Preliminary Investigation (PI-0235)

Caltrans Division of Research, Innovation and System Information

Roadside Design Strategies for Fire Presuppression: Survey of Practice

Requested by
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Executive Summary

Background

In recent years, climate change, drought, forest disease and the increasing wildland–urban interface have exacerbated wildfire danger in California. Roadsides are sometimes the point of origin of fires, and safety and roadside assets are at risk when fire does occur. The California Department of Transportation (Caltrans) is seeking to expand its design toolbox with strategies that enhance roadside fire resilience. Design strategies along roadsides include guidelines or design tools for landscape design, use of materials and treatments, plant selection and setbacks that can be employed to design a fire-resilient roadside and to rehabilitate a roadside after a fire.

Caltrans is seeking information from other state departments of transportation (DOTs) about design strategies implemented to maintain safety and limit the costly environmental and infrastructure damage that results from fire. Caltrans is also seeking plans, specifications and cost estimates for successful fire presuppression projects.

To assist Caltrans in this information-gathering effort, CTC & Associates conducted an online survey of state transportation agencies expected to have experience designing roadsides for fire presuppression. A selected group of fire management experts in California were also contacted to learn about effective roadside design strategies. A literature search of publicly available resources about national and state practices and guidance supplemented the survey findings.

Summary of Findings

Current Caltrans Practice

As part of Caltrans' current fire presuppression practices, district landscape specialists from the Division of Maintenance routinely engage with local fire officials when developing vegetation control plans. The division is also updating the roadside fire strip width from up to 8 feet to up to 10 feet. Recently the division launched an effort to develop defensible space that will focus on establishing fire breaks through both horizontal and vertical spacing of plant materials.

Other roadside design practices already implemented by Caltrans include:

- Using metal post guardrail in fire-prone areas.
- Eliminating the use of high-density polyethylene (HDPE) culverts in fire-prone areas.
- Preventing weed growth under guardrail and around signs, which also increases field crew safety by reducing worker exposure on roadways.

Survey of Practice

An online survey was distributed to members of two committees from the American Association of State Highway and Transportation Officials (AASHTO):

- Committee on Design.
- Committee on Maintenance.

Respondents representing design and maintenance units from 20 state transportation agencies responded to the survey. Seven respondents from six states—Arizona, Colorado, Florida, Michigan, Nevada and New Mexico—reported that their agencies have developed or adopted

roadside design strategies or practices that are intended to make roadsides more resilient to fire. Most of these respondents represented design functional units within their agencies; the respondent from Florida DOT and one respondent from Nevada DOT provided a maintenance perspective. Other transportation agency respondents noted that fires are not an issue in their states that require implementing fire presuppression strategies.

Findings from the six state transportation agencies and other state DOTs participating in the survey are presented in the following topic areas (when available):

- Design strategies.
- Design strategy effectiveness.
- Safety appurtenances.
- Fire-resilient roadside projects and guidance.

Design Strategies

The following roadside design strategies were addressed for fire presuppression:

- Vegetation-free zone along the pavement edge.
- Use of inert materials.
- Culvert materials for fire resilience.
- Plant material.
- Use of a vertical fire break.

Vegetation-Free Zone Along the Pavement Edge

Five states require a vegetation-free zone along the pavement edge (Arizona, Colorado, Nevada, Oklahoma and Utah). Arizona DOT specifies requirements on a project-by-project basis; Nevada and Oklahoma DOTs define specific minimums, ranging from a 7-foot minimum to a 30-foot clear zone; Colorado DOT implements both practices.

Use of Inert Materials

Only Arizona DOT and Nevada DOT's Roadway Design Division respondents reported that their agencies specify the use of inert materials along roadsides in fire-prone areas. In Arizona, requirements are project-specific based on the region, a preapproved list of materials and review by the landscape architecture unit. The Nevada DOT Roadway Design Division uses shouldering material and/or rock mulch.

Culvert Materials for Fire Resilience

Three state DOTs specify culvert materials for fire resilience. Idaho Transportation Department primarily uses corrugated metal pipe and concrete for new construction. When rehabilitating culverts, some of the agency's maintenance sections use metal or concrete culvert instead of plastic liners because these liners are difficult to extinguish when ignited. Nevada DOT Roadway Design Division uses reinforced concrete pipe, corrugated metal pipe, and concrete culvert pipe or boxes, where applicable. The agency also uses HDPE pipe that is buried underground and has metal end sections beyond the 10-foot buffer and clear zone requirements. North Dakota DOT uses nonflammable material for culvert end treatments.

Plant Material

Survey respondents addressed three issues related to plant material: setbacks and appropriate or inappropriate plant material.

Setbacks. Five states require minimum distances or the use of vegetation or landscaping practices to ensure setbacks for plant material along roadsides. Minimum distances are specified in Arizona (30 or 60 feet, depending on the region) and Nevada (Roadway Design: 10-foot buffer from pavement edge; Maintenance: 7 feet). Colorado, Nevada and New Mexico DOTs are guided by vegetation or landscaping practices. In Colorado, native grass and forb seed mixes are typically specified for roadside revegetation following construction. Nevada DOT Roadway Design requires landscaping such as trees, shrubs and large boulders to be outside of the roadway clear zone. New Mexico DOT specifies mowing height.

Appropriate Plant Material. According to the respondent, Arizona DOT has created a list of appropriate plant material (the list was unavailable at the time of publication of this report). While Colorado DOT does not typically specify plant material for fire-prone areas, its standard native seed species can be used on roadsides throughout the state. Species are available in the agency's native seed database and are given a rating of low, medium or high for fire tolerance.

Inappropriate Plant Material. Cheatgrass along roadsides in Idaho and red cedar in rights of way in Oklahoma were identified as inappropriate plant material in fire-prone areas. Because of the invasive nature and combustibility of red cedar, Oklahoma DOT removes this plant material from these areas when feasible.

Use of a Vertical Fire Break

Vegetation practices are part of the vertical fire break strategies implemented by Michigan and New Mexico DOTs. In Michigan, vegetation removal is the primary practice, and New Mexico DOT requires lower mowing heights from right of way fence to right of way fence. Arizona DOT does not use a vertical fire break as a fire presuppression strategy, but other agencies involved in Arizona DOT projects (such as the U.S. Forest Service) have used this practice.

Design Strategy Effectiveness

Respondents from nine states rated the effectiveness of seven design strategies for fire presuppression along roadsides. Vegetation-free zones was the most frequently rated design strategy and received the highest rating; other frequently rated strategies were using inert materials and specifying a setback for plant material. Appropriate plant material was the least rated design strategy, and inappropriate plant material received the lowest rankings.

Other effective fire presuppression design strategies reported by survey participants were frequent mowing (Florida and Utah), prescribed burns (Kansas) and appropriate plant material for living snow fences (Colorado).

Safety Appurtenances

None of the survey respondents described using safety appurtenances such as guardrail and sign posts that were unique to fire-prone areas.

Guardrail. Respondents typically reported using standard hardware (Arizona, Oklahoma, Pennsylvania and Utah) or hardware that is compliant with AASHTO's Manual for Assessing Safety Hardware (MASH) (Idaho). Kansas DOT specifies wood and steel posts, and Colorado DOT typically sprays herbicide under and immediately adjacent to guardrails to suppress weed growth.

Sign Posts. As with guardrail, many states responding to the survey specify standard sign posts (Arizona, Oklahoma and Pennsylvania). Transportation agencies in Idaho and Kansas install metal and wood posts while Colorado DOT sprays areas under and immediately adjacent to sign posts with herbicide to suppress weed growth.

Other Devices. Although Connecticut DOT rarely designates roadside safety appurtenances for fire-prone areas, the survey respondent noted that along nonaccess highways, stand pipes may be used at bridge structures to allow pumping from crossing streets. Colorado DOT relies on maintenance practices to eradicate flammable annual grasses such as cheatgrass (*Bromus tectorum*) in the right of way. Nevada DOT Roadway Design Division also noted the practice of weed-free clear zones in the state; most beautification efforts in Nevada are at interchanges, where decorative rock, sculptures and native plantings are used. Contractors working at these sites are required to submit fire suppression plans that comply with U.S. Forest Service guidelines.

Fire-Resilient Roadside Projects and Guidance

None of the respondents were able to provide information about successful projects that installed a fire-resilient roadside. The respondent from Arizona DOT was the only survey participant who reported that formal, written guidance was available for the design of fire-resilient roadsides, however, the guidance was unavailable at the time of publication of this report. The Colorado DOT respondent reported that the agency has provided recommendations and guidelines for post-fire response to agencies within the state, mainly for erosion or sediment control and seeding recommendations.

Consultation With Fire Management Experts

Fire management experts from California Department of Forestry and Fire Protection (CAL FIRE) and Sierra Pacific Industries were contacted to gain a broader perspective of effective fire presuppression strategies along roadsides. Two senior CAL FIRE leaders responded to the inquiry; the Sierra Pacific Industries representative did not respond to requests for information.

Law Enforcement and Civil Cost Recovery

Gianni Muschetto, staff chief of Law Enforcement and Civil Cost Recovery at CAL FIRE, provided details about various design strategies and practices based on experience with fuels reduction projects that incorporate roadways:

- *Vegetation-free zone along the pavement edge*. Although not required, vegetation-free zones and various types of fuel breaks are incorporated as part of a project.
- *Setback for plant material*. A specific setback is not required, however, the agency provides recommendations if local fire plans are written within specific counties or communities. Typically these recommendations are based on local conditions and historical ignitions in specific areas.
- *Appropriate and inappropriate plant material*. Muschetto referred to the Ready for Wildfire web site, an educational resource for homeowners, noting that the fire-resistant landscaping principles discussed on the web site can be adapted to roadside areas.
- *Use of a vertical fire break*. Both horizontal and vertical breaks and spacing are used in fuels reduction projects. Ladder fuels are typically removed below trees, and trees are limbed to a height of 15 feet.

According to Muschetto, the following strategies are considered extremely effective: implementing vegetation-free zones, using inert materials along roadsides, specifying culvert material, specifying a setback for plant material, specifying both appropriate and inappropriate plant material, and using vertical fire breaks. In addition, extended vegetation setbacks are recommended along roadways where steep road grades cause vehicles to accelerate or decelerate.

Muschetto referred to the Fire Prevention Grant Program as a potential resource for fire-resilient roadside projects. The program, which is part of California Climate Investments, provides funding for fuels reduction projects that reduce the risk of wildfires to homes and communities in California.

Shasta County Fire Department

Johnathon Zulliger, battalion chief of Law Enforcement and Fire Prevention at CAL FIRE, provided insight into the causes of fires along roads in Shasta and Trinity counties. In 2019 approximately 22 vegetation fires were caused by a vehicular mechanical failure, most frequently tire and drivetrain failures or failing exhaust systems. In Zulliger's experience, most roadside fires start within 10 feet of the paved road surface. Dry grass is the most susceptible wildland fuel for starting fires. To effectively reduce roadside vegetation fires, he recommended clearing vegetation to bare mineral soil 10 feet away from the paved roadside edge.

Related Research and Resources

An examination of domestic in-progress and completed research sought information about efforts by transportation and other agencies to design fire-resilient roads. The literature search uncovered very little guidance on this topic. Resources primarily address vegetation management, including an Idaho Transportation Department project in progress that will examine the use of weed-suppressive bacteria to control cheatgrass on Idaho roadsides and provide recommendations for integrating this practice into the department's roadside management practices. A 2010 U.S. Forest Service paper evaluates the response of six non-native invasive plant species to wildfires in the northern Rocky Mountains. A 2008 U.S. Fish and Wildlife Service handbook looks at fire management and invasive plants, presenting fuels management treatments and best management practices for minimizing the potential for plant invasions.

Gaps in Findings

Although 20 state transportation agencies responded to the survey, only six have developed or adopted roadside design strategies or practices that are intended to make roadsides more resilient to fire. Several responding agencies are from high-fire states, but their experience designing fire-resilient roadsides is very limited. Most of the strategies shared through the survey were maintenance practices related to vegetation management. The literature search also uncovered minimal research on this topic.

Next Steps

Moving forward, Caltrans could consider:

- Examining the strategies and resources provided by survey respondents for application in California.

