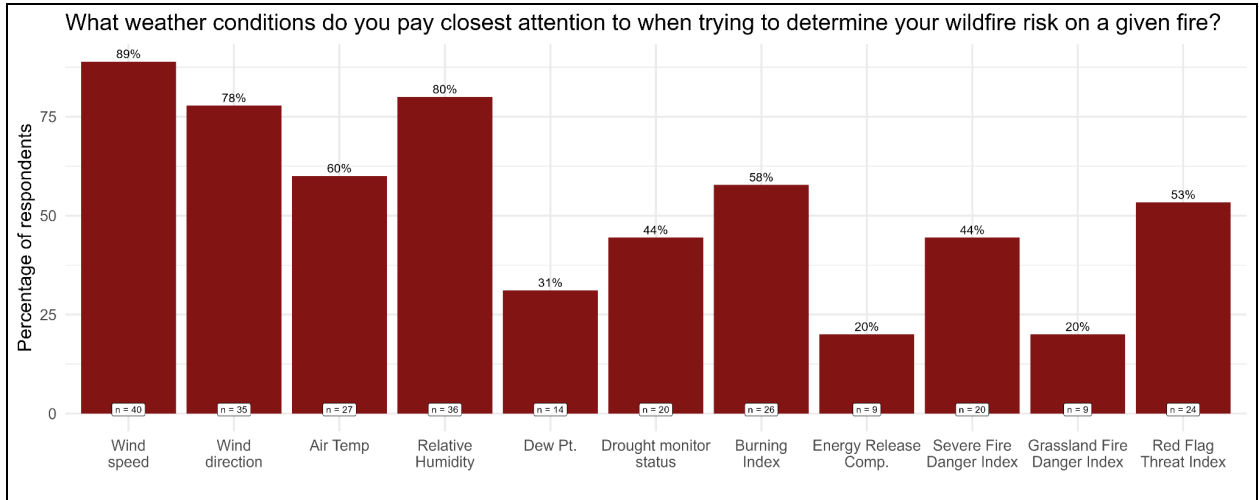
1- Yes [85%, n=35]

2- No [15%, n=6]



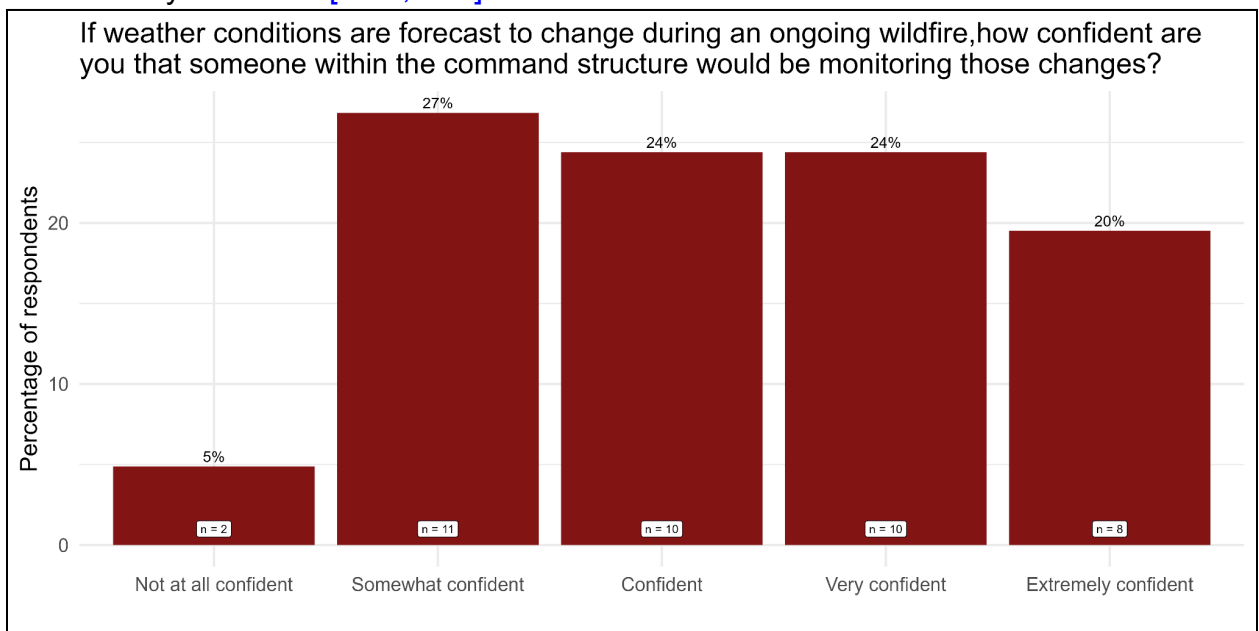
weather_att: What weather conditions do you tend to pay closest attention to when trying to determine your wildfire risk on a given fire? Check all that apply:

- 1- Wind speed [89%, n=40]
- 2- Wind direction [78%, n=35]
- 3- Air temperature [60%, n=27]
- 4- Relative humidity [80%, n=36]
- 5- Dew point [31%, n=14]
- 6- Drought monitor status [44%, n=20]
- 7- Burning index [58%, n=26]
- 8- Energy Release Component [20%, n=9]
- 9- Severe Fire Danger Index [44%, n=20]
- 10- Grassland Fire Danger Index [20%, n=9]
- 11- Red Flag Threat Index [53%, n=24]
- 12- Fosberg Index [0%, n=0]
- 13- Other [VERBATIM] [0%, n=0]



weather_chng_monitor: If weather conditions, specifically wind speed or direction, are forecast to change during an ongoing wildfire, how confident are you that someone within the command structure would be monitoring for those changes?

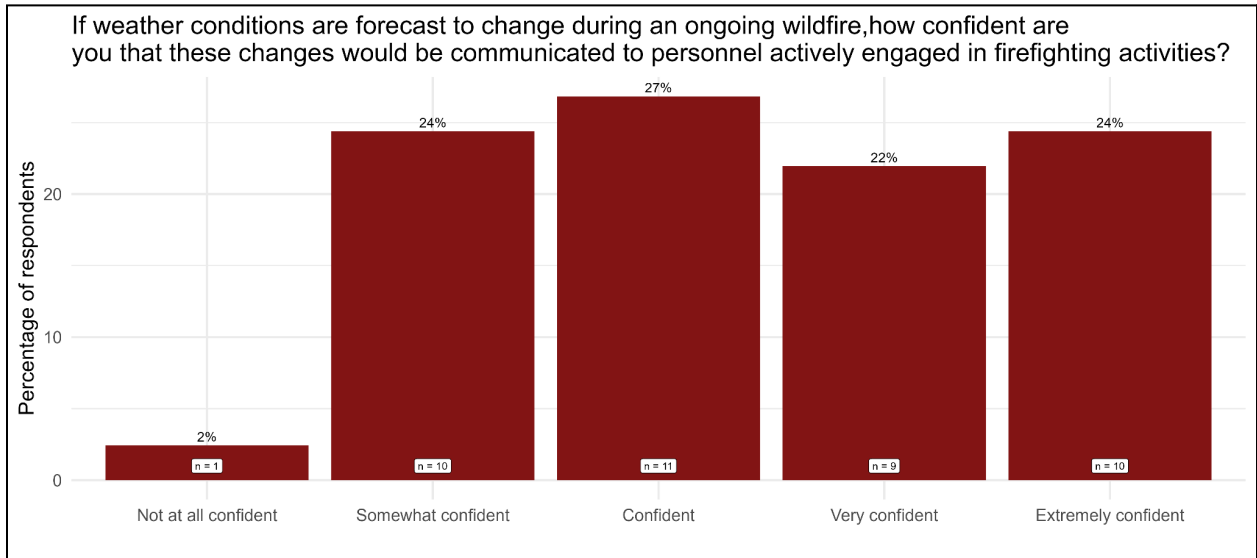
- 1- Not at all confident [5%, n=2]
- 2- Somewhat confident [27%, n=11]
- 3- Confident [24%, n=10]
- 4- Very confident [24%, n=10]
- 5- Extremely confident [20%, n=8]



weather_chng_comm: If weather conditions are forecast to change during an ongoing wildfire, how confident are you that these changes would be communicated to personnel actively engaged in firefighting activities?

