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AEM's 2024 State of North American

Wildfire Resilience Report

Identifying popular techniques & technologies, budget gaps, and key concerns among wildfire leaders

2024 State of North American Wildfire Resilience Report

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Executive summary

Wildfire risk management is one of the biggest growing challenges of our time.

Not too long ago, people talked about "fire season" and "fire country," but thanks to suburban sprawl, the growth of heavy industry in the wildland-urban interface zone (WUI), where developed communities and infrastructure meet wildfire-prone terrain, and a global increase in lightning strikes, wildland fires are more likely than ever to occur in areas where they can seriously damage communities, infrastructure, and natural resources.

Given the financial and human impact of global wildfires, **it's crucial that leaders across the industry work together to share knowledge, collaborate authentically, and identify best practices that can protect citizens, property, and the wildlands.**

To help facilitate that conversation in our role as the world's essential source for environmental insights, AEM conducted a survey with Fire Engineering during the spring of 2024 to understand the wide range of approaches and current states with regard to wildfire prevention, preparedness, detection, response, recovery, and rehabilitation across North America.

Survey respondents included 207 purchasing decision-makers and influencers for wildfire management, prevention,

suppression, and communication. For the sake of focusing the report, that pool was narrowed down to a core group of 173 public sector wildland fire professionals located across more than 48 different North American states and provinces. Responses were drawn from every level of the wildland fire service, including:

- Municipal/local agencies (47%)
- County agencies (21%)
- State/province agencies (18%)
- National agencies (11%)

Among the core response group, the majority work within wildland response units (64%) or emergency management teams (14%).

The following report examines approaches to wildland firefighting through the lens of **budget allocation, fuel management practices, technology adoption, and interagency collaboration capabilities** to provide a "current state" assessment of approaches across North America.

Generally, the survey uncovered that the majority of wildfire budgets are locked up funding day-to-day operations and response while opportunities to reduce wildfire risk at other points in the event cycle remain underfunded and untested. Furthermore, the lack of a shared language and framework for assessing emerging wildfire solutions is making it hard for firefighters to make the most of this moment where so much technology is being developed to support their work.

Budget breakdowns

How do wildfire budgets map against the event cycle?