- Following up with Arizona DOT to obtain:
    - Formal, written guidance that the agency has developed for the design of fire-resilient roadsides.
    - List of appropriate plant material for use along roadsides in fire-prone areas.
- Evaluating Colorado DOT's Native Seed Calculator and database, which provide information about native seed species and rate the fire tolerance of these species.
- Gathering information from agencies that did not respond to the survey to obtain further guidance and perspectives.
- Reviewing the design strategies and recommendations from the CAL FIRE representatives.
- Examining the available resources on vegetation management and wildfire mitigation for potential design practices.
- Incorporating lessons learned from District 8's ongoing ignition reduction project with the U.S. Forest Service and CAL FIRE at southbound Interstate 15–Cajon Pass, including effective methods used and the success of these methods.
- Considering the use of inert materials in roadside and landscape work. District 8, which has used inert materials in several projects, is developing lessons learned related to:
    - Shoulder backing, including materials selection, depth, color, performance (wet or dry), education, specification and application.
    - Maintenance of inert materials, including weed prevention, damage from vehicles or other accidents, material availability, resources and training for maintenance staff about effective restoration efforts.
    - Wood mulch placement, including depth and maintenance.

Detailed Findings

Background

Historically, weather, fuel and topography have made California the "perfect storm" for wildfire. However, as seen in recent years, climate change, drought, forest disease and the increasing wildland–urban interface exacerbate the danger and the stakes involved. Roadsides are sometimes the point of origin of fires, and safety and roadside assets are at risk when fire does occur. One study shows that 74% of fires in national forests occur within 10 feet of a road edge.

Traditionally state departments of transportation (DOTs) have relied on maintenance practices that focus on fuels reduction along the roadside to decrease fire risk. The California Department of Transportation (Caltrans) is interested in information about design strategies implemented in other high-fire states to maintain safety and limit the costly environmental and infrastructure damage that results from fire. These strategies might include guidelines or design tools for landscape design, use of materials and treatments, plant selection and setbacks used to design a fire-resilient roadside. Caltrans is also seeking plans, specifications and cost estimates for successful fire presuppression projects.

To assist Caltrans in this information-gathering effort, CTC & Associates summarized the results of an online survey of state DOTs that examined roadside design strategies used for fire presuppression. In addition, a selected group of fire management experts in California were contacted to learn about effective strategies for fire presuppression along roadsides. A literature search supplemented the findings from the survey and consultation with subject matter experts. This search focused on identifying design strategies for fire-resilient roadsides, not the maintenance activities undertaken to reduce fire starts along the roadway, and included domestic in-progress and completed research and other resources from federal, state and other agencies. Findings are presented in this Preliminary Investigation in the following topic areas:

- Current Caltrans practice.
- Survey of practice.
- Consultation with fire management experts.
- Related research and resources.

Current Caltrans Practice

Below are some of the roadside design practices currently in place as part of Caltrans' fire presuppression program:

- District landscape specialists from the Division of Maintenance routinely engage with local fire officials when developing vegetation control plans. The division is also updating the roadside fire strip width from up to 8 feet to up to 10 feet. Recently the division launched an effort to develop defensible space that will focus on establishing fire breaks through both horizontal and vertical spacing of plant materials.
- Other current design practices already implemented by Caltrans include:
    - Using metal post guardrail in fire-prone areas.
    - Eliminating the use of high-density polyethylene (HDPE) culverts in fire-prone areas.
    - Preventing weed growth under guardrail and around signs, which also increases field crew safety by reducing worker exposure on roadways.

The survey findings presented below will support Caltrans' evaluation of current fire presuppression practices and allow the agency to expand its design toolbox with other roadside design strategies that maintain safety and limit the costly environmental and infrastructure damage that is the result of fire.

Survey of Practice

An online survey was distributed to members of two committees from the American Association of State Highway and Transportation Officials (AASHTO):

- Committee on Design.
- Committee on Maintenance.

Survey questions are provided in Appendix A. The full text of survey responses is presented in a supplement to this report.

Summary of Survey Results

Respondents representing design and maintenance units from 20 state transportation agencies responded to the survey:

- Alabama.
- Arizona.
- Colorado.
- Connecticut.
- Delaware.
- Florida.
- Idaho.
- Illinois.
- Kansas.
- Maryland.
- Michigan.
- Montana (two responses).
- Nevada (two responses).
- New Mexico.
- North Dakota.
- Oklahoma.
- Pennsylvania.
- Utah.
- Virginia.
- Wisconsin.

Seven respondents from six states—Arizona, Colorado, Florida, Michigan, Nevada and New Mexico—reported that their agencies have developed or adopted roadside design strategies or practices that are intended to make roadsides more resilient to fire. Most of these respondents represented design functional units within their agencies; the respondent from Florida DOT and one respondent from Nevada DOT provided a maintenance perspective.

Respondents from some of the state transportation agencies that have not developed or adopted formal roadside design strategies, including Alabama DOT, noted that fires are not an issue in their states that require implementing fire presuppression strategies. Other respondents from this group described fire-resilient practices; information from these respondents is provided when available.

Below are findings from these state transportation agencies and other state DOTs participating in the survey about roadside fire presuppression strategies and practices. Survey results are summarized in the following topic areas:

- Design strategies.
- Design strategy effectiveness.
- Safety appurtenances.
- Guidance for designing fire-resilient roadsides.

When available, supplementary resources provided by respondents or sourced through a limited literature search are provided at the end of each topic area.

Design Strategies

Respondents addressed the following design strategies for fire presuppression along roadsides in fire-prone areas:

- Vegetation-free zone along the pavement edge.
- Use of inert materials.
- Culvert materials for fire resilience.
- Plant material:
    - Setbacks.
    - Appropriate plant material.
    - Inappropriate plant material.
- Use of a vertical fire break.

Vegetation-Free Zone Along the Pavement Edge

Five states—Arizona, Colorado, Nevada, Oklahoma and Utah—require a vegetation-free zone along the pavement edge. Arizona DOT specifies requirements on a project-by-project basis; Nevada and Oklahoma DOTs define specific minimums, ranging from a 7-foot minimum to a 30-foot clear zone; Colorado DOT implements both practices. Table 1 summarizes survey results.

Table 1. Vegetation-Free Zone Requirements

State	Project Specific	Minimum Distance	Other	Description
Arizona	X			Based on the region and review by landscape architecture unit.
Colorado	X	X		• If guardrail exists adjacent to the road edge, weeds are eradicated under and around the structure. • A mow zone of 15 feet (typically) is maintained adjacent to highways.
Nevada/Roadway Design		X		10-foot minimum from the pavement edge.
Nevada/Maintenance		X		7-foot minimum.
Oklahoma		X		30-foot clear zone.
Utah			X	No vegetation on the untreated base course layer.
Total	2	4	1	

Use of Inert Materials

Two state DOTs—Arizona and Nevada (Design)—specify the use of inert materials along roadsides in fire-prone areas. In Arizona, requirements are project-specific based on the region,

a preapproved list of materials and review by the landscape architecture unit. The Nevada DOT Roadway Design Division uses shouldering material and/or rock mulch.

Culvert Materials for Fire Resilience

Among the state agencies responding to the survey, Idaho Transportation Department, Nevada DOT Roadway Design Division and North Dakota DOT specify culvert materials for fire resilience:

- Idaho Transportation Department primarily uses corrugated metal pipe and concrete for new construction. Some of the agency's maintenance sections no longer use plastic liners to rehabilitate culverts because they are difficult to extinguish when ignited. Instead they replace the culvert with metal or concrete.
- Nevada DOT Roadway Design Division uses reinforced concrete pipe, corrugated metal pipe, and concrete culvert pipe or boxes, where applicable. The agency also uses HDPE pipe that is buried underground and has metal end sections beyond the 10-foot buffer and clear zone requirements.
- North Dakota DOT uses nonflammable material for culvert end treatments.

Plant Material

Setbacks

Five respondents from four states—Arizona, Colorado, Nevada and New Mexico—provided information related to setbacks for plant material along roadsides in fire-prone areas. Arizona and Nevada DOTs have specified minimum distances; Colorado, Nevada and New Mexico DOTs are guided by vegetation or landscaping specifications and practices, not by a specific distance. Table 2 summarizes survey results.

Table 2. Setback Requirements for Plant Material Along Roadsides

Method	State	Description
Minimum Distance	Arizona, Nevada	*Arizona*. 30 or 60 feet, depending on the region. *Nevada/Roadway Design*. 10-foot buffer from pavement edge. *Nevada/Maintenance*. 7 feet.
Vegetation/ Landscaping Practices	Colorado, Nevada, New Mexico	*Colorado:* • Native grass and forb seed mixes are typically specified for roadside revegetation following construction, and not the setback of plant material in fire-prone areas. • Clearing setbacks of woody trees and shrubs is a function of maintenance units, generally for traffic safety and sight line clearance. *Nevada/Roadway Design*: • Landscaping (such as trees, shrubs and large boulders) must be outside of the roadway clear zone. • Most beautification efforts are around interchanges. *New Mexico*: Mowing height is specified to deter fires caused by a vehicle's catalytic converter.

Appropriate Plant Material

Among the states responding to the survey, only the respondents from Arizona and Colorado DOTs provided information about appropriate plant material for use along roadsides in fire-prone areas:

- According to the respondent, Arizona DOT has identified a list of appropriate plant material. (*Note*: At the time of publication of this report, the respondent had not provided the list.)
- Colorado DOT does not typically specify different plant material for fire-prone areas. Its standard native seed species can be used for roadsides throughout the state. The agency's native seed database (see Native Seed Calculator in Supporting Documents below) includes criteria for fire tolerance that can be used on projects with site-specific needs. Species in the database are given a rating of low, medium or high for fire tolerance.

Inappropriate Plant Material

Two respondents identified inappropriate plant material for use along roadsides in fire-prone areas: cheatgrass (Idaho) and red cedar in rights of way (Oklahoma). According to the Oklahoma DOT respondent, the invasive nature and combustibility of red cedar make it inappropriate plant material within state rights of way. When feasible, the agency removes red cedar from these areas.

Use of a Vertical Fire Break

Vegetation practices are part of the vertical fire break strategies implemented by Michigan and New Mexico DOTs. In Michigan, vegetation removal is the primary practice, and New Mexico DOT requires lower mowing heights from right of way fence to right of way fence.

The respondent from Arizona DOT reported that while the agency does not use a vertical fire break as a fire presuppression strategy, other agencies involved in Arizona DOT projects (such as the U.S. Forest Service) have used this practice.

Supporting Documents

Colorado

Native Seed Calculator, Colorado Department of Transportation, undated.
https://www.codot.gov/programs/environmental/landscape-architecture/native-seed-calculator
The Native Seed Calculator spreadsheet tool is used to develop native seed mixes for highway projects. This web page provides access to parameters required for creating a list of site-specific plant species, including highway mile and ecozone mile marker points, Natural Resources Conservation Service data about Colorado soil types and the seed calculator tool.

Related Resource:

CDOT Native Seed Calculator Plant Species Selection Guide, Colorado Department of Transportation, April 2019.
https://www.codot.gov/programs/environmental/landscape-architecture/assets/cdot-seed-calculator-instructions-041819
The CDOT Native Seed Calculator is "a tool to develop a [s]eeding [p]lan [t]able to include in [s]tormwater [m]anagement [p]lan (SWMP) [t]emplates. This guide will help SWMP administrators for Design to develop native seed mixes for diverse ecological zones for

highway projects in Colorado." The guide provides step-by-step instructions for using the Native Seed Calculator to prepare a seed list of site-appropriate species based on the local ecozone, soil profile and existing plant communities.

Design Strategy Effectiveness

Using a rating scale of 1 = not at all effective to 5 = extremely effective, respondents from nine states rated the effectiveness of the following design strategies for fire presuppression along roadsides:

- Vegetation-free zones.
- Using inert materials along roadsides.
- Specifying culvert material.
- Specifying a setback for plant material.
- Specifying appropriate plant material.
- Specifying inappropriate plant material.
- Using vertical fire breaks.

Vegetation-free zones was the most frequently rated design strategy; other frequently rated strategies were using inert materials and specifying a setback for plant material. Appropriate plant material was the least rated design strategy, and inappropriate plant material received the lowest rankings. Most of the respondents rated one to three of the design strategies; the Nevada DOT Roadway Design respondent rated four strategies, and the Arizona DOT respondent rated five strategies. Table 3 summarizes survey results.

