



Case Study in Community-Based Recovery Response



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BACKGROUND

UNDERSTANDING FIRES & FOREST HEALTH

Wildfire - in its natural state - cleanses the forest of dead trees and plants, opens cones, releases seed, removes insects and disease, releases nutrients and infuses the forest with a greater diversity of habitat. As fire releases nutrients in the form of ash, soils become more habitable to plants that revegetate the forest floor. Dead wood is consumed, preventing fuels from accumulating to produce hotter, more damaging blazes that are slow to regenerate. Historically, wildfires burned in this way, but complex changes in forest management, climate and human activities have altered this natural pattern.

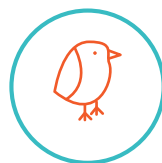
The Benefits of Wildfire



**KILLS INSECTS &
DISEASE**



**REGENERATES
FORESTS**



**DIVERSIFIES
WILDLIFE**



**ENRICHES
SOIL**



**REDUCES
FUELS**

When fire is delayed or suppressed, fuels accumulate, allowing fires to burn intensely. The canopy burns and trees are killed rather than singed. Soils are damaged and destabilized, giving way to increased erosion and flooding that wreaks havoc downstream and delays regeneration as the foundation of regrowth washes away with each storm. As fires burn more frequently and with greater intensity, the benefits of wildfire diminish and are obscured by more negative outcomes for forests, water, wildlife and communities.

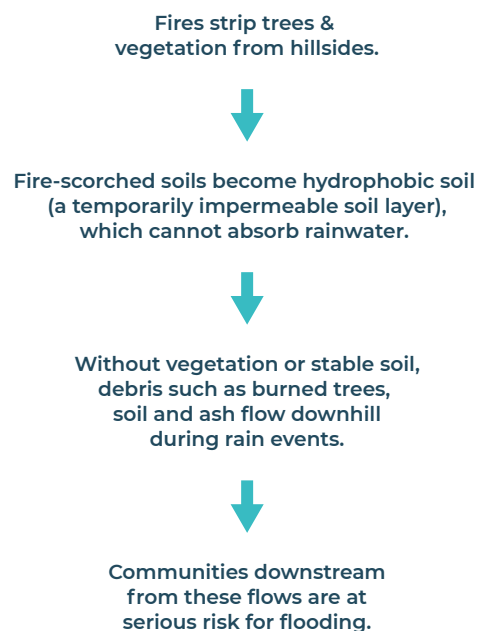
BACKGROUND

HOW FIRE IMPACTS FLOODING

While the natural process of post-fire change unfolds, communities struggle with the fire's aftermath. People living in and downstream of the burn face risks to their safety, homes, roads and water supplies from post-fire flooding.

As rains wash over burned soils, flooding continues to sculpt the land for many years after the flames are extinguished. Hillsides stripped by fire of trees and other vegetation can no longer absorb or catch rainfall. Burned, unstable soils slough easily with even modest amounts of precipitation. Burned trees fall and can be swept downhill with water, soil, ash and other materials in flows that pose a serious threat downstream.

Dangers of Post-Fire Flooding



BACKGROUND

The Community

While the Hayden Pass Fire burned in public forest lands along the flanks of the Sangre de Cristo Mountains above multiple communities, the heaviest post-fire impacts affected the small, rural community of Coaldale, Colorado. Located in the Pleasant Valley, between the foothills of the Sangre de Cristo range and the Arkansas River in southwestern Fremont County, this community of 400-450 residents sits about 30 miles east of Salida, Colorado. While once a mining community and more recently an agricultural community, residents now include a variety of full-time and seasonal homeowners, renters, retirees and working families.

AREA AFFECTED BY THE HAYDEN PASS FIRE & FLOOD



The Fire & The Flood

On July 8, 2016, a rainless lightning strike ignited the Hayden Pass Fire in the Sangre de Cristo Wilderness above Coaldale, Colorado. By the time firefighters contained the fire, it had burned 16,700 acres of forest dominated by beetle-killed trees. Monsoonal storms brought the first flash floods and debris flows to the burn scar area in the months following the fire. Ash flushed into the Arkansas River from Hayden and Big Cottonwood Creeks and generated large debris dams in the rugged, steep upper reaches of those drainages located on United States Forest Service land. Storms continued this process on the burn scar in 2017 and 2018, with the most significant damage occurring on July 24, 2018. During a heavy storm above the Big Cottonwood drainage, an estimated flow rate of approximately 4000 cubic feet per second (CFS) generated flows that destroyed and damaged homes, outbuildings, vehicles, bridges and prompted a helicopter rescue.

