RCD POST-FIRE PLAYBOOK

2024 | Version 2

CALIFORNIA ASSOCIATION OF RESOURCE CONSERVATION DISTRICTS

This is a product of California Association of Resource Conservation Districts. Written, edited and compiled by Sophia Lemmo, Sierra Riker, and Ryan Reger with guest RCD authors throughout the playbook. Thanks to everyone who played a hand in putting this playbook together!

FUNDED BY USFS

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Common Acronyms Forestry / Fire

Not all these acronyms are referenced throughout the handbook. Rather, this was requested from several RCD staff members to track the various acronyms. Think we are missing some? Let CARCD know!

ACRONYM	FULL NAME
1038	Forest Practice Rules Exemptions
1052	Notice of Emergency Timber Operations
BA	Basal Area
BAER	Burned Area Emergency Response
BF	Board Foot
ISA CA	International Society of Certified Arborist
CAWFRTF	CA Wildfire and Forest Resilience Task Force
CCC	California Conservation Corps
CE	Categorical Exemption
CFIP	California Forest Improvement Program
DBH	Diameter at Breast Height
EFRP	Emergency Forest Restoration Program
EFRT	Emergency Forest Restoration Team
EQIP	Environmental Quality Incentives Program
FA	Financial Assistance
FPR	Forest Practice Rules
FRA	Federal Responsibility Area
FRP	Forest Products Permit
FSA EFRP	Farm Service Agency's Emergency Forest Restoration Program
GNA	Good Neighbor Authority
LRA	Local Responsibility Area
MBF	Thousand Board Feet
NBIP	North Bay Improvement Program
PCA	Pest Control Advisor
PCT	Pre-commercial thin
QAL	Qualified Applicator License
RCPP	Regional Conservation Partnership Program
RPF	Registered Professional Forester
Rx	Prescribed burn- Prescription
SCP	Scientific Collection Permit
SOE	Spotted Owl Expert
SPI	Sierra Pacific Industries
SRA	State Responsibility Area
TA	Technical Assistance
THP	Timber harvest plan
TPA	Trees per Acre
UCCE	University of California, Cooperative Extension
USFS	United States Forest Service
WUI	Wildland Urban Interface

Figure 1. Plumas County, CA. Photo credit: Camille Swezy.

Figure 2. Del Norte County, CA. Photo Credit: Sophia Lemmo.

INTRODUCTION

This handbook provides California Resource Conservation Districts (RCDs) information to perform post-wildfire recovery. Wildfires are a natural phenomenon in California. However, decades of fire suppression coupled with an increase in fuels, **climate change effects**, and human development in the wildland-urban interface (WUI) have exacerbated wildfire effects. The size, and intensity of California wildfires have substantially increased in recent years. In 2021, over 2.5 million acres of California burned, destroying over 3,500 structures. This increase in wildfires has cascading social, environmental, and economic costs. As high severity wildfires increase in size, landscapes are at risk of permanent forest loss. The purpose of this handbook is to serve as a guide for RCDs to combat forest and property loss. While the focus is on post-fire action, this handbook recognizes the importance of pre- and during-wildfire actions to effectively accomplish the subsequent post-fire steps. This handbook was created and compiled through a series of Post-Fire Playbook Monthly Forums hosted by CARCD with regular RCD involvement and feedback.

RCDs are deeply rooted in their local communities, serving as hubs for conservation. Just as California counties are environmentally and socially unique, so are the RCDs and the landscapes they work in. For example, the inter-agency dynamics and capacities vary from Humboldt County to San Diego County. Therefore, work associated with wildfires must be community-specific and tailored. The actions listed in this handbook are guidelines and should be adapted as appropriate in each special district.

Unlike other government post-fire recovery entities, RCDs face capacity limitations. RCDs lack sufficient, guaranteed financial investment and yet are often the most nimble and effective entity at providing recovery to private non-industrial forest landowners. Advocating for necessary capacity is a priority of CARCD.

This handbook is intended to be a living document, full of resources, tips, timelines, and guides. Regulatory and physical environments constantly change. If funding permits, this handbook will be updated annually or bi-annually. Due to funding constraints, portions of this handbook are brief, bulleted, or, perhaps even lacking. In some places, this handbook will reference links to other sources to avoid duplication and take advantage of pre-existing resources.

Figure 3. Plumas County, CA. Photo credit: Sophia Lemmo.

PARTNERS

Working with partners throughout the process of preparing, dealing with, and recovering from wildfires enables targeted, leveraged, and coordinated work. To avoid duplicating efforts, it's important to regularly update the following table, tracking the capacity of local entities. Doing so before a wildfire can clarify your RCD's role in post-fire planning, thus streamlining efforts.

Groups / Agencies	Fill-in primary contact(s) information	Collaboration ideas / intentions (e.g., on fuel breaks, sharing resources / maps, etc.)	Strengths of the organization / local capacity
LOCAL GROUPS			
Resource Conservation Districts			
County Contacts			
Tribal Contacts			
Municipality Contacts			
Watershed Group or NGO Contacts			
Local Fire Battalion / Chief			
UC Extension Forest and / or Fire Advisor			
Local Fire Safe Council			
LOCAL EMERGENCY SERVICE			
Local Office of Emergency Services			
INFRASTRUCTURE AGENCIES			
Caltrans contact			
Electric / Utility Contacts			
Public Land Managers / Resources			
NRCS District Conservationist			
NRCS State Forester / Conservationist			
CAL FIRE CFIP Forest Advisor			
Local CAL FIRE Vegetation Management Foresters			
Local USFS contacts (Forest Supervisor, BAER Coordinator)			
BLM Contact			
Local Farm Service Agency Contact			
LOCAL EXPERTS			
(consulting) RPF			
Other?			
OTHER RECOVERY ENTITIES (SAME MAY BE AT TIME OF RECOVERY)			
CA Office of Emergency Services			
CalRecycle			
USFS – BEAR team			
WERT			

TRIBAL ENGAGEMENT

There are 110 Federally Recognized tribes in California, along with numerous non-federally recognized tribes. Engaging local tribes, especially early in project development is vital. This allows for the incorporation of Traditional Ecological Knowledge in to the landscape and empowers tribes to have more control over their ancestral lands. Several tribal members have recommended establishing lasting relationships, and conducting outreach earlier, rather than engaging superficially or for a single project.

RCD EXAMPLE

❋ The Resource Conservation District of Tehama County ("District") works with local Tribes to seek their expertise and assistance on large landscape projects. Recently, the District is in conversations with the Yurok Tribe to implement the removal of large hazardous trees in the community of Mineral. The project is not on tribal land so the District sought legal assistance to better understand contracting with tribal governments and tribally-owned or associated entities off of tribal/reservation lands. **This document** highlights some lessons learned, and areas of needed clarification.

Many groups and entities respond immediately post-fire. Coordination of the fire suppression repair, emergency stabilization and hazardous materials removal phases is initiated by a variety of federal, state, and local agencies including the Burned Area Emergency Response (BAER) Team, California State Watershed Emergency Response Team (WERT), State Debris Task Force, and County Fire Recovery Teams. Additional emergency actions are also launched to protect public roads, utility lines, and mitigate hazardous materials from burned structures. These actions are implemented by contractors for California Office of Emergency Services, utility companies, CAL FIRE, CalRecycle, CalTrans, and USFS. Coordination with these groups can help define the RCD's niche and leverage their existing work.

RCD EXAMPLE

❋ El Dorado RCD was brought into the BAER team under the authority of the team's NRCS Area Engineer, which empowered El Dorado RCD and brought RCD needs into the discussion.

Here are some examples of how to specifically engage with some of the post-fire recovery entities/teams:

1. **Cal OES** often comes in right after fire and works expediently under the Emergency Services Act and Gov code 8571 – to do phase 1 and now, at least in some cases, hazard trees. They get rights of entry through the county and typically have a source for wood. RCDs have had varying levels of success piggybacking off their work by using similar contractors and complementary work. El Dorado RCD was able to engage in document sharing with Cal OES, such as receiving their procurement and contract documentation, which helps with language adoptions for code 8571. GIS data may also be available from Cal OES.

2. **BEAR and WERT** teams have info on resources lost, properties affected, burn severity. Sharing resources and tracking where they are working is recommended.

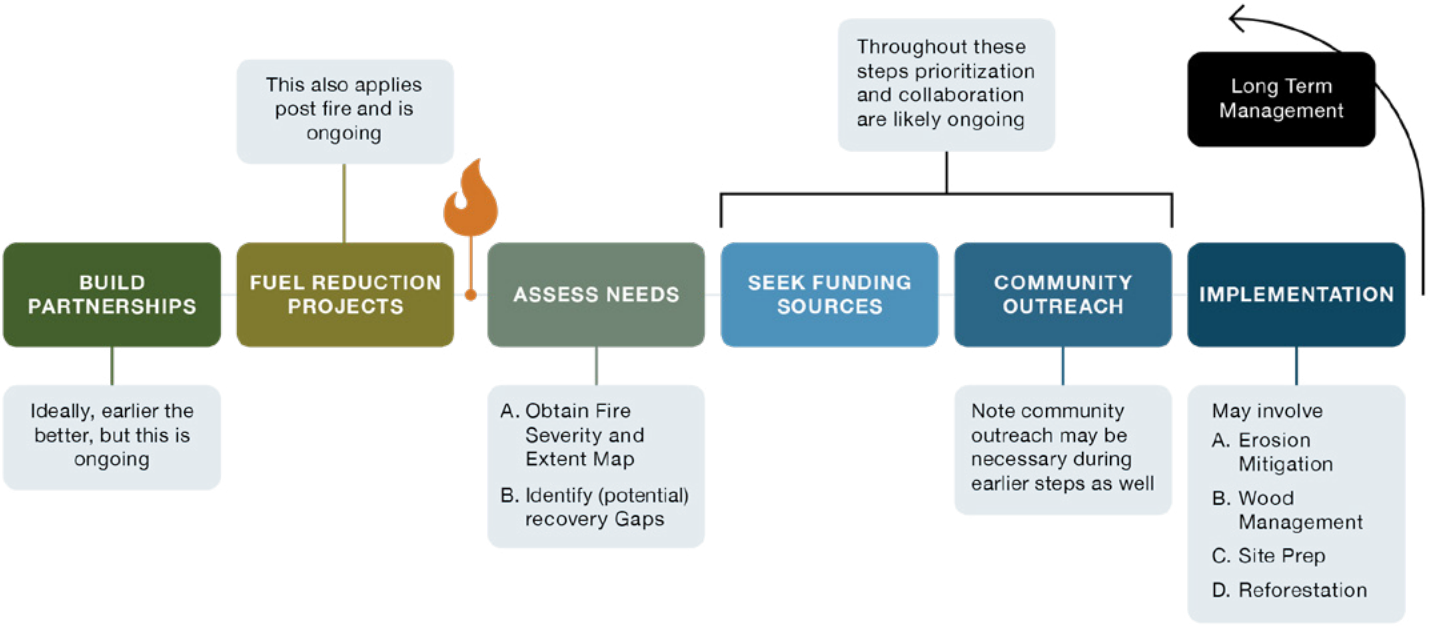
3. Know where **PG&E and Caltrans** efforts are being focused.

4. Some areas have resources such as an **'Ag Pass'** (San Diego County) or a **Disaster Animal Relocation Team (DART)**. It is important to know what kinds of resources are available in your area and to reach out for collaboration.

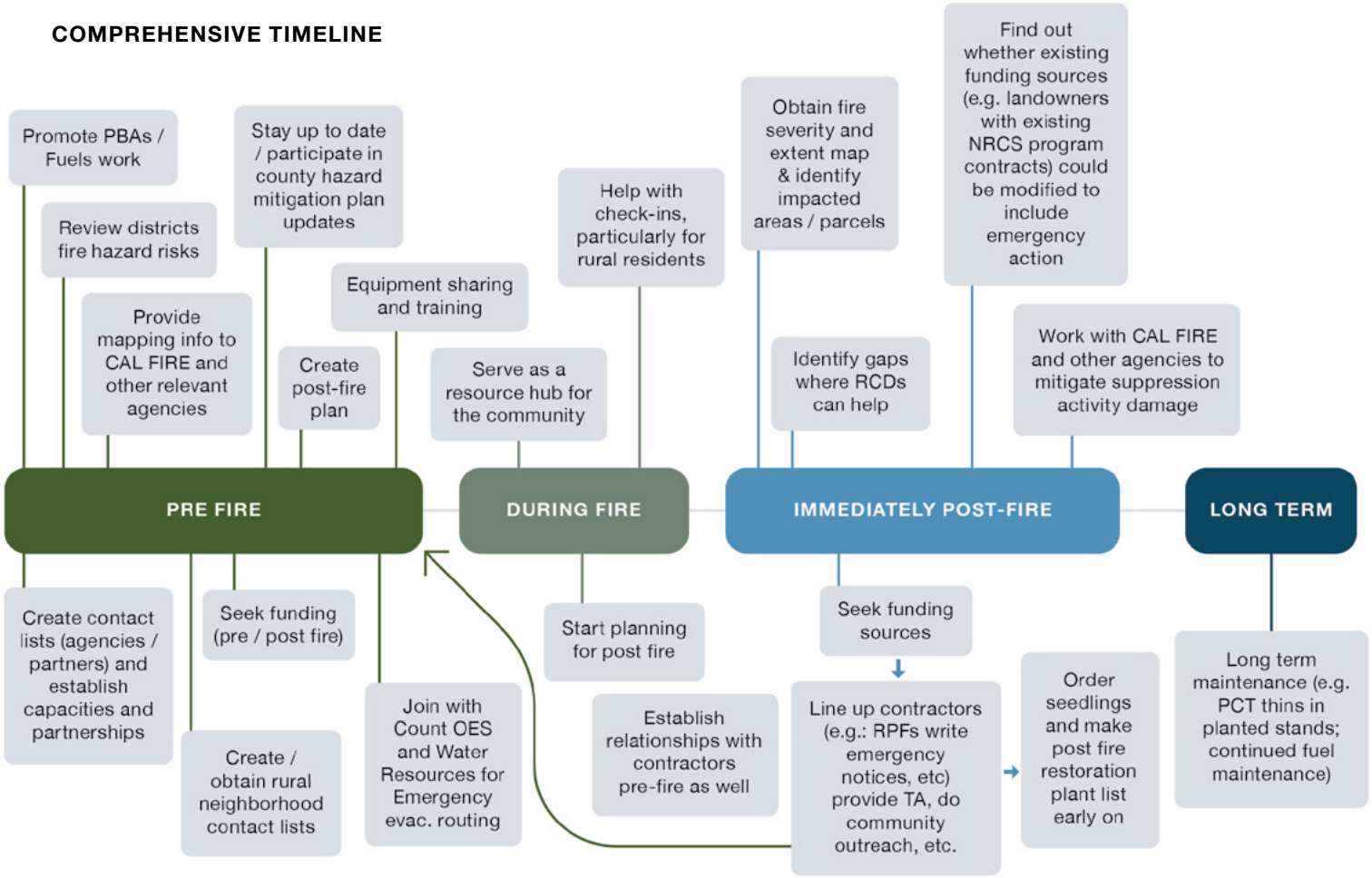
The most important thing is staying informed about what different agencies and organizations are doing. Forming **Emergency Forest Restoration Teams (EFRTs)** may be a viable way to make sure everyone is in the loop on each other's work.

TIMELINES

VERY SIMPLIFIED OVERVIEW



COMPREHENSIVE TIMELINE



ALTERNATIVE TIMELINE

**assuming funding obtained early on for NIPF Landowner assistance*

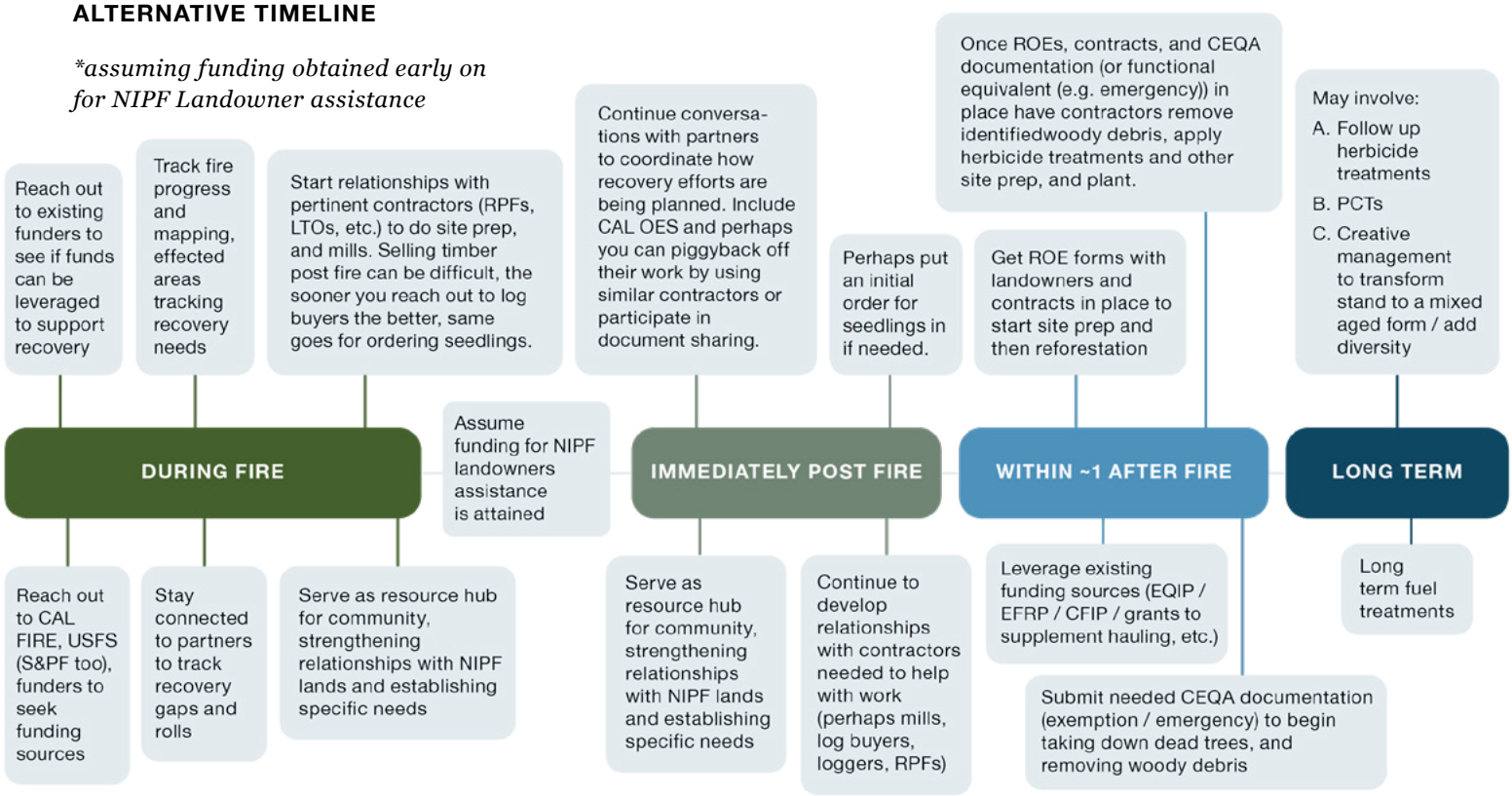


Figure 4. Calaveras County, CA. Photo credit: Gordon Long.

