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Getting More Fire on the Ground: Landscape-Scale Prescribed Burning Supported by Science

Earlier this year, the U.S. Department of Agriculture and the U.S. Forest Service released a new 10-year plan, [Confronting the Wildfire Crisis: A Strategy for Protecting Communities and Improving Resilience in America's Forests](#), to substantially reduce fire risk across the country. The Wildfire Crisis Strategy calls for ramping up forest treatments on Federal, State, Tribal, and private lands well above current levels. Public and stakeholder engagement, consultation, and collaboration are critical to successful implementation of the strategy. Best available science can inform how to improve the way we engage with communities and help us collectively determine the right treatment locations and tools.

Land managers and scientists have identified prescribed fire as one of the critical tools in combating the

current fuels problem. Research and experience on the ground have shown that thinning and mechanical treatment are useful for restoring forest structure and lowering fuel loads, but in many forests these types of treatments can be much more effective when combined with prescribed burning. Prescribed fire can restore fire's ecological role while increasing the likelihood that fuels treatments will slow large wildfires and reduce their severity. There are no substitutes for fire in many western forest types.

Given the scale of the problem, managers and scientists are thinking big: developing innovative strategies for getting more prescribed fire on the land. Rocky Mountain Research Station (RMRS) scientists are digging deep to understand the biological and ecological roles of fire, social



Firefighter lights a prescribed fire on the Caribou-Targhee National Forest in southeastern Idaho. USDA Forest Service photo by the Caribou-Targhee National Forest.

acceptability, risk tradeoffs, wildlife effects, smoke and air quality impacts, and more. Colleagues at other Research Stations are also studying some of these challenging impacts related to wildfire and prescribed fire.

Fire Managers Propose Ambitious Burn Plan

In 2020, fire managers on the Caribou-Targhee National Forest (CTNF) in southeastern Idaho released a plan to use prescribed fire on 266,000 acres of the forest over the next 15-20 years. Forests on the CTNF have become more homogenous and densely packed, with more understory ladder fuels, making them less resilient to wildfire and drought. Introducing vegetation treatments, including prescribed fire, which mimic ecological disturbances that were historically part of these systems can help increase overall forest health by breaking up large, continuous forest stands, which are susceptible to beetle outbreaks and large fires.

Mike Johnston, fire management officer for the Caribou-Targhee, says that large fires have mostly been absent on the CTNF for the past 100 years.

“In the past 30 years, I can count on one hand how many fires have gone over 1,000 acres and none of those have gone over 10,000 acres,” Johnston says. “We’re behind as far as keeping up with our fire regimes and natural return intervals. Then

you couple those considerations with rapidly expanding wildland-urban interface, which complicates our ability to allow natural fire since we have more values to consider on the landscape.”

The forest fuels planner for the CTNF, Dylan Johnson, says that historical photographs and records from the early 20th century show forest stands that were widely spaced and clumpy because of the historical mixed-severity fire regime. Due to fire suppression over the past century, forests have infilled and have become homogeneous at the forest or landscape scale, with 95 percent of the forests in the mature or late seral age class.

The planner also says there is evidence of frequent burning in the forest by Native Americans up to about 100 to 150 years ago. But with the removal of anthropogenic sources of ignition, there has been little fire since.

The story of the CTNF and fire is commonplace among western forest managers. Scaling up the use of fire on landscapes can face many social, logistical, and other challenges.

Managers on the CTNF hope to apply fire to between 30 percent and 50 percent of the targeted acres, with a goal of treating 6,000 acres per year over 15 to 20 years. Plans for burning on the Targhee



Headwaters of Johnson Creek on the Caribou-Targhee National Forest, in 1910 (top) and 2004 (bottom), show a conversion from mountain brush and aspen to conifer. USDA Forest Service photo by Mike Johnston.

side of the forest are currently on hold while the forest staff work with stakeholders and addresses obstacles with the forest plan.

Mike Johnston, the fire management officer, says prescribed fire treatments would create buffers along forest borders and give line officers more confidence in decisions to manage natural ignitions for ecological benefits. Vegetation treatments could also break up the large, continuous forest stands.