With the growing year-round threat of wildfires, it's key to consider the entire event cycle, not just the fire itself. To understand how teams across North America are approaching that transition from a budgetary perspective, we asked them to consider how much of their wildfire budget goes toward each of the three general phases of the cycle: **preparation/prevention, prediction/detection/response,** and **recovery/rehabilitation.**
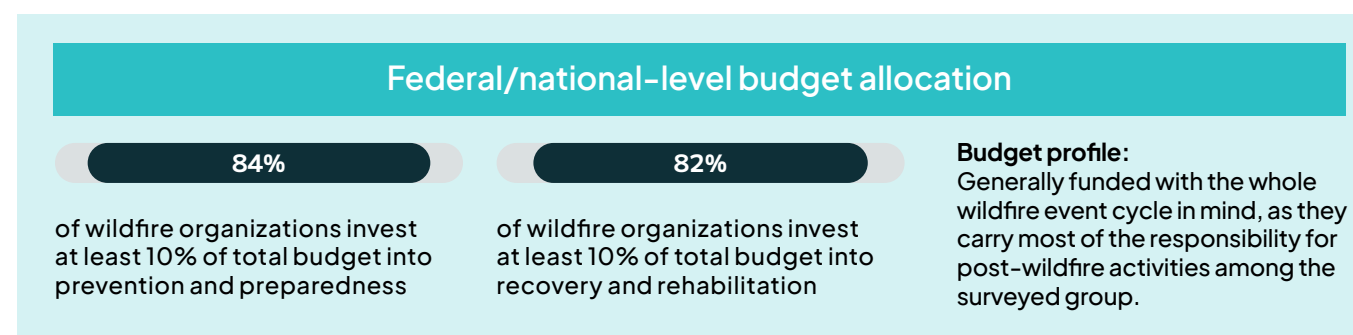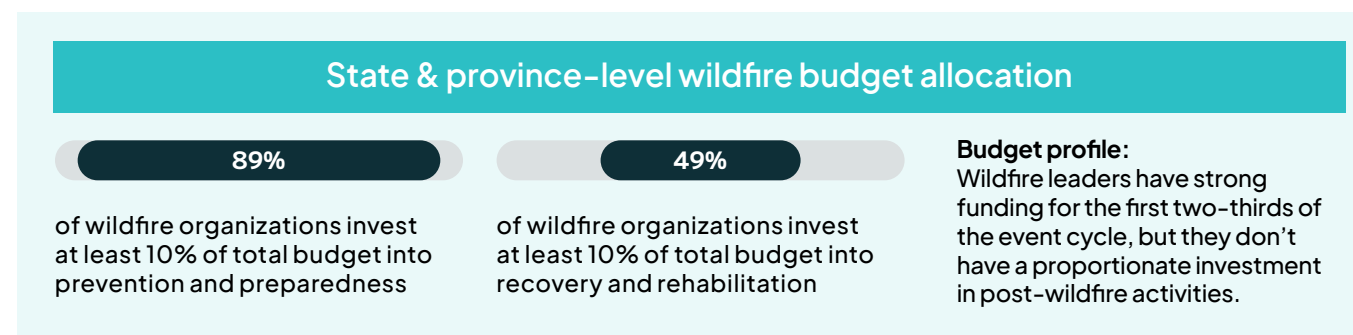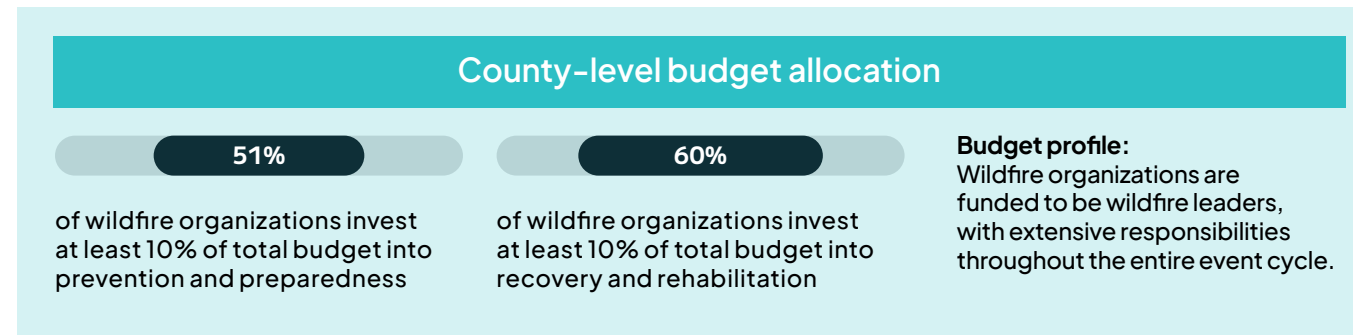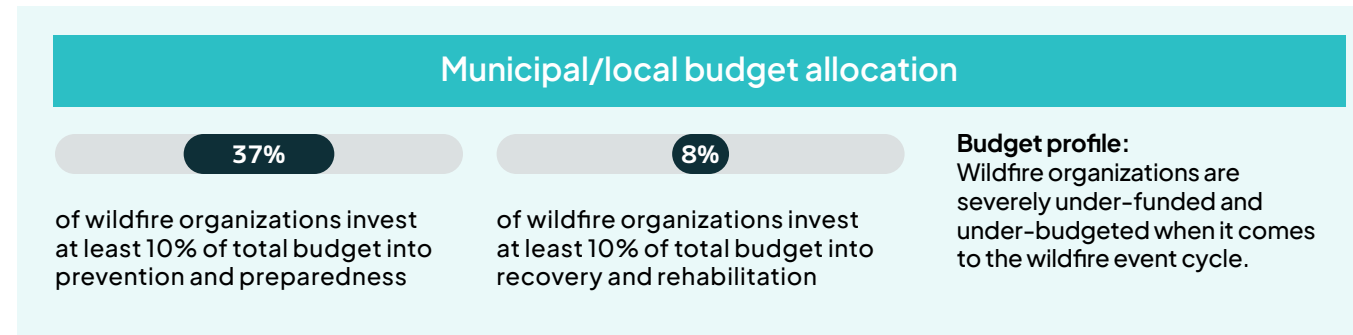
All responders