These late summer storms caused Big Cottonwood Creek to flood the valley bottom, destroying or damaging several homes and depositing debris - including trees, vegetation, soils, rocks and remnants of homes, fencing, equipment and trash - throughout the valley floor. The high velocity, high volume flows cut the channel to depths of more than eight feet in some places. Later efforts by engineering partners estimated that the actual flow rate on July 24, 2018 was closer to 10,000 CFS because of the bulking factor created by debris - rocks, sediment, trees, vegetation and man-made materials - carried in the post-fire flood flow. The typical flow rate of Big Cottonwood Creek prior to the fire and flood was 5.8 CFS. The flood changed the channel from a bucolic, trickling mountain stream to a flow capable of scouring out an eight feet deep, 30 feet wide canyon in a matter of minutes.

BACKGROUND

Challenges to Early Response

In the first two years following the fire, ARWC and its partner organization CO-CO implemented early flood mitigation efforts and attempted to prepare the community and local government for the likelihood of severe post-fire flooding. These efforts were critically important, but wide-scale implementation was hampered by challenges in coordination with landowners, agencies and local government. Without a coordinated process for responding to post-fire conditions in the community, obstacles occurred.

With no significant flood during the first two years after the fire, concerns about post-fire threats dwindled until July 2018 when the community was rocked by the first major flood.

A Call to Action

The flood spurred the community to reach out to their local governments and nonprofits for recovery support. The need for comprehensive planning to guide restoration efforts that protect life, safety and critical infrastructure while enhancing the ecological health and resilience of riparian corridors and their larger watersheds became clear and urgent.

When Natural Resources Conservation Service Emergency Watershed Protection (NRCS EWP) funds became available in late summer 2018 through Fremont County for use in the flood-impacted Big Cottonwood Creek area, three needs became clear. First, a local point of contact to help engage eligible landowners in the immediate EWP process was needed. Second, engagement with all impacted landowners to determine needs and appropriate projects not covered by EWP was necessary. Third, coordination between existing and potential partners would be essential to ensure that all available resources were brought to the

drainage and that each project supported all other existing and proposed work.

To meet these needs and support the County's work, a local collaborative formed. The Upper Arkansas Water Conservancy District, Arkansas River Watershed Collaborative and River Science – collectively known as the *Hayden Pass Fire Recovery Team* – received grants from the Colorado Water Conservation Board to fill these critical gaps.

The New Plan

Fremont County would sponsor the EWP project and work with contractors, engineering firms, landowners and NRCS to develop emergency restoration projects to protect life and property from imminent post-fire flooding threats. The Hayden Pass Recovery Team would assist Fremont County with landowner engagement and provide additional analysis of potential needs not covered by the EWP program.



A local landowner leads ARWC staff through the flooded Little Cottonwood drainage, an area that was a rich riparian habitat prior to the July 2018 flood. Photo: ARWC

EMERGENCY WATERSHED PROTECTION



The confluence of three burned drainages in the Big Cottonwood area was the most heavily damaged private reach. This area became the focus of the NRCS Emergency Watershed Protection project. Photo: ARWC

→ Overview & Considerations

The Emergency Watershed Protection (EWP) program is remarkable in providing essential funding for emergency projects, but implementing it is a considerable undertaking for small, understaffed local governments. The program's key term is "Emergency," which requires that the program be implemented quickly and for specific purposes. The EWP program is quite explicit in how the funding can be utilized and requires the sponsor to take responsibility for all future operations and maintenance of the project components.

→ The Decision

The County was willing to take on the burden of securing all additional funding, hiring engineering firms and contractors as well as managing the project. The County refused to hold responsibility for the operations and maintenance (O&M) agreements and chose to pass this requirement on to the landowners who would be benefitting from the program. The County successfully secured a 25% matching requirement for the program through the Department of Homeland Security & Emergency Management and was awarded \$3.5 million in funding through the EWP program.

→ The Breaking Point

The accelerated EWP program timeline can create obstacles to successful implementation. In this situation, the County needed signed landowner agreements, including the contentious O&M requirements, to move forward with the project. Landowners were wary of signing a contract that required them to operate and maintain structures for which they had not yet seen final designs. As the County raced to meet program requirements, a mismatch developed, creating a breaking point between the County and landowners. The original program scope included 17 landowners at the start, but issues surrounding timing of contracts and responsibility caused 13 landowners to opt out of the program, leaving only four to receive critical post-fire recovery assistance.

OUTREACH TRIAL & ERROR



Community-Wide Outreach

Original Plan: Working concurrently with EWP, the recovery team focused on building a local recovery coalition and identifying needs outside of the EWP program. The team's first step was to hold a community meeting, introduce themselves and ask how the team could best support the community in their recovery efforts.