One Size Doesn't Fit All Wildlife

Fire managers on the CTNF note that one challenge to getting prescribed fire plans in place is concern from some groups about protection of high-profile wildlife species and how the burns will affect habitat for wildlife, such as grizzly bears, lynx, and sage grouse.

Johnson, the CTNF forest fuels planner, points out that the Targhee forest plan does not allow prescribed burning in grizzly bear core areas and that there are multiple restrictions on burning in lynx habitat based on the Northern Rockies Lynx Management Direction guidelines.

John Squires is an RMRS wildlife research biologist who helped complete a regional lynx habitat mapping project for the Greater Yellowstone area. Squires says the lack of snowshoe hare habitat on the CTNF means the quality of lynx habitat on the forest is low.

Summary

The Forest Service is working with partners to achieve the goals and objectives set forth in the Wildfire Crisis Strategy “by dramatically increasing fuels and forest health treatments by up to four times current treatment levels in the West . . . [and] by thin[ing] western forests and return[ing] low-intensity fire to western landscapes in the form of both prescribed and natural fire, working to ensure that forest lands and communities are resilient in the face of the wildland fire that fire-adapted landscapes need.”

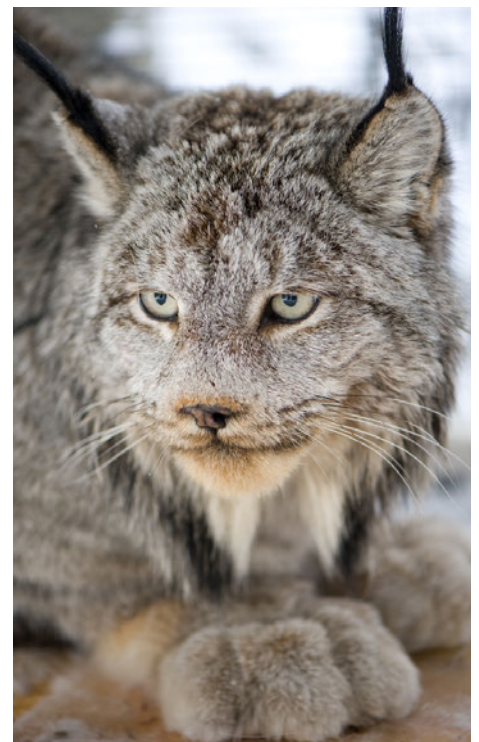
Prescribed fire can restore fire’s ecological role, and it increases the likelihood that fuels treatments will slow large wildfires and reduce their severity. The addition of fire in western landscapes can be successfully complemented with other tools and treatments to promote forests that are more resilient to future disturbance.

Scientists with RMRS, and many others throughout the research community, are working to advance our understanding of fire, developing planning tools, and understanding public perceptions of fire management activities to help managers reduce barriers to conducting landscape-level prescribed fires. Partnerships between land managers, such as those on the Caribou-Targhee National Forest, and scientists may be one of the keys to ramping up prescribed fire programs.

“There are islands of higher potential that could support snowshoe hare (lynx’s primary food source), but most are very poor,” says Squires.

To inform timber salvage and landscape management, Squires and his team are looking at how lynx use burned areas after fires in Montana and over the long term. Squires says lynx generally avoid burned areas for decades after a fire. When burning in lynx country, managers can manage for a mosaic of forest conditions, and can identify areas of refugia for lynx and how those areas fit into the overall burn mosaic.

“Forest managers know where the islands of potential lynx habitat are on their forest, and how their fire plan reflects that,” says Squires. “A natural fire or other disturbance can change conditions on the



Lynx habitat is an important consideration in forest and fire management on the Caribou-Targhee National Forest. USDA Forest Service photo.



landscape and that means their plan has to be flexible enough to change and accommodate the new situation.”

Grizzlies are another threatened species on the CTNE, but Squires says they are much more general in their habitat use compared to lynx. He says it's possible to manage for grizzlies and lynx on the same landscape with a mosaic approach, but lynx will be the more limiting factor because of their constrained habitat needs.