52% of wildfire organizations invest at least 10% of total budget into prevention and preparedness

21% of wildfire organizations invest at least 10% of total budget into recovery and rehabilitation

Budget	Prevention & Preparedness	Prediction, Detection, Response	Recovery & Rehabilitation
0%	13%	15%	52%
1–10%	35%	27%	27%
10–25%	27%	17%	17%
25–50%	12%	14%	2%
50–75%	9%	19%	0%
75–100%	4%	8%	2%

Municipal/local budget allocation

37% of wildfire organizations invest at least 10% of total budget into prevention and preparedness

8% of wildfire organizations invest at least 10% of total budget into recovery and rehabilitation

Budget profile:
Wildfire organizations are severely under-funded and under-budgeted when it comes to the wildfire event cycle.

Budget	Prevention & Preparedness	Prediction, Detection, Response	Recovery & Rehabilitation
0%	18%	23%	65%
1–10%	45%	30%	27%
10–25%	24%	19%	8%
25–50%	8%	8%	0%
50–75%	4%	13%	0%
75–100	1%	7%	0%

County-level budget allocation

51% of wildfire organizations invest at least 10% of total budget into prevention and preparedness

60% of wildfire organizations invest at least 10% of total budget into recovery and rehabilitation

Budget profile:
Wildfire organizations are funded to be wildfire leaders, with extensive responsibilities throughout the entire event cycle.

Budget	Prevention & Preparedness	Prediction, Detection, Response	Recovery & Rehabilitation
0%	17%	7%	7%
1–10%	32%	33%	33%
10–25%	32%	23%	23%
25–50%	13%	13%	13%
50–75%	6%	20%	20%
75–100	0%	4%	4%

State & province-level wildfire budget allocation

89% of wildfire organizations invest at least 10% of total budget into prevention and preparedness

49% of wildfire organizations invest at least 10% of total budget into recovery and rehabilitation

Budget profile:
Wildfire leaders have strong funding for the first two-thirds of the event cycle, but they don't have a proportionate investment in post-wildfire activities.

Budget	Prevention & Preparedness	Prediction, Detection, Response	Recovery & Rehabilitation
0%	0%	5%	39%
1–10%	11%	11%	22%
10–25%	39%	6%	33%
25–50%	17%	28%	0%
50–75%	27%	44%	0%
75–100	6%	6%	6%

Federal/national-level budget allocation

84% of wildfire organizations invest at least 10% of total budget into prevention and preparedness

82% of wildfire organizations invest at least 10% of total budget into recovery and rehabilitation

Budget profile:
Generally funded with the whole wildfire event cycle in mind, as they carry most of the responsibility for post-wildfire activities among the surveyed group.

Budget	Prevention & Preparedness	Prediction, Detection, Response	Recovery & Rehabilitation
0%	0%	0%	0%
1–10%	15%	14%	18%
10–25%	15%	7%	64%
25–50%	23%	29%	0%
50–75%	15%	14%	0%
75–100	31%	36%	18%

Analysis & recommendation:

Local wildfire organizations are expected to focus on response with the understanding that the county and state will pick up the slack on managing the rest of the wildfire event cycle. This inadvertently pushes a disproportionate amount of the most dangerous, grueling, and emotionally taxing work on local first responders who often don't have the context and wildfire expertise of their county- and state-level colleagues.

Qualitative feedback provided later in the survey reinforced that many local wildfire professionals observe firsthand that county-private sector partnerships on fuel reduction just aren't cutting it. They wish they could step in and work directly with local stakeholders to close the gaps, but they simply don't have the budget. After wildfires, the same local teams who put out the fire then must watch their local community and ecosystem suffer while recovery and rehabilitation are led by larger agencies with less authentic connection to the area and local values.

By moving closer toward a model where at least 10% of budgets are allocated to prevention/preparedness and recovery/rehabilitation, local teams can grow as true whole-lifecycle partners with the county and state, not just on-demand responders during times of crisis.

