Butte Forested Watersheds Plan

Cover art by Ali Meders-Knight

A Resilience Framework for "The Next Forest" and

A Living Program of Work for Butte County's Forested Watersheds

Last revised 2/18/2022

Prepared by Butte County Resource Conservation District in collaboration with the Butte County Fire Safe Council and the stakeholders of the Wildlands Task Force/Butte County Wildfire Safety Collaborative

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EXECUTIVE SUMMARY

Butte County's wildlands are in serious trouble, experiencing fires of unprecedented size and severity. Our communities face smoke sieges, evacuations, power shutoffs, and outright destruction year after year. As we grieve the loss or transformation of cherished places, we also reckon with the understanding that the dense dark forest of our 20th century was not as healthy or natural as many of us had believed. Indeed, many of us alive today have never seen a healthy forest! Moreover, we see now that stewarding our forest was never only the responsibility of professionals, but truly of each of us. As we wrestle with our loss, guilt, and frustration, we are also called to reckon with the darker side of Butte County history, a legacy of cultural genocide which directly informs the ecological crisis we face today.

However, we know we have the power to improve our situation. To heal our forests, we'll invent new ways of doing things – new agreements, new programs, new cultures. Since the 2018 Camp Fire, we have focused our vision for "the next forest" through conversation, collaboration, hands-on project design, innovative environmental documents, research and learning. As a Butte County-focused collaborative community, our collective sense of what our forests need, and how we will get there, is captured in our ten goals for forest health:

What the Next Forest is Like

1. The next forest is built to burn.
2. The next forest is a mosaic.
3. The next forest will thrive in the next climate.
4. The next forest has good water quality & quantity.
5. The next forest has lots of herbivores.

How We'll Get There

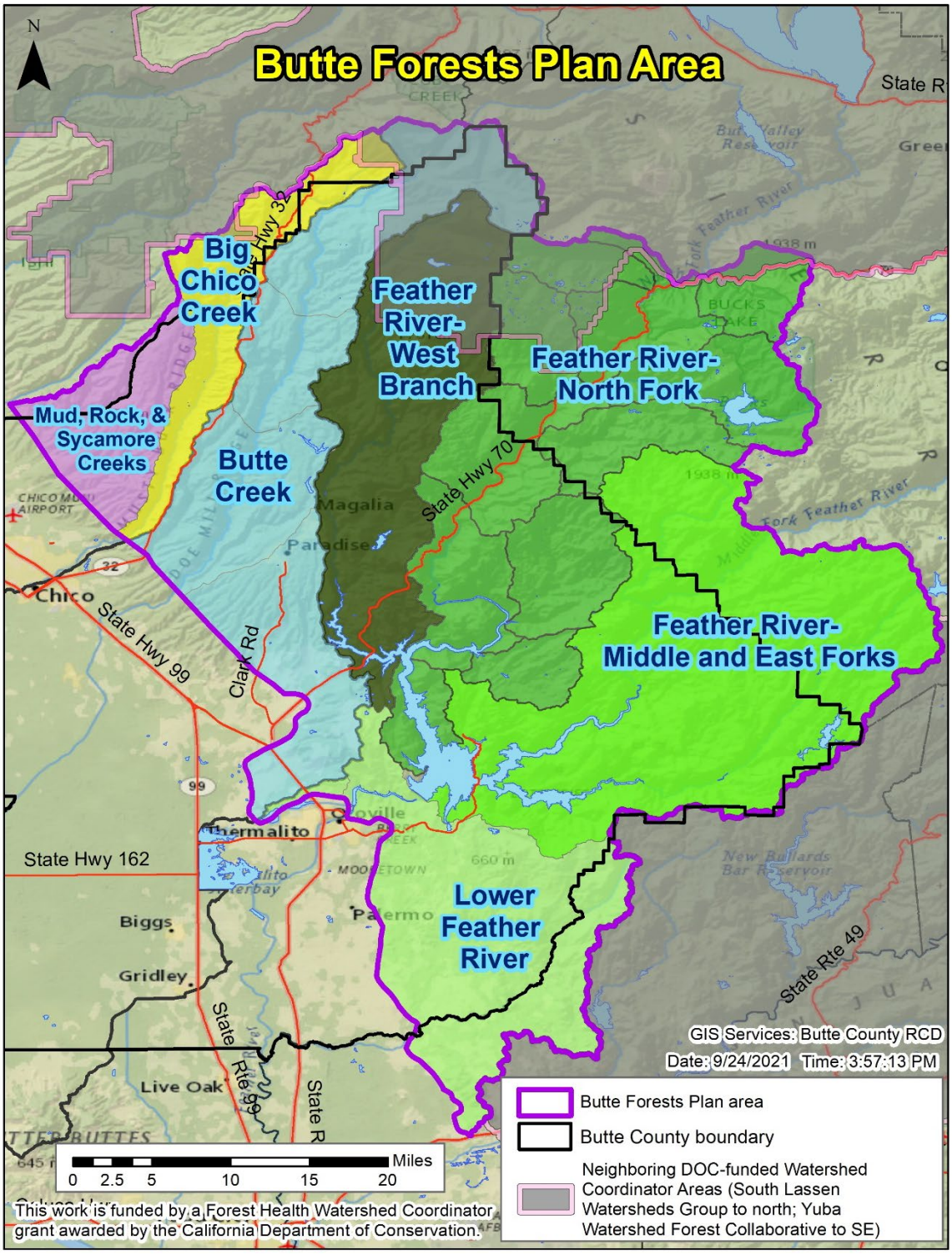
6. We will transition from projects to programs
7. We will build up Tribal capacity.
8. We will develop biomass capacity.
9. We'll become cross-boundary-project experts.
10. We will create a rural culture that's fire-positive.