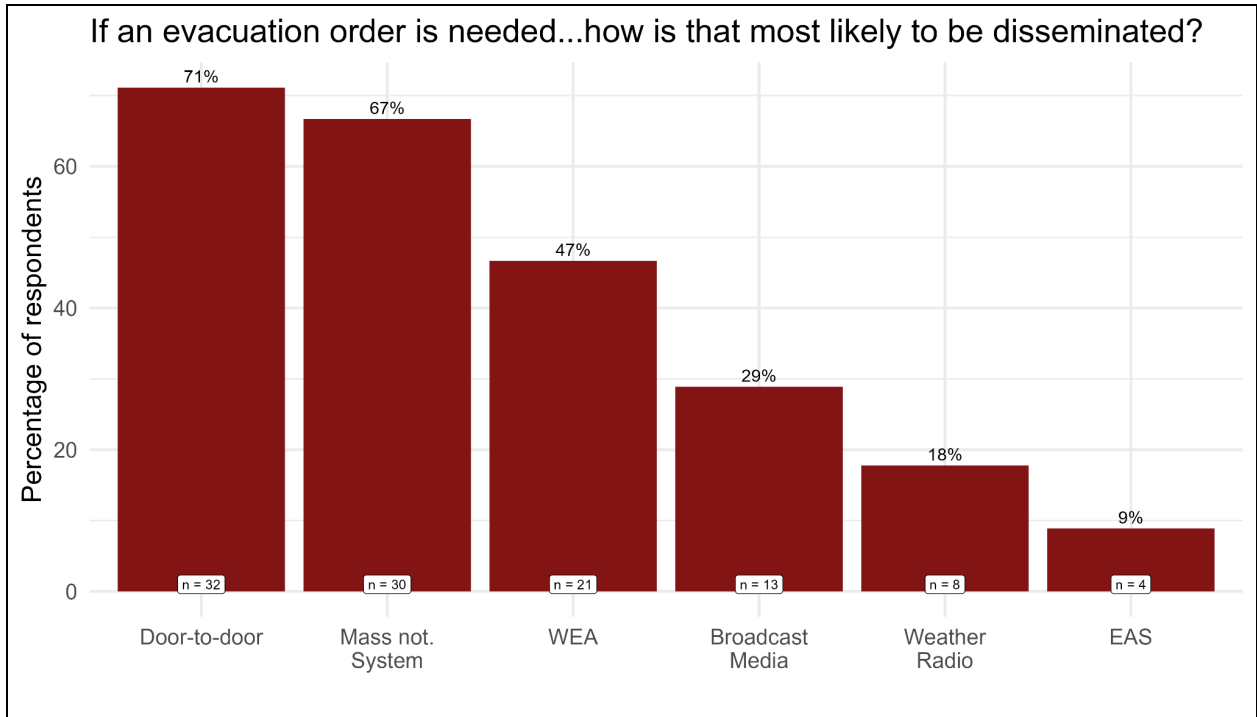
- 1- Not at all confident [2%, n=1]
- 2- Somewhat confident [24%, n=10]

- 3- Confident [27%, n=11]
- 4- Very confident [22%, n=9]
- 5- Extremely confident [24%, n=10]



evac_comm: If an evacuation order is needed for the public within your jurisdiction, how is that most likely to be disseminated? Check all that apply:

- 1- Wireless Emergency Alert (WEA) [47%, n=21]
- 2- Mass Notification System [67%, n=30]
- 3- Broadcast Media [29%, n=13]
- 4- EAS Broadcast [9%, n=4]
- 5- NOAA Weather Radio [18%, n=8]
- 6- Door-to-door or in-person [71%, n=32]



evac_past: Has an evacuation order ever been issued for your jurisdiction due to a wildfire?

- 1- Yes [58.5%, n=24]
- 2- No [31.7%, n=13]
- 3- I don't know [9.8%, n=4]

evac_involved: Were you involved in making the decision to issue an evacuation order?

- 1- Yes [75%, n=18]
- 2- No [25%, n=6]

e. *Awareness of NWS Fire Weather Products*

Next we would like to ask a few questions about specific products issued by your local National Weather Service Forecast Office.

fwatch_famil: Are you familiar with the Fire Weather Watch product issued by the NWS?

- 1- Yes [83%, n=34]
- 2- No [17%, n=7]

fwatch_criteria: Do you know the criteria for the issuance of a Fire Weather Watch in your area?

- 1- Yes [50%, n=17]
- 2- No [50%, n=17]

fwatch_act: If a Fire Weather Watch is issued for your jurisdiction, are you likely to take some kind of action?

1- Yes [94%, n=32]

2- No [6%, n=2]

fwatch_act_what: What kind of actions might a Fire Weather Watch prompt for your jurisdiction? [VERBATIM]

Action	Count
Alert Public/Social Media	15
Alert Fire/First Responder/Dispatch	11
Assess Resources/Staffing/Mutual Aid	11
Alert Stakeholders/Partners/Elected Officials	8
Situational Awareness/Monitoring/Monitor Weather	5
Burn Ban/Decreased Burning Messaging	2

rflag_famil: Are you familiar with the Red Flag Warning product issued by the NWS?