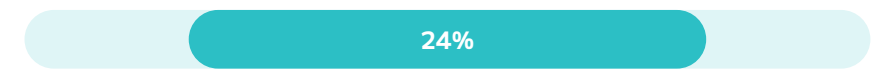## Which wildfire risk management technologies are seeing use?

Respondents from 68 different public sector wildfire agencies provided information about their wildfire technology stack. We asked them about usage rates of the following specific hardware:
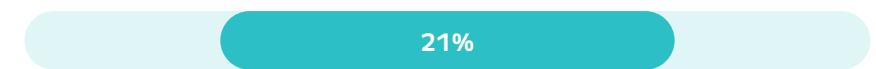
CAMERA USAGE:

38%

of surveyed agencies use wildfire cameras as part of their strategy.
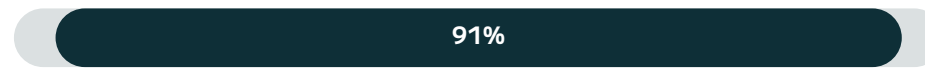
24%

use fixed-position cameras

21%

use pan-tilt-zoom (PTZ) cameras

21%

use AI-supported smoke detection cameras

More than half of agencies with cameras reported using a combination strategy including more than one of the three types of cameras included above.

FIRE WEATHER STATION USAGE:

91%

agencies use weather stations as part of their strategy

75%

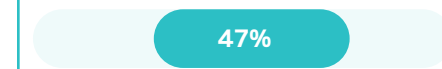use fixed-position stations

51%

use portable quick-deploy stations

32%

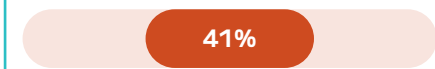use a mix of both station types

FUEL/SOIL MOISTURE SENSOR USAGE:

47%

of surveyed agencies use fuel moisture sensors

LIGHTNING SENSOR USAGE:

41%

of surveyed agencies use lightning sensors

OTHER POWERFUL HARDWARE:

In addition to the focus technologies above, respondents also told us they're seeing value from...

- Handheld fire weather meters
- Drones with thermal detection
- Piloted aircraft for thermal and visual detection

Wildfire software usage and functionality

One hundred and twenty-nine public sector agencies responded to questions about their use of software to support the wildfire event cycle. More than 40% indicated that software doesn't play into their approach to the wildfire event cycle at all.
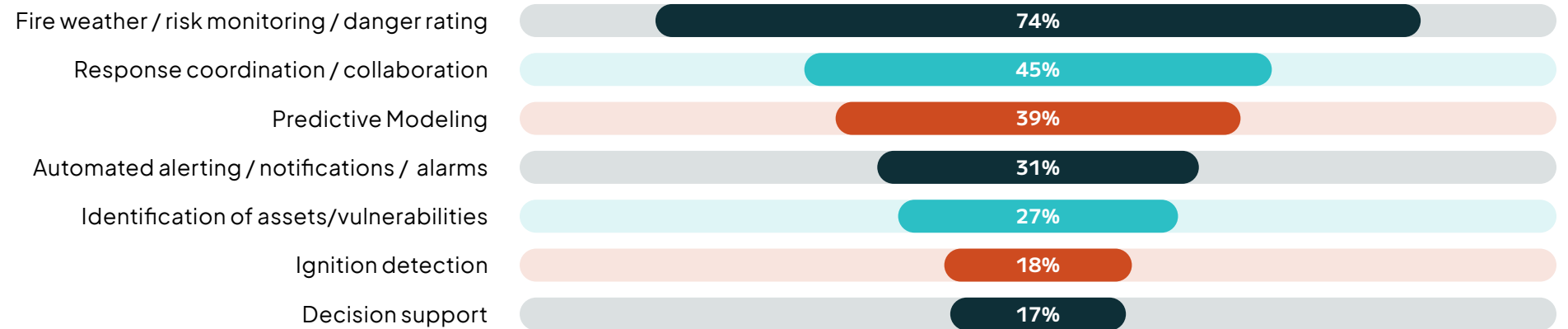
In spite of their increased responsibilities for pre- and post-wildfire activities, 39% of respondents at the county level said they use **no wildfire software at all.**
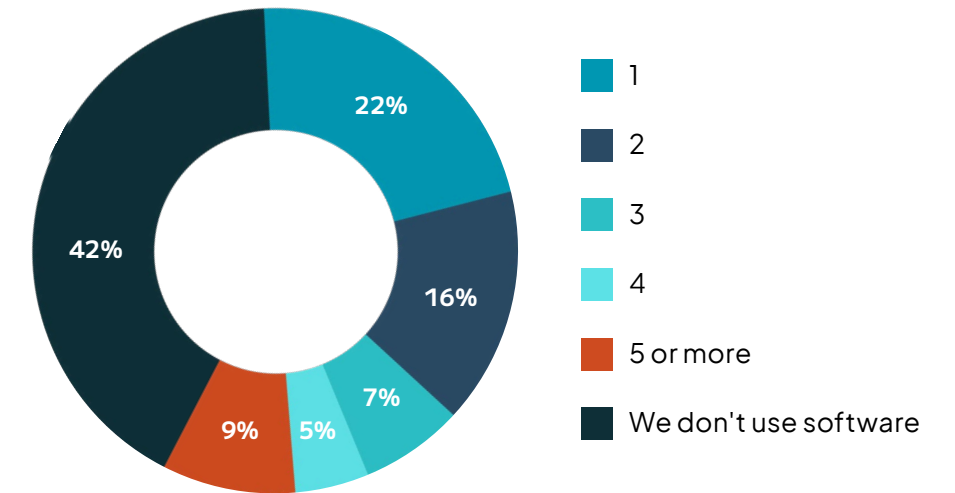
Diving deeper, respondents who do utilize wildfire software provided information into what kind of functionality they get out of their software suite.