Table 3. Effectiveness of Fire Presuppression Design Strategies

State	Vegetation Free Zones	Inert Materials	Culvert Material	Setback for Plant Material	Appropriate Plant Material	Inappropriate Plant Material	Vertical Fire Break
Arizona	4	4	N/A	3	3	3	N/A
Colorado	4	N/A	N/A	N/A	N/A	N/A	N/A
Idaho	N/A	N/A	4	N/A	N/A	2	N/A
Michigan	N/R	N/A	N/A	N/A	N/A	N/A	3
Nevada/Roadway Design	4	4	4	4	N/A	N/A	N/A
Nevada/Maintenance	3	3	N/A	3	N/A	N/A	N/A
New Mexico	3	N/A	N/A	3	N/A	N/A	3
Oklahoma	N/A	N/A	N/A	N/A	N/A	3	N/A
Pennsylvania	3	3	N/A	N/A	N/A	N/A	N/A
Utah	2	N/A	N/A	N/A	N/A	N/A	N/A

N/A Not applicable.

N/R No response.

Other Effective Fire Presuppression Design Strategies

Three additional design strategies are used to reduce roadside fire starts by agencies responding to the survey: frequent mowing, prescribed burns and appropriate plant material for living snow fences. The respondent from Pennsylvania DOT noted the infrequency of burns on state roadsides (one year in the past 30 years, in the respondent's experience), adding that "[i]n all cases, the fires started in low turfgrasses and burned out before reaching taller vegetation or more fuel." Similarly, the Wisconsin DOT respondent noted that fire "is not a major concern" for the agency and that presuppression or select vegetation is considered unnecessary. Generally, large-scale fire protection or response is coordinated by the state's Department of Natural Resources. Table 4 summarizes survey responses.

Table 4. Other Design Strategies and Practices for Fire Presuppression

Method	State	Description
Living Snow Fence Species Selection	Colorado	Landowners who install living snow fences off the roadway are encouraged to avoid highly flammable species such as Rocky Mountain juniper.
Mowing Frequently	Florida, Utah	*Florida*. Frequent mowing to reduce the effect on wildfires. *Utah*. Mowing more frequently in fire-prone areas.
Prescribed Burns	Kansas	Prescribed burns of the grass in the right of way.

Safety Appurtenances

Some respondents provided details about the guardrail, sign posts and other safety appurtenances installed on roadsides in fire-prone areas. Maryland DOT State Highway Administration and Michigan DOT respondents noted that their states have no designation of fire-prone areas. Information about the safety appurtenances used is summarized in Tables 5 through 7 below.

Guardrail

None of the respondents described guardrail that was unique to fire-prone areas. Idaho Transportation Department installs hardware that is compliant with AASHTO's Manual for Assessing Safety Hardware (MASH), and Kansas DOT uses wood and steel posts. Arizona, Oklahoma, Pennsylvania and Utah DOTs specify standard safety appurtenances. Colorado DOT typically sprays herbicide under and immediately adjacent to guardrails to suppress weed growth. Table 5 summarizes survey results.

Table 5. Roadside Safety Appurtenances in Fire-Prone Areas: Guardrail

Method	State	Description
MASH-Approved Hardware	Idaho	N/R
Standard	Arizona, Oklahoma, Pennsylvania, Utah	*Arizona*. Specified but not for fire purposes. *Pennsylvania*. Not aware of any safety appurtenances for fire concerns.

Method	State	Description
Standard	Arizona, Oklahoma, Pennsylvania, Utah	*Utah*. Standard safety appurtenances as used on other roadways in the state.
Wood and Steel Posts	Kansas	N/R
Other	Colorado	Areas under and immediately adjacent to guardrails are typically sprayed with herbicide to suppress weed growth.

Sign Posts

None of the respondents described sign posts that were specified for fire-prone areas. Idaho Transportation Department and Kansas DOT install metal and wood posts. Arizona, Oklahoma, and Pennsylvania DOTs specify standard safety appurtenances. As with guardrail, Colorado DOT implements a practice, typically spraying herbicide under and immediately adjacent to sign posts to suppress weed growth. Table 6 summarizes survey results.

Table 6. Roadside Safety Appurtenances in Fire-Prone Areas: Sign Posts

Method	State	Description
Metal and Wood Posts	Idaho, Kansas	*Idaho*. Metal and wood posts. *Kansas*. Wood and steel posts.
Standard	Arizona, Oklahoma, Pennsylvania	*Arizona*. Specified but not for fire purposes. *Pennsylvania*. Not aware of any safety appurtenances for fire concerns.
Other	Colorado	Areas under and immediately adjacent to sign posts are typically sprayed with herbicide to suppress weed growth.

Other Devices

Although designated roadside safety appurtenances for fire-prone areas are infrequent in Connecticut, the survey respondent noted that along nonaccess highways, stand pipes may be used at bridge structures to allow pumping from crossing streets. Colorado DOT relies on maintenance practices that include weed eradication for flammable annual grasses such as cheatgrass (*Bromus tectorum*) in the right of way. The Nevada DOT Roadway Design Division respondent also noted the practice of weed-free clear zones in the state. According to the respondent, Nevada is mostly rural, and most beautification efforts are at interchanges, where decorative rock, sculptures and native plantings are used. Contractors working at these sites are required to submit fire suppression plans that comply with U.S. Forest Service guidelines. Table 7 summarizes survey results.

Table 7. Roadside Safety Appurtenances in Fire-Prone Areas: Other Devices and Practices

Method	State	Description
Maintenance Practices	Colorado	Maintenance practices include weed eradication for flammable annual grasses such as cheatgrass (*Bromus tectorum*) in the right of way.

Method	State	Description
Stand Pipes at Bridges	Connecticut	The agency provides stand pipes at bridge structures to allow pumping from crossing streets along nonaccess highways.
Weed-Free Clear Zones	Nevada/Design	Weed-free clear zones. Contractors that design interchanges using features such as decorative rock, sculptures and native plantings are required to submit fire suppression plans that comply with U.S. Forest Service guidelines.

Guidance for Designing Fire-Resilient Roadsides

None of the respondents provided information about successful projects that installed a fire-resilient roadside.

The respondent from Arizona DOT was the only survey participant who reported that formal, written guidance was available for the design of fire-resilient roadsides. However, at the time of publication of this report, that guidance had not been received. The Colorado DOT respondent reported that to her knowledge, the agency does not have specifications or written guidelines specifically for fire-prone areas, but the agency has provided recommendations and guidelines for post-fire response, mainly for erosion or sediment control and seeding recommendations.

Consultation With Fire Management Experts

To gain a broader perspective of effective fire presuppression strategies along roadsides, we contacted fire management representatives from California Department of Forestry and Fire Protection (CAL FIRE) and Sierra Pacific Industries. Although we did not receive feedback directly from the initial CAL FIRE contacts, two senior leaders from the organization responded to our inquiry; their comments are summarized below. The Sierra Pacific Industries representative did not respond to requests for information.

California Department of Forestry and Fire Protection (CAL FIRE)

Law Enforcement and Civil Cost Recovery

Gianni Muschetto, staff chief of Law Enforcement and Civil Cost Recovery at CAL FIRE, provided the following details about various design strategies and practices for fuels reduction projects that incorporate roadways:

Design Strategies

- *Vegetation-free zone along the pavement edge*. Although not required, vegetation-free zones and various types of fuel breaks are incorporated as part of the project.
- *Setback for plant material*. A specific setback is not required, however, recommendations are provided if local fire plans are written within specific counties or communities. Typically these recommendations are based on local conditions and historical ignitions in specific areas.
- *Appropriate and inappropriate plant material*. Muschetto referred to the Ready for Wildfire web site (see **Supporting Documents** below), an educational resource for

homeowners, noting that the fire-resistant landscaping principles discussed on the web site can be adapted for roadside areas.

- *Use of a vertical fire break*. Both horizontal and vertical breaks and spacing are used in fuels reduction projects. According to Muschetto, all ladder fuels are typically removed below trees, and trees are limbed to a height of 15 feet.

Design Strategy Effectiveness. According to Muschetto, the following strategies are considered extremely effective: vegetation-free zones, using inert materials along roadsides, specifying culvert material, specifying a setback for plant material, specifying both appropriate and inappropriate plant material, and using vertical fire breaks. In addition, extended vegetation setbacks are recommended along roadways where steep road grades cause vehicles to accelerate or decelerate.

Fire-Resilient Roadside Projects. The Fire Prevention Grant Program, part of California Climate Investments, provides funding for fuels reduction projects that reduce the risk of wildfires to homes and communities in California. The program web site (see **Supporting Documents** below) includes several grant recipients from fiscal year 2019-2020 that conducted fuels reduction projects along roadsides.

Guidance for Designing Fire-Resilient Roadsides. CAL FIRE provides project-specific recommendations when local fire plans or fuels reduction projects are implemented.

Shasta County Fire Department

Johnathon Zulliger, battalion chief of Law Enforcement and Fire Prevention at CAL FIRE, provided some insight about the causes of fires along roads in Shasta and Trinity counties. Zulliger regularly responds to all types of fires in these counties and conducts origin-and-cause fire investigations.

According to Zulliger, the Shasta–Trinity Unit responds to approximately 200 wildland fires each year. In 2019 approximately 22 vegetation fires occurred that were caused by a vehicular mechanical failure, most frequently tire and drivetrain failures or failing exhaust systems that emit glowing hot internal parts, typically from catalytic converters. In 2018, the Carr Fire in Shasta County started from a blown trailer tire (the tire rim scraped across the paved road surface, creating sparks that landed in the dry grass along the roadway).

In Zulliger's experience, most roadside fires start within 10 feet of the paved road surface. Dry grass is the most susceptible wildland fuel for starting fires. To effectively reduce roadside vegetation fires, he recommended clearing vegetation to bare mineral soil 10 feet away from the paved roadside edge.

Supporting Documents

Intersection of Forestry and State Highways: Wildfire Risk Reduction Strategies for 2020-2030, Lisa Worthington, Helge Eng and John Exline, California Department of Transportation, California Department of Forestry and Fire Protection, U.S. Forest Service, December 12, 2019. See Attachment A.
This presentation addresses the interagency stewardship of California roads and forests to prioritize fuels reduction projects and provide safe access to state communities. Slide 19 presents California's fire plan:

- Identify assets at risk.

- Land use planning.
- Use of wildland fire protection plans.
- Defensible space standards.
- Multijurisdictional fire and fuels management.
- Plan for fire suppression resources.
- Post-fire recovery and rehabilitation of natural landscapes.

Slides 8 through 11 address efforts to prioritize highway corridors in need of fuels reduction. Slide 35 lists the proposed fuels reduction strategies for 2020 through 2030. Other topics include funding, trade-offs and challenges in fuels reduction.

Fire Prevention Grant Program, California Climate Investments, California Department of Forestry and Fire Protection, undated.
https://www.fire.ca.gov/grants/fire-prevention-grants/
The Fire Prevention Grant Program awards funding to cities, counties, fire districts, Native American tribes and other nonprofits for fuels reduction projects that reduce the risk of wildfires to homes and communities in California. The grant program is part of California Climate Investments, a statewide program to reduce greenhouse gas emissions, strengthen the state economy, and improve public health and the environment, particularly in low-income and disadvantaged communities. In fiscal year 2019-2020, 55 local fire prevention projects (https://www.fire.ca.gov/media/10803/cal-fire-california-climate-investments-awarded-grants-fy19-20-03062020.pdf) received funding for hazardous fuels reductions (including numerous projects along public and tribal roads), wildfire preparedness planning and fire prevention education.

Ready for Wildfire, California Department of Forestry and Fire Protection, undated.
https://www.readyforwildfire.org/
This wildfire preparedness web site targets California landowners and other residential stakeholders. Included on the site are action steps to prepare for and prevent wildfire, and to repair and restore residential property after a wildfire.

Related Research and Resources

An examination of domestic in-progress and completed research sought information about efforts by transportation and other agencies to design fire-resilient roads. The literature search uncovered minimal guidance on this topic. The findings are organized below in two topic areas:

- Vegetation management.
- Wildfire mitigation.

Vegetation Management

National Guidance

Fire Management and Invasive Plants: A Handbook, Matthew Brooks and Michael Lusk, U.S. Fish and Wildlife Service, 2008.
https://www.fws.gov/invasives/pdfs/USFWS_FireMgtAndInvasivesPlants_A_Handbook.pdf
From the executive summary:

> Fire management can help maintain natural habitats, increase forage for wildlife, reduce fuel loads that might otherwise lead to catastrophic wildfire, and maintain natural succession. Today, there is an emerging challenge that fire managers need to be aware of: invasive plants. Fire management activities can create ideal opportunities for invasions by nonnative plants, potentially undermining the benefits of fire management actions.
>
> This manual provides practical guidelines that fire managers should consider with respect to invasive plants.