PRE-FIRE CONSIDERATIONS

This playbook focuses on post-fire actions and thus lacks a detailed pre-fire section. However, being aware of local community dynamics, culture, fire hazard severity rating, responsibility areas, weather alerts and spreading this awareness within your district is key. The following is a list of just some of the MANY pre-fire considerations. Thus, more thoughts applicable to pre-fire steps are contained throughout the book, like in the timelines above and in the **Fuel Management** section.

VEGETATION MANAGEMENT PROGRAM (VMP)

The goal of the VMP, per CAL FIRE, "is to reduce the chance of large, damaging wildfires by reducing fire hazards on wildland in California." It is a program "that provides public and private landowners participation in wildland vegetation treatment projects on State Responsibility Area (SRA) lands with advice and assistance from CAL FIRE. Under the VMP, the primary tool used is prescribed fire, although in more recent years the Department has used the program for mechanical and hand treatments of vegetation as well." It's a cost share program that landowners can apply for. CAL FIRE assumes liability for prescribed fire for approved VMP projects. Reach out to your Unit VMP Coordinator for more information.

HAZARD SEVERITY RATINGS

Find your **fire hazard severity rating here**. Note that the fire hazard severity ratings can change. There is a **slider on the Fire Marshall** website where you can compare the old and new maps.

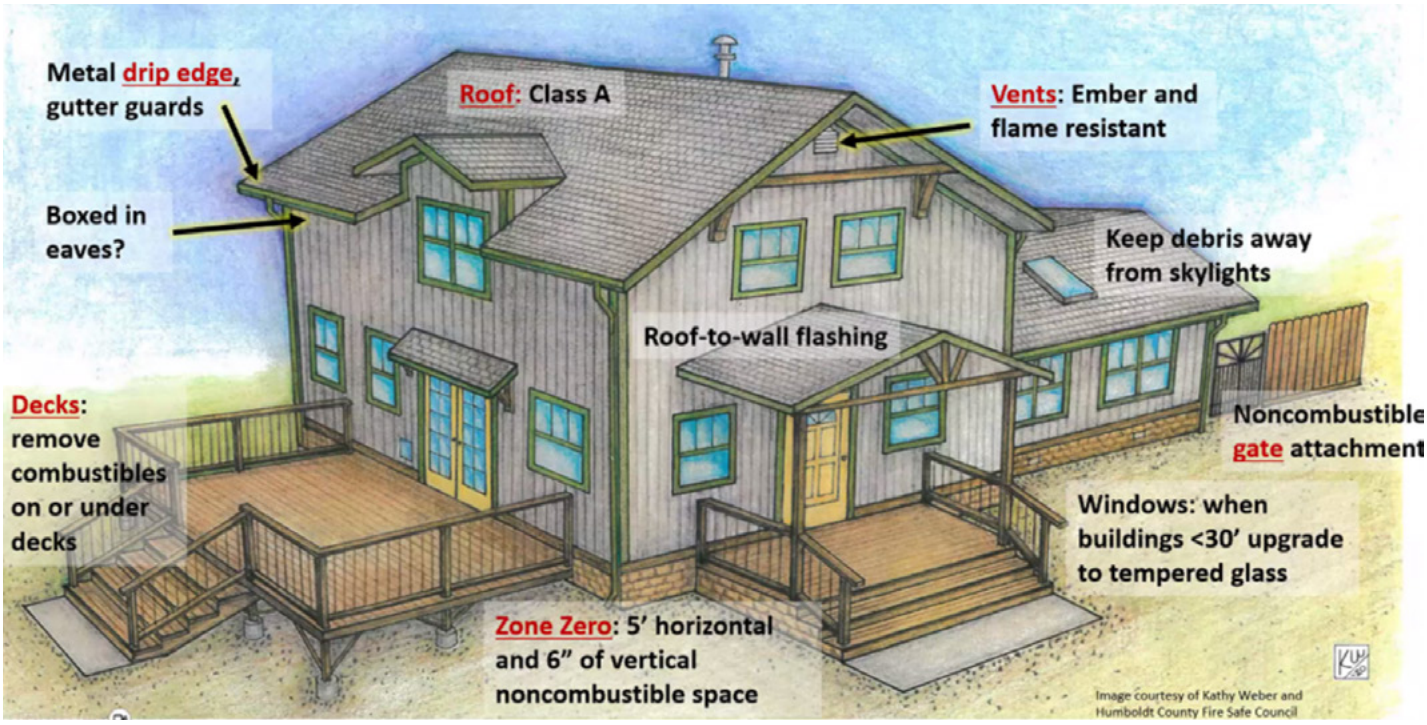
RESPONSIBILITY AREAS

Knowing which responsibility areas (e.g., Federal, State, or Local) exist in your district clarifies regulations and dynamics. Keep in mind that tensions can arise between Local Responsibility Areas (LRAs) and state regulations. However, it's important to note that LRAs in high or very high severity zones still need to comply with certain state regulations.

> *During the fire there are some options for private timberlands in FRA to advocate for "SRA like-treatment" through getting in the fold of daily briefings and planning. California Forestry Association is working on improved communication and planning in this area. Some regions are deploying PODs (or Potential Operational Delineations, see as an example:* **https://research.fs.usda.gov/rmrs/projects/pods***) to help in pre-fire planning.*

HOME HARDENING & DEFENSIBLE SPACE

Often the most combustible fuel in the landscapes are houses. The most important time to incorporate these concepts is in the construction phase and in choosing building locations/materials, etc. Mariposa County RCD has an array of their **Home Hardening Materials** available, including **flyers**, **sample assessments**, **permission slips**, and more. CARCD also did a Home Hardening Workshop with UCCE Forest Advisor, Yana Valachovic that can be found **here**.

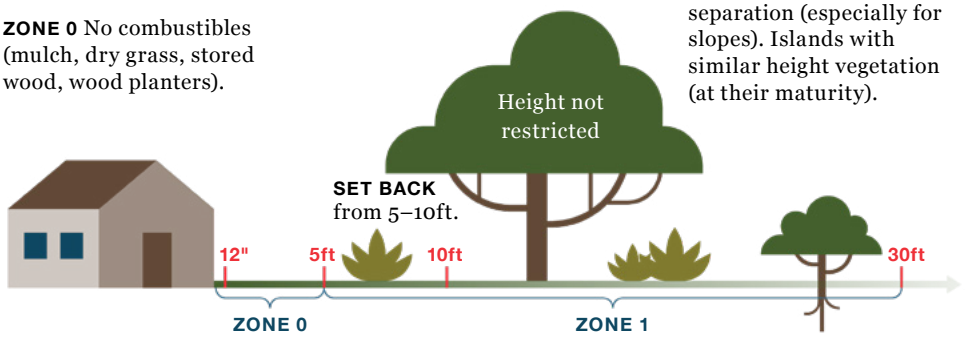


- AB 3074 was signed in 2020 and is starting to be rolled out. Part of this includes a zone zero (a 5' foot non-combustible zone). Helping with the awareness of the importance of hard homes can help prepare folks for the future.

ZONE 0 AND ZONE 1 INTERPRETATIONS

ZONE 0 No combustibles (mulch, dry grass, stored wood, wood planters).

GROUP VEGETATION Plant height as guideline for separation (especially for slopes). Islands with similar height vegetation (at their maturity).



This figure and the figure on page 7 are taken from Yana Valachovic's presentation in 2023. As demonstrated in the picture, Zone 0 will address items like lawn, non-woody plants, decorative structures, gate or fences that attach to the building, parallel fence, covered storage facilities, landscape materials, and potted plants.

- Some LRA cities have already started to incorporate the Zone and some County Safety Elements are being written in anticipation of the Zone. It will include a two-phase rollout with new construction coming first and then a year later it will apply to existing construction in SRA. The state Office of the Fire Marshall will have to adopt it for it to apply to VHRHZ LRA. The Insurance Commissioners Safer from Wildfire program already incorporates the Zone as well.

COMMUNITY PREPAREDNESS

Helping community members enroll in weather alerts and understand when the conditions are extremely prone to wildfire enhances preparedness.

OTHER LOCAL PLANS

Be involved in the county's local hazard mitigation plan (FEMA) so you have jurisdiction to act in an emergency.

IMMEDIATELY POST-FIRE

Fire Damage Assessment

FIRE EXTENT, SEVERITY, AND PARCEL MAPS

Obtaining a fire extent and severity map is a strategic first post-fire step. Overlaying this map on a parcel boundary layer illustrates how different landowners in your district were affected. Referencing debris flow hazard maps created by entities including USFS, CAL FIRE, County, and the U.S. Geological Survey further aids treatment **Prioritization**. Along with guiding management **Prioritization**, this knowledge is helpful for accessing funds and evaluating prescriptions. For example, in high-severity areas near important waterways (such as a Class I fish bearing stream), erosion control may be a priority, while in areas of low-severity burns near the WUI, removal of any hazardous trees and brush may be the best management.

RCD EXAMPLES

- Sierra RCD worked with Fresno County and the Assessor's office to secure a database of all the parcels in their district. Having that database in advance of the 2020 Creek Fire made post-fire outreach easier and faster. Sierra RCD also went out to properties and used a **Post Fire Risk Evaluation** to assess damage across properties in a uniform manner.
- El Dorado RCD also obtained parcel information from the Assessor's office and found it to be out of date. Many landowners were also displaced and located at a different address than the assessor's parcel database. This complicated landowner outreach.

Parcel maps containing landowner information can be difficult to obtain. While Sierra RCD and El Dorado RCD were able to work with their counties, other RCDs have been unable to do so. Many private companies use a database called **parcelquest** while some RCDs use **Land Glide**; CARCD is currently looking into making parcel info available to RCDs. Additionally, agency and government contacts can be helpful in obtaining parcel information.

Here are some sources of fire boundary and severity map layers:

1. **https://data-nifc.opendata.arcgis.com/**
2. **mtbs.gov**, **MTBS | Burn Severity Portal**
3. **BAER** (BAER and WERT reports contain burn severity, tree mortality, and other relevant information)
4. **RAVG**

CARCD currently, and potentially in the future, has funding to make maps for RCDs. Need a fire severity map overlaid on parcels in your district? Reach out! CARCD is also exploring funding to support enhanced parcel database access and more map making support.

WILDFIRE SEVERITIES

Wildfires typically result in a mosaic of severity. Often, after a mixed severity burn, particularly in low to medium severity burn footprints, the forest will look healthy and natural recovery is likely. These low or moderate severity fires offer ecosystem benefits including fuels reduction, nutrient cycling, and improved forest health. Landowners may be turned off by some brown needles or very mild mortality, but natural regeneration is likely to occur. Even with patches of high-severity burns, this can still be representative of historical "balanced" fire regimes.

However, **large high severity footprints are at risk of permanent forest loss**. Although wildfire is a "natural" and cultural process in California, fire suppression, mismanagement, and climate change have led to increased high-severity footprints. While burns in landscapes that are still "in-balance" are an important mechanism for sustaining a healthy ecosystem, some portions of California are at risk of ecological hysteresis. A recent study published by Steel et al. found that 30% of conifer forest extent was lost between 2011-2020 in the southern Sierra Nevada. We want to avoid generalizations, but this playbook's main purpose is addressing these expensive high-severity areas which are typically the most in need of recovery. This playbook is limited to forested ecosystems, and it is currently more focused on coniferous forests, however, we are actively working to balance it with other forested ecosystems.

Figure 5. 2021 Dixie Fire that reburned areas previously burned. Photo Credit: Ryan Tompkins, UCCE.

Figure 6. Fresno County, CA. Photo credit: Sierra Riker.

Wildfire Burn Severity Classification [PDF]

To address these different severities, we created a generalized decision tree for post-fire recovery. While this tree can be used to guide approaches, management decisions should be dependent on habitat and objectives. Typically, a mix of treatments and decisions is the best approach. This decision tree was primarily based on a mixed conifer ecosystem. Other resources include CNPS's decision trees. CNPS's decision tree is less focused on heavily forested areas, where leaving an abundance of standing dead trees can ultimately contribute to reburn. However, the CNPS tree can be an excellent resource in other environments.

DECISION TREE RESOURCES

CNPS's decision tree

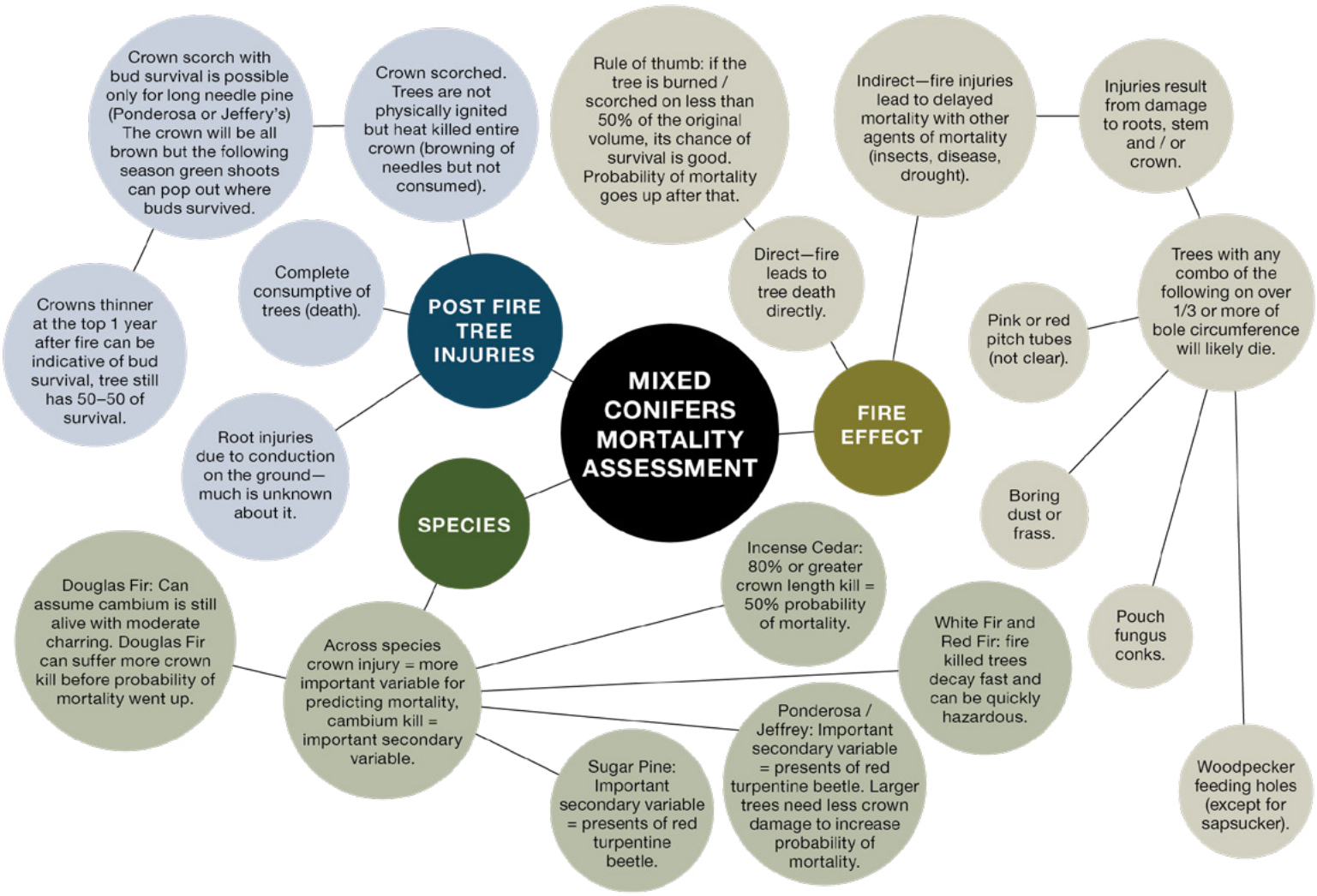
Tree Mortality Assessment Resource

Understanding Wildfire impacts Resource

*Keep in mind wildfire severity is always patchy and likely a mixture of these decisions is necessary. *Note that habitat (e.g. mixed conifer vs. oak woodland) and specific characteristics can always alter decision tree, For example, hazard trees near populated areas should always be removed, as well as landowner objectives alter decisions.*

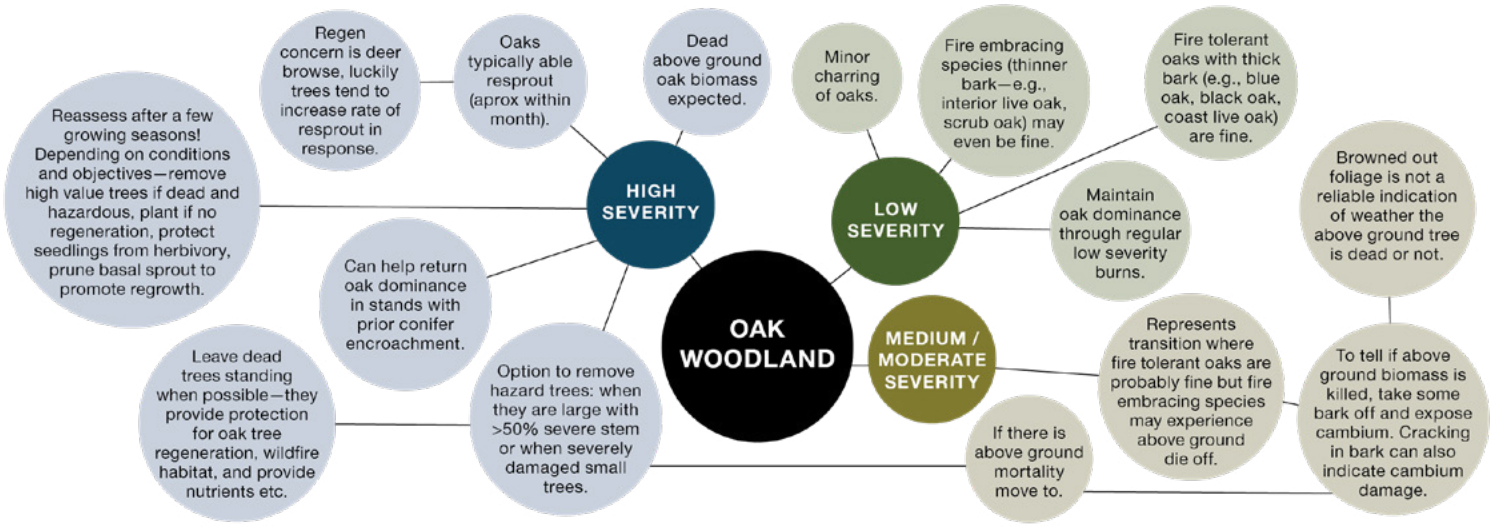
SELECT HABITAT TYPES

Wildfire severities have diverse implications across habitat types. Below is some information by habitat type to provide context before delving into management decisions.