Most of the major megafauna associated with Yellowstone National Park, including grizzly bears, can be found in Caribou-Targhee National Forest. Adapted from photo courtesy of Gregory "Slowbird" Smith, CC BY-SA 2.0.

Taking the Long View: Building Trust and Community Partnerships

Sarah McCaffrey, a social scientist recently retired from RMRS, has been studying social aspects of fire for more than two decades.

This includes how managers and the public view wildfire risk, as well as strategies for increasing the social acceptability of prescribed fire and thinning projects.

McCaffrey says her research highlights the importance of building foundational relationships with stakeholders that will pay dividends when planning for large-scale burn projects begins.

“The fuels problem we face has built up over 100 years,” McCaffrey says. “Expecting to resolve it in a couple of years just isn’t realistic. We need to take the long view: Where do we want our landscape to be in 20 or 50 years?”

McCaffrey has studied fire-prone communities across the United States, and her work has demonstrated that managers build trust with communities in relation to their fire program by establishing a reputation for both competence and intention to act in the community’s best interest.

“Every place I’ve seen that is successful in building support for fire programs has shifted out of an oppositional view and instead put energy into working with citizen

groups and engaging partners,” McCaffrey says.

In the initial stages of building trust with stakeholders, fire managers who start with smaller projects that are incremental and based on common goals often end up being more successful. McCaffrey points to the Deschutes National Forest in Oregon as an example of where managers built trust with stakeholders by starting with smaller projects based on goals that mattered to everyone. They worked with local environmental groups to train logging contractors who were doing prefire thinning on the forest. The managers’ direct involvement with the groups eased concerns that the contractors were taking too much timber out under the guise of thinning to prepare for burns.

McCaffrey also points to the work she is engaged in where fire managers on the Arapaho and Roosevelt National Forests (ARNF) and partners along the Front Range in Colorado are taking steps to increase thinning, prescribed fire, and other types of fuels treatments on the ground. The treatments are designed to give managers a chance at stopping large fires.

“Every place I’ve seen that is successful in building support for fire programs has shifted out of an oppositional view and instead put energy into working with citizen groups and engaging partners.”



In 2014, ARNF managers joined with a wide range of partners to form the Northern Colorado Fireshed Collaborative.

The partnership organized around the goal of increasing the pace and scale of prescribed fire in an area stretching from the Wyoming border to south of Rocky Mountain National Park that could slow or stop fires moving from west to east, the typical path taken by fires in this country. The groups started reducing tree density and using prescribed fire to consume fuels in a series of large fuels reduction projects. Managers built the ARNF burn plan using potential operational delineations (PODs).

McCaffrey notes the key to the success so far on the Arapaho National Forest and adjacent lands, like the Deschutes project, has been working incrementally both to build local capacity among partners to implement burns, including funding for training of volunteer fire departments, and to build public support.