Obstacles:

- The normal process of engagement was not working in this situation.
- This community was not interested in participating in a formal coalition.
- The community was confused by the different partners, projects and roles.
- In general, more information was needed.

Conclusion: The team listened, reorganized and approached the community again in the months to follow.



Individual Outreach

New Plan: The recovery team built trust and developed relationships within the community by hiring a local resident to serve as their liaison and recovery coordinator. Next, the team worked one-on-one with landowners to understand their needs and assess impending threats. Lastly, the recovery team began developing resources (flood mapping, hydrologic and hydraulic modeling, etc.) to prioritize projects and support conversations with landowners.

Obstacles:

- Trust-building within the community was not moving quickly enough to salvage the EWP program.
- Most landowners opted out of the program.

Conclusion: With a better understanding of this population and a new, immediate need to help those most impacted by post-fire flooding, the team redirected resources to assist landowners with flood protection and clean up work on their properties.



A local landowner leads Luke Javernick of River Science along a large flood-caused headcut bisecting a road in the Mosher and Sullivan Creeks area. Photo: ARWC

Luke Javernick of River Science discusses flood damage with a landowner in the Mosher and Sullivan Creeks area. Photo: ARWC



Post-fire flooding scoured the drainage, damaging domestic and agricultural water infrastructure and creating water quality impairments in and below the flooded area. Photo: ARWC

RESOURCES

Mapping & Modeling

Flooding after fire is not well understood, can be challenging to predict, and is often devastating. Understanding the behavior and extent of a post-fire flood event allows us to better predict and prepare for future catastrophic flood events. Resources needed to characterize these floods – including flood inundation mapping and hydrological modeling – are crucial to developing accurate recovery strategies and engaging in meaningful, targeted discussions about recovery efforts.

Luke Javernick of River Science and Seth Mason of Lotic Hydrological completed hydraulic modeling and a hydrologic study for the Big Cottonwood Creek drainage, supporting rapid need identification and prioritization for the highly impacted area. In the Hayden Pass Fire recovery work, these models were essential in helping the team better understand risks and identify immediate threats within the drainage. Additionally, the team used the models to support discussions with landowners on potential risks or non-risks on individual properties. Today, these models are shaping the foundation for long-term recovery efforts throughout the watershed.



Top. Luke Javernick of River Science and Seth Mason of Lotic Hydrological completed hydraulic modeling and hydrological studies of the impacted drainages, which enabled the identification of high-priority needs and projects to address them. **Photo: ARWC**

Bottom. A flood inundation map illustrates the extent of the flood water and debris in the Big Cottonwood Creek area during the July 2018 flood. This information informs recovery work and assists in planning for future floods. **Image: River Science**

RECOVERY & TRUST

→ Building Trust Through Action

The team's decision to put the development of a traditional coalition on hold and instead jump in and work with landowners individually became the golden ticket to success for the team and the community. The team worked in partnership with the local workforce training program to help landowners remove debris, log jams and piles of trash from their properties. This work reduced threats to life, safety and property, and supported the health of the watershed.

→ Development of a TRUE Coalition

Through this process, a truly grassroots coalition of sorts began to develop. Neighbors began helping neighbors. Communication and collaboration began to flow throughout the drainage, and eventually, all involved built trust one project at a time. Throughout the 2019 summer, the team, in partnership with a seven-man workforce crew and several landowners, cleared over 1750 linear feet of the channel and removed or chipped over 4000 cubic feet of debris from the floodplain. By the end of the summer, neighbors who had never spoken before were working side-by-side, helping each other prepare for the next potential flood.

→ Valuable Lessons

The team recognizes this as a valuable lesson that not every community comes together in the same way. For this community, which values their independence, individuals needed to see action and be involved in the effort before they would trust and commit to communal recovery.



*A workforce crew from Canon City clears a flood-borne debris dam in Big Cottonwood Creek, allowing flows to move freely through the channel rather than diverting toward homes and the road. **Photo: ARWC***



*When post-fire flooding hit the Big Cottonwood area community, landowners faced fears for their safety and significant damages to their property. We slowly built trust by listening to - and responding honestly - to their concerns. **Photo: ARWC***

LONG-TERM RECOVERY PLANNING

Recovery of land, watersheds, wildlife and human communities is a long-term process, with many challenges. Fire and flood threaten life and safety, uproot people from their homes, create unmanageable expenses for landowners and municipalities, cause loss of income for recreation and agriculture, damage water supplies and have difficult ecological consequences that ripple throughout the system, affecting all living things in it. But natural and human communities are resilient, and the recovery process also uncovers opportunities for new growth and adaptation to change.