[Tree Note - Survival of Fire Injured Conifers in California]

Species based off Hoot et al., 2010. For more information refer to that paper and **www.youtube.com/watch?v=9zt2FuohDlc*



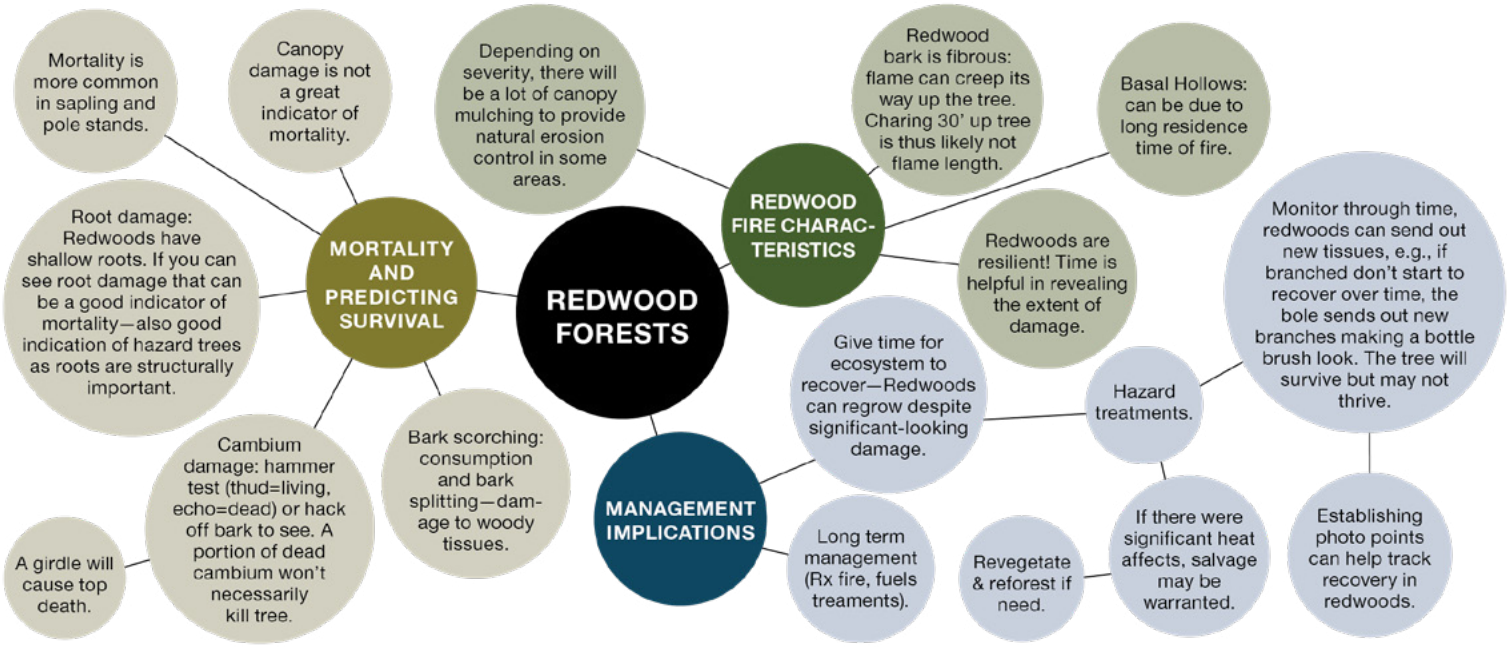
Note that all oak species re-sprout—so fire may kill above ground mass but may not kill below ground biomass. Information pulled from* ***oaks.cnr.berkeley.edu/oak-woodland-fires/* *and* ***www.youtube.com/watch?v=UE5g3-EkGNU***

MANAGEMENT CONSIDERATIONS: *Depends on goals and objectives. Often the answer is to do nothing. These are highly fire adapted ecosystems. Keep in mind wildfire severity is typically patchy and likely a mixture of these decisions is necessary.*

How to Grow California Oaks

Burned Oaks: which ones will survive?

Oak survival and regeneration



Understanding frequency of fires in redwoods is tricky due to their less reliable rings— in some place it's between 12–26 year fire return interval. More historically frequent than we think! There can be a lot of total fuels in redwood environment. For more information: ***www.youtube.com/watch?v=roSDppaPqZU***

Damage and Mortality Assessment of Redwood and Mixed Conifer Forest Types in Santa Cruz County Following Wildfire

Lessons learned from post-fire redwood survival and regeneration

Forest Type	Observed (O) and projected (P) impacts of climate change	Factors affecting vulnerability
mixed conifer	O: increase in evergreen oaks and shade-tolerant species O and P: increase in risk of fire and pests due to increase in temperatures and decrease in snowpack	historical management practices, including firesuppression, have led to dense, homogeneous stands, which increases vulnerability
Douglas-fir	O: inconclusive P: species range shift difficult to predict	populations are adapted to local conditions, which may increase resilience
oak woodland	O: increase in oaks in montane woodlands P: decrease in total area with suitable growing conditions	mature oaks appear to be fairly resilient; growth and survival of new seedlings is more likely to be impacted by climate change; sensitive to groundwater depletion, grazing stresses, and competition from invasive species
riparian woodland	O: increase in oaks in montane woodlands P: decrease in total area with suitable growing	reliant on streamflow, which is likely to change, but exact patterns are still uncertain
red fir	O: inconclusive P: may be threatened by reduced snowpack; need for deep soil may reduce ability to migrate	depend heavily on snowpack and deep soil
redwood	O: decrease in fog frequency; possible increase in sudden oak death (SOD) in tanoak P: future fog frequency is uncertain; SOD could be exacerbated by warm, wet conditions	long-lived; can regenerate through sprouting; heavily dependent on fog
subapline conifer	O: tree growth increased by warming; increase in density of small trees P: highly uncertain; refugia could help resilience, but increased density could lead to increased fire frequency	high elevation sites may be especially vulnerable; new habitat is limited if old habitat becomes unsuitable
montane chaparral	O: shifted upward in elevation in one southern California study P: vegetation likely to increase, but uncertain	drought resistant; adapted to fire
pinyon-juniper	O: longer, more extreme fire seasons; large areas of pinyon die-off in the southwestern United States P: drought and bark beetle infestations could lead to further die-off	stands have increased density and have expanded in some places and had significant die-off in others; mechanisms for change are location-dependent but may include fire exclusion, recovery from past disturbance, livestock grazing, and climatic variability
aspen	O: inconclusive P: sudden aspen decline (SAD), as well as the insects and pathogens associated with it, may be exacerbated by climate change; temperature and moisture stress are threats, but fire could reduce conifer encroachment	conifer encroachment due to fire suppression has suppressed aspen; increased fire may favor aspen vigor; ability to reproduce by both seed and sprouting could provide adaptive capacity

Table 1. © 2017 Regents of the University of California. Used by Permission.

Identify Recovery Gaps

Identifying **Partners** capacities and roles in pre-fire planning minimizes recovery gaps. However, finite capacities and wildfire unpredictability lead to inherent recovery gaps. Identify the place where RCDs are the most beneficial is key.

NRCS EXAMPLE

* **NRCS's Post-Wildfire Restoration and Response: A Resource Guide for NRCS California District Conservationists** specifically outlines their post-fire role. The Resource Guide lists the variety of post-fire recovery efforts that exist including the Burn Area Emergency Response (BAER) team, Federal Emergency Management Agency (FEMA), USDA Rural Development (RD), and their respective roles. This can be helpful in identifying potential gaps.

Figure 7. Trinity County, CA. Photo credit: Sophia Lemmo.

If possible, communicating or participating with your Local Assistance Center (LAC) can help identify the RCDs role and place among partners. Typically, LACs are set up by Cal OES following state and federally declared Natural Disasters and are a convening location for local, State and Federal agencies. In some cases, RCDs work with NRCS to staff a LAC.

RCDs provide expertise and environmental services in a variety of areas that differ between districts. Here are some key RCD niches:

NON-INDUSTRIAL PRIVATE FOREST LANDOWNER RECOVERY

- Facilitate salvage logging, fuel removal, site prep, reforestation, and long-term maintenance. In low to moderate severity burns, or in **Select Habitat Types**, actions can also include natural regeneration monitoring, education about fire benefits, and invasive plant management.
  - Private landowners often face knowledge, financial, and regulatory barriers when it comes to restoring their land after wildfire. RCDs counteract these barriers by serving as effective hubs for landowners and offering a range of resources. Often RCDs collaborate with or have RPFs on staff to help facilitate and provide expertise.
  - RCDs can take these steps to further enhance post-fire recovery efforts:
    1. Facilitate connections among neighboring landowners to promote landscape-level restoration rather than isolated efforts.
    2. Assist in connecting neighbors to cost-share resources or other financial assistance programs.
    3. Conduct targeted outreach to landowners, establishing personal contacts and fostering direct communications to tailor support.
- Long-term Management
  - Unlike agencies and groups that focus on immediate post-fire recovery and gradually disengage over time, RCDs are community embedded and remain dedicated for the long term. RCDs can continually look for grants and funds to maintain recovered areas, such as planted areas that need pre-commercial thins (PCTs). If RCDs' capacities are properly supported, this ongoing commitment ensures that progress achieved in post-fire recovery is maintained. See **Long Term Funding Sources/Options**.

AGREEMENTS WITH USFS, OR OTHER GOVERNMENT LANDOWNERS

- Establishing agreements with an RCD enables the USFS and government entities to be nimble and efficient in getting recovery work done. The collaborative approach not only streamlines operations, but also can open doors to additional funding and further cross boundary cooperation.

RCD Post-Fire Webpage

Immediately launching a webpage is an effective way of engaging with the community. This webpage can contain a collection of resources on post-fire preparedness, recovery resources, community support, and news and updates. The website will also convey your RCD's authority and demonstrate commitment to the community.

Funding Source Assessment

Funding is the largest limitation on RCD post-fire recovery work. Unlike many RCD counterparts, RCDs lack the necessary baseline funding. As CARCD and RCDs continue to demonstrate the need for dedicated capacity, other funding sources need to be established. Exploring if existing funding can be adapted or leveraged to fund post-fire recovery can be a quick method to obtain funds. For instance, perhaps landowners already enrolled in NRCS programs and can modify their program to include emergency actions. Reaching out directly to funders or CARCD for assistance in securing funding can be an effective strategy. CARCD is actively looking into ways to accumulate a larger general post wildfire recovery pot accessible to RCDs.

Check for Disaster Declaration

CAL OES FUNDING (DISASTER DECLARED)

https://wildfirerecovery.caloes.ca.gov/current-incidents/

FEMA

Post-Fire Funding in the Hazard Mitigation Grant Program:

Recipients will be eligible for up to 10 percent of the award amount for management costs. Subrecipients will be eligible for up to 5 percent of the award amount for management costs. FEMA will provide one estimate of the management costs available under each HMGP Post-Fire award, which will be included in the formal funding notification. The estimate will be subsequently increased as appropriate for each FMAG event that is aggregated.

CAL FIRE

Wildfire Resilience - CAL FIRE (*wasn't offered in 2023)

Especially flexible for working with NIPFl as it does not have a minimum acreage amount or require exact work areas to be pre-identified.

Other CAL FIRE grants (including Forest Health)

Suppression recovery funds from CAL FIRE may be available to help restore areas where suppression efforts were destructive, like cut line.

Figure 8. San Mateo, CA. Photo Credit: Sophia Lemmo.

COST-SHARE PROGRAMS: EQIP, CFIP, FSA's EFRP

These cost share programs have pathways for catastrophic wildfires and are among the few funding vehicles explicitly for non-industrial private forest landowners. While valuable, these programs have inherent drawbacks. Funding may be less than anticipated or have burdensome upfront costs coupled with lengthy reimbursement waits. Relying on these programs while maintaining public trust requires transparency with landowners about past challenges and learning from experienced RCDs. Building pre-fire connections with the pertaining local agencies fosters communication for smoother plan approval. CARCD will continue to work on a state level to carve out new pathways and support existing ones. If you want help thinking through any of these options, please do not hesitate to reach out to CARCD.

CAL FIRE's VMP program is another cost-share program, although it does not have pathways specifically designated for post fire. **See above** for more information.

Regional Cost Share Programs

Some localized areas have specific cost-share programs for their region. Most of these are lead and planned by RCDs. Examples include the **North Bay Forest Improvement Program** and Butte County's Small Forest Landowner Assistance Program (SFLAP). There is also a **Sierra Nevada Crisis to Opportunity RCPP** good through 2027. To build one of these in your area will require funds (RFFCP EA, CAL FIRE's Wildfire Resilience, USFS Disaster Recovery, etc.)

Here are some additional resources:

After the Fire: NRCS Emergency Assistance of Private Lands 2020

fy20 Catastrophic Fire Recovery EQIP Ranking Pool

Emergency Forest Restoration Program (EFRP)

The EFRP is a federal program administered by the Farm Services Agency (FSA). After a natural disaster that impacts forest health, the county FSA office can initiate the EFRP. The program has two forms of assistance for non-industrial private forest landowners:

- **Financial Assistance** in the form of incentive payments for forest restoration activities. This assistance is administered by the county FSA office.
- **Technical Assistance** in the form of site visits, expert advice, and the writing of plans. At the federal level, FSA has an MOU with the USFS to provide grants to the states for TA for the EFRP program. In California, the USFS has a contract with CARCD to provide technical assistance through sub-contracts to RCDs or by putting a project out to bid directly to RPFs.

ADDITIONAL REGIONAL COST SHARE PROGRAM RESOURCES:

- **After the Fire: NRCS Emergency Assistance of Private Lands 2020**
- **fy20 Catastrophic Fire Recovery EQIP Ranking Pool**

Figure 9. El Dorado County, CA. Photo credit: Sophia Lemmo

EFRP is a relatively new program to California. That paired with FSA's limited background in forestry has provided for a challenging roll out of the program here. The scenario differs from EQIP, offering better payments with 75% of costs paid of what the government determines is rebate for those practices on a per acre basis. However, it is confusing for landowners and can take a long time to get plans through. RCDs have put in many hours before having a contract in place to bill to. CARCD will continue to work with USFS and FSA to advocate for a better EFRP program. Recently (11/24) CARCD has been informed that RCDs may be able to bill for TA immediately. This could make the program more feasible for RCDs to participate in. This news isn't reflected in the documents below. Reach out to CARCD for more on this.

For more background information on the EFRP program, see the **Emergency Forest Restoration Program (EFRP)** fact sheet.

FIRST STEPS TO EFRP: FROM USDA-FSA EFRP Implementation Process.

Natural Disaster Occurs

1. FSA County Office assesses the natural disaster, with support from the local State Forestry Agency staff. The Assessment includes:
    a. Location, timing/dates, extent, and type of the natural disaster;
    b. Identifies practices needed, number of farms/landowners affected and estimates funds.
2. FSA County Committee (COC) determines if an EFRP signup is needed to provide federal assistance for restoration measures.
3. If EFRP is needed, FSA COC will submit a request to implement EFRP to the FSA State Office.

Request for EFRP Implementation

4. FSA State Office reviews the request from the COC and submits the EFRP assessment and request for implementation to the FSA National Office for approval.
5. FSA National Office reviews assessment and request. If approved, they will:
    a. Assign Disaster ID;
    b. Records data in CSS;
    c. Verify FEMA designation
    d. Respond and notify the requesting FSA State Office
    e. FSA State Office notifies the requesting FSA County Office(s) of the EFRP implementation approval.

For the remainder of steps see **USDA-FSA EFRP Implementation Process**.

Figure 10. Pleasant Valley, CA. Photo credit: Sierra Riker.

Figure 9. Map of EFRTs in California. Mapped by Sophia Lemmo.

INVOICING FOR THE PROGRAM ONCE CONTRACTS ARE IN PLACE

RCD -> CARCD -> USFS -> EFRP TA Funds

Visit this PDF for more information on the **FSA Disaster Assistance Programs at a Glance 2017**.