1- Yes [95%, n=39]

2- No [5%, n=2]

rflag_criteria: Do you know the criteria for the issuance of a Red Flag Warning in your area?

1- Yes [66%, n=25]

2- No [34%, n=13]

rflag_act: If a Red Flag Warning is issued for your jurisdiction, are you likely to take some kind of action?

1- Yes [87%, n=33]

2- No [13%, n=5]

rflag_act_what: What kind of actions might a Red Flag Warning prompt for your jurisdiction? [VERBATIM]

Action	Count
--------	-------

Alert Public/Social Media	13
Coordinate Staffing/Staff Fire Depts/EOCs	5
Equipment/Resource Prep/Preposition Resources	5
Alert/Coordinate with Fire Depts	4
Alert Stakeholder/Partners/Elected Officials	4
Situational Awareness/Monitoring/Monitor Weather	4
Burn Ban/Prohibit Burning	4
Dispatch/Coordinate Mutual Aid/Multi Agency Response	3
Issue "Wildland Automatic Response (WAR) Day"	1
Fly red flags in jurisdiction	1
"Same as Watch"	2

fwarning_famil: Are you familiar with the Fire Warning product issued by the NWS, at the request of local emergency management officials?

1- Yes [67%, n=26]

2- No [33%, n=13]

fwarning_process: Are you familiar with the process by which a local emergency manager can request a Fire Warning to be issued and disseminated by the NWS?

1- Yes [54%, n=14]

2- No [46%, n=12]

fwarning_past: Have you personally, or your jurisdiction, ever requested that a Fire Warning be issued by the NWS?

1- Yes [14%, n=3]

2- No [86%, n=18]

3- I don't know [19%, n=5]

fwarning_helpful: In your opinion, how helpful was that Fire Warning for public awareness and response?

- 1- Not at all helpful [0%, n=0]
- 2- Somewhat helpful [0%, n=0]
- 3- Helpful [0%, n=0]
- 4- Very helpful [67%, n=2]
- 5- Extremely helpful [33%, n=1]

hotspot_famil: Are you familiar with the Hot Spot Monitoring and Notification service that some local NWS Forecast Offices provide?

- 1- Yes [67%, n=26]
- 2- No [33%, n=13]

hotspot_past: Have you personally, or your jurisdiction, ever been notified directly by a representative of your local NWS Forecast Office that a potential wildfire has been detected via satellite?

- 1- Yes [54%, n=14]
- 2- No [42%, n=11]
- 3- I don't know [4%, n=1]

hotspot_helpful: How helpful was that notification for early detection and response?

- 1- Not at all helpful [0%, n=0]
- 2- Somewhat helpful [14%, n=2]
- 3- Helpful [7%, n=1]
- 4- Very helpful [36%, n=5]
- 5- Extremely helpful [43%, n=6]