- 1 — 22%
- 2 — 16%
- 3 — 7%
- 4 — 5%
- 5 or more — 9%
- We don't use software — 42%

WHICH SPECIFIC CAPABILITIES DOES YOUR SOFTWARE SUITE SUPPORT? (SELECT ALL THAT APPLY.)

Capability	%
Fire weather / risk monitoring / danger rating	74%
Response coordination / collaboration	45%
Predictive Modeling	39%
Automated alerting / notifications / alarms	31%
Identification of assets/vulnerabilities	27%
Ignition detection	18%
Decision support	17%

Cross referencing these two data stories, respondents with wildfire software use a weighted **average of 2.4 platforms** to manage the entire event cycle (rounding "5 or more" to 5). **Only 38%** of responding agencies possess three or more of the above capabilities, and to achieve that level of functionality, that group is averaging 3.5 software platforms.

Analysis & recommendation:

When it comes to sensors in the field, weather station networks like those operated by the National Interagency Fire Center (NIFC) and Canadian Interagency Forest Fire Center (CIFFC) are the main tech tool that wildfire leaders call upon to understand conditions, plan, and respond accordingly. Fuel and lightning sensors can be added to provide more detail to the picture and increase detection capabilities, and cameras are getting more useful when it comes to visualizing fires in real time.

On the software side, it's unsurprising that adoption rates are relatively sluggish, given the difficulty of piecing together a satisfactory solution. More capable, function-rich software is required to make adoption feasible at scale for wildfire organizations across North America.