For more information about engaging with EFRP you can reach out to **Napa RCD'S forestry team** and CARCD.

EMERGENCY FOREST RESTORATION TEAMS (EFRTS)

One-pager on EFRTs as of August 2024

UCCE Report on EFRTs and **report summary**

Per **the Private Landowner Assistance Work Group's Implementation Strategy**, EFRTs provide rapid technical and financial assistance to restore private forest lands and help prevent further damage to life, property, and natural resources. One goal of the work group is to facilitate the creation of EFRTs throughout the state. In 2021, three pilot EFRTs were deployed in response to the Dixie, Tamarack, and Caldor fires, led respectively by Feather River RCD, Alpine County, and El Dorado RCD. Since then 10 other RCDS were funded through a USFS CARCD pass through grant to complete post–fire recovery work within the footprints of 2019–2021 wildfires. These RCDs function in as or in a similar capacity to EFRTs. These EFRTs are supported primarily with direct funding through CAL FIRE and USFS.

The **CA Wildfire and Forest Resilience Task Force, Private Landowner Assistance Work Group** is exploring pathways to creating permanent or semi-permanent funding available for EFRTs. The goal is to fund entities, including RCDs, prior to a wildfire such that partnerships can be strengthened and organized for rapid post-fire treatment. If your RCD needs funding for post-fire disaster recovery or to establish an EFRT, you can fill out **this form**.

For more information and an RCD example, Feather River RCD compiled a **EFRT Handbook**.

NRCS TA AGREEMENTS

NRCS-CA has extended and added funding to its existing forestry technical assistance agreement with CARCD. The agreement passes funding to local RCDs to provide forestry technical assistance services to NRCS-CA Field Offices.

Another way to become more involved with NRCS is to become a Technical Service Provider, or TSP. To learn more about how to visit the link below:

Technical Service Providers | Natural Resources Conservation Service (usda.gov)

If you are providing TA on behalf of NRCS programs it is highly recommended to review their **Post-Wildfire Restoration and Response: A Resource Guide for NRCS California District Conservationists.**

The guide includes an array of post-fire recommendations such as: "Make every effort to expedite the preparation of the FMP for clients that only want immediate/near term recovery actions. Consider using the FMP Disaster Assessment Form, Tree Mortality FMP, or the 100-Foot Around the Home FMP for means of expediting completion of FMPs. Communicate and work with CAL FIRE's California Forestry Improvement Program (CFIP) or Farm Services Agency's Emergency Forest Restoration Program (EFRP) to share post-wildfire FMPs and avoid duplicate preparation".

CALIFORNIA WATER BOARDS

The California Water Boards have funding originating from the EPA 319h grant for their Nonpoint Source Pollution program. This funding can be used for restoration projects. Projects that are post-fire (declared emergency zones) also have some carve outs from normal requirements.

https://www.waterboards.ca.gov/water_issues/programs/nps/319grants.html

Nonpoint Source Program | California Water Boards

CARBON FINANCING FOR REFORESTATION CONSIDERATIONS

Increasingly, RCDs are being contacted by organizations/developers offering reforestation through leveraging carbon markets. These emerging markets in CA either work through (1) paying landowners based on the carbon removed via reforestation or (2) the programs tap into funding sources previously unavailable to fund reforestation. Carbon project developers currently (2024) in CA include: Mast, American Forests, American Forest Foundation, Spatial Informatics Group, New Leaf Climate, RenewWest, Land Life Company, Forest Carbon Works. While all of their offerings differ, generally landowners would be paid in one of two ways (or often a combination):

Upfront, before credits are issued

- Payment guaranteed by project developer with upfront payment and subsequent payments per year
- Payment reevaluated every X number of years

After credits are retired

- Payment could be between 50-80% of what credits are sold for on the open market

BEN RUSHAKOFF, AMERICAN FORESTS

If you are engaging with a carbon project developer to help fund reforestation for a NIPFL there are **some key questions you should ask**, as programs greatly differ:

- How long is the contract?
- What happens in the case of a land transition?
- What happens in the case of an accidental reversal (e.g. forest fire?)
- Before vs. After verification – replanting responsibility?
- What happens if there is an intentional reversal (unallowed harvest)?
- How much will I get paid and what is the payment schedule?

- Upfront payment? Guaranteed payment? Landowner see the upside of future prices?
- How is verification done?
- What happens if the carbon program goes bankrupt?
- Does landowner have option to cancel project?
- What happens to your data?
- Tribal data sovereignty considerations
- Who is buying the carbon credits?
- Can Landowner specify buyer sector preferences?

BEN RUSHAKOFF, AF

For more information see our **Carbon Market 101 webinar**

CONTRACTUAL CONSIDERATIONS

Prevailing Wage

Prior to soliciting proposals or bids for a project, RCDs should always determine whether the project is subject to prevailing wage. Prevailing wages MUST be paid if a project:

- Is $1,000 or more;
- Done under contract;
- Involves "public works"(ie. construction, alteration, demolition, installation, or repair work, including but not limited to pre-construction and post-construction activities like inspection and surveying work)
- Is paid for in whole or part by public funds.

Circumstances in which RCDs would be considered a contractor are rare. In cases where RCDs are using funds awarded from a state agency, they will most often be considered the awarding body. An awarding body is the entity that awards a contract for public works and is sometimes known as the project owner. The awarding body can be any kind of public agency, official, or private entity using public funds.

For example, if an RCD enters into an agreement with the state (ie. CAL FIRE) to implement a project on their behalf, and that RCD then enters into a contract with a contractor for implementation, the RCD is an awarding body. Even if the special district performs work with its own forces, the Labor Code provides that the work is not subject to prevailing wage. However, RCDs with specific questions about prevailing wage should seek legal counsel.

CARCD hosted a three-part workshop on Prevailing Wage. The recordings of the workshop can be found here, and a detailed **summary document is linked here**. Workshop topics included a general overview of prevailing wage requirements, what constitutes a "public work", contractor registration with DIR, prevailing wage determinations and applicability to specific projects, required language in solicitation documents, and when and how to file a PWC-100.

RECOVERY PLANNING & ORGANIZATION

To avoid redundancies, refer to the **Partners** section throughout these phases of work.

Education

If necessary, review pertinent training and education information available to RCDs. Becoming an expert or someone who can provide reliable guidance to your community is important.

Reach out to other RCDs, particularly those on the RCD Post-Fire "Team" (Informal), or CARCD for support.

Community Outreach

Community outreach strategies, including timing, methods, and prioritization, will be place specific. In some circumstances, (e.g., RCDs that are inundated with existing clients), waiting a few months to a year before beginning outreach to private landowners is logical. Some RCDs may choose to begin outreach immediately after a fire. Remain sensitive to the fact that some landowners are dealing with other priorities and are not ready to think about reducing fuel loads, prepping, and getting trees in the ground immediately after experiencing loss.

RCDs have multiple options to conduct outreach to landowners, including:

- Ads in publications, and at local hubs (Safeway Grocery Stores, gyms, etc.)
- Tabling at local events
- Community Meetings
- Attending Fire Safe Council Meetings or other local group meetings
- Partnering with County OES to advertise RCD programs. County OES fields a lot of calls after a fire and can be helpful in funneling folks to RCDs
- Local newspapers can be a good resource for reaching community members who are less active on social media
- Radio ads
- Going door-to-door. There is a precedent of doing some for some Rx burns
- Nextdoor (a hyperlocal social networking service for neighborhoods) is currently offering free accounts to special districts. It can be a method for reaching neighborhoods/watersheds and folks hard to reach by other methods. You can apply **here**
- Facebook or other social media outlets
- Consider local languages (i.e., is Spanish a common language in your community)
- Snail mail, email list-serves

Figure 11. Fresno County, CA. Photo credit: Sierra Riker.

RCD EXAMPLES

✱ **El Dorado RCD (EDRCD):** After the Caldor Fire, EDRCD struggled with community outreach as many landowners were displaced. However, through public meetings the RCD compiled a landowner contact database to use for communication. The public meetings also helped the RCD build connections in the local neighborhoods to reach landowners who were no longer in the area. Other agencies doing post fire work, like Ca lOES, also presented at the meetings. This helped landowners distinguish between the different agencies and programs taking place in their neighborhoods.

✱ **San Mateo RCD (SMRCD):** After the 2020 CZU Lightening Complex, San Mateo RCD conducted outreach for a range of services. These included Spanish translation, locating temporary lodging for animals and displaced community members, and providing technical guidance on post-fire recovery. To engage the community promptly, the RCD quickly disseminated a list of their services through newsletters (see examples below), inviting community members to seek assistance. San Mateo RCD led community coordination and asset mapping, and compiled information on post-fire conditions of existing rural roads to prioritize erosion work. Additionally, since the RCD previously provided technical assistance to the rural roads program and worked on irrigation efficiency, they were able to use that data to have state contractors pay for some of the damages created during cleanup efforts.

When the fire occurred, San Mateo RCD sprang into action prior to securing funds. They were able to do so through having confidence in the community, cultivating a non-overly risk-adverse board, and fostering strong partnerships. The RCD's swift action built stronger community ties and influenced the county to change how they respond to natural disasters. The RCD also received more donation funding immediately after the fire due to their vast and quick response.

To effectively aid the community after a disaster, San Mateo RCD recommends:

1. Maintaining a board that is not risk averse
2. Acting proactively to help the community however possible
3. Understanding and leveraging the core values of the RCD to benefit the community
4. Reaching out to all available contacts as soon as possible
5. Participating in the county's local hazard mitigation plan (FEMA) to have jurisdiction in emergencies, and
6. Establishing a fire recovery webpage promptly, even if basic or unrefined.

San Mateo RCD's Example Fire Recovery Customer Spreadsheet

San Mateo RCD's Example Newsletter 1

RESOURCES FOR RCD EXAMPLE

San Mateo RCD's Example Fire Recovery Customer Spreadsheet

San Mateo RCD's Example Newsletter 1

San Mateo RCD's Example Newsletter 2

San Mateo RCD's Fire Recovery Webpage

Sonoma RCD's Fire Recovery Webpage

San Mateo RCD's Example Newsletter 2

San Mateo RCD's Fire Recovery Webpage

Sonoma RCD's Fire Recovery Webpage

In 2025, CARCD, in cooperation with UCCE, and American Forests, will release an Underserved Forest Landowner Outreach Plan—please reach out to us with any questions or to get a copy.

Workshops are an effective method to educate groups of landowners. Field tours of property walk-throughs showcasing actions taken by other landowners have proven successful. Coordination with UCCE is recommended as they do workshop series like their **Post-fire Forest Resilience Workshops**.

Organization

LANDOWNERS

Staying organized throughout the landowner onboarding and tracking processes can be challenging. Having a streamlined and efficient method for fielding requests is key. Consider the following strategies:

1. Utilize Free Online Survey Software: Incorporate free online survey software, such as Google Forms, into your website. Create a survey that includes enrollment options, contact information, APNs (Assessor's Parcel Numbers), acre size, requested services, and the option to schedule a site assessment. This allows landowners to provide essential information in a convenient and standardized manner.
2. Explore Survey123 through ArcGIS Online: While not free, Survey123 through ArcGIS Online provides another option for managing requests and data collection. Placer RCD successfully utilized this method by sending letters to all private landowners within fire footprints. The letters included a QR code that directly linked to Survey123. Alternatively, landowners who are not comfortable with online surveys can be offered the option to respond through traditional mail. **Survey123 training CARCD hosted.**
3. Accommodate Different Communication Preferences: Recognize that some rural landowners may prefer snail mail or phone communication. To accommodate their preferences, offer the option of mailing back a paper response or communicating via phone. However, collecting information by phone may require a significant time commitment.

By implementing these strategies, RCDs can efficiently gather and manage information from landowners seeking assistance, ensuring timely and organized onboarding processes.

Figure 12. Plumas County, CA. Photo credit: Sophia Lemmo

STAFF

Along with keeping landowner information organized, maintaining clarity in staff roles and responsibilities is essential. RCDs have found a few strategies to help maintain staff organization:

1. Delegate communication channels, including assigning responsibilities for checking phones, and monitoring website messages.
2. Leverage ArcGIS Online to keep track of work locations, timelines, and prioritize landowners geospatially. This helps visualize, prioritize, and manage the progress of post-fire activities.
3. Early on, identify non-profit organizations and agencies that can collaborate with you. Determine which roles each entity will undertake in the post-fire process.

Prioritization

Deciding which properties will receive assistance in an equitable way, while prioritizing landscape effectiveness and conveying information to the public, is challenging work. Some metrics to help weigh treatment prioritization include:

- Does it leverage other work or neighboring work?
- Is it in the WUI?
- Are there public safety concerns?
- Is it close to water supply or important infrastructure?

Treatment should be prioritized by landscape, infrastructure, and feasibility attributes. It is recommended to use tools like **Planscape** (free) to better target treatment locations. Consider attributes like population proximity, topography, ingress/egress routes, are important, along with individual landowner attributes. Landowner attributes include their financial ability to conduct implementation, their priorities and objectives, and perspectives on land stewardship. It's also important to assess which landscapes are suitable, feasible, and prepared for recovery. Areas with high productivity and accessible terrain, where mechanical treatments can be effectively deployed, are the most practical for reforestation investments. In contrast, remote areas with limited or no access present higher costs and challenges, making successful reforestation efforts more difficult.

RCD EXAMPLE

❋ One way Honey Lake RCD uses landowner attributes to prioritize effective treatments is that they only reforest for landowners who allow **Herbicide** treatments.

Coordinating with partners to learn about pre-existing fuel breaks and recovery efforts can help better target and leverage restoration. This collaborative approach enhances connectivity and improves the ability to influence future fire behavior. A handful of counties, including Nevada and Placer counties, have teams that track projects throughout their boundaries. Some partners to reach out to include:

- Caltrans for road-related fuel breaks and treatments
- NRCS for information on their internal maps of where projects are
- Local non-profits involved in fuels management (e.g., American Forests with My Sierra Woods, local PBAs/Fire Safe Councils)
- USFS/BLM
- Industrial landowners: SPI, Collins Pine, Humboldt, and Mendocino Redwood Company, etc.
- Local consulting RPFs who may have knowledge of where commercial fuel reduction and recovery projects are.

There are efforts underway by the **California Wildfire & Forest Resilience – Task Force** to create public mapping and tracking systems to show all work being done, which can allow for more coordinated efforts.

Figure 13. El Dorado County, CA. Photo credit: Sierra Riker.

RCD EXAMPLES

❋ Butte County RCD's Small Forest Landowner Application Program (SFLAP) uses a ranking criterion that they developed and works best within their local area. They determine rank by:

1. If the landowner lives on site or has returned after the fire
2. Proximity to other neighbors in the program (banding together)
3. If the landowner has a maintenance plan
4. Income

❋ Additionally, the North Bay Forest Improvement Program (NBFIP), led by Sonoma County RCD, Mendocino County RCD, and Napa County RCD, accepts applications that are under 5,000 acres but more than 5 acres. They rank their applications by:

1. The amount of treatable acreage
2. If the landowner has a management plan
3. If the landowner is in a disadvantaged community

Figure 14. Fresno County, CA. Photo credit: Sierra Riker.

As referenced in the ranking criterion of SFLAP, prioritizing treatments in areas where multiple landowners can be banded together to create a larger project footprint is an effective strategy and an especially great niche for RCDs. While coordinating between multiple landowners can be challenging, requiring extensive communication and transparency, the benefits are high. Costs can be distributed, and effectiveness amplified. Economies of scale are another criterion some RCDs use, but don't advertise. For example, offering assistance to one ten-acre parcel in the middle of the woods will be more costly and take longer than 20 parcels in the town or close to a mill. In some cases, prioritization may be determined by Cal OES and FEMA. This can be a collaborative process, or a district can let them make the decisions and follow behind.

RCD EXAMPLE

❋ Sonoma RCD finds collaborating across multiple private ownerships post-fire to be highly advantageous. Due to the scarcity of large private landowners in Sonoma County, the RCD focuses on connecting multiple 20–100 acre ownerships. By initiating work on a larger landowner, the RCD establishes a solid project that already justifies high equipment mobilization costs. Subsequently, smaller, neighboring ownerships can be added as the project develops, enabling funding for properties too small to normally qualify for or afford post-fire restoration programs. NRCS also tries to group neighborhood level landowners together in single EQIP agreements post-fire to streamline administrative processing. Developing MOUs between the lead EQIP holder and subordinate landowners is recommended.

Sonoma RCD often prioritizes treatments near structures and egress routes. Funding for defensible space is generally limited, and in CAL FIRE's response area (State Responsibility Area, SRA) landowners are legally required to comply with 100-foot defensible space work under Public Resources Code 4291. The RCD also focuses on areas where heavy equipment can be used (e.g., slopes <35–40%), thus allowing for more efficient and economical work. For example, ridgelines, which can be important for suppression efforts, are generally flat, allowing for easier equipment use.