As recovery projects take hold and the natural landscape begins to heal, immediate threats to life, safety and property begin to diminish. The most critical healing takes place within the first five years after the fire, after which the most imminent threat of destructive flooding generally dissipates. This critical period can last for up to 10-20 years following intense fires that burned in very steep terrain. When the most intense threat wanes, new perspectives and priorities for long-term recovery of the land and communities have space to emerge.



A Trout Unlimited crew builds a riparian restoration structure in Washington's Upper Columbia River Basin. Similar projects across the west have effectively restored degraded streams and the methods demonstrate the potential to improve riparian resilience after a fire. Our long-term plan explains similar low-cost, highly effective projects for recovery in the Hayden Pass Fire area.

Photo: Matteo Moretti/Trout Unlimited Odyssey

LONG-TERM RECOVERY PLANNING



Restored riparian ponds provide a refuge for fish and wildlife in a burn scar near Hailey, Idaho. Restored riparian ponds help to rebuild and protect critical riparian habitat after fire. Our long-term recovery plan provides the background and resources needed to complete similar projects in the Hayden Pass Fire area.

**Photo: Joe Wheaton/
Utah State University**

Now that recovery is taking hold five years after the Hayden Pass Fire, we are shifting our focus to explore recovery strategies that support natural long-term regeneration of land, water, wildlife and communities. We recognize that every function within a watershed is connected and that even small changes directly impact the entire system. We are carefully considering the impacts each project could have on landowners, water rights, agricultural production, wildlife habitat and recreation.

We are developing a long-term recovery plan to guide the community through prioritization and implementation

of restoration activities that reduce flood hazards and improve ecological conditions within the flood-impacted channel systems.

The plan lays out designs, cost estimates and implementation guidance for work to meet a wide range of objectives that support long-term recovery after the most devastating post-fire floods. The plan describes a comprehensive approach to help mitigate damage from potential future floods, support recreational and economic opportunities within the watershed and encourage healthy riparian habitat for fish, wildlife and native plant communities.

KEY TAKEAWAYS & LESSONS LEARNED



Expert Guidance

The effects of wildfire and post-fire conditions are complex. From emergency response, hydrology and engineering, wildlife management, soil and vegetation recovery and community support, the needed response is complex and urgent. Organized, funded networks of experts that can provide resources and consultation immediately to communities facing post-fire conditions is critically needed.



Adaptable Strategy

Every fire is unique from the intensity of the burn to the way it impacts land, water, wildlife and communities. Communities vary in the ways they respond to fire and flood depending on resources, experience and community culture. Rigid approaches leave many gaps. While lessons learned from one community offer valuable guidance, they may not fit another situation. Each affected community must have its learning process, armed with information, adaptable guidance and resources.