These 10 goals are discussed in detail in the first half of this plan, where each goal is fleshed out with several *key actions* (e.g. 1.1, 1.2, etc). BCRCD is the compiler of these goals and key actions, but not their originator: they are the insights, advice, words of caution, suggestions and requests contributed by over 60 partner organizations and individuals over three years of collaboration. The audience for this plan is decision-makers (at county, regional and State levels); State funding agencies; Butte Collaborative members; and members of the wider forest resilience community in and around Butte County, especially new arrivals. Landowners can access several guides developed by the Fire Safe Council in alignment with this plan, e.g. the Cohasset and Paradise Ridge forest management plan story-maps and the Butte County-wide Forest Health Guidebook.

In the second half of this plan, we address the needed pace and scale to restore our forests to the resilient condition we seek, and we try to estimate the costs and benefits of doing so. This plan is designed around the assumption that forests require fire (or a fire surrogate such as thinning or grazing) on a regular interval tied to their *rightful fire return interval (FRI)*. The rightful FRI is always partly a product of elevation, climate, aspect and vegetation community, and partly a product of human goals and desires. As humans, our job is to see to it that forests get treated as often as their fire return interval requires.

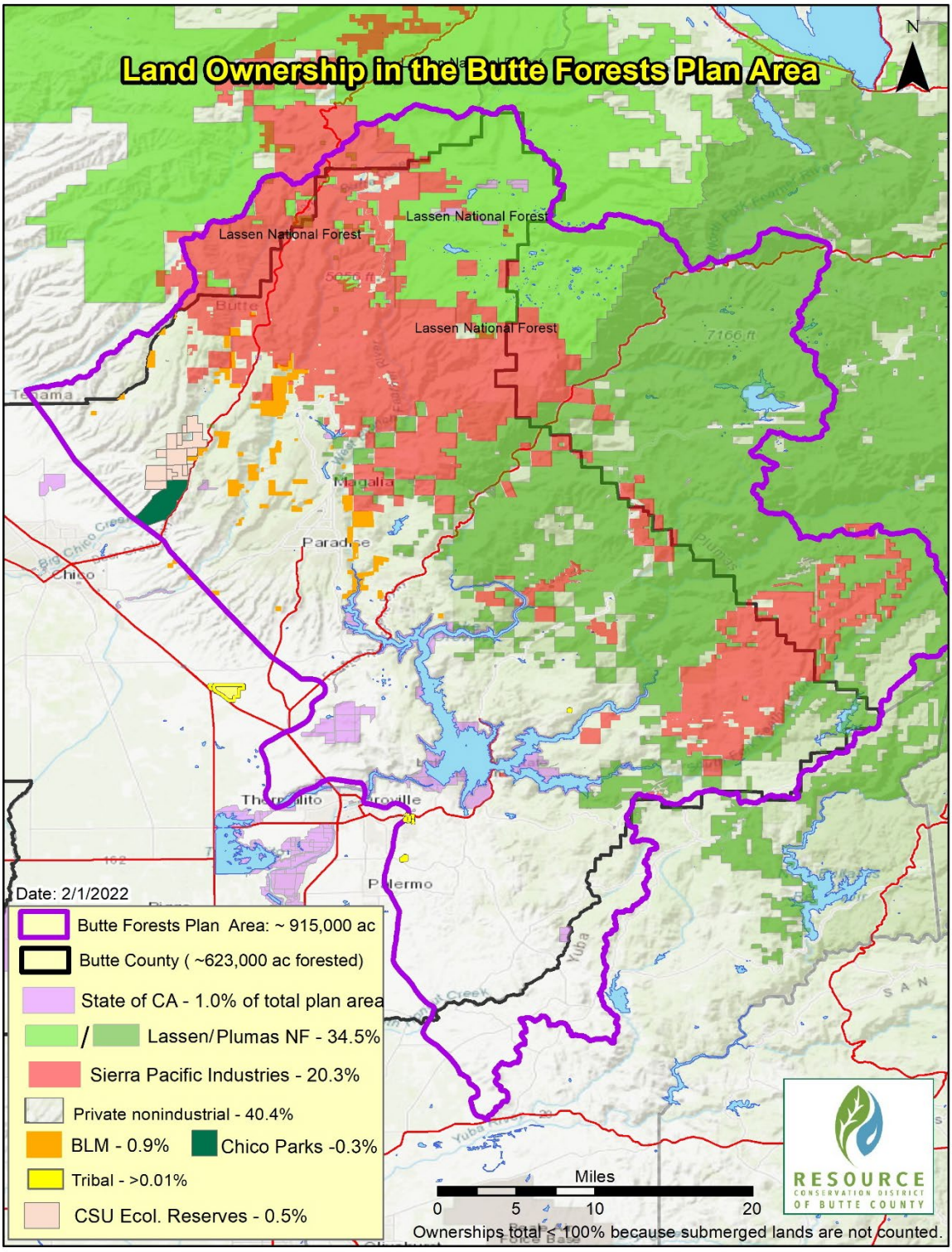
The concept of the rightful fire return interval, when combined with our core principles of collaboration and the geodata shared by the land managers who share stewardship of Butte County's forests, allows us to design a program of forest resilience work stretching far into the future. For the first time, we will have the ability to project a countywide plan of work, budget, biomass capacity, and workforce demand decades into the future, if we want to. This work will not be free or cheap, especially at first, but it will be worth it to live in better peace with fire.