There is an art to prioritizing treatments within a property. The goal is to maximize the "bang per buck", while meeting the landowner objectives. For example, if funding is only secured for the next three years, planting at a lower density may maximize "bang per buck" and reduce the need for a PCT. UCCE developed a self-assessment tool for landowners to prioritize treatments on their property. The tool, while basic, is below:

Climate Impact	Questions for self-assessment	If yes, management options to consider and applicable "Forest Stewardship Series" (FSS) publications to consult	Vulnerability	Importance	Cost to address	Time frame	Investigate further?
			High, medium, or low			Short, ongoing, or long	Yes or no
fire risk	Are your home, other structures, and the spaces around them built and maintained to be defensible in case of a fire?	Update and maintain. See *Homeowner's Wildfire Mitigation Guide* and *Home Survival in Wildfire Prone Areas: Building Materials and Design Considerations*					
	Are there significant surface or ladder fuels in your forest?	Consider fuel management strategies. See FSS 15.					
	How long has it been since your forest last burned?	Thinning; fuels management; prescribed fire. See FSS 15.					
moisture stress	Is your forest in a moisture-limited area?	Manage for appropriate stand density to reduce moisture competition. See FSS 5.					
	Is your forest at risk for indirect impacts of climate change (fire risk, pests, etc.) that may be exacerbated by moisture stress?	Manage for appropriate stand density to reduce competition for water; consider management options for indirect impacts. See FSS 5.					
native pests	Do you have conifer forest that may be susceptible to bark beetle infestation?	Manage for diversity and reduced competition for water resources. See FSS 16.					
	Are there other native pests in your forest or region that may be more successful in warm temperatures?	Seek further resources; management options vary significantly depending on species of concern.					
invasive pests and plants	Do you have oaks or sudden oak death in your region?	Avoid spreading SOD. Be vigilant in warm/wet conditions.					
	Are there invasive plants (e.g., broom species) on or near your property that may survive well in warmer temperatures?	Monitor property; identify and remove invasives before they become established. See FSS 14.					
changing stream-flow	Is there riparian vegetaion along you stream?	Plant or maintain riparian vegetation to create shade over the stream and control water temperatures. See FSS 10.					
	Are there aquatic species of interest that may be sensitive to warming water temperatures?	Plant or maintain riparian vegetation to create shade over the stream and control water temperatures. See FSS 10.					
	Is your property susceptible to increased flooding?	Maintain culverts, stormproof roads. Assess structures in floodplain. See FSS 17.					
changing wildlife habitat	Are there endangered species on or near your property that may be stressed by climate change?	Maintain habitat (specific actions are species-dependent). See FSS 8.					
	Does your property have refugia that may be useful for sensitive wildlife? "Refugia" are areas that may remain cool or moist as conditions warm and dry; they may be found in wet areas, valleys, or northern aspects.	Protect refugia from development or impact; account for refugia in planning.					
changing species suitability	Are the tree species on your property likely to be stressed by warmer or drier conditions? This may be the case if you are at the warmer edge of a species' range.	Favor diverse species or those that may be resilient to warmer temperatures in management activities. See FSS 3.					

Table 2. © 2017 Regents of the University of California. Used by Permission.

Figure 15. Lassen County, CA. Photo Credit Honey Lake RCD.

Right of Entry Agreement Process

Post-fire evacuations and displacements can make tracking down landowners to acquire a Right of Entry (ROE) Agreement challenging. For example, 80% of the Grizzly Flat Residents were displaced in the 2021 Caldor Fire. Leveraging partnerships, such as with Cal OES and the county, can help alleviate this challenge by building on existing ROE processes and gaining access to the land. In the case of Grizzly Flats, the partnership between Cal OES and El Dorado County yielded a 90% landowner response rate for the removal of hazardous waste and biomass. Here is an example **ROE** from Mariposa RCD.

RCD EXAMPLES

❋ RCD of Santa Cruz County (RCDSCC) was able to forgo the ROE process due to extenuating circumstances. The governor declared a county emergency, which allowed the county to pass a resolution of health emergency determining the water quality will be polluted if no action is taken. The RCD then wrote a proposal through the county to have CCC crews come address post-fire concerns, without ROEs in place. However, RCDSCC did send out a mass email to property owners informing them of upcoming work, and excluded those who were uncomfortable with the access.

❋ Feather River RCD encountered challenges with the ROE process due to differing landowner preferences. Some landowners were hesitant to sign a contract without knowing the exact details of the work down to the removal of individual trees. On the other hand, some landowners wanted to sign contracts immediately to secure their participation in the program. This presented a dilemma, as entering into a legal agreement without a defined scope of work or RPF was difficult.

To navigate these situations, the RCD developed a non-binding **contract** that allowed flexibility. The contract becomes binding once a work plan is created and an emergency notice is approved by CAL FIRE. The **work plans/scope of work** are relatively simple and include any special circumstances (e.g., logs left on site for firewood). This approach strikes a balance between the need for an agreement and the requirement for specific project details. Feather River RCD has the following on their website regarding the application:

The Feather River Resource Conservation District (RCD) has created a fire prevention and recovery program that will provide technical assistance to private landowners who seek to protect and repair their land.

The RCD is a non-regulatory agency and your information will be kept confidential. Please complete this questionnaire concerning your property, which will help us determine the best way to help you.

Submitting this application does not constitute any sort of obligation for participation. Submitting the form acknowledges that representatives from the RCD, including foresters, archaeologists, and RCD employees may access the property to develop a scope of work.

This blurb and questionnaire give the RCD enough leeway to do a site visit with an RPF. Feather River RCD recognizes that one of the major challenges lies in the varying perspectives of landowners regarding forestry work. To address this, Feather River RCD gauged landowners' attitudes to better identify those more prone to filing lawsuits. Recognizing the importance of this issue, Feather River RCD is actively collaborating with lawyers to enhance the contract development process. As progress is made, the playbook will be updated accordingly to incorporate these legal considerations.

FUEL MANAGEMENT

This may appear obvious, but when heading out to the field post-fire, inherent field hazards are elevated. Safety gear including hard hats, sturdy boots, safety glasses, and possibly N95s are important. Sharing these safety concerns with landowners is recommended.

The removal of fuels after a wildfire reduces hazards and mitigates the threat of reburns, as untreated post-fire environments foster high shrub amounts and large loads of dead wood. The process of salvage logging and post-fire management can be controversial and should be done thoughtfully while considering the site and its objectives. Typically, human intervention, such as fire suppression and forest mismanagement, have already created a situation prone to catastrophic wildfires. Thus, opting out of any recovery efforts can be irresponsible, especially as the site was already significantly impacted by human activity. Removing dead and dying standing trees can help mitigate the following risks: (1) increased dead/downed fuel loading, (2) the choking out of wildlife habitat (e.g., foraging grounds), and (3) increased risk of future catastrophic wildfires. However, retaining wildfire snags and downed logs for habitat can and should be a part of salvage operations.

Removing fuels sooner rather than later is important for a variety of reasons. (1) It increases the chances that landowners can recover merchantable salvage logs. (2) Removing fuels should be done prior to reforestation to ensure that the investment of planting is worthwhile. Falling snags, debris and wood fuel increase the risk of a high severity reburn. The cost of site prep increases with time.

Fuel management is both a pre-and post-fire activity. Thus, fuel reduction treatment does not belong in just a single point on the wildfire timeline and is rather a recurring and continuous activity. Fuel treatments need to be maintained, expanded, and connected to augment their effectiveness. RCDs are unique in their ability to support and participate in fuels management on all lands, from federal to private.

Figure 16. Plumas County, CA. Photo credit: Camille Swezy.

PERMIT & RPF REQUIREMENTS

WHEN IS A PERMIT NEEDED?

A permit is needed when a project creates a significant direct or indirect environmental impact.

If any of the generated products from the project are bartered, sold or traded, including logs, chips, or firewood then a permit under the California Forest Practice Rules is needed.

All projects using public funding (state or federal) require review under CEQA or NEPA, depending on ownership jurisdiction and/or funding source.

Permits are required from multiple agencies when projects include: clearing land, grading land, operating in or adjacent to wetlands or watercourses, causing smoke, or affecting sensitive plant and animal species.

WHEN IS AN RPF REQUIRED?

- For projects falling under the jurisdiction of the CA Forest Practice Rules (i.e., commercial endpoints) with some exemptions (e.g., Post-Fire Recovery Exemption [1038(g)] and Structure Protection 150-300 feet Exemption [103(c)(6)]).
- CA Vegetation Management Program (VMP)
- CA Forest Improvement Program (CFIP).
- CalVTP in forested landscapes.

However, it can often be prudent to consult with RPFs even on forest management projects that don't require a license for their expertise.

Permitting

One recent resource for post-fire permitting is: **Planning and Permitting Forest Fuel-Reduction Projects on Private Lands in California**—a publication by University of California, Agriculture and Natural Resources with authors: Yana Valachovic, Jared Gerstein, and Brita Goldstein.

Some key elements include:

- Decisions trees
- Types of CAL FIRE permits and basic requirements
- More specifics on overall permitting
  - Developing projects that fit into a categorical Exemption can streamline the process. Elements necessary for this include:
    1. No operations in sensitive areas or at sensitive times of year
    2. Minimal ground disturbance
    3. Focus on small trees and brush
- Possible funding sources

PERMITTING PATHWAYS

General environmental compliance choices:

State funds/state or private lands → CEQA

Commercialization of woody material → Forest Practice Rules

Federal lands/direct federal funds → NEPA

Common Post Fire Environmental Compliance

Often, the best options for small private landowners wanting to manage and remove trees immediately after a wildfire are a **CEQA exemption** or an emergency notice under the **Forest Practice Rules** (FPRs, which apply if removed woody material is or has the potential to be commercialized).

General CEQA Process

If your RCD determines the proposed project is under CEQA, and if the proposed activity is not within the scope of a current Programmatic Environmental Impact Report (PEIR, e.g., CA Vegetation Treatment Program EIR (CalVTP), Chaparral Management, and California Forest Improvement EIRs), then you must determine: (1) whether the project falls under a statutory or categorical exemption from CEQA (2) If the project is not exempt, prepare an Initial Study to determine whether the project might result in significant environmental effects; and (3) Prepare a negative declaration, mitigated negative declaration, or Environmental Impact Report (EIR), depending on the initial study.

CARCD hosted a **two-Part CEQA Workshop for RCDs** with experienced staff from Tehama RCD, and the Governor's Office of Planning and Research. The workshop addressed what CEQA is, what it means to be a lead agency, which document to use when, how much to budget for CEQA document prep, and what types of forest projects require CEQA. Presenters went over a CEQA checklist, providing tips on how to navigate the process and included some specific **CEQA Examples**. The workshop targeted individuals ranging from CEQA experts to newcomers.

Often, specific grants and projects will require compliance with other environmental laws and regulations on top of CEQA, like the State and Federal Endangered Species Acts and the Porter-Cologne Water Quality Control Act.

Other helpful resources include **CAL POLY's Fuels Management Training program**. They regularly feature webinars discussing the California Vegetation Treatment Program (CalVTP), which streamlines the CEQA process when working in specific ecosystems with specific treatments. **Learn more about the CalVTP here**.

RCDs can serve as CEQA lead agency and thus are well positioned to organize collaborative projects. The lead agency decides whether a project is exempt and has the responsibility of carrying out or approving a project. This includes deciding if an Environmental Impact Report (EIR), CEQA Exemption, or Negative Declaration is applicable for the project. CEQA projects, especially when an EIR is required, can take longer and be more cumbersome than expected, so RCDs should budget accordingly. Referencing previously completed environmental compliance documents whenever possible will save time and unnecessary effort. While the FPRs are essentially a functionally equivalent to an EIR under CEQA, the RCD cannot be lead agency - CAL FIRE is.

RCD EXAMPLES

* El Dorado RCD wrote and filed a single scope of work and Class 4 Categorical Exemption for all their post fire restoration activities (dead tree removal, woody biomass treatment, soil ripping, herbicide, and planting) for the entire Grizzly Flats community as part of their EFRT work. The RCD was able to adopt relevant environmental protection and avoidance measures from the Environmental Protection Plan (EPP) that covered Cal OES hazard tree removal in the area. The EPP had been accepted by US Enviromental Protection Agency (EPA), U.S. Fish and Wildlife, the Water Board, and CA Fish and Wildlife, etc. While the RCD wasn't strictly working within the bounds of the EPP, by using this EPP the RCD helped justify their use of the Categorical Exemption. The RCD further leveraged Cal OES work when completing their cultural resources surveys. Note that El Dorado RCD did not have any merchandised, bartered, or traded wood products resulting from their work.

Forest Practice Rules (FPRs)

A Timber Harvest Plan under the FPRs is considered a "functional equivalent" to an EIR, because the regulation of harvesting timer by CAL FIRE and the California Board of Forestry and Fire Protection (BOF) has been

approved as a "Certified Regulatory Program" by the Secretary of the California Natural Resources Agency. Because of this, CAL FIRE is responsible for the enforcement of the FPRs. Commercial purposes, that would mean the FPRs should be followed, include:

A. the cutting or removal of trees that are processed into logs, lumber, or other wood products and offered for sale, barter, exchange, or trade, or;

B. the cutting or removal of trees or other forest products during the conversion of timberlands to land uses other than the growing of timber including, but not limited to, residential or commercial developments, production of other agricultural crops, recreational developments, ski developments, water development projects, and transportation projects.

In most cases, permit options under FPRs require an RPF to prepare and a Licensed Timber Operator (LTO) to conduct the Timber Operations. After many fires, if woody material will be commercialized, RCDs firstly rely on Emergency Notices, and then on exemptions including Forest Fire Prevention Exemption and an Exemption for production of firewood for sale. Along with the Emergency notice, RCDs must get proper permits, if applicable, from the Water Quality Control Board (e.g., Category 2A Notice of Intent for watercourse crossing that could potentially discharge sediment into streams) and California Department of Fish and Wildlife (1600 permit).

Submitting permitting under the FPRs means CAL FIRE is the lead agency. Recently CAL FIRE **issued a memo noting that**: "CAL FIRE's Forest Practice Program has observed an increasing practice by project proponents of grant-funded fuel reduction projects to utilize timber harvest documents to meet the requirements of CEQA where no Timber Operations on Timberland will occur. The primary harvest document that has been used by these project proponents has been a Notice of Exemption (from the requirement to prepare a THP)." Thus, only use the FPR documents if Timber Operations will occur on Timberlands. "Timberland" means land, other than land owned by the federal government and land designated by the board as experimental forest land, which is available for, and capable of, growing a crop of trees of a commercial species. "Timber Operations" means the cutting or removal, or both, of timber or other solid wood forest products, including Christmas trees, from timberlands for commercial purposes together with all the incidental work, including, but not limited to, construction and maintenance of roads, fuel breaks, firebreaks, stream crossings, landings, skid trails, and beds for the falling of trees, fire hazard abatement, and site preparation that involves disturbance of soil or burning of vegetation following timber harvesting activities, but excluding preparatory work such as treemarking, surveying, or roadflagging.

NEPA

CARCD has organized NEPA workshops, but unfortunately recording permission was not granted. However, the presentations and resources are linked below. If you are interested in obtaining more NEPA material, please feel free to reach out. Existing Resources on Public Lands:

Forest Service NEPA Workshop Resources

Post-fire Restoration Framework for National Forests in California

Good Neighbor Authority USFS

Good Neighbor Authority BLM

Entering into a Good Neighbor Authority (GNA) with USFS or BLM allows RCDs to conduct projects on federal lands, including hazardous fuels reduction. GNAs do have some work limitations such as construction of permanent roads.

If your RCD doesn't already have one set up, CAL FIRE has a master GNA with USFS and BLM with funding and may be able to subcontract with your RCD. CAL FIRE is also working on a "parent" agreement RCDs can work under statewide. More information to come.

Note that unlike work under the FPRs, an LTO is not required for projects under NEPA. The commercial general liability and Loggers Third Party Property Damage insurance required for an LTO license may not apply to the activities being conducted under a federal project, or any other vegetation management or grant project that does not include conduct of Timber Operations on Timberland.

ARCHEOLOGY

Completing archeology (arch) review for permitting is often a pinch point. However, if CAL FIRE is the lead agency (under FPRs), you can utilize the MOU CAL FIRE has with CLFA to allow RPFs/arch certified staff to work underneath their licenses. CAL FIRE is the lead agency if the FPRs are being used.

If CAL FIRE is not the lead agency, as in most CEQA cases, budget adequately for a certified professional Archaeologist. This can be an expensive and time-consuming process, so starting on the Arch process with a professional as early as possible is recommended.

RCD EXAMPLE

❋ Under their Emergency Forest Restoration Team, El Dorado RCD efficiently utilized existing cultural resource reports developed by other sources: (1) Cal OES Hazard Tree Removal Program: For parcels previously assessed by the Cal OES hazard tree removal program, the RCD leveraged the cultural resource reports already filed by Cal OES. (2) Current FPR Permits: For parcels with an existing Forest Practice Rules (FPR) permit, the RCD utilized the cultural resource reports filed by the corresponding Registered Professional Forester (RPF). Additionally, for parcels without prior assessments, the RCD ensured thorough compliance by hiring a professional archaeologist to complete new cultural resource reviews.

Figure 17. Alpine County, CA. Photo credit: Sierra Riker.

Figure 18. El Dorado County, CA. Photo credit: Sophia Lemmo.

Wood Management and Utilization

COMMERCIAL OPTIONS

Contracting

Writing a Request for Proposals (RFP) for work across a diversity of landowners and properties can be challenging. **Here** are two examples from El Dorado RCD after the Caldor fire.

RCD EXAMPLES

❋ As part of their Emergency Forest Restoration Team, Feather River RCD sub-awards to Plumas Fire Safe Council to implement some of the restoration. To streamline operations, the Plumas Fire Safe Council issued a $1.25 million Indefinite Delivery/Indefinite Quantity (IDIQ) contract to a single primary operator, covering work through the end of 2025. TThe contract includes established per-acre payment rates for various activities—mastication, hand thinning, chipping, etc.—scaled by complexity levels (low, moderate, and high). As site-specific information becomes available, amendments are made to the IDIQ. While the main contractor may subcontract to additional operators as needed, centralizing the contract with one operator reduces administrative work and offers greater flexibility.

WITH LANDOWNERS Some RCDs have considered doing landowner reimbursement processes, mimicking CFIP or EQIP. Just note that this creates a tax liability for landowners. Some RCDs, like Feather River, pivoted upon learning this.

Salvage Logging

Salvage logging, the selling of burnt logs to mills, can be a good post-fire option for small non-industrial landowners to remove standing dead trees and fuel, and potentially sell the trees. While current market challenges make profitable salvage operations difficult, there are still examples throughout the state of these funds being used to offset other recovery efforts. Often there is a bottleneck at the mills after large wildfires, so lining up the logs and contractors as quickly as possible is necessary to take advantage of this option. Also, the wood quality degrades quickly after fire, so log removal is best done in the first post-fire season, sometimes second. The rate of degradation depends on environmental conditions like precipitation amounts.