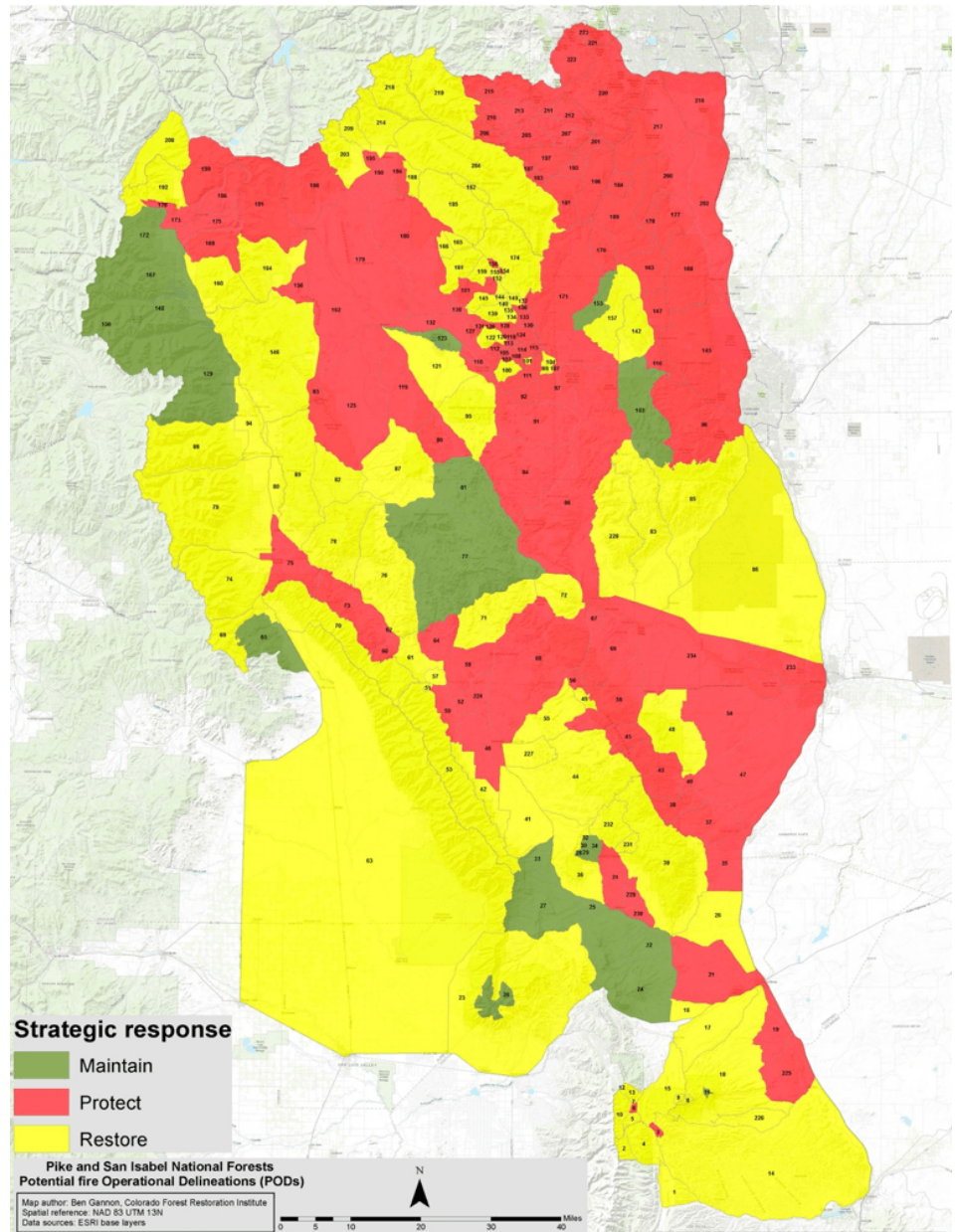
Forest managers “recognized that if they move too quickly with their treatments, they wouldn’t have the capacity to pull it off,” she says. “So, they said, ‘We’re going to build that support first so we can do bigger things down the road.’”

Tribes Are a Powerful Voice

Serra Hoagland is a member of the Laguna Pueblo in New Mexico, and RMRS Tribal liaison officer and research wildlife biologist.

She believes Tribes can help break the gridlock of litigation that land and fire managers often face from citizen and environmental

groups. She says that the Tribal Forest Protection Act (2004) gives Tribes the ability to take part in projects on adjacent Forest Service



Strategic response PODs summarize quantitative wildfire risk assessment results for each POD on the Pike San-Isabel National Forests in Colorado. Green PODs indicate areas where fire is likely to have positive impacts on resources, yellow PODs are areas where fire may provide positive benefits under the right fire weather conditions, and red PODs are areas where fire under any condition will negatively impact resources and assets. Image courtesy of B. Gannon, Colorado Forest Restoration Institute.



and Bureau of Land Management lands that treat excessive fuels and perform needed forest health projects.

“Tribes are more than just stakeholders. Tribes’ legal authority gives them a powerful voice,” says Hoagland. “Bringing Tribes to the table in Forest Service decision making can make the case for improving forest health by linking prescribed fire with Tribal values and traditional knowledge.”