MAP 1: BUTTE FORESTS PLAN PROJECT AREA



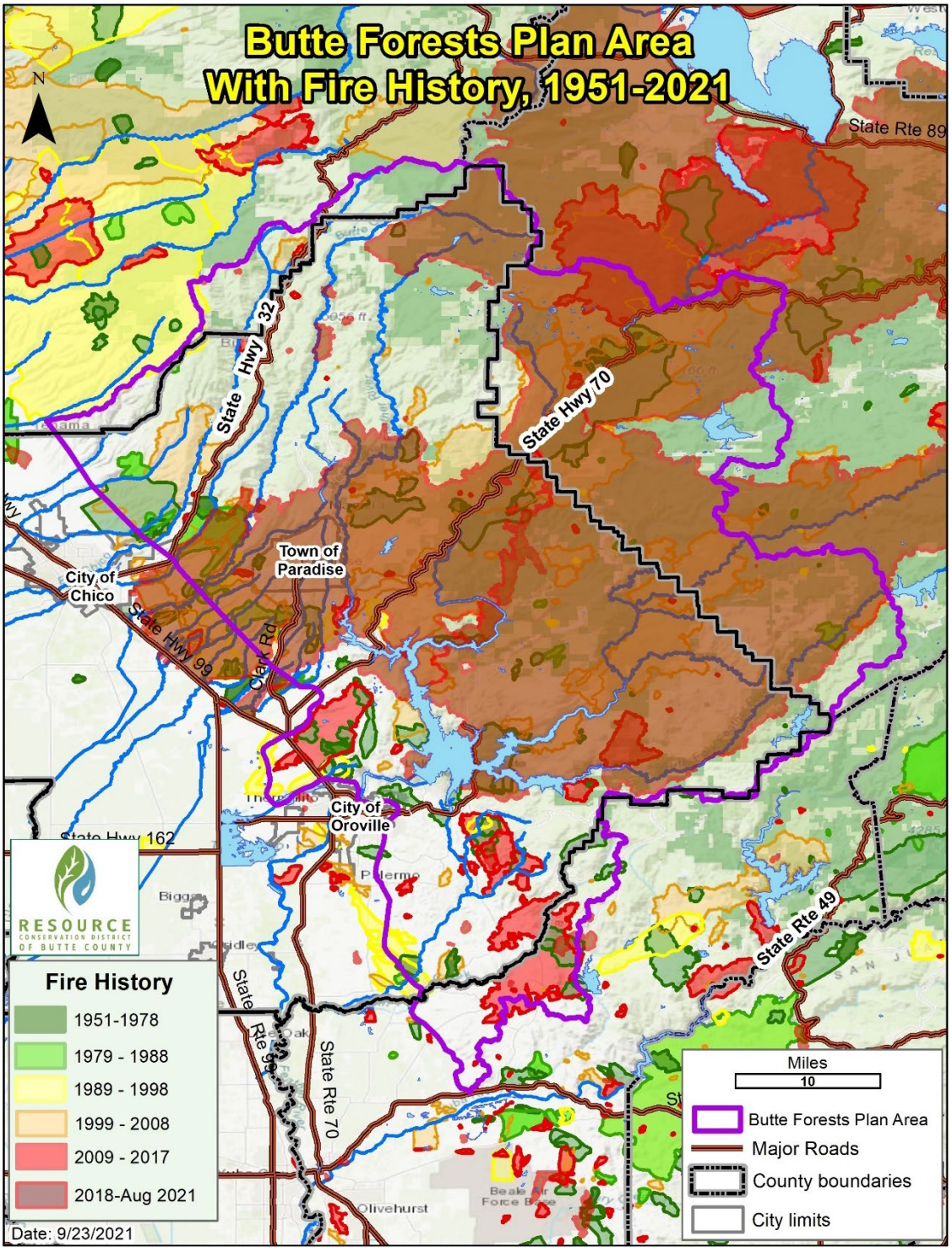
The Butte Forests Plan's project area is centered on the forested watersheds of Butte County. Its boundaries also include some watershed lands in Tehama, Plumas, and Yuba counties that flow into Butte County. The western boundary of the project area is the western limit of where the California Department of Conservation considers "forests" to exist. Different agencies have different definitions of forestlands; the DOC's is generous and generally includes any forests, woodlands or savannahs with more than 10% tree cover.

MAP 2: LAND OWNERSHIP IN BUTTE FORESTS PLAN AREA



For a county with so much forest, Butte County's land ownership is unusually evenly divided; Federal, private industrial, and private non-industrial lands are almost equally represented. This diverse ownership adds challenges to planning forest health projects. Fires, insects, water and wildlife don't usually respect property boundaries, but grant contracts, burn plans, timber harvest plans, CEQA-NEPA documents, and insurers do!

MAP 3: FIRE HISTORY IN BUTTE COUNTY, LAST 70 YEARS



This map only shows fire perimeters, not severity, so it doesn't tell us much about conditions inside each of the fire footprints. What it does show is the areas in our watersheds that haven't burned at all in *at least* the last 70 years. (For example, Cohasset, Forest Ranch, Colby-north of Jonesville, parts of the High Lakes; Strawberry/Sly Creek Reservoir area.) Depending on the ecological community, 70 years without fire represents from one to thirteen missed fire returns. Some areas have missed fire for even longer.