Section VI (beginning on page 16 of the report, page 21 of the PDF) presents fuels management treatments and best management practices for minimizing the potential for plant invasions.

State Guidance

Multiple States

Response of Six Non-Native Plant Species to Wildfires in the Northern Rocky Mountains, USA, Dennis E. Ferguson and Christine Craig, Rocky Mountain Research Station, Forest Service, U.S. Department of Agriculture, 2010.
https://www.fs.fed.us/rm/pubs/rmrs_rp078.pdf
From the abstract: This paper presents early results on the response of six non-native invasive plant species to eight wildfires on six National Forests (NFs) in the northern Rocky Mountains, USA. Stratified random sampling was used to choose 224 stands based on burn severity, habitat type series, slope steepness, stand height, and stand density. Data for this report are from 219 stands (875 plots) that have repeated measures 1 to 7 years post-fire. Six invasive plant species are abundant enough to analyze for early indications of response to burning. Spotted knapweed occurrence is highest on Douglas-fir and ponderosa pine habitat types on the Bitterroot NF. Canada thistle occurs on most of the sampled wildfires but at low occurrences and percent plot coverage. Bull thistle has rapid increases on the Bitterroot, Flathead, Kootenai and Malheur NFs, generally with increasing occurrence at higher burn severities, but average percent coverage is low. Orange hawkweed has low occurrences (<5 percent) and never more than 1 percent coverage on a plot. Meadow hawkweed has its highest occurrence on the Bitterroot NF in low burn severities on Douglas-fir and ponderosa pine habitat types. Prickly lettuce is found on most NFs, the highest occurrences being on the Malheur and Panhandle

NFs, with increasing occurrence at higher burn severities; however, average percent cover of prickly lettuce is low. Populations of the six species (especially spotted knapweed, bull thistle, and prickly lettuce) need continued monitoring to determine if occurrence and cover continue to change.

California

"California's Bad Romance With Bromus Fuels Wildfire," Pamela Kan-Rice, University of California Cooperative Extension Capitol Corridor, Blog Post, July 22, 2019.
http://cecapitolcorridor.ucanr.edu/?blogtag=weeds&blogasset=84198
From the blog post: When wildfires burn in California, people often call them forest fires or brushfires, but the odds are high that an invasive weed is an unrecognized fuels component, says a [University of California (UC)] Agriculture and Natural Resources scientist.

"We have all of the nasty non-native *Bromus* species here in California, and these weeds are key drivers of increasing fire frequency," said Travis Bean, UC Cooperative Extension weed science specialist based at UC Riverside.

The invasive, non-native *Bromus* species aggressively outcompete native plants, forming dense stands that grow fast and dry out quickly, becoming highly flammable. Fire can move rapidly through these dense patches of dry grass, especially during windy conditions or on slopes.

"When you have understory of dry *Bromus* or other weedy grasses, their ease of ignition can allow fire to spread from areas like roadsides where ignition sources are plentiful to more pristine native plant communities," Bean said. "Additionally, these fast-moving fires can throw embers that allow the fire to jump long distances or even reach high into the air, igniting structures."

Idaho

Project in Progress: Integration of Weed-Suppressive Bacteria With Herbicides to Reduce Exotic Annual Grasses and Wildfire Problems on ITD Right-of-Ways, Idaho Transportation Department, start date: October 1, 2019; expected completion date: October 31, 2021.
Project description at https://trid.trb.org/view/1671384
From the project description: Exotic annual grasses continue to expand along Idaho's highways, negatively affecting roadside vegetation efforts, increasing wildfire occurrence and creating a need for greater use of herbicides and tillage. Example species include cheatgrass (*Bromus tectorum L.*), medusahead (*Taeniatherum caput-medusae L.*) and North-Africa wiregrass (*Ventanata dubious L.*). Exotic annual grasses easily disperse seed and readily establish in disturbed areas, such as where road construction or improvements have disturbed vegetation cover and soil. Their persistence along roadsides increases overall costs of roadside management and leads to poor establishment of desirable seeded plant species. The resulting increases in fire ignitions and soil destabilization, along with corresponding water or wind erosion (dust storms), create major highway hazards in Idaho. This study will build upon a previous study (ITD Research Project RP 258) to evaluate the feasibility of using a [w]eed-[s]uppressive [b]acteria (Strain ACK55) to control cheatgrass on Idaho roadsides and to provide recommendations for integrating the use of the [w]eed-[s]uppressive [b]acteria into the department's roadside management practices.

The objectives of this project include:

1. [B]uilding upon previous ITD research on the use of [w]eed-[s]uppressive [b]acteria (WSB) (ITD Research Project RP 258) by:
    a. [C]ollecting additional data on the impact of the WSB on test plots included in the previous study to better assess the long-term performance of the WSB.
    b. [E]stablishing new experimental plots testing the effectiveness of WSB on target (i.e., exotic annual grasses) and non-target species with and without pre-mowing or co-application of herbicides or drill seeding.
2. [D]eveloping best practice and an integrated vegetation management plan for future utilization of the bacterium.

Related Resource:

Weed-Suppressive Soil Bacteria to Reduce Cheatgrass and Improve Vegetation Diversity on ITD Rights-of-Way, Ann Kennedy, Idaho Transportation Department, June 2017.
https://rosap.ntl.bts.gov/view/dot/34952
The research in this study, which evaluated the use of weed-suppressive bacteria (Strain ACK55) to control cheatgrass on Idaho roadsides, is the basis for the project in progress described in the previous citation.

Wildfire Mitigation

National Guidance

Wildfire Mitigation Tools and Resources: I Work for State/Local Government, Federal Emergency Management Agency, U.S. Department of Homeland Security, last updated March 2019.
https://www.fema.gov/wildfire-mitigation-tools-and-resources-i-work-state/local-government
While the focus is primarily on best practices for wildfire safety in communities, this web page offers numerous tools and resources that are designed to help planners and state and local officials mitigate wildfire.

Job Aid: Bioengineered Wildfire Mitigation, Federal Emergency Management Agency, U.S. Department of Homeland Security, November 2018.
https://www.fema.gov/media-library-data/1543347790158-ced293462a58da1afb194eea4874500b/FEMABioengineeredWildfireMitigationJobAidRev_Nov_2018.pdf
From the document:

Audience: The intended audience for this Job Aid is state, tribal and local governments; emergency managers; and first responders. This audience does not have an in-depth technical background or experience with bioengineering techniques pertaining to wildfire mitigation. The audience may consider incorporating bioengineered wildfire mitigation techniques into their hazard mitigation planning or implementing these techniques with the Federal Emergency Management Agency's (FEMA) Hazard Mitigation Assistance (HMA) planning and project grants. Further, the audience may consider using HMA funded planning-related activities to advance certain elements of the hazard mitigation plan,

integrate information with other planning efforts, build capabilities, or evaluate adoption and/or implementation of codes and ordinances. As appropriate, HMA funded activities should be coordinated with activities funded under other FEMA programs, such as Public Assistance (PA) and other federal grant programs to make effective use of federal funds.

Definition: Bioengineered wildfire mitigation uses aspects of the natural environment to mitigate the risk of wildfire to the community, including residential and commercial property, utilities and infrastructure. While various wildfire mitigation methods exist, this Job Aid addresses methods applicable to the relevant HMA programs (i.e., Hazard Mitigation Grant Program (HMGP) and Pre-Disaster Mitigation (PDM)).

Contacts

CTC contacted the individuals below to gather information for this investigation.

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Appendix A: Survey Questions

The following survey was distributed to members of two American Association of State Highway and Transportation Officials (AASHTO) committees:

- Committee on Design.
- Committee on Maintenance.

Roadside Design Strategies for Fire Presuppression

1. Has your agency developed or adopted roadside design strategies or practices that are intended to make roadsides more resilient to fire?
    - No
    - Yes
2. Does your agency require a vegetation-free zone along the pavement edge?
    - No
    - Yes (please identify the width of this zone and when it is required)
3. Does your agency specify the use of inert materials along roadsides in fire-prone areas?
    - No
    - Yes (please describe the material used and when it is required)
4. Does your agency specify culvert materials for fire resilience?
    - No
    - Yes (please describe the material used and when it is required)
5. Does your agency specify a setback for plant material along roadsides in fire-prone areas?
    - No
    - Yes (please describe the setback and when it is required)
6. Has your agency identified a list of appropriate plant material for use along roadsides in fire-prone areas?
    - No
    - Yes (please provide this list)
7. Has your agency identified a list of inappropriate plant material for use along roadsides in fire-prone areas?
    - No
    - Yes (please provide this list)
8. Has your agency employed the use of a vertical fire break as a means of fire presuppression along roadsides?
    - No
    - Yes (please describe this type of fire break)
9. Please rate the effectiveness of the following strategies your agency has used as a fire presuppression practice along roadsides using the rating scale of 5 = extremely effective to 1 = not at all effective.
    - Vegetation-free zones
    - Using inert materials along roadsides
    - Specifying culvert material
    - Specifying a setback for plant material

- Specifying appropriate plant material
- Specifying inappropriate plant material
- Using vertical fire breaks

10. Please describe any other strategies or practices your agency uses to reduce fire starts along the roadside. Include in your description your assessment of the effectiveness of these strategies.
11. Please describe the safety appurtenances your agency installs on roadsides in fire-prone areas.
    - Guardrail
    - Sign posts
    - Other (please describe)
12. Does your agency have plans, specifications and estimates you can provide for successful projects that installed a fire-resilient roadside?
    - No
    - Yes (Please provide links to documents or send any files not available online to carol.rolland@ctcandassociates.com.)
13. Has your agency developed formal, written guidance for the design of fire-resilient roadsides?
    - No
    - Yes (Please provide links to documents or send any files not available online to carol.rolland@ctcandassociates.com.)

Wrap-Up

Please use this space to provide any comments or additional information about your previous responses.

Item 14

Caltrans Executive Board
December 12, 2019

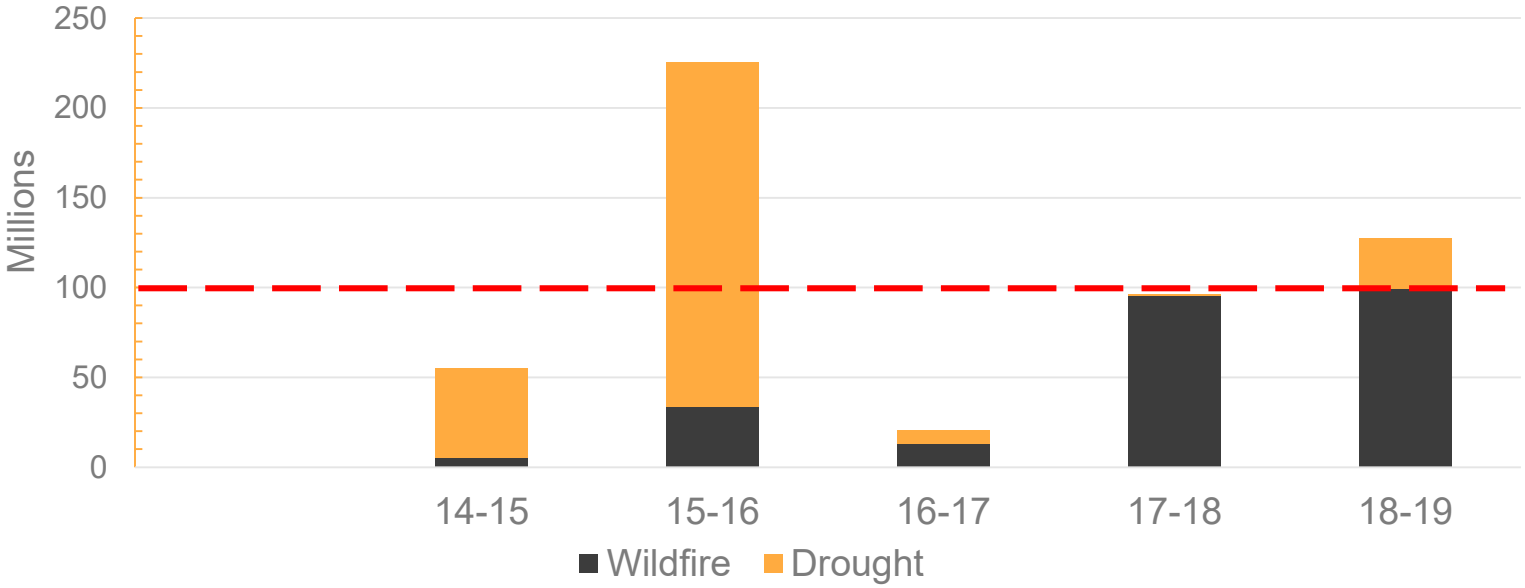
Lisa **Worthington**
Caltrans, Forest Management Program
Helge **Eng**
CAL FIRE, Resource Management
John **Exline**
US Forest Service Region 5, Ecosystem Management