Hoagland points to several collaborative fuels reduction

projects between the Forest Service and Tribes initiated under the Tribal Forest Protection Act. One notable example is a fuels reduction project on the Lolo National Forest in Montana that was a collaboration between the Confederated Salish and Kootenai Tribes and the forest to reduce the threat of fire in forests along the border between the Lolo and the Flathead Indian Reservation.

She notes that Tribal consultation and engagement do not require policy change. The Forest Service is legally required to consult with and

engage with Tribes on a meaningful level when any Federal actions might affect Tribal trust resources.

Understanding Smoke and Minimizing Its Impacts

Smoke from wildfires and prescribed fires can severely impact air quality and threaten the health of the public and firefighters and others working on a fire. These air quality and health effects are now recognized as a serious issue by environmental regulatory agencies, such as the U.S. Environmental Protection Agency (EPA), which sets the National Ambient Air Quality



Fire crews monitor a prescribed burn on the Caribou-Targhee National Forest. USDA Forest Service photo by the Caribou-Targhee National Forest.

Standards under the Clean Air Act. Land and fire managers face the challenge of minimizing smoke impacts on communities while expanding the role of fire in land management.

Smoke emissions are made up of a complex mixture of gases and fine particles, including carbon monoxide, carbon dioxide, water vapor, hydrocarbons and other organic chemicals, nitrogen oxides, trace minerals, and particulate matter. The fine particulate matter (known as PM_{2.5}) in smoke is the greatest concern to public health because it is inhaled deep into the lungs, where it can cause irritation, inflammation, and shortness of breath, and aggravate existing heart and lung diseases.

A recent collaborative research project headed by the EPA and including the Forest Service and other Federal land management and regulatory agencies sought to clarify the comparative smoke impacts of prescribed fire and wildfire on air quality and health. The study found in two study areas that while a prescribed fire can reduce the overall size of a future wildfire and the associated smoke emissions and smoke-related health impacts, smoke is still emitted and thus has human health impacts. The difference is that smoke is being produced in a prescribed fire with the goal of minimizing smoke impacts while potentially reducing a larger amount of smoke produced over a longer duration from a future large-scale wildfire. In one

modeled scenario, a prescribed fire reduced the footprint of a later wildfire and resulted in a 40 percent reduction in estimated health impacts.

According to climate scientist Sim Larkin of the Pacific Northwest Research Station's AirFire Research Team, "Prescribed fires are an essential tool in restoring natural fire cycles to the land and controlling the intensity and growth of any wildfires that do occur. Smoke science can help potentially avoid adverse smoke impacts of prescribed fires by modeling fire emissions and smoke dispersion in advance, potentially allowing managers to adjust the timing of prescribed burns for minimal impact. This is why our team, and other teams across the Forest Service and

partner agencies, are dedicated to advancing smoke models and their predictions—making them more accurate and useful in tackling these real-world needs."

Additionally, there are differences in smoke composition between wildfires and prescribed fires in western forests. Shawn Urbanski, a physical scientist with RMRS, studies emission factors (EFs) from fire, which quantify the amount of various pollutants emitted per amount of fuel burned. Urbanski has found that wildfires in western forests emit around 25 g of fine particulate matter (PM_{2.5}) per kg of fuel consumed (EF_{PM2.5} = 25g/kg), while prescribed fires in western forests emit around 13 g of PM_{2.5} per kg of fuel consumed (EF_{PM2.5} = 13). In general, western forest wildfires produce



more pollutants per unit mass of fuel consumed compared with prescribed fires.

There are also a number of Forest Service and interagency efforts to better understand smoke dynamics and create tools that help managers forecast when and where smoke will travel. The Pacific Northwest Research Station [AirFire Research Team](#) studies wildland fire emissions, smoke, and air quality, with the goal of producing forecasting tools that can help inform prescribed fire decision-making. AirFire researchers created the [BlueSky Modeling Framework](#) to simulate fire emissions and smoke impacts by incorporating data on fire location, type and amount of fuels burned, current and predicted meteorology, and the amount and trajectory of smoke in the atmosphere. BlueSky is regularly used for understanding smoke impacts in order to provide information to wildfire incident management teams and prescribed burn managers.