INTRODUCTION: A PROGRAMMATIC APPROACH TO BUTTE FORESTED WATERSHEDS

Due to long term fire suppression, Butte County's forests have too many trees, especially conifers. Prior to settlement, the area's forests would have been dominated by mostly large, widely spaced trees, which experienced frequent fires (both wildfires and deliberately ignited cultural fires), without undergoing significant landscape-scale transformation. In addition to being much less dense on average, the forest was also much less homogeneous, so it had many openings and dense clumps of brush, scattered in a finer-grained mosaic than is usually seen today. This open, mosaic type of forest structure is described throughout this document as "healthy" and/or "resilient."

By the early 2020s, the area's (surviving) forests are dominated by skinny, light-starved trees that are packed close together. When wildfire encounters this overgrown forest structure, it is likely to burn at catastrophic intensity and rapidly convert large landscapes from forest to brushland, with few or no surviving large trees for miles. High-severity burn patches of more than a few acres are not normal for Sierran[1] forests[2] and pose significant threats to public safety, carbon sequestration goals, cultural values, water quality, and vibrant wildlife habitat.

Healthy forest structure, at least in the dry fire-adapted forests of California, is not something that can be achieved and walked away from, like a demolition. Rather, it needs to be regularly maintained, like a building. Just like caring for children or operating a farm, forest resilience work is labor that needs to be re-done every day. Forests can be maintained through fire, cutting, grazing, or a combination of these. In Sierran forests, however, the primary and by far the most cost-effective mode of maintenance is fire. Regular, low-to-mixed-intensity fire keeps Sierran forests healthy by killing most small trees but leaving most large ones, cycling nutrients as it goes.

In California, forests that burn frequently actually sequester far more carbon than those that are fire-suppressed (largely because fire-suppressed forests eventually release massive amounts of carbon through catastrophic wildfire). Regular low-intensity burning releases far less smoke per acre than high-intensity fire[3], and the beneficial effects of that smoke are becoming better understood: for example, it helps to cool salmon streams and it improves oak recruitment. The pyrogenic carbon (charcoal) left behind by fire is stable on a millenial scale and is what allows Californian forest soils to sequester tremendous stores of carbon. To remain healthy, productive, and carbon-negative, then, forests need to burn. But how often?

As a key part of a site's fire regime – i.e., the pattern, frequency, and intensity of fire that is native to a particular site and its natural community -- the *rightful fire return interval* is one of the most

[1] **"Sierran":** Butte County, of course, sits at the junction of the Sierra Nevada and Cascade ranges; this geological boundary is often placed between the Butte Creek and Feather River watersheds, i.e. the ridgeline connecting Pentz Road, Lovelock, Powellton, Inskip, etc. For simplicity's sake, this plan follows the State of California's lead in generally referring to all the area's forests as "Sierran" or as part of "the Sierra Nevada." This usage is not intended to ignore the geological or ecological differences between the Sierran and Cascade provinces.
"Forests": Also, this plan uses the term "forests" and "woodlands" interchangeably, to apply to a diverse range of woodlands, not all of which resemble the mixed conifer forest most people envision when they hear "forest". In doing so, we follow the CA Department of Conservation's lead in defining any land with more than 10% natural tree cover as a woodland.

[2] Safford and Stevens 2017.

[3] Hankins 2021b

important things we can know about a place. It tells us which trees we should plant and at what spacing, how we should design our homes and roads, and even the classes our schools and colleges should offer our kids so they will be prepared to be good forest citizens.

This plan uses the term *rightful fire interval* in place of "natural fire interval" which is sometimes interpreted to exclude human-led fire. ***The Sierran fire regime is not complete without human-led fire.*** This is because, for many thousands of years, Indigenous people in the area (e.g. Maidu, Yana, Yahi, Nisenan) supplemented wildfire by lighting frequent deliberate fires. This practice of cultural fire was extensive (i.e., it had landscape-scale effects) and it occurred over millennia, more than enough time to profoundly shape the fire-adaptive traits of Sierran vegetation communities. Cultural fire was applied at times and intensities that created optimal habitat for dozens of Indigenous cultures' most important species, such as deer and elk, redbud, sugar pine, black oak, beargrass and mushrooms. It also had the benefit of further reducing the intensity of future wildfires. Because of this long co-evolution between Indigenous cultures and their forests, California forests require human-led fire. Lightning ignitions are simply not sufficient to meet the land's fire needs while also achieving an acceptable level of public safety.

If a forest has a rightful fire return interval of 10 years, that means it stays resilient and productive if it burns, on average, *about* once every ten years. Different patches within the same forest will have different fire return intervals based on their elevation (higher forests burn less often), climate (fires are likely to be more frequent as climate warms), aspect (south-facing forests will burn more often), species composition (oak woodlands and ponderosa pine forests need to burn much more often than McNab cypress groves), and location (ridges might burn more often than canyon bottoms).

Of course, there is more to know about a forest than just how *often* it burns. The intensity and pattern of burning a vegetation community needs is just as important. Taken together, these three factors form a community's *fire regime*. In a fire-adapted landscape, understanding a place's rightful fire regime is the single most crucial factor to manage it well. ***The central assumption of this Plan is that forest resilience work can and should be planned out far into the future as a program of work based on rightful fire return interval,*** not as a series of discrete projects.

Based on this insight, the Butte County Fire Safe Council and Butte County Resource Conservation District worked together to develop BCFSC's "WUI Program of Work." This program of work is a comprehensive permanent plan to achieve BCFSC's vision "to create communities within a landscape that are resistant to the devastating impacts of wildland fires." Its treatment goals are based on the observation that Butte forests should be treated about as often as they would have burned prior to 1850. This Butte Forests Plan takes that same sensibility and extends it across the entire forested watersheds area of Butte County.