f. 2023 OK Wildfires

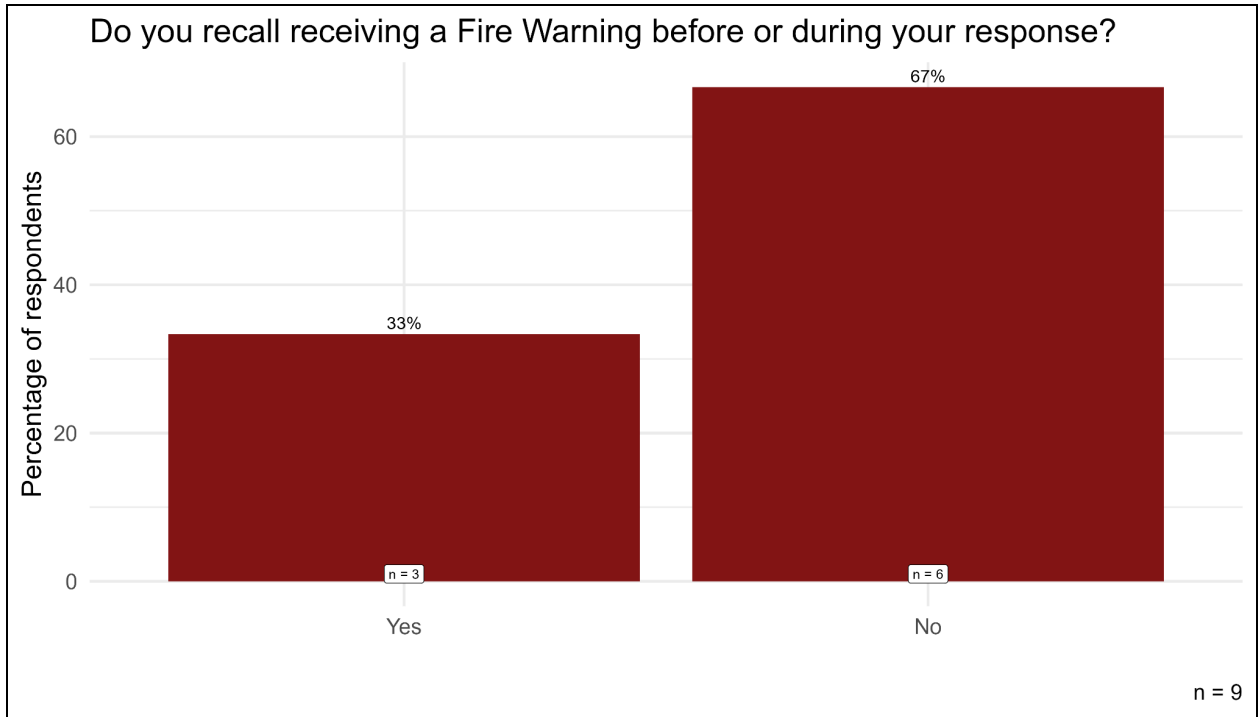
Finally, we would like to ask a few questions about the wildfires in Oklahoma on March 31 (Simpson Road and Hefner Road Fires in Oklahoma and Logan Counties) and April 4 (Route 66 Fire in Custer County), 2023.

pastfire_response: Were you actively part of the response to either the Simpson Road and Hefner Road fires in Oklahoma and Logan counties on March 31st, 2023, or the Route 66 fire in Custer County on April 4, 2023?

- 1- Yes [23%, n=9]
- 2- No [77%, n=30]

pastfire_fwarning: Do you recall receiving a Fire Warning for this fire before or during your response?

- 1- Yes [33%, n=3]
- 2- No [67%, n=6]



pastfire_fwarning_how: How did you receive notification about this Fire Warning?

Check all that apply:

- 1- NWS Chat [2%, n=1]
 - 2- NOAA Weather Radio [0%, n=0]
 - 3- WEA [4%, n=2]
 - 4- Relayed via Radio from Incident Command [4%, n=2]
 - 5- Relayed via Radio from Dispatch [2%, n=1]
 - 6- Media [2%, n=1]
 - 7- Social Media [0%, n=0]
 - 8- Other [VERBATIM] [4%, n=2]
- Other responses: cell phone, inter office communications

pastfire_fwarning_helpful: How helpful was the Fire Warning in terms of communicating potential conditions or severity of the fire for your response efforts?

- 1- Not at all helpful [0%, n=0]
- 2- Somewhat helpful [0%, n=0]
- 3- Moderately Helpful [67%, n=2]
- 5- Very helpful [33%, n=1]
- 6- Extremely helpful [0%, n=0]

pastfire_fwarning_helpful_spec: Please elaborate on your answer to the previous question. In particular, what information contained in the Fire Warning did you find useful? [VERBATIM]

Fire location, direction fire heading, winds, air temperatures, humidity levels

pastfire_fwarning_continue: Are these types of Fire Warnings from the National Weather Service something you would like to see continue or expand for future wildfire activities?

1- Yes [100%, n=3]

2- No [0%, n=0]

3- Unsure [0%, n=0]

3. Discussion

a. Initial Conclusions

Survey results indicate that the majority of respondents feel their areas of responsibility are at high or very high risk of wildfire (31 respondents; 70%). While many feel such risk, only around one quarter (12 respondents; 27%) consider themselves “well-resourced” for wildfire operations. The greatest resource limitation is personnel. Thirty-eight respondents (86%) replied their local fire departments consist of either entirely volunteer or a mix of volunteer/career firefighters, meaning they rely heavily on their local communities and residents for support during operations. Emergency managers indicate they bear critical responsibilities during wildfires, including monitoring firefighting activities and weather conditions, coordinating and ordering resources, and communicating with the public. Most respondents are located at an incident command post during operations, so they can be best positioned to carry out such responsibilities. Additionally, being physically located at an incident command post allows them to make time sensitive decisions regarding evacuations, which most survey respondents indicated they are legally authorized to do.