Forest Service and interagency efforts are underway to better understand smoke. A number of smoke impact simulation tools, including those routinely used by Air Resource Advisors on wildfires, are being used to predict smoke impacts of prescribed fires, facilitating successful prescribed burns in a number of Forest Service Regions across the United States. One tool used by land managers to minimize smoke production from prescribed

burns is the First Order Fire Effects Model (FOFEM), which simulates fire effects, including fuel consumption and smoke emissions. Recently, the EFs used in FOFEM have been updated to simulate the greater pollutant production per unit mass of fuel consumed for wildfires compared with prescribed fires.

The Pacific Northwest Research Station-led [Fire and Smoke Model Evaluation Experiment \(FASMEE\)](#) is a large-scale interagency effort, of which RMRS was also a partner, to identify how fuels, fire behavior, and meteorology interact to determine the dynamics of smoke plumes and the long-range transport of smoke. This project is designed to collect observations from large prescribed fires by combining LiDAR (light detection and ranging), ground monitoring, aircraft and satellite imagery, and weather and atmospheric measurements. Knowing more about how prescribed fire behaves helps land managers better predict smoke impacts plus fire behavior and the short- to long-term effects of fire.

Whether the smoke source is wildfire or prescribed burning, limiting the exposure of both fire management personnel and impacted communities requires real-time observations of smoke pollutant concentrations. RMRS has partnered with the EPA to advance the development of accurate, low-cost, and easy-to-deploy air quality sensors for monitoring

wildland fire smoke impacts. This effort to expand and improve smoke monitoring is expected to protect community health; advance scientists' understanding of the health, climate, and environmental impacts of smoke; and support the expanded use of prescribed fire.

Strategic Placement of Treatments

Mark Finney, a senior fire scientist with RMRS, is one of the leading experts in the world on fire behavior, fire growth modeling and risk analysis, and landscape fuel management.

“When done right, the placement and the size of treatments clogs the landscape, making it hard for the fire to find paths through it,” Finney says. “You’re using a spatial analysis, looking at the way fires move across the landscape, then treating it based on how the treatments fit into the landscape and change fire movement.”

Finney suggests creating visual tools to communicate with the public, showing fire history from other nearby forests and how new fires stop when they bump into old fire scars and treatments. Managers can use that presentation to transition into showing how creating a mosaic pattern with different objectives for the different vegetation types would be helpful in stopping or slowing large fire growth.

Finney, like his colleague Serra Hoagland, also says the role of Native American burning before



Europeans arrived is an important point supporting the use of fire in managing these forests.

“We may not be able to rely on natural ignitions in order to get the kind of fire that we want. This is very true on east-side, high-elevation forests,” Finney says. “Historically, Native Americans moved through

landscapes and used fire a lot. The landscape found by western settlers was absolutely not untouched by humans.”

The CTNF and many other forests bump against forest plan limitations when thinking about scaling up fire on the landscape.

All Fuels Treatments Are Not Created Equal

The current emphasis on forest management and treatments to reduce fire risk means there’s also a lot of conversation about what the most appropriate treatments are. Long-term studies of treatment effectiveness are particularly useful to inform these conversations. Rocky Mountain Research Station research forester Justin Crotteau weighs in.

Crotteau says that while fire and burning rightly receive the most attention, exemplified by the refrain to “get more fire on the land,” thinning is also an important tool for building resilient forests, especially in places where burning is not feasible.

The National Fire and Fire Surrogate (FFS) study (1998–2009) was a large-scale, collaborative effort to compare the effectiveness and ecological consequences of prescribed fire and mechanical “surrogate” fuels reduction treatments. At each site, researchers measured the effects of burn-only, thin-only, and combination thin-burn treatments (plus an untreated control) on forest structure, composition, and resistance to future fire.