Butte County is diverse and ranges from sites that were traditionally burned almost every year to high-altitude sites that might not even burn once in a generation. While each *individual site* should be treated with respect to its unique condition and community – chaparral on Musty Buck Ridge might be likely to burn about every twenty years, while a valley oak woodland on the lower Feather River might benefit from fire every two to six years – we can still use averages across our landscape to understand the **needed pace and scale of work** to be done. Looking across all the diverse communities in Butte County, we can estimate how often the "average" acre in Butte County's forested watersheds should be burning.

If we use the Forest Service's FRID data (see pp. 11-14), then we would estimate an "average" acre in our plan area has a fire return interval of about 14 years. Therefore, we would aim to treat an

area equal to 1/14 of our forested watersheds plan area every year. For the Butte Forests Plan Project Area, that works out to about 58,000 acres per year. Perhaps humans can take responsibility for about half of this (29,000 acres of treatment per year) and allow wildfire to treat the rest.

Many Butte County residents, foresters, and Tribal leaders have suggested that for Butte County, the Forest Service data's intervals are a little too long. If we decided the average fire return interval across our plan are was 10 years, we would need to aim to treat 92,000 acres a year in our plan area. Many sites were reportedly burned every single year in the pre-settlement days. Treating every acre in the plan area every year would mean treating (or welcoming wildfire to burn) 919,000 acres a year.

HOW OFTEN SHOULD THIS LAND ACTUALLY BE BURNING?

If 20th-century forest management relied on unnatural fire suppression, and if most people alive today have not seen a healthy forest, how can appropriate fire return intervals (FRIs) be determined? We who are alive today have three main tools for determining rightful FRIs: forensic forestry, interviewing knowledge-keepers, and trial and error.

Forensic forestry includes analyzing old fire scars in tree sections, charcoal deposits in soils, etc. to estimate the frequency of past fires. This method would be expected to produce FRI estimates that are a little too long, because if a fire wasn't high-intensity enough to leave a scar or a significant layer of charcoal, it wouldn't be counted. However, this method gets more accurate the more data points are sampled (because a low-intensity fire might miss four trees in a clump but scar the fifth). Therefore, parts of California that are very well-studied (such as the Tahoe basin) probably have more accurate data than parts that are less studied (such as low-elevation oak savannahs or scrublands). This is the primary method used by the Forest Service to establish FRID data for National Forest lands in California[4], which has become a statewide reference for fire return intervals (and has been used in both this plan and the Butte County Fire Safe Council's WUI Action Plan). Interviewing knowledge-keepers was another method that also contributed to the FRID data layer. (For a complete accounting of how FRID data sources were selected and the FRID layer was developed, see Van de Water and Safford 2011.)

Interviewing knowledge-keepers can involve asking people how often their grandparents or great-grandparents report having burned, prior to the era of dispossession and fire suppression. Because so much knowledge was lost during the genocide of Native people in what is now Butte County, this method has limitations but is still extremely important. Compared to other methods, Tribal leaders and older settler families consistently report the most fire (e.g. "Dad always said his grandparents burned every year").

Contemporary foresters and fire managers also have valuable place-based knowledge, so people who have fought fire or worked in forestry for a while in one place can be asked how long after a fire it takes the forest they work in to accumulate enough fuel to be ready for the next fire.

There is a third method of determining rightful FRI. This is **experimentation and monitoring.** It involves actually lighting fires (or permitting wildfire to burn), then monitoring the outcomes after successive burns. This is a method used, in conjunction with the other two methods, on the Big Chico Creek Ecological Reserve, among other places. This method takes years or even generations to yield reliable conclusions, but once they are obtained, they are likely to be very robust (place- and climate-specific). An important advantage of this method is that it measures the land's response to fire in the climate of the twenty-first century, not the past.

Establishing and remapping rightful FRIs for Butte County -- based on consensus rightful vegetation communities, local expert knowledge, experimentation and monitoring, and an evolving understanding of climate change -- could be a valuable exercise for the regional resilience community in the 2020s.

[4] Safford and Van de Water, 2014.

HOW FIRE RETURN INTERVAL DATA IS BEING USED IN BUTTE COUNTY RIGHT NOW

The Butte County Fire Safe Council's "WUI Program of Work," as developed 2020-21, was based on the FRID data (Forest Service/PSWRS data)[5]. This data was used, not because it was considered perfect, but because it was convenient and the best-quality data available at the time. The FRI map in this Plan (map 4) is a little more detailed than the one that was created for the WUI Program of Work. It shows finer distinctions and a wider range of habitats than the WUI Program of Work's map, and it also uses some slightly different FRIs, based on more recent guidance from fire ecology experts[6]. However, when acres are averaged across community-scale planning areas, the differences are not very significant.

To create the WUI Program of Work, the Fire Safe Council looked at the dominant or average FRI for each CWPP planning area (e.g., Cohasset or Concow-Yankee Hill). Within each planning area, some sites naturally have very long fire return intervals (e.g., McNab cypress groves!) while some sites have quite short fire return intervals (e.g., south-facing ponderosa pine woodlands). However, thinking about a planning area's *average* FRI allows us to estimate about how many acres of treatment need to happen per year. Treatment targets in the WUI Program of Work were determined this way:

$$\frac{\text{Acres in a planning unit}}{\text{Fire return interval of an "average" acre in the planning unit}} \div 2$$

For example, the Cohasset Planning Area has a total (treatable WUI) acreage of 48,468 and an average FRI of 12 years. Therefore, about 4,039 acres of the Cohasset Planning Area "should" burn or otherwise be treated in each year (because 4,039 is one-twelfth of 48,468). This figure is then divided in half to make it more manageable and to acknowledge that wildfire will inevitably treat some acres. (As long as communities and wildlands are wildfire-ready and conditions are not too extreme, treatment by wildfire can be a good thing!) The Cohasset planning area thus ends up with a total target of 2,019 acres to treat per year, and people can decide how to reach that target using fire, mastication, logging, grazing, or a combination of tactics.