The Intersection of Forestry and State Highways

Wildfire Risk Reduction Strategies for 2020-2030

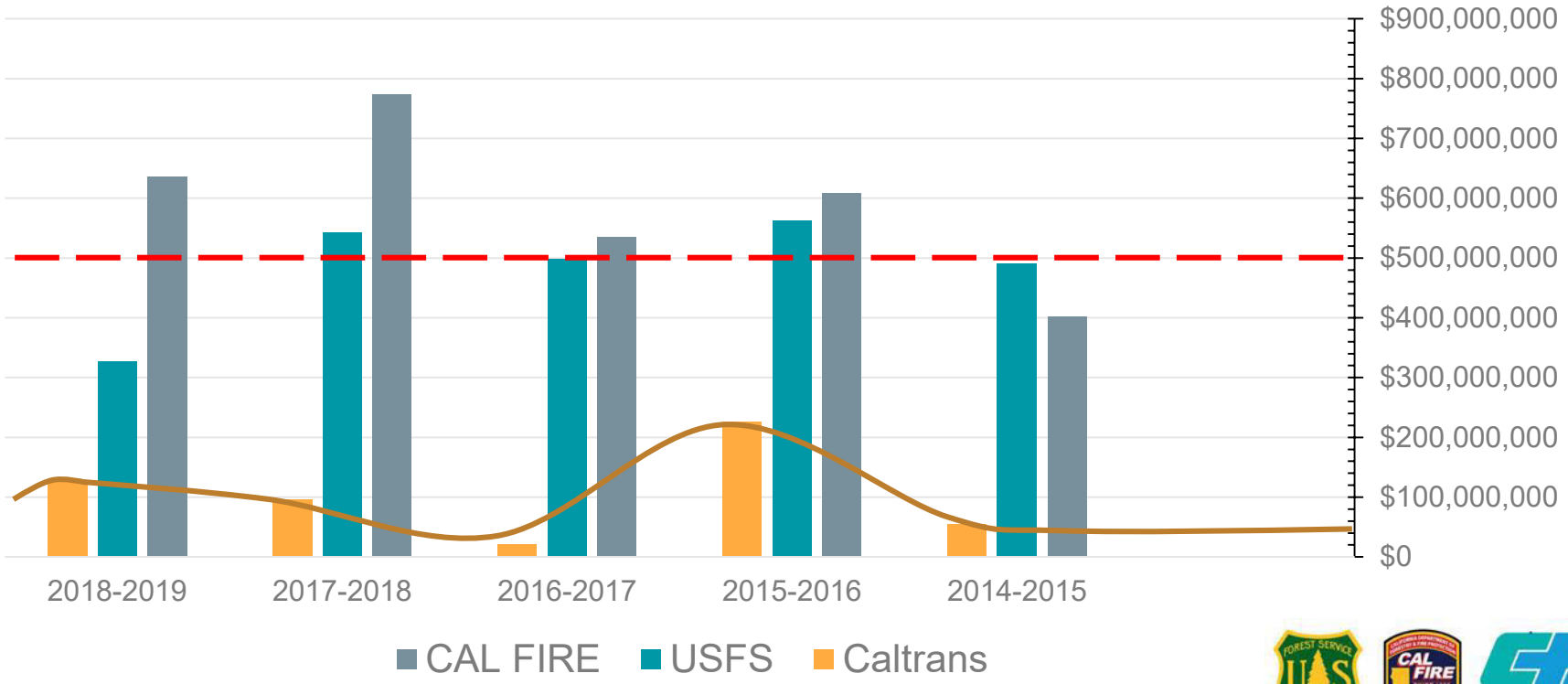
Emergency Fund - Wildfire follows Drought

Caltrans only $524,080,000 M (five years combined)



Emergency Fund (Combined) 2014-2019

Wildfire Suppression Total $5,900,515,000 B



*Caltrans Expenditures are Director's Orders

One year ago.... *November 8, 2018*

Camp Fire Butte County & Town of Paradise

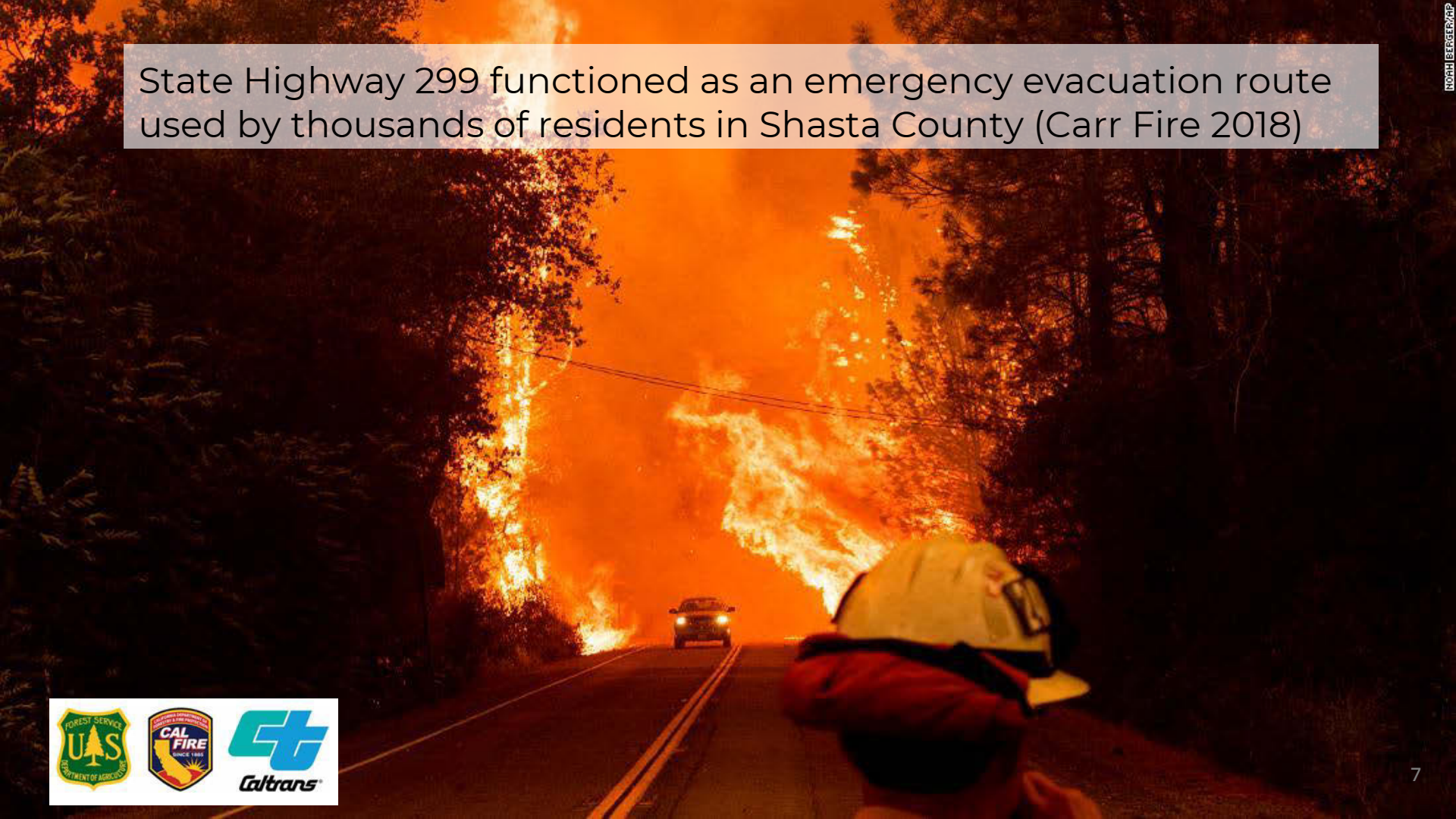
Impacts: 152,000 ac, 85 fatalities, 18,800 structures

Caltrans

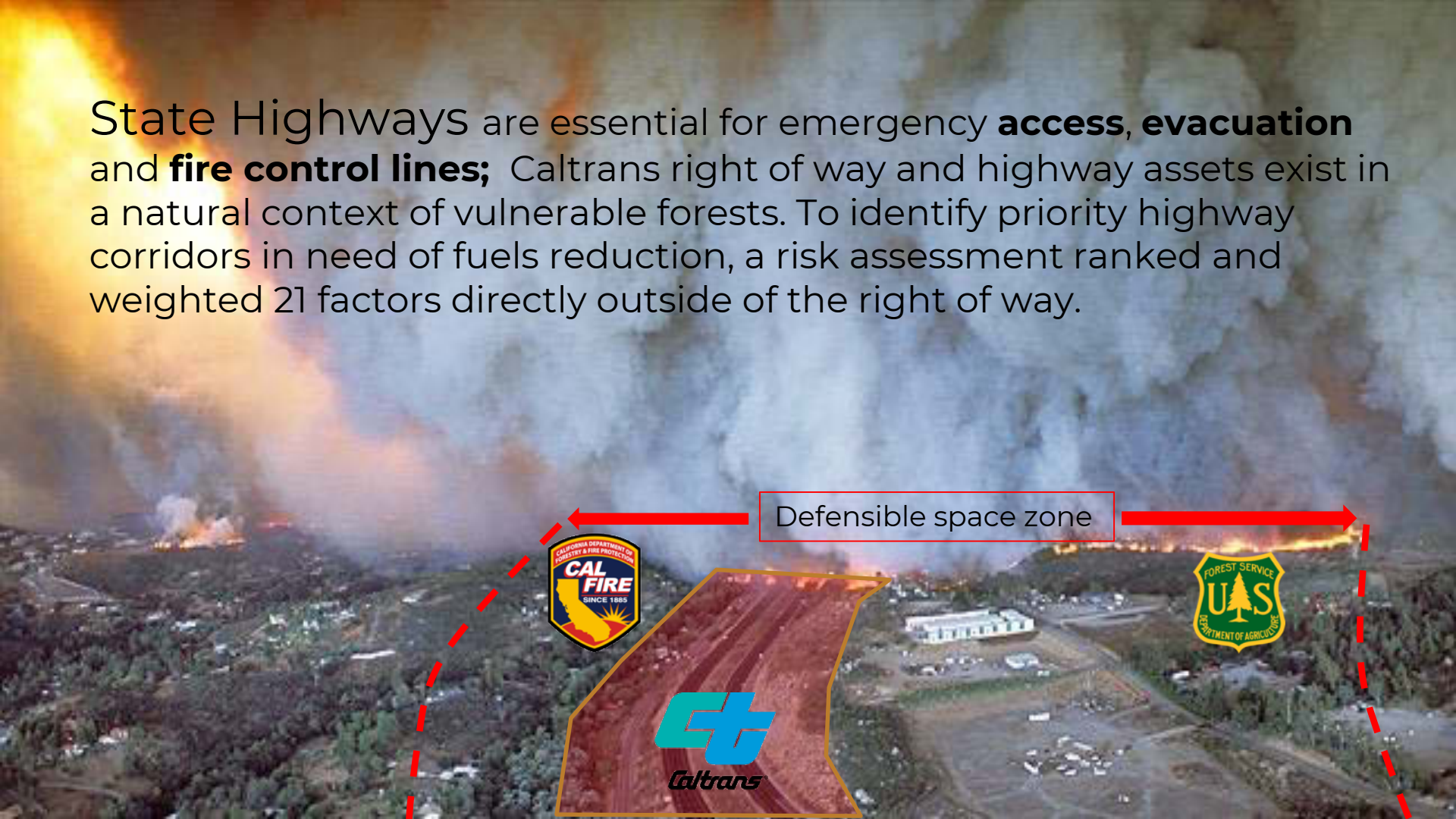
Four state highways were part of the zone-by-zone **emergency evacuation plan** in Butte County (Camp Fire 2018)