One of the major findings of the project was that fuels reduction treatments are most effective at mitigating fire hazard with a combination of thinning and burning strategies because they reduce surface and canopy fuels and restore a desirable species composition.

A series of recent studies by RMRS scientists builds on the results of the FFS project to examine the long-term effectiveness of thinning and burning treatments, and how posttreatment disturbances, such as a bark beetle outbreaks, affect fuel treatment effectiveness.

A study at one of the original FFS study sites—the University of Montana’s Lubrecht Experimental Forest—showed that thinning treatments (thin-only and thin-burn treatments) designed to increase resistance of ponderosa pine-dominated fires to high-severity fires also increased defenses at the individual tree level and at the stand level to mountain pine beetles.

Another study from this site, looking at ponderosa pine and Douglas-fir forests, found that thinning treatments (thin-only and thin-burn) altered tree characteristics in a manner that may increase tree resistance to future disturbances compared to the control and burn-only treatments.

“In the FFS framework, thinning had the largest effect on resistance metrics,” says Crotteau. “Thinning increases tree diameter growth, so it changes the tree’s taper and makes them more stable to wind and snow. Thinning also improves growth efficiency, which is associated with resistance to bark beetles. Whereas fire can be used to ‘thin’ forests as well, silvicultural thinning is a finer tool useful for the more precise management needed in certain areas.”

A longer-term study at the Lick Creek Demonstration/Research Forest in the Bitterroot National Forest in western Montana reinforced the result that a combination of thinning and burning strategies is most beneficial for fuels reduction and restoration goals. However, the study also showed that to maintain treatment benefits, cutting and burning must be repeated in a cycle that mimics fire’s natural return intervals on the landscape. A recent [Science You Can Use](#) highlights the Lick Creek science conducted by RMRS research ecologist Sharon Hood and others.

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“Forest plans often talk about sustainability, productivity, wildlife habitat, and so on,” says Finney. “Getting rid of fire is anathema to almost all of those objectives.”

PODs: A Collaborative Prefire Planning Tool

In 2020, the Cameron Peak Fire, which became the largest fire in Colorado history, ignited near the Continental Divide north of Rocky Mountain National Park. The fire made three runs at the fuels treatments put in place by the Arapaho-Roosevelt National Forest and other partners in the Northern Colorado Fireshed Collaborative. And where it ran into prior vegetation treatments or old fire scars, it was effectively stopped. However, the fire blew through areas where work was planned but hadn't been completed. This allowed the fire to grow to 208,000 acres and also led to the loss of more than 200 homes that burned in the last big run.

While these losses were devastating, it could have been much worse without the strategic work in the years leading up to the fire. Many fire managers are looking to the Arapaho-Roosevelt approach to managing the Cameron Peak Fire as a model for using PODs, or potential operational delineations, in fire management and fuels planning (see this [video](#) for a more detailed description of the role of the treatments and the PODs process in management of the Cameron Peak Fire).

Think of PODs as “containers” drawn on a map based on potential fire-control features, such as roads and ridge tops, that can help coordinate responses to wildfires before they occur. Once POD boundaries are drawn in a cross-boundary, collaborative workshop setting, they are often integrated with quantitative wildfire assessments to identify strategic wildfire response categories that establish risk-informed objectives and strategic guideposts for fuels management and fire response. The combined PODs strategic response approach then summarizes levels of risk to “values” on a landscape. Values can include homes, structures, water supply, power grids, natural and cultural resources, community infrastructure, and other economic, environmental, and social values.

PODs, coupled with risk assessments, provide a strategic framework for fuels reduction activities that can improve wildfire management effectiveness and help get more of the right kind of fire in the right place.

Dave Calkin, an RMRS research forester who has led the team that co-developed PODs-based risk assessment, describes it as a process of looking at the landscape through the lens of where fires can be contained and identifying what is at risk in that “container.” The process shows where the values are and how managers can manage fire and treat fuels on the landscape based on values and suppression opportunities. He says the PODs analysis takes a three-category approach, based on values at risk, fuel conditions, and treatment needs.