Local foresters may observe that shorter treatment intervals are better. (For example, Pete Sundahl of Sierra Timber Services recommends a re-treatment interval of no more than 10 years for most of Cohasset Ridge. Many Tribal leaders state much of Butte County should be burned annually.) In case

[5] After exhaustive research using forensic forestry and interviewing knowledge-keepers, the FRID team established fire return interval ranges for each of California's main *vegetation communities* (habitats). They then mapped these vegetation communities as they existed across California in the early 2000s. Some of these communities were more widespread by the year 2000 than they had been historically (e.g., white fir forest), while others covered less ground in 2000 than historically (e.g., meadow). Each acre of National Forest in California was assigned a fire return interval based on the vegetation community occupying it as of the early 2000s. Because these FRIs are ranges, local managers can and should use their best judgement to adapt it to their local lands. You can see adapted FRID data for Butte watersheds in Map 4.

[6] E.g. North et al 2021.

future managers decide to use different FRI standards for Butte County, the WUI Program of Work is designed to be easily revised based on new information. So is this plan.

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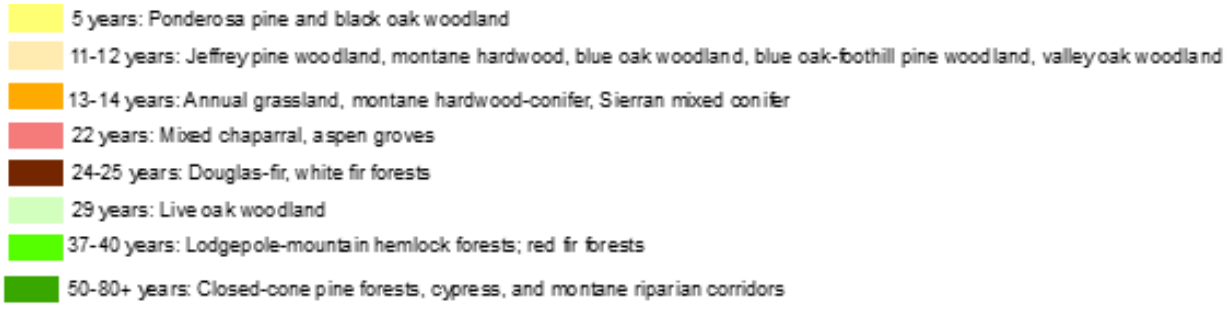
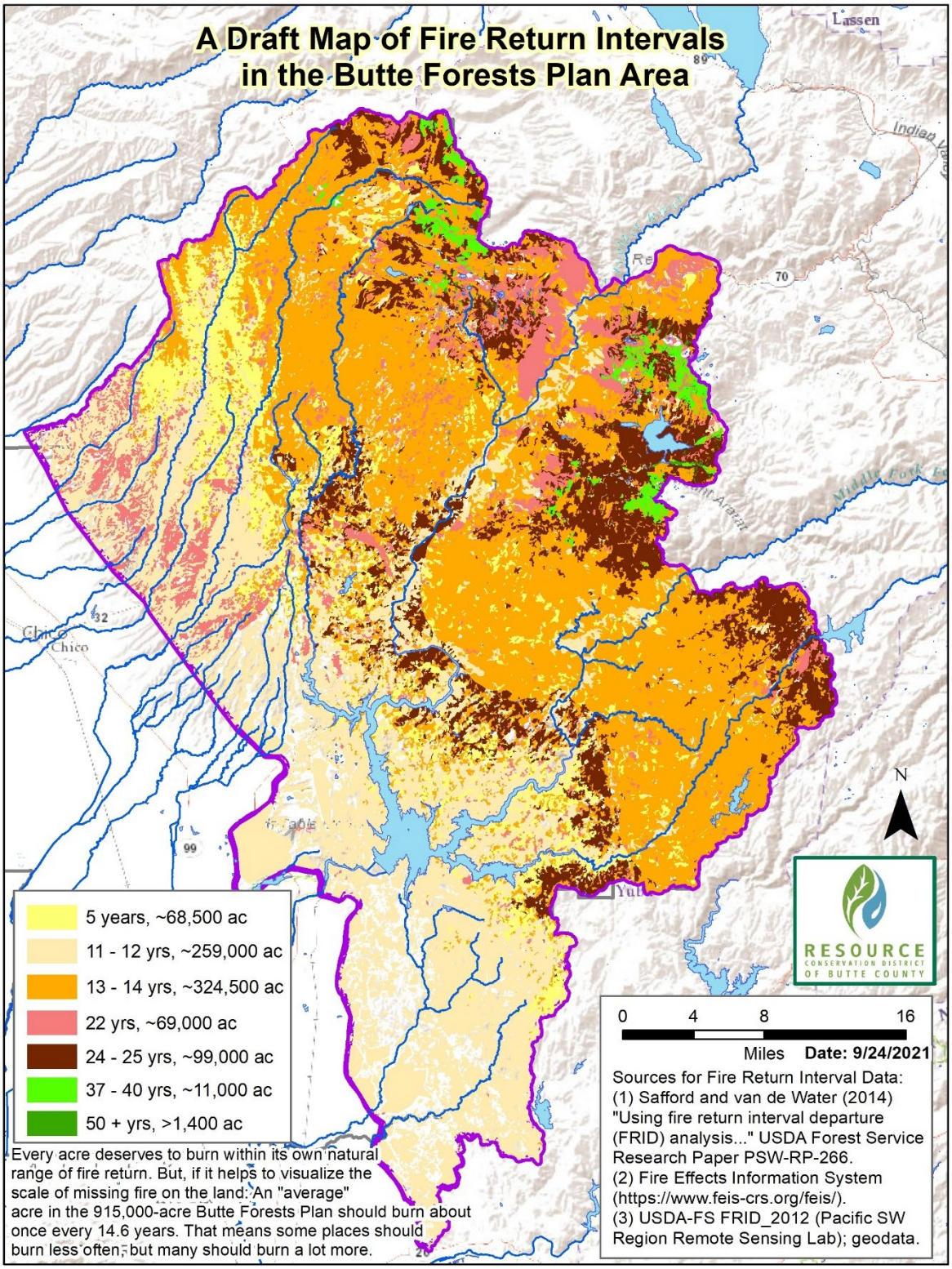
Vegetation communities of Butte County and their USDA-charted fire return intervals, as shown in Map 4:



MAP 4: A DRAFT MAP OF FIRE RETURN INTERVALS IN AND AROUND BUTTE COUNTY



This draft map would benefit from input from more local knowledge-keepers. Many Tribal leaders state the intervals should be much shorter and annual burning should be the goal. Developing and updating a map of desired fire returns across Butte County forested watersheds would be good work for the Butte County Collaborative.

DESIRED CONDITIONS: 10 GOALS FOR THE "NEXT FOREST"

Since the Camp Fire, land managers, fire managers, citizens and ecologists in Butte County have sustained a rich collaboration through a variety of channels (see Appendix A). Recognizing that megafires and climate change could make Butte County's wildlands look very different over the next several decades, the forest resilience community took up the challenge of visualizing "the next forest". The following ten goals integrate the understanding developed through two and a half years of countywide collaboration since the 2018 Camp Fire. These goals were developed mainly for the majority of Butte County forests where maximizing timber harvest is not the primary management goal.

Just as no two happy families look exactly the same, no two healthy forests look exactly alike. But just as all happy families share some basic elements like trust and love, all healthy forests in our bioregion will share some basic features too. Based on years of collaboration and discussion since the Camp Fire, the following ten goals were identified. Because the exercise reminded us of the Tahoe-Central Sierra Initiative's Twelve Pillars of Resilience, you might have heard them playfully called the Butte Forest Caterpillars:

WHAT THE NEXT FOREST WILL BE LIKE

1. ***The next forest is built to burn.***
2. ***The next forest is a mosaic***
3. ***The next forest will live in the next climate***
4. ***The next forest has good water quality and quantity***
5. ***The next forest has lots of herbivores***

HOW WE'LL GET THERE

6. ***We will transition from project thinking to program thinking.***
7. ***We will build up Tribal capacity.***
8. ***We will develop biomass capacity.***
9. ***We will become experts at cross-boundary projects***
10. ***We will create a rural culture that's fire-positive.***

In June 2021, the BCRCD's Forest Health Watershed Coordinator worked with the Butte County Fire Safe Council, the Butte County Wildfire Safety Task Force, and numerous local Tribes to compile and refine these goals. Next, BCRCD sought comments and strategies for putting these principles into action. BCRCD recorded the input provided by dozens of local partners. This input became the 32 key actions nested under each of the ten goals.

GOALS AND KEY ACTIONS, PART I: WHAT THE NEXT FOREST IS LIKE

1. THE NEXT FOREST IS BUILT TO BURN

Every acre of land in Butte County is fire-adapted. That means every acre of land in Butte County has a fire return interval. Some acres, located near long-term village sites, may even have historically been burned every year. Many others might burn every five to seven years on average, while at the highest elevations one fire every 40 or 50 years might have been enough. What all forested acres in Butte County have in common is that they all, historically, burned regularly while vegetation communities and age classes remained in dynamic equilibrium. If our forest health projects need to be protected from wildfire to stay healthy and stay forest, we have failed.

Prescribed fire and cultural fire are critical to forest health, but wildfire also has an important role to play. Putting out every wildfire as soon as possible is counterproductive and (along with the suppression of indigenous fire traditions) is how we got into this mess. To recover a fire- and drought-resilient forest, we will need to invest massively in boosting everyone's Rx fire capacity: Federal land managers, CAL FIRE, Tribes, local agencies (e.g. parks and cities), industrial and non-industrial timberlandowners, and ordinary homeowners in WUI communities.

The entire project area needs fire, but most areas are not ready for it. Massive amounts of thinning need to be done before fire can be safely reintroduced. This is true in virtually all areas that have missed a fire return interval. It's also true in many areas that burned at high severity three to ten years ago. High severity fire can beget high severity fire in a vicious cycle. The following key actions are proposed to cultivate wildlands that can burn regularly at severities society can live with.