KEY TAKEAWAYS & LESSONS LEARNED



Resources

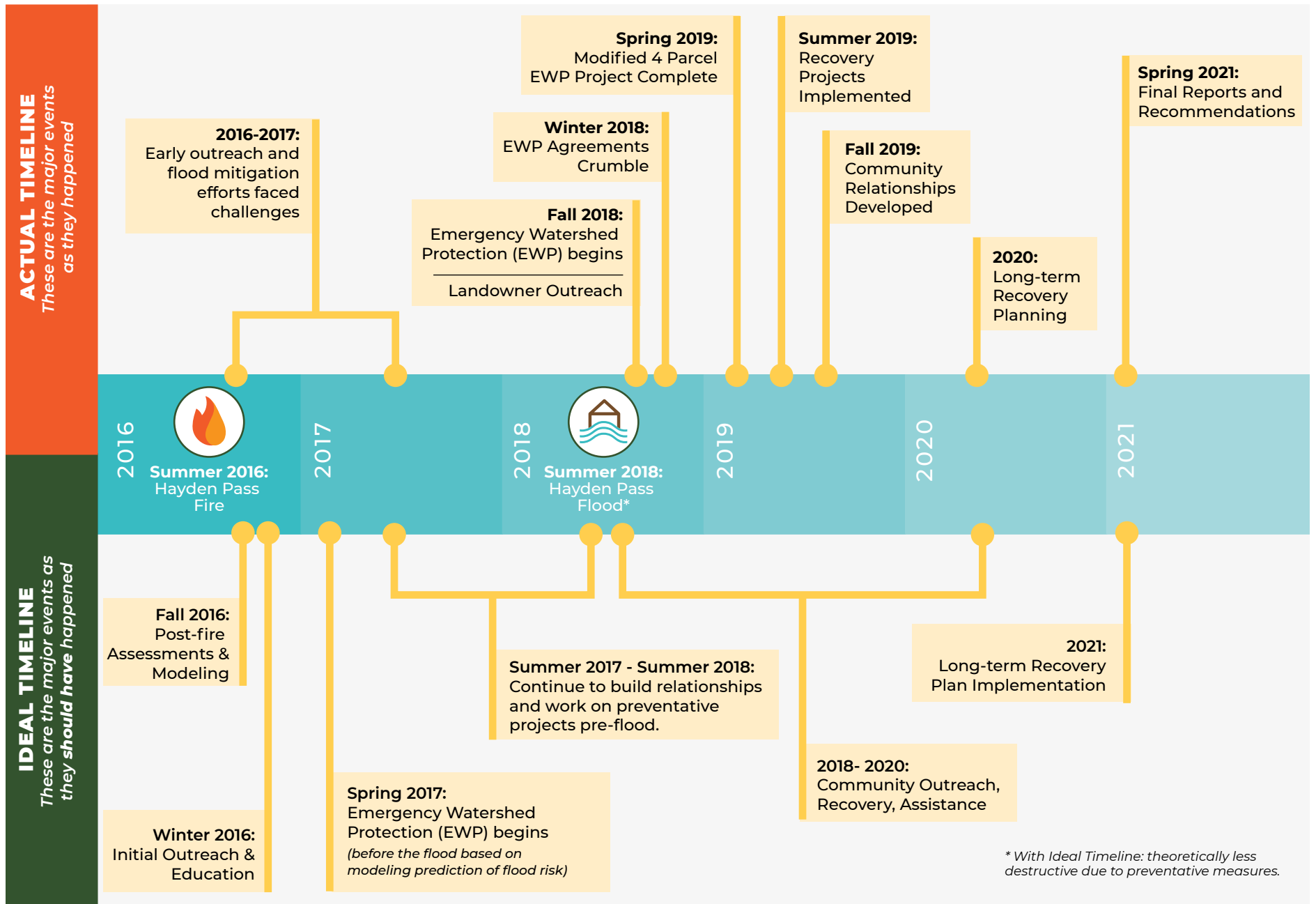
Critical resources are needed immediately after a wildfire, to engage the community and prepare for flooding before the first flood hits. A plan for mobilizing the community – led by community members who understand local needs – should be initiated as soon as the fire starts. Hydrologic modeling to forecast expected post-fire flooding is needed as soon as is feasible after a fire. This visualization of the potential severity of flooding is key in educating and preparing landowners and municipalities, and positions communities to secure funding preemptively to help quickly when the floods come.



Restructuring

Current post-fire response programs enable life-saving work to be completed. But there are mismatches between program requirements and how recovery often plays out on the ground. Each community and fire is complex, and programs must be flexible to accommodate these variations. Programs should reinforce early preparation for fire and flood, rather than a reactive response once the first flood has hit. These changes would enable municipalities and communities to prepare and respond in a thoughtful, organized way prior to the panic mindset that comes with facing a wildfire and its aftermath. The timeline on the following page illuminates how recovery program restrictions and timelines created obstacles when the reality of the community's response diverged from existing program structure and requirements.

FIRE & FLOOD TIMELINES





FINAL THOUGHTS

Wildfire changes the land and our communities - and the forces of flood continue this change for many years after the fire is out. Work is needed immediately to protect people, structures and water supplies. Long-term recovery focuses on restoring and protecting the land and water that we cherish and rely on – by stabilizing soil, reducing erosion and sedimentation, increasing native vegetation and rehabilitating wildlife habitat. Fire and flood is difficult to manage. We are not in control. But natural and human communities are resilient, and the painful changes that follow fire create opportunities for regrowth and adaptation.

Each fire and every community is unique and recovery is complex. The social and emotional impacts to landowners and communities must be taken into account early on – trust must be carefully built – if recovery projects will be successful. It is essential to have local input and buy-in to help inform the

process from the beginning. Communities and watersheds will heal overtime, but compassionate, experienced response that includes early community input will be most successful. Communities that have watershed health organizations in place before the fire can respond quickly and equitably to fire and flood. These organizations should include many voices - from landowners, the recreation community, agricultural producers, water managers, wildlife and others unique to each community.

As communities and the land continue to heal five years after the fire, we are building on this regeneration. We are planning projects that will support long-term recovery of the forests, wildlife, watersheds and communities affected by the fire. We share this community's story of fire and recovery to empower others to prepare to respond to the difficult, overwhelming challenges of fire and flood.



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