In the POD network, as shown in the figure on page 5, yellow areas are locations where managers know they need fire, but they have to be very careful when they intentionally allow fire to burn in these areas. Green areas are where, if the conditions are right, they are most likely to be successful in managing fire for resource benefit and risk reduction objectives. And in red areas, they're going to have to use aggressive suppression responses, at least for the foreseeable future, because of the values at risk and fuel conditions. The idea is to use treatments to move areas from red to yellow and yellow to green, and to keep green areas from slipping back into yellow.

Calkin says that after managers “bin up” the landscape into PODs, the next step is to look at the PODs and boundaries between them that could be problematic. They should look for areas where they would want to be successful, but it doesn't seem likely they would be currently. Those are the areas to start with fuels reduction treatments to stop a big fire from moving across the landscape.

The real value of PODs is that they can help managers look at a large landscape, then carve it into manageable pieces that they can work on one chunk at a time. PODs and their strategic response categories may also



provide a tool for communicating with partners and the public about what managers are trying to accomplish and why they are doing it.

Caribou-Targhee fire management officer Johnston says the forest's fire staff have worked with partners and the RMRS science team to build PODs which will go through some ongoing refinements annually. They have fine-tuned the boundaries by adding attributes, including more descriptions of the line features and information on probabilities of success in holding lines. They have also established strategic response criteria using quantitative wildfire risk assessments to map the probability of fire occurrence, intensity of burning, and likely effects of fire on highly valued resources and assets to help decision makers and incident responders. The Caribou-Targhee proposed prescribed burn areas are strategically located where they would complement their POD boundaries providing additional buffers thus further reducing risk to [Highly Valued Resources or Assets \(HVRA\)](#) while increasing decision space for managing future wildfires.

The PODs User Community is an emerging network formed to share knowledge and build capacity to implement and monitor cross-boundary prefire response planning in areas of high wildfire risk. Calkin says the group is forming so managers and researchers within geographic areas can get together and work on these fire tools together.

Management Implications

- Building trust and forming collaborative partnerships with Tribes and citizen groups can pay dividends when planning for large-scale burn projects.
- Fire plans designed with the aim of creating burn mosaics can benefit wildlife with more flexible habitat needs while creating refugia for sensitive wildlife species.
- Scientists recommend combining spatial analysis, fire history, and fire behavior modeling to locate treatments strategically on the landscape to impede large fire spread.
- Potential operational delineations, or PODs, create a strategic framework for fuel-reduction prioritization that can improve suppression effectiveness when needed.



FURTHER READING

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The following individuals were instrumental in the creation of this Bulletin:



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Justin Croteau is a research forester with RMRS. Justin’s research focuses on stand responses to natural disturbances or silvicultural practices in multiple-benefit forests, and has implications for timber production, biodiversity, restoration, and resilience to future disturbances.

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Mark Finney is a research forester with RMRS. Mark’s research interests include fundamental processes in fire spread and applications of fire behavior models for fire management decision support and actuarial risk assessment.

Sarah McCaffrey is a research forester (recently retired) with RMRS. Sarah’s research focuses on broader social pieces of the fire management system, including how stakeholders conceive of becoming a fire adapted community and barriers to increased use of fire as a management tool.



Sim Larkin is a climate scientist with the Pacific Northwest Research Station and part of the AirFire Research Team. Sim studies smoke and fire impacts and interactions between climate change and fire and smoke.

John Squires is a research wildlife biologist with RMRS. John’s research focuses on how sensitive wildlife responds to increased natural (e.g. forest insect outbreaks, fire) and human-caused disturbance.



Michael “Mike” Johnston is currently the Forest FMO for the CTNF and Curlew National Grasslands. Mike’s experience includes working on Forest Service units across the Greater Yellowstone Ecosystem for 30 years, and he is an incident commander for one of the Great Basin’s Incident Management Teams.

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About the Science You Can Use Bulletin

The purpose of SYCU is to provide scientific information to people who make and influence decisions about managing land.

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