The use of artificial intelligence has expanded rapidly in the last few years, with more than one in five agencies now saying that AI is part of their visual wildfire detection strategy. If early adopters can translate those tools into reduced loss, it should make it easier for the next wave of organizations to rally support and budget behind AI and other new wildfire tools.
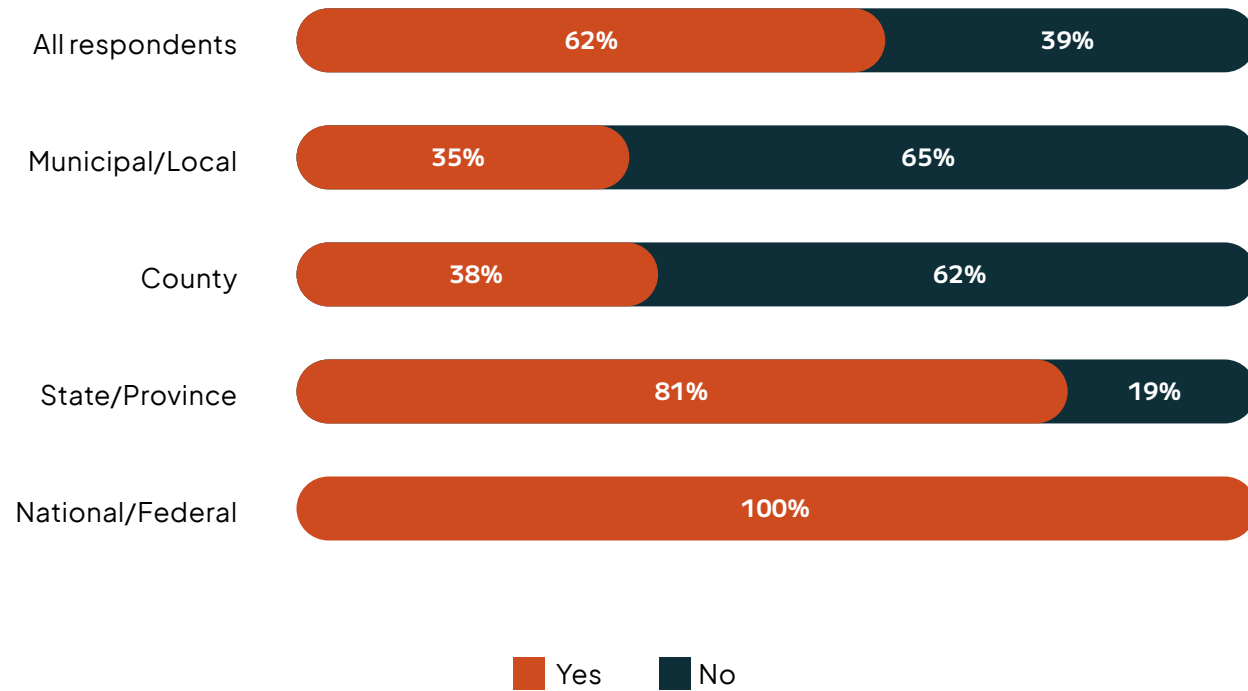
Are agencies increasing their use of preventative practices?

Benchmarking use of prescribed burns

Among the response group, representatives from 138 different wildfire teams provided information on their use of prescribed burns to create a profile of at which level this key work is most frequently taking place.
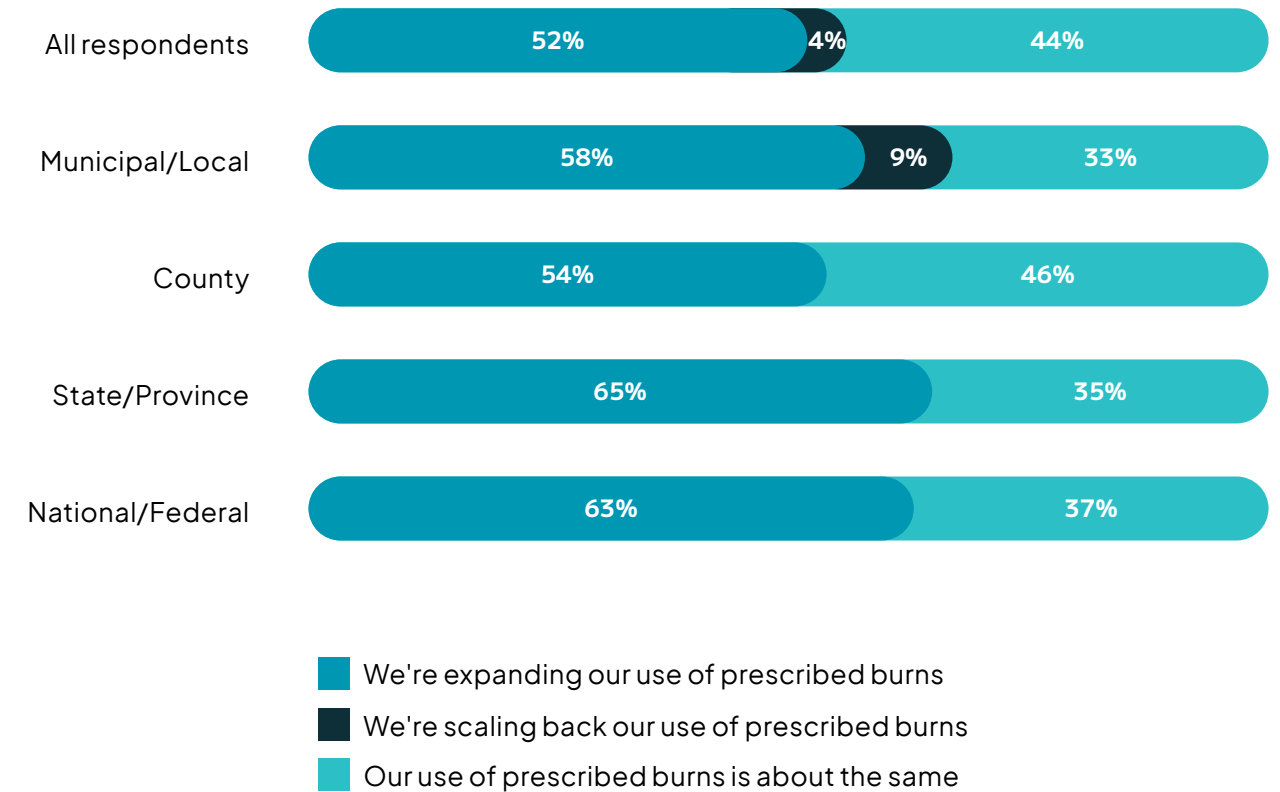
DOES YOUR ORGANIZATION CURRENTLY UTILIZE PRESCRIBED BURNS FOR FUELS MANAGEMENT?