Post-fire permits that allow for commercial salvage logging include a Notice of Emergency Timber Operations (an "Emergency Notice" [1052], only cut dead and dying) or a Post-Fire Recovery Exemption [1038(g)] (only for 300' around an existing or destroyed permitted structure). While both are from the FPR's only the Notice of Emergency requires an RPF. You can find **helpful flyers that CDFW and WQCB provide regarding post-harvest timber operations here**. These flyers are attached to validated Emergency Notices when they are sent to landowners.

RCD EXAMPLE

❋ In Feather River RCD's EFRT program, revenue from log sales is typically used to offset the operating costs. Feather River RCD achieves this through vesting the ownership of merchantable materials with the contracted LTO. The RCD then tracks log and chip revenue and balances it against operating costs. Removal of biomass can be more expensive than mastication or on-site chipping, and usually requires a subsidy to cover transportation costs. Once grant dollars are involved, landowners will not see any revenue.

Biomass market

While selling logs and biomass is currently challenging in many parts of the state, there are a variety of grant options that can be used to help remove wood from the forest including the **American Forest Foundation's Forest Biomass Transportation Incentive Program**.

Due to market constraints, being creative with wood utilization is becoming necessary. More information on Mobile/Modular Wood Processing Technologies can be found **here** written by Martin Twer, Biomass Program Director of The Watershed Center.

NON-COMMERCIAL OPTIONS

See call out box on page 30 for **when is a permit needed**.

Debris Removal

For non-commercial debris removal, permit needs depend on funding and impact. Often a CEQA exemption is used. Note that if the wood is not sold, finding an outlet for the material is still important. The State's Consolidated Debris Removal Program has two phases:

- **Phase 1** "Local government, state and federal agencies have organized teams of experts and contractors to inspect the property and assess, make safe, and/or remove any household hazardous waste that may pose a threat to human health, animals, and the environment such as batteries, herbicides, pesticides, propane tanks, asbestos siding, and paints. Phase I is automatic and includes all residential properties that have been destroyed by the fires." – Cal OES
- **Phase 2** "...local, state and federal officials will coordinate to conduct fire-related debris removal from the property elected to participate in the State Program by signing a Right-of-Entry Form." – Cal OES

Cal OES has tasked CalRecycle to manage wildfire debris removal operations throughout the state. Property owners should contact their local county or city for details on enrolling in this government-financed disaster recovery program. Check if your County is included **here**.

Prescribed Fire (Rx fire)

Before colonization, Indigenous populations in California used fire to manage and coexist with the landscape. Fire plays a crucial role in maintaining the health of California's forested ecosystems, and prescribed burning remains a valuable tool for controlling fuel loads. Additionally, it is often one of the most cost-effective methods for fuel management.

PERMITS NEEDED

For residential burning on properties in the State Responsibility Area (SRA), CAL FIRE permit requirements are based on Public Resources Code 4423 and depend on county location in Zone A and Zone B.

- **Zone A (PRC 4413)** includes Mono, Inyo, San Bernardino, Santa Barbara, Ventura, Los Angeles, Orange, Riverside, San Diego, and Imperial Counties. **Permits are required year-round in Zone A.**
- **Zone B (PRC 4414)** includes all other counties. CAL FIRE permits are required from May 1st until the director declares that hazardous fire conditions have abated for the year based on weather conditions. Permit restrictions may be lifted as early as October, however in recent years, permits have been required as late as December. It's important to check with your local unit to find out whether permits are required. **Check here for residential burn status.**

There are two permit types that fall outside of residential backyard burning: LE-5 and LE-7.

- **General Burn Permit (Form LE-5)** allows agricultural and large pile burning (piles greater than 4 ft x 4 ft). This permit also covers other burn activities including incinerator barrel burning, small plots of grass or weeds, or burning on vacant land. If a state agency is obtaining this permit, small pile burning is an allowed activity (however private residents should obtain a residential permit for small pile burning). The permit is void when burning is prohibited and on no-burn days as determined by the local Air District.
- **Project Type Burn Permit (Form LE-7)** allows landowners to conduct broadcast burns on burn days as determined by the local Air District when burning is not prohibited. This type of burning is sometimes called a controlled burn, prescribed fire, or prescribed burning. This permit sets Minimum Precautions (Form LE-8) that must be taken by the permit holder to conduct the burn. In both these cases, CAL FIRE does not assume any liability for the burn. These permits do not replace other required permits like those of the Air District (See California Health and Safety Code 13055, 39011, 41801, 42311.2). For more on CAL FIRE permitting see **here**.
  - **Air quality permit**s are required year round—work with your local air quality district.
    - Building a good relationship with your local district is important and relies on good communication, inviting them out on burns so they can see the good work you are doing.
    - For more on Air Board permitting see **here**.

- A Smoke Management Plan may be required depending on the size and nature of your burn: When conducting broadcast burns, Smoke Management Plans are required when a burn unit is larger than 10 acres, will emit more than 1 ton of particulate matter, or will affect a smoke sensitive community (i.e., school, nursing home, etc.). See the **Prescribed Fire Information Reporting System User Manual** for more information regarding Smoke Management Plans and other management plans.

- **CEQA/NEPA permits** are only required depending on funding/ lead agency/ownership
  - A lot of PBA burning is volunteer based, with no funding, and led by the landowner themselves - in which case it does not trigger CEQA unlike if you had CAL FIRE grant funding your work or you are burning on state land.

CAL FIRE Prescribed Fire Guidebook: A guidebook informing "CAL FIRE employees how the Department engages in prescribed fire (Rx fire) activities."

RECENT POLICY AND LIABILITY WORK

There has been a lot of recent work to increase prescribed and beneficial fire in CA. A lot of the policy work done recently is to provide more protections to those implementing Rx and beneficial fire.

- **Recognition/Certifications**

  Establishment of the California State-Certified Burn Boss program (CARX) mandated by SB1260 (2018). It's not a requirement, but opens other policy options, including liability ones.

- **Liability**

  SB332 (2021, Dawd). SB332 was one of the first pieces of legislation to help reduce the likelihood of burn practitioners facing financial consequences of escapes. An escape can result in two types of financial consequences: (1) suppression costs–bill from agency(s) sending resources to extinguish fires that have escaped and State investigation costs - state investigating cause of fire, and (2) costs associated with damage caused to third party(s). SB332 specifically addresses those suppression and investigation (#1) costs by changing liability standard from simple negligence to gross negligence if certain conditions are met. These conditions include: the burn has to be done for enumerated public purposes, necessary permits (CAL FIRE, air quality permits, and others if required) must be obtained, written permission from landowner to conduct the burn, state certified burn boss review and approval of the burn plan (SB310 may expand this to federally qualified burn bosses), and the burn has to be done in compliance with the plan. Required parameters differ for cultural burn practitioners (e.g., they don't need a burn plan and thus burn doesn't need to be in compliance with it).

- **Insurance**

  SB926 (2022, Dodd) $ 20 million state-backed claims fund or third party damages: Public Resource Code (PRC) sections 4500 and 4503 establish this Fund. The Claims Fund will cover up to $2 million in damages caused by an escaped prescribed burn as long as the burn boss/cultural fire practitioner followed their burn plan and acted with due diligence. However, there are a number of **guidelines** to understand, such as who can apply for the fund, etc. Enrollment in the Fund is achieved by completing the **California Prescribed Fire Claims Fund Online Application**. Claims and questions can be sent to liabiltyclaimsfund@fire.ca.gov.

  - For more information on the Claims Fund, you can watch the **Prescribed Fire Claims Fund Pilot Project Introductory Webinar**, or for a paper on the subject, see **here**.
  - CA is the first state to do this!
  - While this insurance pool is a huge step in the right direction there are some limitations: “Smoke damage to real property, other than to agricultural or natural resources, are eligible for coverage, as are damages, losses, physical injury or death resulting from vehicle accidents solely caused by smoke." "Smoke damages are not eligible for coverage by the Fund except in the limited circumstances described above. This ineligibility for coverage by the Fund includes smoke-related and fire related health claims such as asthma or exposure to toxic fumes are not eligible for coverage by the Fund." This lack of coverage has resulted in tensions between vineyards and prescribed fire practitioners in Napa and Sanoma Counties, where vineyards have threatened to sue but would need to prove causation.

- **Tribal Sovereignty**

  - Cultural burning officially recognized and defined in state law: SB332 (Dodd 2021) and AB642 (Friedman 2021)
  - Cultural practitioners legal equivalent recognition with federal and state burn bosses: SB332 (Dodd 2021) and SB926 (Dodd 2022)

QUALIFICATIONS FOR RX FIRE

There are no state requirements for qualification, personal protective equipment, or burn planning (although there are recommendations, or policy options that would trigger requirements)

The WFRTF Prescribed Fire Working Group is looking to implement a “Prescribed Fire Training Center”, which is a place where those looking to get certified can find information on training opportunities around the state. Additionally, the **National Wildfire Coordinating Group (NWCG)** lists different certifications and qualification requirements needed to participate in Rx fire. Prescribed fire training exchanges (TREX) opportunities may also be available in your county. See **here** for more information on TREX.

Pile Burning

UCCE Resource contains great information on how to construct and burn piles, including a checklist.

Pile burning is a great option for many landowners. To get the proper permit, check whether the property is in a local, state, or federal responsibility area **here**. If you are not located within the SRA, contact your local fire department for information.

If you are in SRA check if a permit is needed **here**. (See CAL FIRE permit types above). Typically permits are required starting May 1st, however, some local units may require it early so its important to check. If it is required, apply for a CAL FIRE Residential Burn Permit **here**.

An air quality permit will depend on your local Air Quality Management District (AQMD) and where the property is located. Its good practice to always check **with your AQMD** prior to burning to verify their regulations and permit requirements. Some AQMDs don't allow residential pile burning within their jurisdiction, while others may not require a permit depending on the pile burning.

On the day of your burn, check with your local AQMD to ensure it's a permissible day to burn. Continue to follow the checklist laid out in this document.

Lop and Scatter

In the short term, lop and scatter treatments increase fire risk and intensity. This increase in fire risk decreases over time with decomposition. While this technique can be helpful to reduce erosion and stream sedimentation, and to aid potential suppression efforts, it should be carefully considered in the context of location and objectives. Many RCDs choose to avoid this treatment unless other prescriptions are not possible.

RCD EXAMPLE

✱ Sonoma RCD notes that lop and scatter is not an effective fuels treatment in the interior coast ranges. There is insufficient quantities of snow and rain to compact fuels and aid in reasonable decomposition times. Sonoma RCD only uses lop and scatter as a last resort and reserves the treatment for ladder fuels on slopes that exceed equipment limitations, or in areas where equipment can be used to trample the slash.

RCDs in the lower foothills record similar observations about insufficient quantities of precipitation to justify lop and scatter. Given the frequency of drought, the same is often true for higher elevation zones as well. Lop and scatter is also not right for all slash types. For example, Manzanita takes decades to decompose, even with moisture. Some forestry practitioners steer clear of lop and scatter whenever possible. However, lop and scatter can be necessary in steep areas not accessible with equipment or where pile burning isn't an option.

Figure 19. El Dorado County, CA. Photo credit: Sierra Riker.

Figure 20. El Dorado County, CA. Photo credit: Sophia Lemmo.

Chipping (blowing/piling/etc.)

Chipping converts small diameter trees and shrubs into wood chips, usually for onsite disposal. While commonly used in wildfire mitigation, leaving chips on site temporarily increases fuel density and therefore fire severity. While chips decompose faster than lop and scatter debris, the rate depends on environmental conditions. Benefits of chipping and leaving on site include reducing soil erosion, enhancing soil moisture retention, creating a fire suppression-friendly environment, and contributing to a more fire-adapted landscape in the long term. Chipping is best at reducing ladder fuels when burning is not a viable option. Chipping programs for private landowners are offered by many Fire Safe Councils and some RCDs, often funded through the California Climate Investments initiative or CAL FIRE.

Mastication

Mastication is the process of mulching down smaller trees and brush, leaving behind finer debris (similar to the output from a chipper). It's completed with a skid-steer or excavator with a mounted attachment. It can be cost effective for larger areas and has many of the same pros and cons as chipping.

Landowner firewood

Logs/debris can be left onsite for landowner firewood. However, if the firewood will be sold, bartered or traded, an **FRP permit** is required.

Other Brush Management Options

Along with the aforementioned chipping, mastication, and burning options, herbicide, herbivory, and hand grubbing are other brush management options. For more information about them please refer to the **Competing Vegetation** section below.

FOREST REGENERATION

Please refer back to the **Wildfire Severities**, and **Select Habitat Types** sections for decision matrices and information about when it is appropriate to reforest. Depending on the environment, low to moderate severity fires may recover with natural regeneration. Also, some species, typically hardwood or serotinous species, are great re-sprouters and are adapted to coming back after fire.

Rather than reinvent the wheel, this playbook recommends this resource: **Reforestation Practices for Conifers in California**. Many considerations go into reforestation—**site assessment, seeds, seedlings, site preparation, vegetation management, planting, pre-commercial thinnings, etc.** A planted stand is a long-term investment that needs monitoring and maintenance over time. One challenge is finding grant money that will allow for this long-term maintenance.

This handbook highlights some reforestation considerations throughout this chapter, however, please refer to the Reforestation Practices for Conifers in California book for extensive information on conifer regeneration.

Here are some other resources on reforestation:

- **Post-fire Reforestation Considerations**
- **Reforestation/Reburn Reading List**

  Originally compiled and distributed at the UCCE Reforestation Field Tour led by Ryan Tompkins: Reforestation in a burning landscape field tour 2022.

  This reading list includes information on why removing fuels from the landscape is important in large patches of high severity burns, the importance of managing the planted stand well into the future, and (if it is a management goal) how to eventually foster a more complex forest structure and maintain it until it can eventually have a regular fire return frequency.
- **Post-fire Conifer Reforestation Planning Tool**

  This tool allows for a projection of where conifers will regenerate on their own after wildfire and where reforestation efforts should be targeted.
- **Climate-wise Reforestation Toolkit**

  Another guide on where planting efforts should be targeted and information on best practices.
- **PReSET Reforestation Tool**

  Allows for a projection of where planting efforts would be most and least effective in increasing seedling density
- **Seedlot Selection Tool**

  Matches seedlots with planting sites based on future climate scenarios.
- **Reforestation Hub**

  Provides estimates of potential new forest acres and how much carbon those would store.
- **What to Plant After the Trees Die**

  Brief overview of post-fire actions and replanting

Figure 21. Mariposa County, CA. Photo credit: Sierra Riker.

PLANTED STANDS

When reaching out to the public about reforestation, verbiage can be important. Recently, Rob York of UC Berkeley recommended calling areas planted after fires "Planted Stands" rather than "Plantations." This typically evokes better and more apt imagery.

Figure 22. Antelope Cluster Plantation, Plumas County, CA. Photo credit: Travis Freed, SIG.

Ordering Seedlings

Ordering seedings requires planning up to two years in advance.

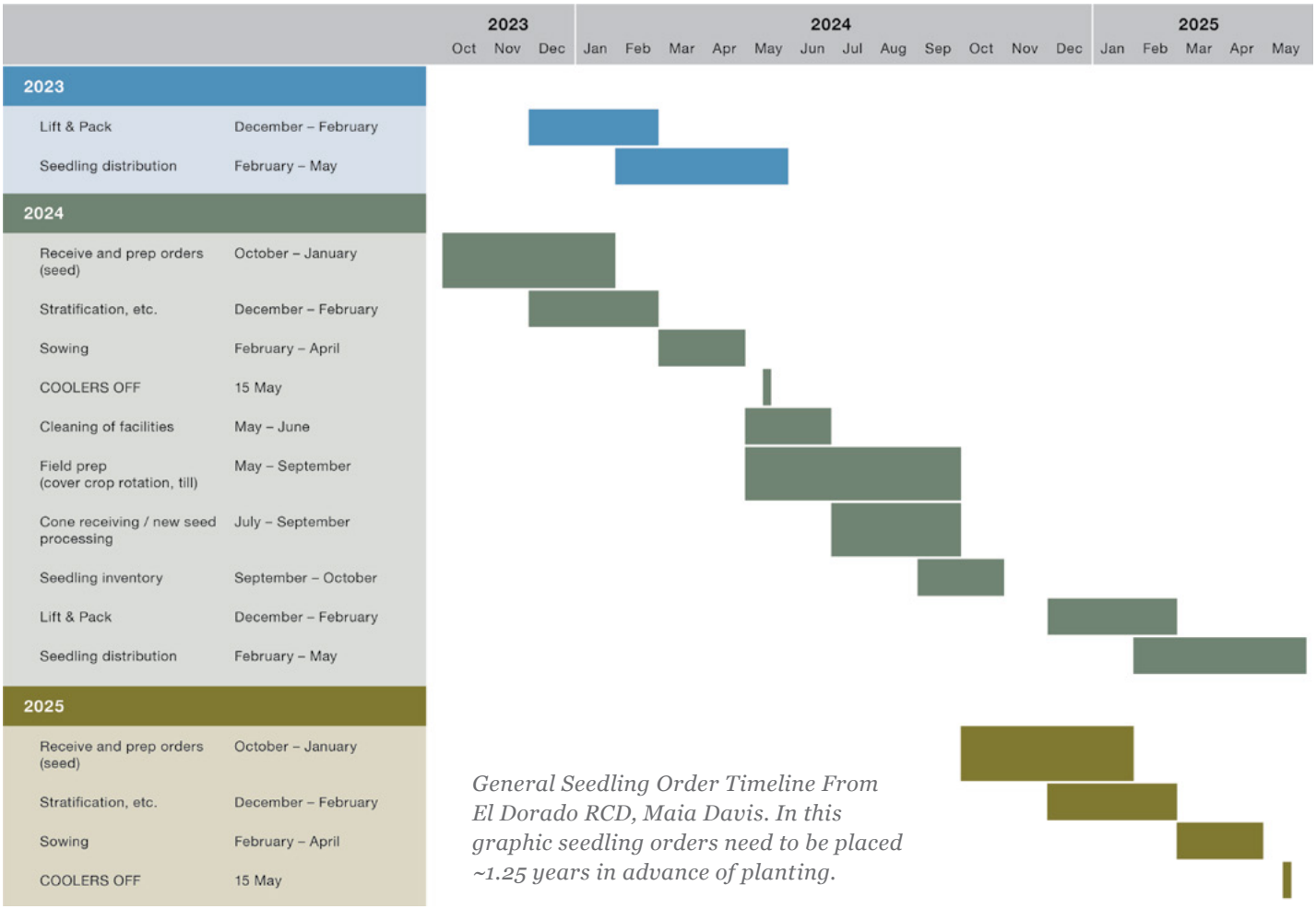
SEED SOURCE

The first step in ordering seedlings is considering seed source. You should start by calling around to seed banks to see if they have applicable seeds for your **California Seed Zone** (**more info on seed zones**). CAL FIRE and USFS both maintain seedbank. If CAL FIRE doesn't have applicable seeds, you could try reaching out to Sierra Pacific Industries. CAL FIRE holds a lot of SPI's seeds in their bank but they don't manage them. You could also call MAST reforestation (previously Cal Forests Nursery) and ask about their seed bank. Finally, you could reach out to El Dorado RCD about their seedlings. If you are unable to secure seeds in your zone another tool for choosing seed is the **climate adapted seed tool**. It takes a year plus after securing seed and it's necessary to pre-plan species, and trees per acre. Each nursery has ordering deadline as well:

- **One tree planted**
  - Sometimes they have last minute seedlings leftover so it is always worth reaching out.
- **Seedlings of Hope**
- **El Dorado RCD**
  - In 2014, the RCD entered into an agreement with the US Forest Service's Placerville Nursery to grow seedlings ordered through the RCD by landowners to be used for establishing forests, woodlots, windbreaks and wildlife areas throughout the state of California.
  - Orders must be in by December 1st, 2023 for planting in the winter '24/spring '25 planting season.
  - **Seedling Order Form**
- **Lewis Moran Reforestation Center**
  - The center also is in need of cone crops. They are planning to make hardwoods available soon.
- **Mast Reforestation**
  - They recently have been making a lot of acquisitions of nursery and tree seeds and are now the biggest tree seed holder in western US. They have a focus on private landowners.
- **Cal Forest Nurseries**
  - Recently bought by Mast.