Though emergency managers are able to access raw weather conditions related to fire weather on their own through the OK-FIRST program (Oklahoma Mesonet 2024), NWS products are very or extremely critical to their operations (82%) and are the most frequently shared pieces of information with their response partners and the general public. Fire weather forecast information prompts a wide variety of pre-event actions, including adjustments to response and mutual aid, equipment checks and staging, public information, and personnel adjustments. Once fires are actively burning, continued weather monitoring is important for both firefighter safety and for making decisions related to evacuation orders.

b. Reflections from Collaborators

Upon analyzing survey responses, results were shared with key collaborators from the Oklahoma Forestry Services (OFS) and National Weather Service (NWS) Forecast Office in Norman, OK. Key reflections were as follows:

- A higher than anticipated number of respondents indicated that they used information from both OFS and NWS for preparedness and decision making

purposes. Consistent messaging between OFS and NWS, therefore, is crucial for local preparedness efforts prior to wildland fire starts.

- On-scene situational awareness is crucial and is often accessed through tools provided by OK-FIRE via the Oklahoma Mesonet app.
- The recent transition of NWSChat to the Slack platform will provide a new channel for situational awareness and support for on-scene crews and should be used in a manner similar to severe weather operations.
- There is still a great deal of uncertainty around the Fire Warning process that likely needs to be addressed through education and outreach campaigns involving all stakeholders. A deeper understanding of this process will allow emergency managers to better take advantage of this product in the event of needed evacuation orders.
- Though numerous tools are available to emergency managers for accessing and monitoring weather conditions, the interpretation of those conditions and forecast changes continues to be a crucial role filled by subject matter experts from both OFS and NWS.
- Though limited in the total number of responses, the emergency managers that had direct experience with both hot spot notifications and Fire Warnings view these services favorably and support a continuation or expansion of these efforts.

c. Next Steps

Following the successful deployment of this survey effort among Oklahoma emergency managers, it is clear that additional research in this space is needed to better understand the current state of fire weather forecast use among end-users and response partners across geographies and jurisdiction types. Similarly, social science research may be able to inform end-user needs to refine current practices of forecast communication, NWS product suitability, and emerging alerting technologies for public awareness. Specifically, the research team has identified the following areas to prioritize for future fire weather research:

- Expand survey efforts geographically to cover different wildland fire regime types across the United States. While this effort was focused primarily on a regime common to the Southern Plains of fast-moving grass fires, other wildland fire types across different topographic and vegetative areas may be more receptive to other forecast tools.
- Expand survey efforts to cover different jurisdiction types and response partners. The role that emergency managers play in Oklahoma wildland fire operations is likely not shared equally across the U.S., so identifying key fire officials and decision makers in other regions that use fire weather information for operational

decision making purposes will be a key step in understanding the overall state of end-user practices and needs.

- Conduct a case study of the February 2024 wildfires that impacted parts of Texas and Oklahoma, particularly the Smokehouse Creek Fire, to better understand the use of fire weather forecast information, as well as the effectiveness of Fire Warnings disseminated by the National Weather Service Forecast Offices in Amarillo and Norman.
- Collaborate with fire forecasters at NOAA's Storm Prediction Center to investigate in greater detail the current use of SPC fire weather products, as well as to potentially identify development of new SPC products or workflows.
- Identify shared research goals that could be incorporated into NOAA's new Fire Weather Testbed activities, to improve the uptake nationwide of NOAA fire weather forecasting techniques and awareness of end-user needs.

4. References

- Lindley, T. T., A. R. Anderson, V. N. Mahale, T. S. Curl, W. E. Line, S. S. Lindstrom, and A. S. Bachmeier, 2016: Wildfire detection notifications for impact-based decision support services in Oklahoma using geostationary super rapid scan satellite imagery. *J. of Operational Met.*, **4**, 14, 182-191, <https://doi.org/10.15191/nwajom.2016.0414>.
- Oklahoma Mesonet, 2024: OK-Fire, Accessed 9 May 2024, <https://www.mesonet.org/index.php/okfire/home>.
- U.S. Fire Administration, 2024: What is the WUI?, Accessed 9 May 2024, <https://www.usfa.fema.gov/wui/what-is-the-wui.html#:~:text=The%20WUI%20is%20the%20zone.undeveloped%20wildland%20or%20vegetative%20fuels>.