	Yes	No
All respondents	62%	39%
Municipal/Local	35%	65%
County	38%	62%
State/Province	81%	19%
National/Federal	100%	

■ Yes ■ No

Is prescribed burning a growing practice?

We followed up with respondents who indicated their team does prescribed burning to learn if it's growing as a wildfire prevention/preparation activity and at which levels of the fire service.

HOW DOES YOUR USE OF PRESCRIBED BURNS COMPARE TO THE PAST?

	We're expanding	We're scaling back	About the same
All respondents	52%	4%	44%
Municipal/Local	58%	9%	33%
County	54%		46%
State/Province	65%		35%
National/Federal	63%		37%

■ We're expanding our use of prescribed burns
■ We're scaling back our use of prescribed burns
■ Our use of prescribed burns is about the same

Analysis & recommendation:

The results above align with our finding that prevention represents an increasing budget priority and activity as wildfire organizations become larger and larger. It's generally encouraging to see the practice growing at every level of the fire service, however, as it indicates a trend toward the kind of big-system organization and local engagement that will be required to create a unified, consistent culture of wildfire readiness and safety.

With that said, it is somewhat surprising to see that nearly two-thirds of counties are not employing controlled burns, in spite of their generally adequate funding for prevention/preparation. Further research is required to uncover what techniques and strategies are being invested in at that level instead.

As prescribed burning grows, it becomes more and more important to ensure those fires stay prescribed. Connecting with the right strategies, expertise, and technologies to master prescribed burning will be a key priority for wildfire organizations who want to maximize the impact of their efforts.

How are our fire leaders feeling about the current situation?

Defining ROI for wildfire investments

To understand how wildfire professionals assess the usefulness and impact of the hardware and software tools above, we asked all survey respondents,

HOW DO YOU MEASURE OR DETERMINE THE RETURN ON INVESTMENT FOR WILDFIRE SOLUTIONS YOU'VE PURCHASED OR ARE CONSIDERING?

46%

of all our respondents – more than 75 North American wildfire leaders – said one or some variation of the following:

- We can't
- We don't
- We're not sure how to
- We don't know that it's possible
- It's ambiguous

Even though public sector fire teams aren't in business to make money, it's striking that nearly half of survey respondents don't have a framework for quantifying the value/impact of the tools and techniques they invest in with taxpayer money.