Sometimes, the USFS has a backstock of seedlings that become available. These excess seedlings are posted on the **Reforestation Pipeline's Podio page**. Maintaining partnerships with regional representatives is another means to claim excess seedlings. The drawback to last-minute seedlings is that often trees can only be planted on lands that have already completed CEQA/NEPA.

To proactively ensure local seed availability, investing in cone collecting is a good option. You can do this through partnering with the state of California or organizations like American Forests through their **Reforestation Pipeline Partnership**, which are creating cone surveying and collection programs.



General Seedling Order Timeline From El Dorado RCD, Maia Davis. In this graphic seedling orders need to be placed ~1.25 years in advance of planting.

Planning for Resilience

Incorporating climate resilience in your planting design is important. For example, a **recent study** (Bernal et al., 2022) found that future conditions will reduce the carrying capacity of forested landscapes. Thus, carefully considering tree densities is recommended (taking into account survival rates and recommendations of Reforestation Specialists). Different species warrant different planting densities as they have varying survival rates (see **Chapter 12, Reforestation of Areas Burned by Large Wildfires**). Your confidence levels on if there will be pre-commercial thinning or burning in the young stand, or not, should also influence your planting density. The years of planting 300 trees per acre post fires are largely gone. Instead, most NIPFLs now plant at lower, targeted densities. There are also adaptive ways to design the planting, like employing an individual, clumps, and openings (ICO) method. "For example, planting 3 seedlings close together in a group with 27 foot spacing between groups would require planting only about 180 trees per acre. If the goal is to have at least one tree remaining in each group, the stand will soon have spacing more similar to the historical spacing of a mature forest. This approach addresses the possibility of mortality at each planting site and allows multiple species to be planted at each site. It also could serve to reduce the cost of manual release in rehabilitating burned sites projects where herbicide use is restricted as the number of manual release circles per acre is reduced" (Grey, **Chapter 12, Reforestation of Areas Burned by Large Wildfires** page 8) (see Figure 14).

There are emerging theories on "assisted migration" or shifting species distributions to reflect projected climates. Note, however, that the scientific literature on assisted migration is not well developed and is mixed in some cases. Always critically think/research about objectives, site characteristics, resilience, and adaptability.

RCD EXAMPLE

❋ Butte County RCD's Concow Resilience Project is a 784-acre climate-adaptive reforestation project on federal lands in the highest-severity burn portion of the Camp Fire. In the year after the Camp Fire, Butte County residents and land managers gathered to envision "the next forest." Residents identified closely with the dense conifer forest they lost, even as they acknowledged that without a century of fire suppression (including the dispossession and genocide of Indigenous peoples), the forest would never have been so dense or coniferous. By 2055, the Concow area's climate is projected to no longer support black oaks and ponderosas, but rather blue oaks and gray pines. As a result, partners chose to focus on restoring pertinent oaks, and at a relatively low tree density. Managing for a future climate rather than a past climate helps reduce the possibility of repeated disasters.

Here are some additional resources on resilient reforestation:

Growth and Spatial patterns of Natural Regeneration in Sierra Nevada Mixed-Conifer Forests with Restored Fire Regime

Operational Resilience in Western US Frequent-fire Forests

TAMM Review: Reforestation for resilience in dry western US forests

Competing Vegetation

The post-fire environment is ripe for brush species to take over. The open canopy and added nitrogen create an ideal situation for many competing vegetation, especially invasive species. In certain environments, within a year of the fire, brush like Ceanothus sp. can become dense and choke out other species. Burned snags and debris, paired with brush fosters an environment highly susceptible to reburns. Competing vegetation is also highly competitive at accessing limited resources, such as water, which negatively impacts forest seedling survival (see Figure 23). Early mitigation not only increases success of subsequent reforestation, but also reduces costs. The more time transpires before site prep, the harder the competing vegetation is to control.

Figure 23. Seedling roots versus shrub roots. Photo credit: Ryan Tompkins, UCCE.

RCD EXAMPLE

❋ After the 2020 CZU burn, broom cropped up and dominated a lot of the burn scar. RCD of Santa Cruz wished they had the foresight to warn landowners about this and act earlier.

The options generally consist of:

- Chemical control (herbicide, desiccants or growth regulators)
- Mechanical control (logging, piling, ripping, mulching, masticating, subsoiling, chipping, etc.)
- Manual control (cutting, grubbing, pulling, etc)
- Biological control (using naturally occurring plants/substances/organisms)
- Cultural (burning, grazing, etc.) – also refer to the The Use of Fire as a Tool for Controlling Invasive Plants

The use of one does not preclude the use of another; they often can complement each other. Assessing your site and limitations will help tailor the treatment prescription: slope, aspect, what species do you predict, time after fire, etc.

Again, **Reforestation Practices for Conifers in California** is the go-to guide on all things related to conifer reforestation. However, controlling competing vegetation can be critical in reforesting conifers and thus is highlighted here. Below is an excerpt from the Vegetation Management Chapter.

Competing Vegetation Management Treatment Toolbox			
Treatments	Cost / Acre	Considerations	Effective Duration
No Action	$0	▪ Seedlings survival threatened ▪ No control over shrub resurgence ▪ High fuel load, potential for reburn	No effectiveness
Chemical (Herbicide)	$–$$	▪ Reliably effective germinant suppressant shrub ▪ Low soil disturbance ▪ Weather / seasonally dependent ▪ High knowledge need	4–6 years
Mechanical	$$+	▪ Soil disturbance ▪ Limited to prior to planting	3–5 years
Manual (hand-grubbing)	DIY, or $$$	▪ Time-consuming ▪ Laborious ▪ Often only possible at low acreage	1–2 years
Targeted Grazing	$$–$$$	▪ Unmanaged grazing may cause damage to seedlings ▪ Requires supervision	1–3 years
Prescribed Fire	$$–$$$	▪ Potentially removes shrubs / herbaceous fuels if targeted ▪ May not be suitable for young seedlings	1–6 years

Table 3. Competing Vegetation Management Treatment Toolbox. UCCE Forest Factsheets: Post-fire Competing Vegetation Management Series.

Figure 24. Mariposa County, CA. Photo credit: Sierra Riker

Figure 25. Plumas County, CA. Photo credit: Feather River RCD.

"The success of forest regeneration depends on many things. In California's Mediterranean climate, the most critical factor which influences the success or failure of establishing a new forest is competing vegetation (Powers 1999). Competing vegetation can and will deprive newly established conifer seedlings of valuable light, nutrients and most importantly, water (White & Newton 1989). In California, where summer temperatures can exceed one hundred degrees, relative humidity may be in the single digits and long periods without rainfall are common, competing vegetation in excess of just twenty five percent cover may be enough to influence growth and survival of first year seedlings. (Oliver 1984)

Pioneer brush species and hardwoods inherently grow faster than conifer seedlings and can quickly overtop planted trees depriving them of valuable light needed for photosynthesis (McDonald & Abbott 1997). Herbaceous vegetation in the form of grasses and forbs has adapted to capitalize on early available soil moisture for growth, and can quickly deplete available water for seedlings (White, Witherspoon & Newton 1990). It is important to realize that any vegetation other than the planted conifers are utilizing light, nutrients and water that are required for successful establishment of new seedlings.

The impacts of competing vegetation on conifer seedlings have been well documented. Ponderosa pine (Pinus ponderosa) survival was dramatically increased by controlling bear clover (Chamabatia foliolosa). Tappeiner & Radosevich (1982) demonstrated that in areas where bear clover was not controlled, ponderosa pine survival ranged from six to twelve percent survival compared to eighty to one hundred percent where it was removed. The same study also predicted wood volume losses of 75 percent by age 50 if bear clover was not controlled. Fisk (1984) also estimated volume losses of up to 70 percent in mixed conifer forests where bear clover was not controlled. Oester et al. (1995) showed survival increased from 18 percent to 63 percent and stem volume increased from 39 cubic centimeters to 819 cubic centimeters in ponderosa pine five years after planting from a single application of hexazinone compared to untreated controls in northeastern Oregon. In a study by White & Newton (1989) ponderosa pine growth was substantially reduced by manzanita ground cover as low as 20 to 30 percent. Powers (1999) showed a threefold gain in stem volume averaged over all sites using herbicides compared to the non-treated controls eight years after treatment in the Garden of Eden Study... Controlling competing vegetation is most important early in the life of a new forest. McDonald & Fiddler (2001) showed that delaying release treatments until four years after planting and then treating each year for the next three years did not significantly increase growth over the non-treated controls. Small trees that received release treatments during the first three years after planting were statistically larger McDonald & Fiddler (2001)" (excerpt from Chapter 8: Forest Vegetation Management by Ed Fredrickson and Mark Grey in the **Reforestation Practices for Conifers in California**)

Also see: Bohlman, G.N., North, M. and Safford, H.D., 2016. Shrub removal in reforested post-fire areas increases native plant species richness. Forest Ecology and Management, 374, pp.195-210.

Herbicide

In many environments, like the Sierra Nevada or Cascades, herbicides may be necessary for successful reforestation (see Figure 23). However, their use can be controversial among private landowners. CARCD is currently working with UCCE on creating pamphlets and info-graphs on herbicide use. Below are some helpful tables about herbicides:

Chemical Compound	Product Name Containing the Chemical	Application
Glyphosate	Accord XRT, RoundUp Pro	Foliar
Imazapyr	Polaris	Foliar / Soil
Triclopyr	Garlon	Foliar
Hexazinone	Velpar	Soil
Indaziflam	Esplanade	Soil
Sulfometuron	Oust	Soil
Aminopyralid	Milestone	Soil / Foliar
Clopyralid	Transline	Foliar / Soil
Penoxsulam	Cleantraxx	Soil
Metsulfuron	Escort XP	Foliar

Table 4. Common Herbicides.

Several certifications are often required to utilize herbicides and other pest control measures. A Pesticide Control Advisor (PCA) is a person who offers a recommendation on any agricultural use, holds themself as an authority on any agricultural use, or solicits services or sales for any agricultural use. A PCA with experience in forest management should be involved whenever herbicide is applied. Often spray contractors have a particular PCA they partner with. A Qualified Applicator Certificate (QAC) allows you to apply or supervise the application of federally restricted use pesticides or state restricted materials. A Qualified Applicator License (QAL) does the same, but also allows you to supervise the pesticide applications made by a licensed pest control business/contractor. For forestry projects, ensure your contractor holds a **"Forestry" category QAL (category E)**. For more information about how to receive these certifications, see the links below.

PCA certification info

QAL certification info

QAC certification info

Reporting requirements for pesticide use vary by county so be sure to look into your county's requirements.

Figure 26. Impact of the 2021 Dixie Fire on an area previously burned and then planted after the 2007 Moonlight Fire. The left side shows a USFS planted stand that used minimal brush control, while the right side shows private land that used herbicides. Photo credit: Ryan Tompkins, UCCE.

CARCD did an **office hour with Ed Fredrickson on Herbicide Use**. Some takeaways: If you have bare ground (e.g. no brush on site), often managers will just use a soil active herbicide , which means all mechanical treatment would need to be done prior to the residual herbicide treatment for planting. If the burn has been sitting for 4-5 years, Imazapyr is often used, however it is more soil active and can be detrimental to conifers. In this case, managers will spray with Imazapyr two years prior to planting and let the Imazapyr break down and disappear in soil profile. If Imazapyr isn't used, you can often plant right into the unit.

Planting

Note that this playbook is only highlighting portions of the **reforestation** process. Once you have made it to the planting stage you should have secured an appropriate seed source of high quality and controlled competing vegetation. Consider factors like species, location, time of planting, and bare-root verse container seedlings (which can depend on the previously mentioned factors [e.g., container is better for fall]). Plan spacing and species based on expert advice, applicable regulations, and research. Planting season varies based on aspect, elevation, climatic condition, soil and ground, and access.

See **Planning for Resilience** section for more on different planting techniques.

RCD EXAMPLES

* Feather River RCD is replanting portions of the Dixie Fire at around 150 trees per acre and planting them in a clump formation. 3 seedlings in a clump, each about 10 ft apart. They designed this reforestation in collaboration with UCCE and new research. They hope planting a lower density will alleviate the need for follow up treatments like PCT, and foster a more resilient and resistant landscape.

Due to the seedling shortage in California, it is important to avoid wasting seedlings. Handle, transport, store, and plant them properly, ensuring refrigeration or freezer storage to preserve their quality and carbohydrate reserves. Keep the root systems moist. Be mindful of differences between bare-root and container seedlings, such as “bagging-up” fewer bare-root seedlings on hot, dry, or windy days. Employ experienced contractors for planting and follow a systematic and organized planting plan. Focus on one seedling at a time during planting, paying attention to scalping, planting hole preparation, tree positioning, soil compaction, and micro-sites. If pests are prevalent on your site, protect the seedlings from damage. Please refer to the **Reforestation Practices for Conifers in California** for more information.

In other words, ensure you are well versed in the process of planting prior to planting and/or supervising planters.

FOLLOW UP TREATMENTS

Once you plant, the work is far from over. Planted stands are an investment that need maintenance. Information on Monitoring, and other **Long Term** considerations are found below. If you're working with small private landowners it's best practice to leave them informed and with a Forest Management Plan to increase their odds of continued conservation management.

Types of follow up treatment in planted stands:

Precommercial Thins (PCT)

"the removal of trees not for immediate financial return but to reduce stocking to concentrate growth on more desirable trees" (Helms 1998). See **Chapter 10: Precommercial Thinning in California Forests**. There are both commercial reasons to PCT (enhanced growth), and restorative reasons (increase in resilience towards insects and disease, reduction in fire and fuels if done correctly, etc.).

Prescribed Fire in Young Stands

Prescribed fire in planted stands is becoming a progressively "mainstream" alternative for achieving maintenance. While it's less precise than a PCT (you can't just mark which trees to remove), there are gains in fuel reduction, economics, and restoring natural processes. **Rob York, UC Berkeley gave a presentation** on implementing prescribed fire in planted stands which referenced the following example literature:

1. **Stephens and Collins 2004** Pre-suppression fire regime providing argument for burning in young stands.
2. **York et al. 2021; Fire Ecology** Opportunities for winter prescribed burning in mixed conifer plantations of the Sierra Nevada. Includes references to other studies with data on burning in plantations
3. **York et al. 2021; CJFRl** Data on fire related mortality associated with stand age and species
4. **Coming soon:** Basubi et al. In Prep (Glassman lab, UC Riverside) - information on fall v. spring burning in young stands.

Continued fuel reduction: see forms of **Fuel Management** in above section and **Competing Vegetation Management**.

Figure 27. Tamarack Fire restoration in Alpine County, CA. Photo credit: Sierra Riker.

Figure 28. Lassen County, CA. Photo credit: Ryan Thompkins.

EROSION

There is a need for effective communication to landowners about when to take immediate action relating to hazardous runoff from structures verse a less immediate need for remediation.

RCD EXAMPLES

- After the 2020 CZU Fire in Santa Cruz County, the drinking water supply for approximately 100,000 people was threatened by toxic materials from 1,500 burned structures. With the rainy season approaching, the RCD of Santa Cruz County partnered with the County of Santa Cruz, CalOES and CCC to develop and implement a Toxic Runoff Control Program. To implement the program as quickly as possible, the County of Santa Cruz declared a Public Health Emergency, which allowed the partners access to properties forgoing the Right of Entry Agreement Process. Over just a few weeks, the program installed runoff control measures on the 450 properties with the greatest potential to contaminate drinking water. While the mission had some serious challenges, including logistics and costs related to the CCC camp and the Covid pandemic in general, ultimately, the partners were successful in protecting critical drinking water supply and water quality for threatened steelhead and endangered coho salmon.

- Mariposa RCD's NRCS office is doing assessments but are not able to help with erosion control unless erosion is actively occurring. NRCS keeps Mariposa RCD informed of those assessments to allow the RCD to reach out and conduct erosion prevention work.

If you would like to engage in erosion control work, a good contact for information is **richard.muhl@waterboards.ca.gov**.