NASA earth observatory

State Highway 299 functioned as an emergency evacuation route used by thousands of residents in Shasta County (Carr Fire 2018)

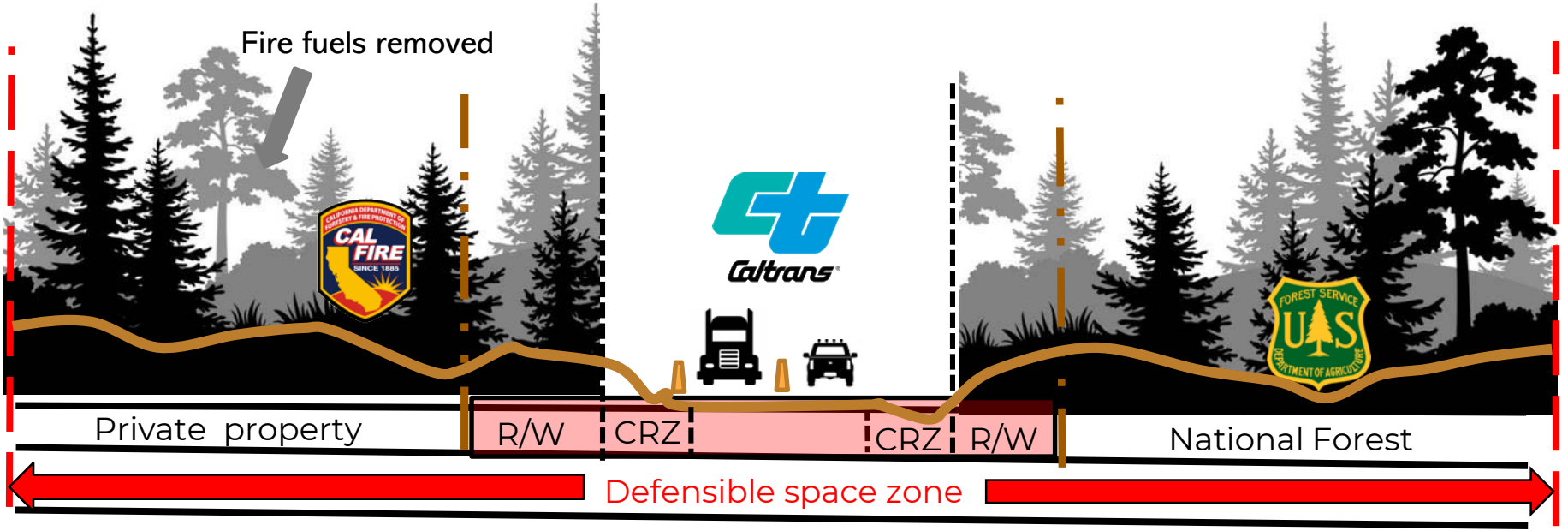


State Highways are essential for emergency **access**, **evacuation** and **fire control lines;** Caltrans right of way and highway assets exist in a natural context of vulnerable forests. To identify priority highway corridors in need of fuels reduction, a risk assessment ranked and weighted 21 factors directly outside of the right of way.

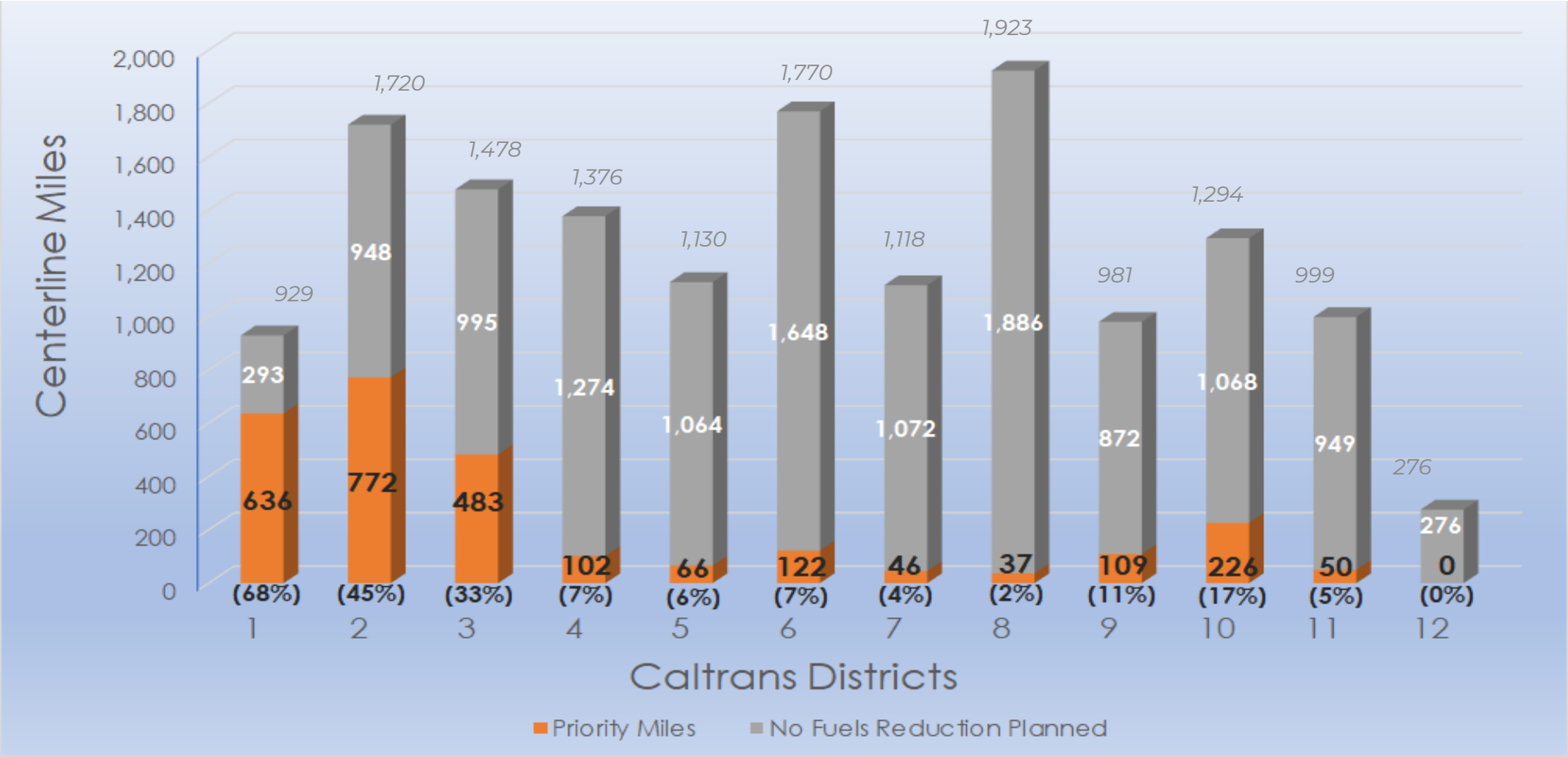


State Highways with “defensible space zones”

are specified by Foresters as thinned (not clear cut) timber and fire fuels



Statewide Fuel Reduction Needs

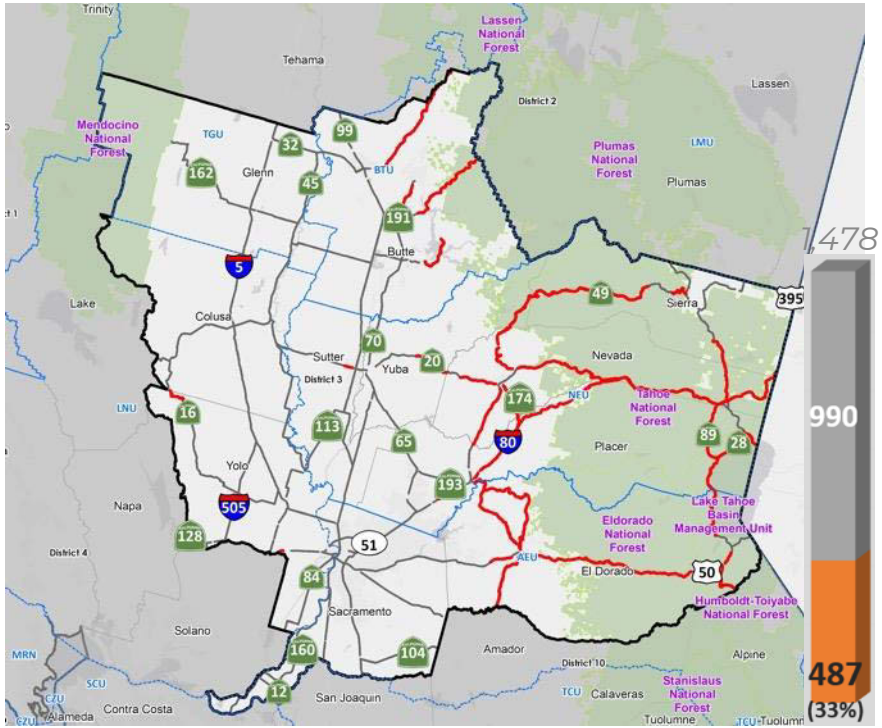


Statewide Fuel Reduction Needs

District	Total Centerline Miles	Priority Centerline Miles	Percent in this District	Acres	Cost ($2,400/acre)
1	929.39	636.44	68	40,115	$96,276,146
2	1,720.07	772.11	45	48,666	$116,798,979
3	1,477.46	482.85	33	30,434	$73,042,299
4	1,376.9	102.47	7	6,459	$15,500,619
5	1,129.68	65.82	6	4,149	$9,956,575
6	1,770.01	121.77	7	7,675	$18,420,042
7	1,117.97	45.52	4	2,869	$6,886,308
8	1,923.12	36.77	2	2,318	$5,562,739
9	980.29	108.65	11	6,848	$16,435,261
10	1,294.17	226.02	17	14,246	$34,190,297
11	998.38	49.82	5	3,140	$7,536,396
12	275.74	0	0	0	0
TOTAL	**14,993**	**2,648**		**166,919**	**$400,605,662**

Caltrans

District 3 Priorities



Total Highways: 13	
Total Segments: 95	
Total Priority Centerline Miles: 487 mi	
District Average Weighted Score: 76	
Counties Impacted: Butte, El Dorado, Nevada, Placer, Sierra, Sutler, Yolo, Yuba	

Routes	Miles	Weighted Score	Post Mile Markers
I-80	109	87	1.6-31.8, 20.8-58.7, 9.9-16, 58.7-62.6, 62.6-69.8, 18.8-20.2, 0-1.6, 0-1.3
SR-16	4	70	0.6-5.1
SR-162	9	73	21.4-31
SR-174	12	79	2.88-9.3, 0-2.9
SR-191	6	70	3.4-9.6
SR-193	26	76	0-26.7
SR-20	44	76	41.3-45.9, 17.7-41.3, 13.1-14.9, 13.2-21.7, 3.5-11.7
SR-267	3	71	6.6-9.9
SR-28	10	71	0.1-10.3
SR-32	22	77	15.1-37.1
SR-49	114	76	0-1.8, 0-16.5, 0-9.4, 25.6-32.7, 0-34.4, 0-13.5, 15.9-24.8, 41.1-47.4, 0-14
SR-70	21	79	26.4-48.1
SR-89	58	72	21.6-27.4, 13.1-27.4, 0.1-31.8, 0-8.7, 24-70.6
US-50	47	76	10.2-15.1, 21-59, 66.7-69.9, 71.4-74.1

District 3 is still recovering from the Camp Fire in Butte County. FEMA has made monies available for fuels reduction in adjoining counties. In the ranking criteria, the Caltrans score was extremely high for Interstate 80 because it is a Life Line route for a lot of foothill communities in the WUI.
Caltrans currently has a $28.8M dollar FEMA hazard mitigation grant in final review to address fuels reduction projects on state highways 49 and 20.
Majority of priority segments are in the Lake Tahoe region and the upper elevations of the Tahoe and El Dorado National Forests.