Among respondents who provided specific guidelines, repeated responses included:

Qualitative stakeholder feedback

Public satisfaction

Reduction in financial, structural, or human loss compared to prior events

Measurable increases in firefighter safety

Comparing fuel treatment/reduction costs to actual costs of prior responses

The responses indicate that there is no official or even consistent informal framework among wildland fire professionals for assessing the effectiveness of emerging wildfire tools and technologies. Even in organizations where leaders are ROI-minded, they're struggling to find the tools and language with which to grade solutions.

Growing areas of concern and need

To better understand how wildfire challenges are being felt differently in various locations and different levels of the fire service, we asked all survey respondents, **"What are your biggest concerns when it comes to wildfire?"**

COMMON THEMATIC ANSWERS

Public Safety

A primary concern in many states, emphasizing the need to protect residents and communities.

Resource Management

Issues related to the availability and allocation of resources to effectively manage and combat wildfires.

Environmental Factors

Concerns about changing environmental conditions, including climate change, which exacerbate wildfire risks.

Infrastructure and Urban Interface

The threat of wildfires encroaching on urban areas and damaging critical infrastructure.

Perhaps unsurprisingly, these themes were expressed with more urgency and concern from respondents in the western United States. Fire professionals in California, Oregon, and Washington stressed the potential for large losses due to both containment and public safety challenges. In Colorado and Texas, respondents emphasized rapidly expanding wildland-urban interface as a major challenge.

I'm concerned about our ability to continue to do our job safely as we begin to lose more experienced senior leadership and funding support.

– Oregon State First Responder

We're challenged by non-mitigated properties, one way in/out roads, and an aging population who cannot move rapidly or may refuse to evacuate.

– Local Firefighter/Medic in Colorado

I'm worried about manpower during response to areas with potential for increased damage to private property and buildings.

– Kentucky Fire Chief

We simply don't have enough training or gear.

– Nova Scotia Fire Captain

We go through cycles. We know the forest needs to burn to become healthy and sustainable. So we burn and allow "fire-use wildfires" to grow. Then, we have a destructive wildfire and go back to putting them out as quick as possible. My fear is we will continue this cycle and not be effective in either managing healthy forests and protecting communities.

– California Fire Engine Operator

We have no budget for prevention. The city will say it's the county's responsibility, and the county says it's the private landowners' responsibility.

– City Firefighter in Texas

Dead ash trees and urban development have compromised the wildfire containment, and due to drought and weather conditions, fighting forest fires has become a unique experience... Urban development has impeded firefighting and control. There are avenues of unprotected residence due to over-development and access to the fire ground.

– New Jersey Forest Fire Warden

Key Takeaways

The North American wildfire community is aware of and extremely concerned with the growth of wildfires in frequency and scope. They know that property, people, and infrastructure within their communities are at risk, and they're frustrated with budget constraints and collaboration frameworks that aren't working like they're supposed to.

Local and municipal teams have a growing role to play in community wildfire resilience. In order to achieve that, they require more budget for preparation/prevention as well as rehabilitation/recovery. By evolving as whole-cycle wildfire stakeholders and not just firefighters, local companies can increase wildfire readiness at the community level, building a foundation of resilience and awareness that has the potential to reduce the impact of fires.

Fuel reduction efforts are often budgeted for at the county level, but there's a need for progress in terms of execution. About two-thirds of county respondents indicated that they are not using prescribed burns, which calls into question how their budgets are being invested. County and private sector leaders need to step up and address the issue of fuel in their communities.

Wildfire cameras with drivable pan-tilt-zoom functionality and AI-assisted smoke detection are growing tools that wildfire professionals can add to their arsenals to increase visibility into the field to monitor potential ignitions and detect fires without endangering any people.

There are a variety of software tools that wildfire teams are leveraging to support their efforts, but many of the available platforms lack comprehensiveness. Organizations and solution providers need to work together to identify ways to pack more functionality into a single interface to increase value, ease of use, and adoption.

Wildfire professionals lack a common language to discuss the evolving tools and solutions designed to enable their teams, protect the community, and keep everybody safer. It's important that the community finds a consistent, reliable way to discuss how evolving tools and techniques translate into success and fire reduction.

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