OTHER EROSION RESOURCES:

- More broad then just pertaining to fires, but often road work is associated: **2015 Handbook for Forest Ranch and Rural Roads**
- **Understanding Wildfire Impacts**
- **Managing Drainage and Erosion on Private Property and Roads After Fire—Santa Cruz RCD**
- **Preparing for Post-Fire Changes Along Streams and Waterways—Santa Cruz RCD**

LONG TERM

Monitoring

From Monitoring to Management: Charting Future Forest Paths. Section written by Nic Dutch, UCCE with input and edits from UCCE and CARCD staff and those listed in the acknowledgements.

IMPLEMENTATION VERSUS EFFECTIVENESS MONITORING

Implementation monitoring focuses on operational aspects and immediate accomplishment of restoration activities, while **effectiveness monitoring** assesses whether treatments have met predetermined goals for ecological restoration. Both types of monitoring are vital for successful reforestation and ecological restoration but serve distinct purposes and timelines.

Implementation monitoring evaluates the immediate accomplishment of specific restoration activities, such as site preparation, planting, and post-planting treatments. The primary objective is to ensure that operational components of restoration treatments are carried out correctly and efficiently. Implementation monitoring focuses on short-term achievement of treatments and is typically conducted through systematic inspections and checklists before, during, and shortly after the implementation of treatments.

Effectiveness monitoring involves a systematic approach to collecting data, ideally over extended periods. In the example of reforestation, effectiveness monitoring allows land managers to identify the level of success of the treatments including the trends and changes in species composition, stand development, and overall, long-term success at establishing a resilient forest (Hutto and Belote, 2013).

Monitoring Dynamics of Developing Forests

Monitoring in naturally regenerating conifer stands has demonstrated that early monitoring can inform long-term trends (>10 years post-fire) in tree density and species composition (Tortorelli et al., 2024). Understanding how seedling dynamics—such as recruitment and mortality—are influenced by short-term post-fire conditions can inform forest management and reforestation strategies, promoting desired ecological outcomes and enhancing ecosystem resilience.

The survival and growth of planted and natural seedlings following wildfire may be influenced by several factors, including the initial dominance of shrubs and herbaceous vegetation(UCCE Post-Fire Competing Vegetation Fact-sheet), and drought stress (Williams et al., 2013), to which early post-fire conifer seedlings are especially vulnerable during the critical two to four years following a fire. Young conifers may be unsuccessful in competing with shrubs for water and other resources, therefore if they do establish, the conifers often spend 10 or more years at heights vulnerable to subsequent fire. Burned areas left with standing dead trees and high

shrub cover contribute to a higher fuel load, therefore risking a future high severity reburn (Coppoletta et al., 2016). Planting seedlings ensures tree establishment and augments natural regeneration, which is especially crucial after high-severity fires where seed source limitations risk conversion of burned forests into non-forested landscapes. (Coop et al., 2020). With many factors contributing to the development of a resilient forest stand, it may be desirable to monitor multiple aspects of the post-fire ecosystem, such as shrub and herbaceous vegetation cover and fuel loading.

Tracking the spatial arrangement of planted seedlings is essential for understanding future forest dynamics, as the spatial structure directly influences tree interactions, competition for resources, and overall forest resilience to environmental stresses. The spatial distribution of seedlings affects competition for light, nutrients, and water, which allows forest managers to better anticipate relationships between competing trees and inform future management practices such as thinning (Ziegler et al., 2017). Research shows that lower stocking densities and more spatially heterogeneous planting patterns can enhance resilience to fire and adaptation to summer-dry climates compared to regularly spaced, densely planted conifers (Lyons-Tinsley and Peterson, 2012; Knapp et al., 2006). Managers who track the spatial arrangement of planted seedlings may also want to track the position of naturally regenerating seedlings. This will allow managers to strategically plan thinning interventions to promote the health and growth of both planted and naturally regenerating trees, facilitating the establishment of diverse and resilient forests.

Aligning Monitoring with Grant Objectives

By systematically tracking key metrics, land managers can present compelling and quantifiable evidence of their project's success in meeting stated goals and objectives.

SCOPE OF WORK

A scope of work establishes monitoring questions and metrics that align with treatment goals and objectives, considering an organization's capacity and available budget and resources. A scope of work must establish clear expectations regarding time and resources devoted to monitoring, as well as expected monitoring deliverables. Each organization must evaluate whether the project can support extensive data collection and analysis or if a more limited approach is necessary due to time, funding or personnel constraints. Whether intensive or more limited, a standardized schema with a clear scope of work is essential. Collaboration with key partners or advisors can be beneficial. Currently, UC Cooperative Extension Post-Fire Forest Resilience Program is partnering with Feather River and El Dorado RCDs on long-term reforestation monitoring for their Emergency Forest Restoration Team (EFRTs) projects on non-industrial private land. (See more information below)

Establishing Goals and Objectives

- **Goals** broadly define the desired end results of a project or initiative. They provide a general direction and purpose but do not specify how those results will be achieved.

  Example: A reforestation project might have the goal of "promoting the growth of large mature trees for long-term forest health and resilience by introducing spatial variability in planting structure and lower stocking density".

- **Objectives** outline specific, measurable steps for achieving the broader goals. They are narrow in focus and provide clear criteria for success, often including timeframes and specific metrics. Objectives are typically short- to medium-term and can be quantified to assess progress.

  Example: An objective could be "plant at 100 trees per acre following an individual, clumped, and opening (ICO) planting design. Seedling clumps are spaced 32 feet apart and made of three seedlings spaces 8 feet apart in a triangle formation."

Bridging the Gap: Monitoring Questions, Metrics, and Data

- **Monitoring questions** are specific inquiries designed to assess whether goals and objectives are being met. They determine the metrics for data collection and evaluation efforts, focusing on specific aspects of project performance.

  Example: A monitoring question for the above objective may be: How does this planting design influence the growth of planted seedlings over time?

IDENTIFYING METRICS THAT INFORM MANAGEMENT IMPLICATIONS

- **Measurable indicators, or metrics,** selected for a monitoring project must be clearly defined and relevant. Selected metrics inform the extent of data collection, depending on what is required to derive that specific metric. Metrics should provide actionable insights and reflect the factors most critical to the success of the objectives. If possible, having a threshold for each metric that denotes the acceptable effectiveness of an objective's success can be useful. Management implications can be based upon the defined effectiveness criteria. For more examples of metrics see **Resource Folder**.

  Example: One metric for the previous monitoring question could be a seedling's height to diameter ratio. An effectiveness criterion could be having a low H:R ratio, which indicates durability and resilience to drought, frost, and wind.

  Example: Another example of a monitoring question and the metrics used to collect data that will answer is listed below in table 1

Table 1. Example of a monitoring question and associated metrics, data, effectiveness criteria, and management implications.

Monitoring Questions	Metrics	Data Collected	Effectiveness Criteria	Management Implications
Example What is the influence of competing vegetation on planted seedling growth?	**Seedlings** [survival rate, height:diameter ratio) Free to grow (Y/N), all by species] **Competing Vegetation** [percent cover, avg. height, avg. diameter]	Status, seedling species, height, diameter, free to grow within 1m around seedling, species, height, crown diameter of selected competing vegetation	*dependent on organization's objectives, may be specific stocking level retention	May require further competing vegetation treatments

DATA COLLECTION

Frequency and Timing

The frequency of data collection determines how often monitoring activities occur, such as annually to assess tree survival and growth. More frequent assessments may be necessary during critical growth periods or after disturbances to capture rapid changes and inform timely management decisions. The timing of collection refers to when the assessments are conducted, often considering seasonal factors that can influence tree performance, ensuring evaluations are conducted during key periods for accurate insights. Monitoring seedling survival, ideally within the first

year, enables managers to strategically identify and plan interplanting interventions for effective ecosystem recovery.

Fitting Methodology to Capacity and Resources

An organization's capacity and project scope determine the extent of data collection and the methodology. If time and resources are limited, narrowing the data collection to critical variables increases feasibility and can still meet objectives. Consider the time and resources required for data processing and analysis. Circumstances may require modification. For example, if unable to establish permanent plots, then consider acquiring a supplemental global navigation system sensor (GNSS) unit to improve the accuracy of GPS plot locations for repeated measurements. Modifying the sample size, sampling unit, and sampling intensity are other ways reduce time and effort.

Methodologies for data collection

The method of data collection will depend on the desired metrics. [DW4] Here are some examples of methods and corresponding metrics.

FIELD SURVEY METHODS

- **Seedling Stocking Surveys**
  - Plot type: Typically a 1/10th acre fixed radius plot
  - Data collected: seedling number, status (live, dead), qualitative notes
  - Metrics: TPA (trees per acre) by species, observations on vegetation cover
- **Photo-Monitoring**
  - Location: Standardized photo-point locations photographed over time
  - Data Collected: ocular estimates
  - A general impression of forest conditions; ocular estimates of seedling numbers, shrub density, etc.
  - See the UCCE Photo-monitoring Fact Sheet for more information
- **Intensive Belt-Transect Surveys**
  - See example on the next page

REMOTE SENSING

Use of imagery from satellites or drones or Unmanned Aerial Vehicle (UAV)/ to assess vegetation cover and health over time.

- Remotely sensed imagery can be utilized to characterize site conditions pre-fire, assess fire severity, and infer from localized data to the landscape scale.
- UAV imagery can provide site-specific information at higher resolution

EXAMPLE

In 2023, UC Cooperative Extension's Post-fire Forest Resilience Program

partnered with Feather River RCD and El Dorado RCD to create a field protocol for long-term reforestation monitoring of the Emergency Forest Restoration Team's to document the project's success.

Objectives

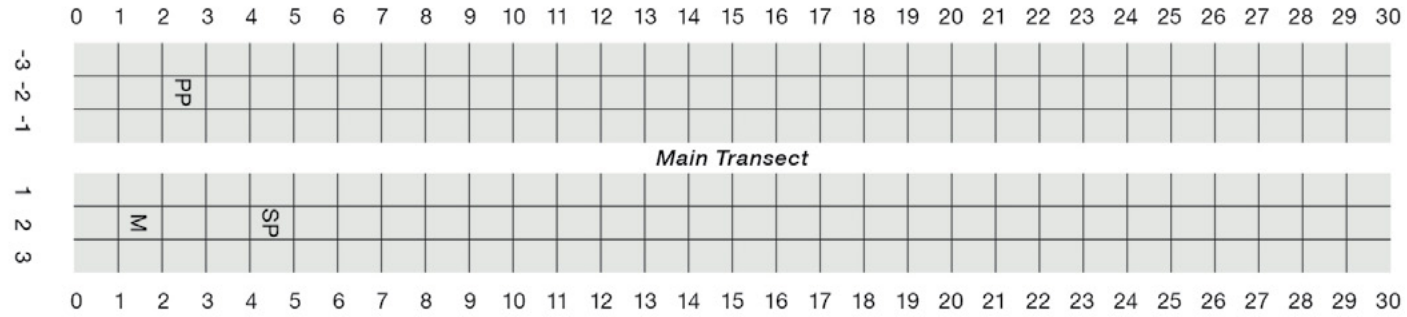
- Evaluate seedling survival, growth, and vigor by individual seedling over time
- Understand surrounding attributes (competing vegetation and fuels) of seedlings that may influence their survival and growth
- Assess developing forest structure via spatial mapping
- Minimize biased subjective measurements by standardizing data collection

Methodology

Instead of a fixed-radius plot, this design tracks seedlings spatially over time on a wide belt-transect grid to account for different planting configurations (ICO, line spacing).

The center-line of the belt serves as the main transect, where competing vegetation and fuel measurements are taken. Two plot-markers are established at the start and end of the transect.

Figure: A diagram and corresponding datasheet table on the design of the belt-transect seedling tracking.



Seedling	Location		Species	Status	Height (0.1 cm)	Diameter (0.1 mm)	Free to Grow	Species	Height (cm)	Diameter (cm)
	L	W								
	2	2	DF	L	7	1.4	N	ARPA	54	76
	2	2	PP	S	16	2.5	Y			
	3	-2	PP	L	17	2.4	Y			
	5	2	SP	L	13	1.9	Y			

MONITORING DESIGN

Sampling Methods

By establishing clear criteria for the sampling process, the data collected is both reliable and valid, which allows for inferences to be drawn.

A study area refers to a specific geographic region or land section where data collection is conducted for a particular project. This area is defined by explicit boundaries and may vary in size depending on the objectives. Considerations include adjusting for possible constraints, like right of entry into a study area, and limitations, such as edge effects of adjacent land.

A sampling unit, such as a fixed area plot or photo-point, is utilized to make inferences on the larger **population**, such as all the seedlings growing on the total area of a project. The sample must be representative of the population and is typically randomized systematically. Within the sampling unit, data can be collected to analyze a variety of objectives. It is vital to determine the **number of samples** needed to achieve objectives for acceptable levels of accuracy and precision.

Stratification of a population into distinct subgroups, or strata, can improve accuracy and analysis of data collected. Dividing the population into types allows for adequate representation in the sample and comparison of different types. Groupings can be based on attributes such as location, treatment history, and acreage.

Sampling intensity refers to the percentage of an area that is sampled. It provides insight into the statistical power of the data to answer the monitoring questions. For monitoring, sampling (or collecting data) on 1% of the area treated should be considered a minimum sample intensity.

Some factors that help determine sample intensity when monitoring include:

1. **Plot Size**

- Set the size of the plot to be efficient to collect data while also capturing adequate data for the precision required.

2. **Variation within the environment**

- When there is significant variation in species composition or structure within a forest—such as a mixed stand containing pine and hardwoods—a higher sampling intensity may be necessary to achieve the desired level of precision. In contrast, more uniform stands, like a monoculture pine plantation, may require lower sampling intensity to provide reliable data.

3. **Size of the Stand**

- Increasing the sample intensity generally increases the representativeness of the sample, reducing sampling error and improving the reliability of the results.
- Larger forest stands may not need as high a sampling intensity because even a smaller, well-distributed sample can provide adequate data across the entire area.

4. **Stratification**

- If a population is stratified by distinct characteristics, the sample

intensity can be changed to be in proportion to the population's stratification scheme.

5. **Budget**

- The budget available for conducting the sampling must also fit the sampling intensity. Costs associated with fieldwork, data collection, and analysis should be carefully considered to verify that the sampling design is financially feasible while still meeting the project's objectives.

6. **Time**

- Time constraints can impact the intensity of the sampling. If the schedule is tight, project monitors might opt for a lower intensity sample that can be completed more quickly, accepting a trade-off in precision.

Data Storage, Evaluation, and Analysis

Prior to sampling, a method of collecting data must be defined (e.g. a data sheet or tablet). During data collection, continued supervision of crews is important for data quality assurance. This also provides opportunities for troubleshooting and improving approaches. Once data is collected, a database management plan should be in place to direct storage, sharing, and documentation. Processing and analysis must also be documented.

Reporting and Outreach

Plan to disseminate results to stakeholders and the public. This ensures transparency and fosters engagement with landowners and the public.

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To the paramount support and guidance of Ryan Tompkins

UCCE in collaboration with El Dorado and Feather RIver RCD developed this post-fire monitoring protocol. If you'd like training on the protocol CARCD is happy to come provide it. More of UCCE's monitoring resources are linked here.

Funding Sources/Options

Long term funding to maintain post-fire restoration is a huge challenge. Often RCDs rely on cost share programs to work on private lands, CAL FIRE grants, along with other Funding Source Assessment. A few RCDs have relations with local community foundations or with their water district to maintain some regular funds. Other RCDs participate and apply for USFS/NRCS Joint Chiefs Proposals.

If reforestation was part of your post-fire work, completing PCTs and creative silviculture to transform the stand from a single age cohort to a multiage complex stand may be desired.

KEY PHRASES IN FORESTRY

ENGLISH	SPANISH
Aspect	Aspecto
Basal Area Factor	Factor de Área Basal
Best Management Practices	Mejores Prácticas de Gestión
Biomass	Biomasa
Buffer	Amortiguador
Burn Pile	Pilas de quema
Chip Depth	Profundidad de corte
Climbing	Escalada
Cruising	Conducir
Equipment exclusion zone	Zona de exclusión de equipos
Flagging	Señalización
Ingress/egress	Ingreso /Salida
Invasive species	Especies Invasoras
Leak/spill	Fuga/ Derrame
Legally protected species	Especies legalmente protegidas
Mastication	Masticación
Nest	Nido
Non-merchantable	No comercializable
No-cut zone	Zona sin cortes
Planting density	Densidad de plantación
Power washer	Hidrolavadora
Salvage logging	Tala de salvamento
Selection cutting	Corte de entresaca
Silviculture	Silvicultura
Site quality	Calidad del sitio
Soil compaction	Compactación del suelo
Soil is too wet/saturated	El suelo está muy húmedo/saturado
Special status species	Especies de estatus especial
Stand density index	Índice de densidad de masa
Thinning	Aclareo
Timber harvest plan	Plan de extracción de madera
Watercourse protection zone	Zona de protección de cauces
Woodrat	Rata cambalachera

This material has been translated by the Cross-Border and Bilingual Sub-Region of the California Fire Science Consortium. The translation and logistical team include Guadalupe Ricon, Cristian Martinez Soriano, Dula Leon Lopez, Dr. Samrajya Thapa and Dr. Jeanette Cobian-Iñiguez.

REFERENCE RESOURCES FROM RCD'S

As illustrated in this playbook, recovery from wildfire is a complex and never-ending process. Along with the resources referenced throughout this handbook, CARCD maintains a **shared drive of post-fire resources found here**. Feel free to add to it, request additional resources, and use the ones available. It is intended to be a living drive that facilitates peer learning.

Figure 29. Lassen County, CA. Photo credit: Catherine Wooster.

RCD Post-Fire "Team" (Informal)

Below is a list of RCD contacts who have delt firsthand with post-fire recovery and have relevant knowledge to share. Many of them also have helpful licenses for completing forest management. The "Team" will host quarterly peer-forums to share post-fire lessons and questions. Meetings will be emailed out on CARCD forest and fire listserv. Reach out to CARCD to be added.

CONTACTS TO REACH OUT TO WITH ADDITIONAL QUESTIONS

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