Forest Management Program

9 Steps

Forest Management Program

Outcomes

Highway Safety = 179,862 hazards removed

Hazardous Trees Removed Mapped via GIS point of each tree to obtain RW certification of parcel boundaries	**Caltrans RW**	**USFS owned** National Forest(s) within project limits	**Private Property** PTE obtained by District RW or Construction	**Other gov**
179,862	34,174	73,743	68,348	3,597
As of April 30, 2019	19%	41%	38%	2%

Note: Caltrans projects generated electricity to power 31,190 homes by converting low-value timber to fuel chips and delivering to Biomass Energy plants for sustainable reuse (as of December 2019)

Forest Management Program

Accomplishments (2016-2019)

Goals

1. Safety - Remove hazardous trees and fire fuels from Caltrans right-of-way
2. Sustainability - Ensure reuse of low value timber for bioenergy production
3. Funding – Secure short and mid-term funding for continuous fuels reduction

Statistics

- 63% hauled to biomass in a “chips to watts” process
- 114,600 low-value, dead trees*
- 80.05 MBF (million board feet)
- 218,332 BDT (bone dry tons)
- 218,332 MWh energy
- 31,190 homes* were powered in CA for a year
- 81% of trees were removed from mountainous routes
- 19% from urban corridors, which also suffered water conservation mandates to shut off irrigation systems
- 43 of 58 counties are experiencing tree mortality along 87 different highways
- $160M in construction capital expended to date

*This quantity excludes any vegetation management performed by Caltrans Maintenance activities or by others by Encroachment Perm
**Avg CA home uses 7 MHw energy/year

Caltrans

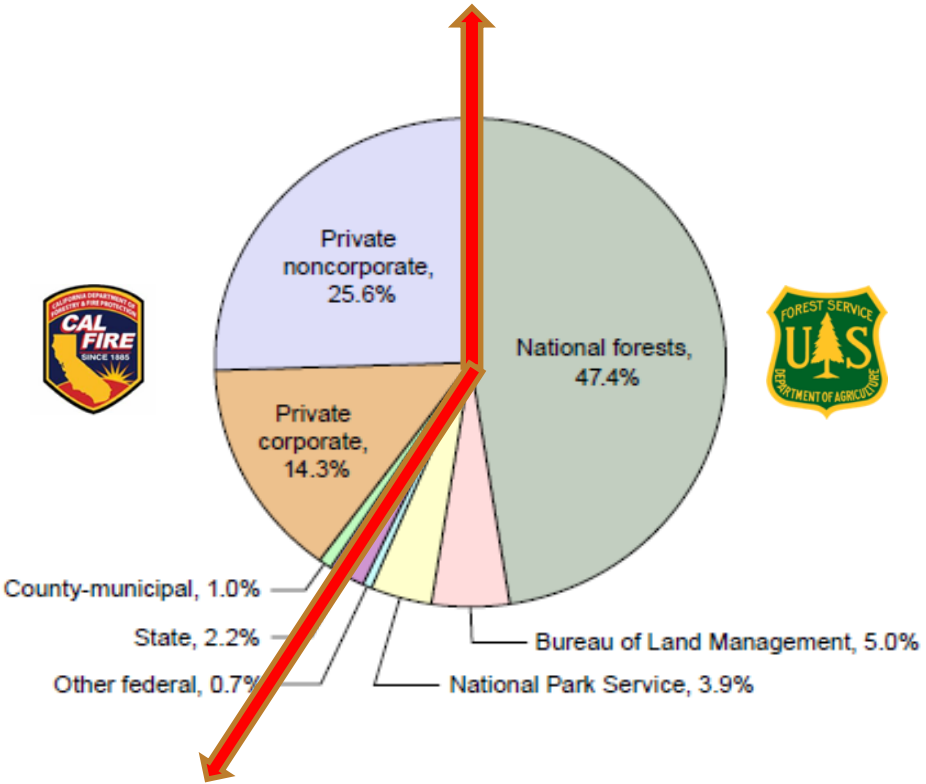
…”CAL FIRE is lead agency in California on 35 collaborative projects for wildfire risk reduction, and in every County, the **state highways are a critical part of the solution**.”

Scott Wyatt, CAL FIRE Deputy Director of Fire Prevention and Planning

CAL FIRE Units
(21 + Contract Counties)

Caltrans Districts
(12)

Forest Distribution



California's Fire Plan

1978

2006

+

- Identify Assets at Risk
- Land-Use Planning
- Use of Wildland Fire Protection Plans
- "Defensible Space" Standards
- Multi-Jurisdictional Fire & Fuels Management
- Plan for Fire Suppression Resources
- Post Fire Recovery & Rehabilitation of Natural Landscapes

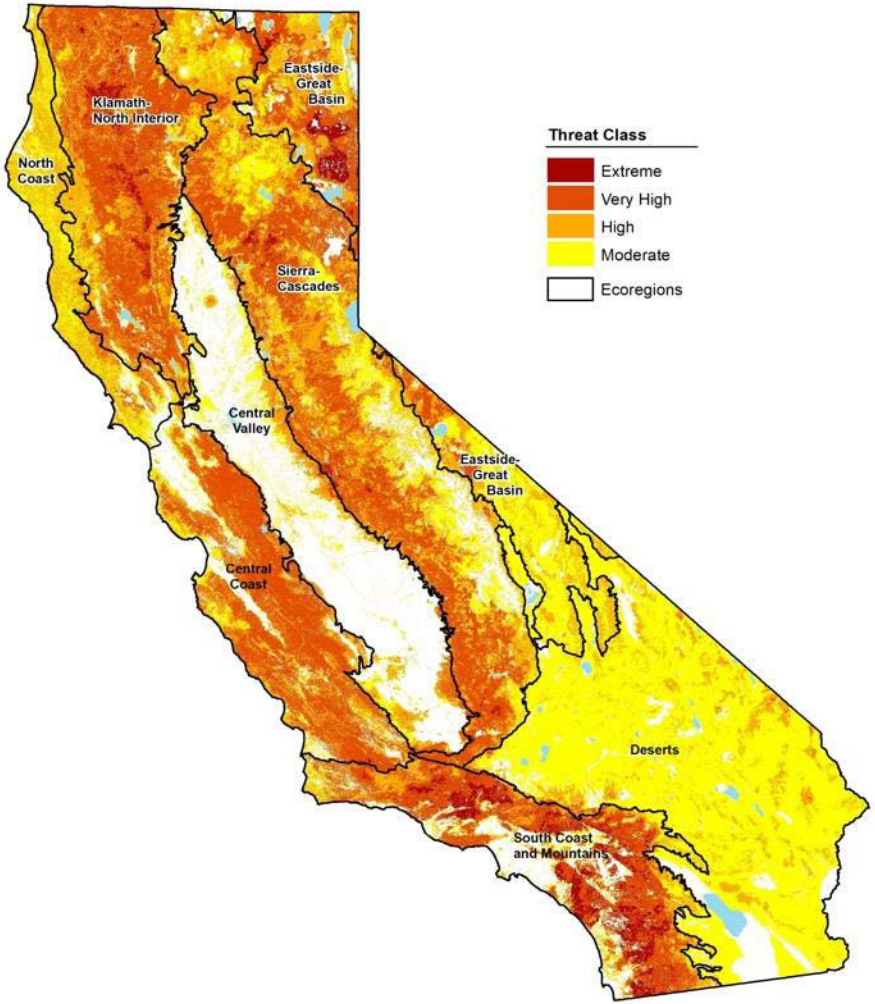
2018 STRATEGIC FIRE PLAN FOR CALIFORNIA

A vision for a natural environment that is more fire resilient; buildings and infrastructure that are more fire resistant; and a society that is more aware of and responsive to the benefits and threats of wildland fire; all achieved through local, state, federal, tribal, and private partnerships.

STATE BOARD OF FORESTRY AND FIRE PROTECTION

CALIFORNIA DEPARTMENT OF FORESTRY AND FIRE PROTECTION (CAL FIRE)

August 22, 2018


Threat Class
Extreme
Very High
High
Moderate
Ecoregions
Klamath-
North Interior
Eastside-
Great
Basin
North
Coast
Sierra-
Cascades
Central
Valley
Eastside-
Great
Basin
Central
Coast
Deserts
South Coast
and Mountains

Funding

- CAL FIRE $200 M for additional 4 years (2020 - 2024)*
  *SB-1 allocation to be approved by Legislature
- USFS + Partners received $97 M to date
- USFS + Partners will compete in current grant cycle (18 applications, 14 forests and R&D)
- Caltrans will compete for $2.2M in CCI Fire Prevention Grants (1 application) focused on fuels reduction in District 1

Climate Change Initiative				
FY 14-15	**FY 16-17**	**FY 17-18**	**FY 18-19**	**FY 19-20**
$24	$40	$220	$165	$210

CAL FIRE “45-Day Report”

EO N-05-19

35 projects / 90,000 acres fuels reduction

3 major projects on state highways

02-SHA-**44** (30 mi) commercial timber harvest

06-MAD-**41** (11 mi) prescribed fire

04-SCL-**17** (6.5 mi) complex fuels reduction

Fuel Break & Commercial Timber Harvesting

02-SHASTA-44

Prescribed Fire 06-MADERA-41

Controlled burn by CAL FIRE of range land grass along state highway

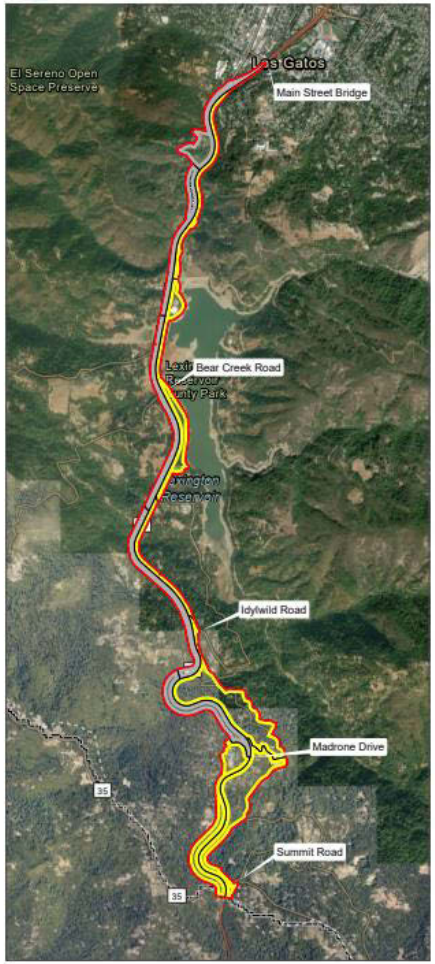
Highway 17
Shaded Fuel Break

04-Santa Clara-17

www.firesafe17.com

STATE ROUTE 17 SHADED FUEL BREAK

Public Information Map - Progress Update



The State Route 17 Shaded Fuel Break project is a collaboration between these public and private entities and is part of California Climate Investments, a statewide initiative that puts billions of Cap-and-Trade dollars to work reducing greenhouse gas emissions, strengthening the economy, and improving public health and the environment.

Progress Update as of Friday, November 8th:

This Week's Work Progress - November 4-8 (Week 11):
Work continued this week from Madrone Drive (Redwood Estates) to Old Santa Cruz Hwy. Crews removed ladder fuels in the Moody Gulch area and hazard trees around Alma Station. There were lane closures on SR-17 northbound from Monday through Thursday, 9:00AM to 3:00PM, from the Summit Road interchange to Bear Creek Road.

Next Week - November 11-15 (Week 12):
NO WORK ON MONDAY NOV 11: VETERANS DAY.
SR-17 northbound lane closures this week from 9:00AM to 3:00PM:
Tues/Wed: Madrone Drive (Redwood Estates) to Idylwild.
Thurs: Summit Road to Madrone Drive (Redwood Estates).
No lane closures Friday Nov 15. Users of the Los Gatos Creek Trail may be experience brief delays while crews remove hazard trees and vegetation. Trail users are advised to maintain a safe distance when encountering crews and equipment and may use St. Joseph's Trail as an alternate route. Safety signs at Main Street Bridge and Alma Bridge Road show map of alternate route.

November 18-22 (Week 13):
SR-17 northbound lane closures Nov 18-21 from 9:00AM to 3:00PM will be from Summit Road to Redwood Estates. Erosion control work will occur between Big Moody Curve and Bear Creek Road, rolling shoulder closures will be in place. Additionally, erosion control work will be conducted on the Los Gatos Creek Trail between the dam face and Main Street in Los Gatos, which may impact trail use/access.

Impacts:
- Please plan your northbound SR-17 trips before 9:00AM and after 3:00PM if possible.
- Traffic impacts to the SR-17 corridor will occur during weeks 12 and 13. Stay informed of delays and alternate routes. www.511.org and www.firesafe17.com will provide traffic information.
- The project team is working to minimize traffic impacts whenever possible on local and regional travel and will provide weekly updates to residents and highway drivers.
- Over the next several months, crews will be working along SR-17 and adjacent communities. Traffic in the communities and along SR-17 will be intermittently impacted.
- Besides electronic media, several physical locations in the area where you can get updated information. Redwood Estates Pavilion, Redwood Estates Post Office, Redwood Estates Store, Chemeketa Park, Loma School, Lakeside School bulletin boards will be updated regularly.

Visit FireSafe17.com for more information.

Project Area
Not Started
In Progress
County Boundary

1:40,000

Funding Goals

- Wildfire Resilience
- Healthy Forests
- Diversity of Species
- Carbon Sequestration

Tradeoffs and Challenges

- Carbon storage vs wildfire resilience
- Desired vs achievable future conditions
- Hard to restore historic, natural fire regimes, forest conditions
- with a population of 46 M in CA
- Frequent, light ground fire – people's tolerance for smoke is limited
- Acceptance of some impacts in short term to achieve long term goals
- Insurance – liability and homeowners

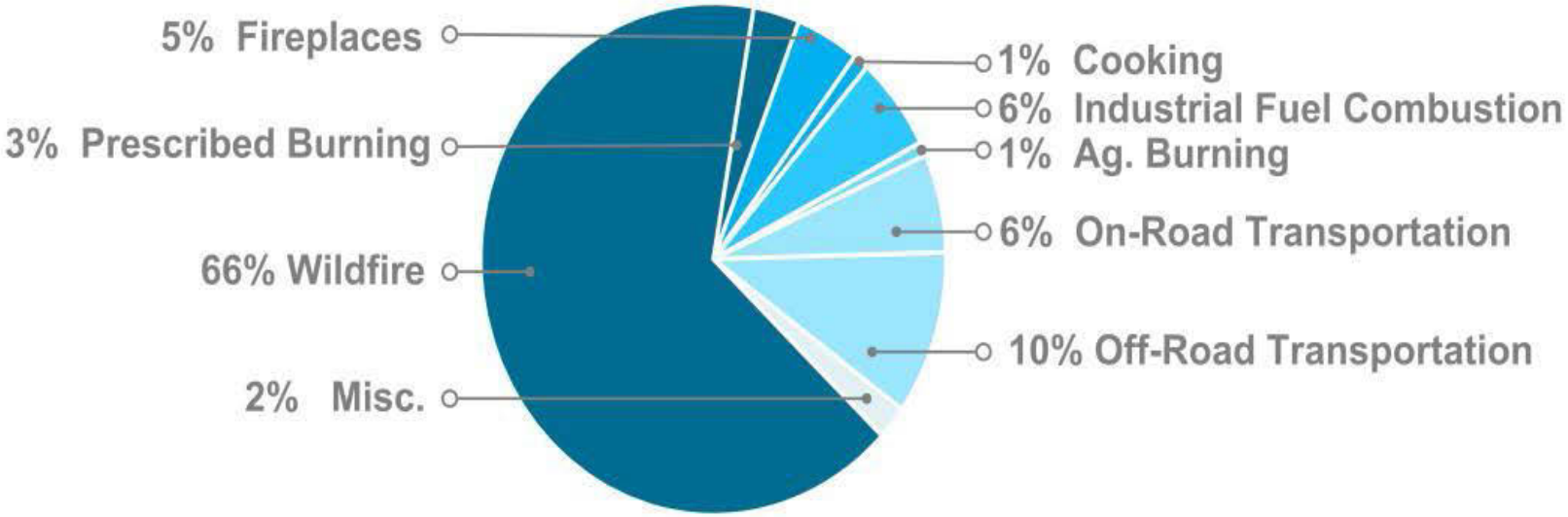

"With **over 3,000 miles** of state highways crossing California's National Forests, we have an excellent **shared stewardship** opportunity to prioritize fuels reduction projects, providing safe access to all of the communities we serve..."
Barnie Gyant, USFS Region 5, Deputy Regional Forester
FOREST SERVICE
US
DEPARTMENT OF AGRICULTURE


Inyo National Forest
FOREST SERVICE
US
DEPARTMENT OF AGRICULTURE

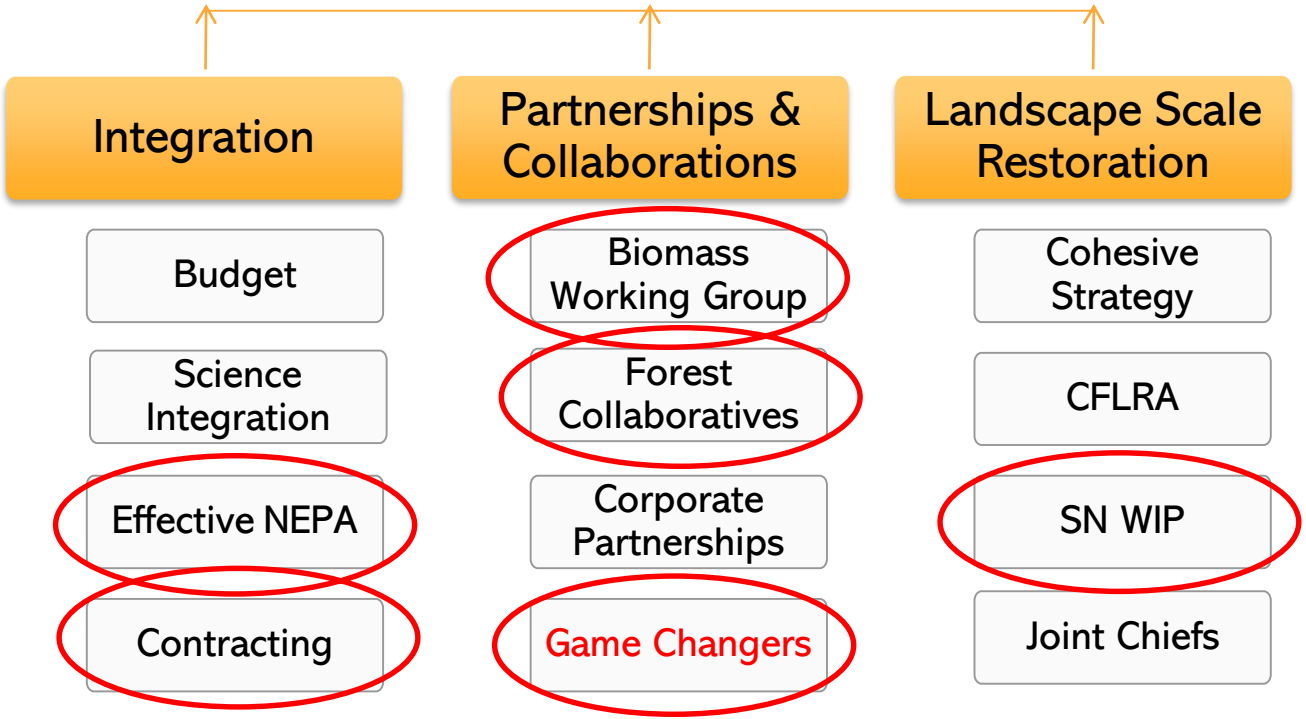

TAHOE
National
Forest
U.S. DEPARTMENT OF AGRICULTURE
FOREST SERVICE
US
DEPARTMENT OF AGRICULTURE

USFS National Forests (18) Caltrans Districts (12)

Air Quality Impacts of wildfires



Strategies for Increased Forest Collaboration



Fire-Adapted 50 Project

USDA

U.S. Forest Service
Eldorado National Forest
100 Forni Road
Placerville, CA 95667
530-622-5061
www.fs.usda.gov/eldorado

News Release

For Immediate Release
November 14, 2019
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steve.nelson@dot.ca.gov

Highway 50 Traffic Control while Crews work on Fuel Break Next Week, Nov. 19-21

Placerville, Calif. - Traffic control measures will be in place on Highway 50 next week between Ice House Road and Strawberry while crews are working on the Highway 50 Fuel Break. CAL FIRE hand crews will be cutting, piling, and chipping vegetation on the north side of the highway in the Eldorado National Forest between 9:00 a.m. and 4:30 p.m. Tuesday through Thursday, Nov. 19-21.

Caltrans will close portions of the westbound lane next to the road and direct traffic around the area where crews are working. The purpose of the Highway 50 Fuel Break is to improve the safety and effectiveness of wildfire response in this major transportation corridor.

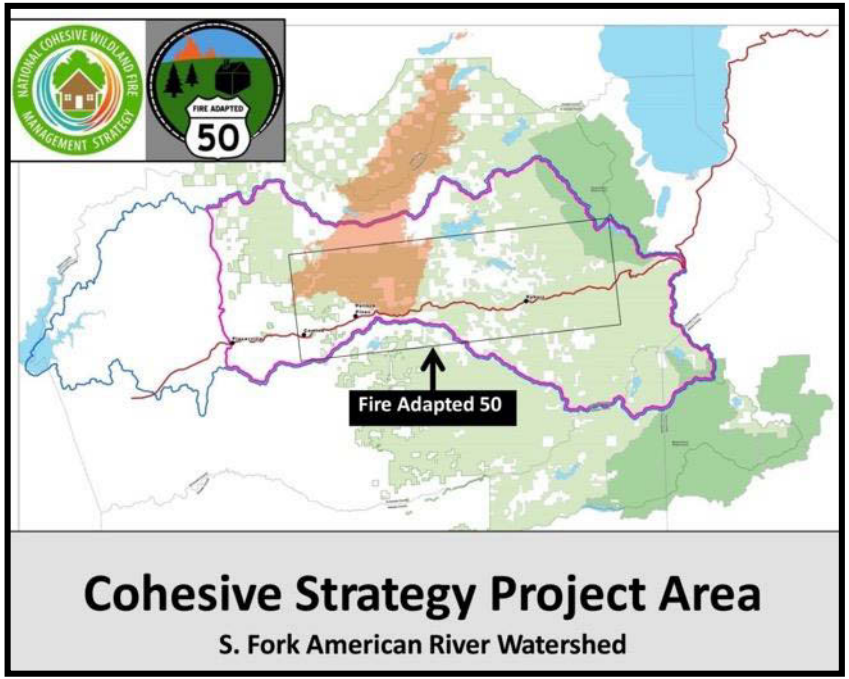
The Highway 50 Fuel Break is creating a 300-foot fuel buffer by removing small diameter trees, lower limbs, and understory vegetation along the highway and around the communities of Strawberry and Kyburz. The current work on the Eldorado National Forest is part of a Good Neighbor Authority agreement in which the U.S. Forest Service has provided funding to CAL FIRE to reduce hazardous fuel on National Forest lands.

CAL FIRE also has an encroachment permit with Caltrans to treat the vegetation in the Caltrans right of way immediately adjacent to the highway. Caltrans removed approximately 2,800 hazardous dead trees between Camino and Echo Summit after the recent drought that caused widespread tree mortality in California. In addition to reducing fuel, forest thinning along the highway increases visibility for motorists and reduces ice by opening the road to more sunlight.

The Highway 50 Fuel Break is part of Fire Adapted 50, a collaborative all lands approach to fuel reduction on both public and private land in the Highway 50 corridor. Fire Adapted 50 grew out of joint strategic planning by the U.S. Forest Service and CAL FIRE after the 2014 King Fire. The King Fire was one of many large human caused fires that have started along Highway 50, including the Kyburz Fire (1973), Wrights Fire (1981), Cleveland Fire (1992), and Freds Fire (2004).

Fire Adapted 50 also includes fuel reduction projects in the Sly Park area and the Camino-Pollock Pines Fuel Break from Slab Creek Dam near Camino to Pony Express Trail near Pollock Pines.

Maps links for the Highway 50 Fuel Break Project can be found here.



Proposed Fuel Reduction Strategies 2020-2030

1. Support CALFIRE's finalization of **CalVTP EIR**
2. Renew CALFIRE + Caltrans **Interagency Agreement** (expired 2012)
3. Finalize USFS + Caltrans **Master Good Neighbor Authority Agreement** (GNA)
4. Caltrans to join existing Forest Collaboratives to add highways to project scope of Other Lead Agencies
5. Caltrans to **identify new funding** and expanded staffing **for fuels reduction Contracting** within R/W
6. Ensure continued compliance with CEQA/Forest Practice Law and NEPA/Federal Timber Contract Law

Q & A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