1.1 KEEP FORESTS OPEN (70% CANOPY CLOSURE OR LESS, WITH LIMITED LADDER FUELS)

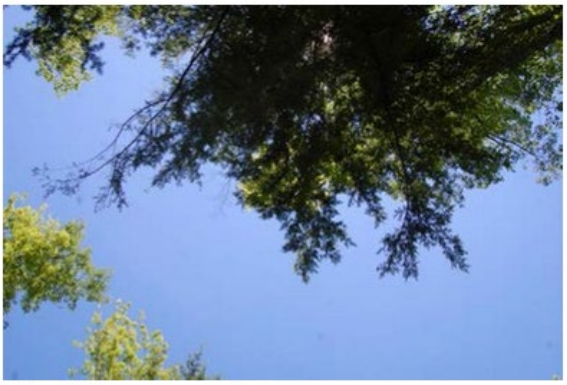
Early photographs and descriptions of the Sierra Nevada portray a surprisingly sunny and open forest. These forests aren't shady or private: sunlight reaches the forest floor, so grasses and wildflowers are common on the ground. In some places, especially along ridgetops, a person could even safely ride a horse at full gallop through the forests. Sightlines were long. Hearing an animal crunching through the underbrush just a few feet away, but not being able to see it, is a modern experience.

These sunny forests are very productive in wildlife habitat, are drought-and fire-resilient, and are safe and enjoyable to be in. However, they quickly accumulate brush and lose resilience unless they are regularly burned.

How dense is too dense? Because of low capacity for maintenance, Butte County WUI managers have traditionally recommended a canopy closure of about 70% for the most common type of forest treatments. This level of closure is sometimes known as a "shaded fuelbreak" density. A 70% canopy closure works out to an average tree spacing of 20 feet, or 109 trees per acre. Foresters realize this 70%-closed forest is

often still too overstocked to be optimally fire-resilient, but they choose this target because it is dense enough to suppress brush regrowth while still open enough to provide firefighters or residents an improved opportunity for suppression/evacuation. (70% shaded fuelbreaks still require maintenance every 10 years[7] at elevations around 2000-3000'.) Map 5 shows where in the plan area canopy cover is greater than 70%.

The Cohasset and Paradise forest management plans[8], developed for the Fire Safe Council and partners, call for a general watershedwide standard of no more than 70% canopy closure. However, within 100' of homes and structures, they state canopy closure should be 40%, which works out to a 30-foot spacing between trees and 48 trees per acre on average. Watershed-wide, spacing closer to 40% is more in line with historical densities[9] and may turn out to be more appropriate on many sites, at least on warmer and drier ones like ridges. In a warmer and drier climate where fire suppression may become more difficult and forest water yield may become a more critical factor, Butte County's forests are likely to see increased pressure to thin out well beyond 70%. A landscape-scale wildfire risk assessment developed for the South Lassen Watershed Group[10], covering upper Butte Creek watershed and lands to the north, recommends at least some thinning for forests any denser than 50% canopy closure[11].



30-40% canopy closure

70-80% canopy closure

There is more to a forest than its canopy, of course. Even if the big trees are widely spaced, the understory can still become unhealthily dense (i.e., accumulate ladder fuels) and lead to catastrophic fire. And there is a trade-off between canopy density and understory density: The less tree canopies overlap,

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[7] STS 2021; Martinson and Omi 2013; Agee and Skinner 2005.

[8] STS 2021 and Desotle and Sundahl 2021, respectively.

[9] For instance, FTMF 2020 states that historic densities in mature ponderosa pine forests averaged 30-45' between trees, with 10-50 trees per acre, and fire returning every 5-10 years.

[10] DCR 2021.

[11] On Forest Service Lands, the 2004 Sierra Nevada Forest Plan Amendment (USDA 2004) requires that spotted owl Home Range Core Areas (HRCAs), 1000-acre areas surrounding and counting the 300-acre PACs, be maintained generally at canopy closures of at least 50-70%, and has usually been interpreted as strongly discouraging any treatment inside PACs. However, the 2019 Conservation Strategy (USDA 2019) does explicitly allow treatment in up to 100 acres of a PAC as long as canopy cover remains at 50% or above, and encourages treatments in PACs that promote resilience to catastrophic disturbance. For a project to comply with the 2019 guidance, it would need a project-level plan amendment proposed during scoping. The Hat Creek Ranger District on the Lassen provides an example of this in their Backbone Project.

the faster ladder fuels will usually grow. When forests are as open as 50% or 40% canopy closure, brush can grow rapidly because a lot of sunlight reaches the forest floor. This brush is most cost-effectively controlled by regular fire. The SLWG assessment recommends forests with 50% canopy closure or less be prioritized for prescribed fire to sustain their current levels of health.

One simple and direct way to look at a forest's vertical density is to look at its canopy layer count – how many vegetation canopies a raindrop would hit on its way from the sky to the earth. You can view the area's canopy layer count in Map 6.

Desired Conditions for Butte Forests			
	Canopy closure	Average tree spacing	Average trees per acre
Watershed lands (not immediately around a house)	50% - 70% or less	20 feet or more	109 or fewer[12]
Defensible space (within 100-150' of a home), ridges, etc	40% or less[13]	30 feet or more	48 or fewer
Shrubs in defensible space or close to communities	Space between shrubs or clumps of shrubs should be 2x the height of shrubs on level ground, 4x the height of the shrubs on 20-40% slopes, and 6x the height on slopes steeper than 40%[14]		n/a
Shrubs in wildlands	Fine-grained mosaic of clumps of shrubs, individual shrubs, individual trees, and open space. "Cells" in the mosaic will usually be a few acres or less. All age classes are present; spatial heterogeneity will be self-reinforcing over time as shrub clumps grow and burn away "like little lights blinking on and off across the landscape".[15]		Depends on vegetation community
Surface fuel loading for watershed lands	No deeper than 2-3 inches[16]. About 2 tons/ acre[17].		

[12] STS 2021

[13] STS 2021

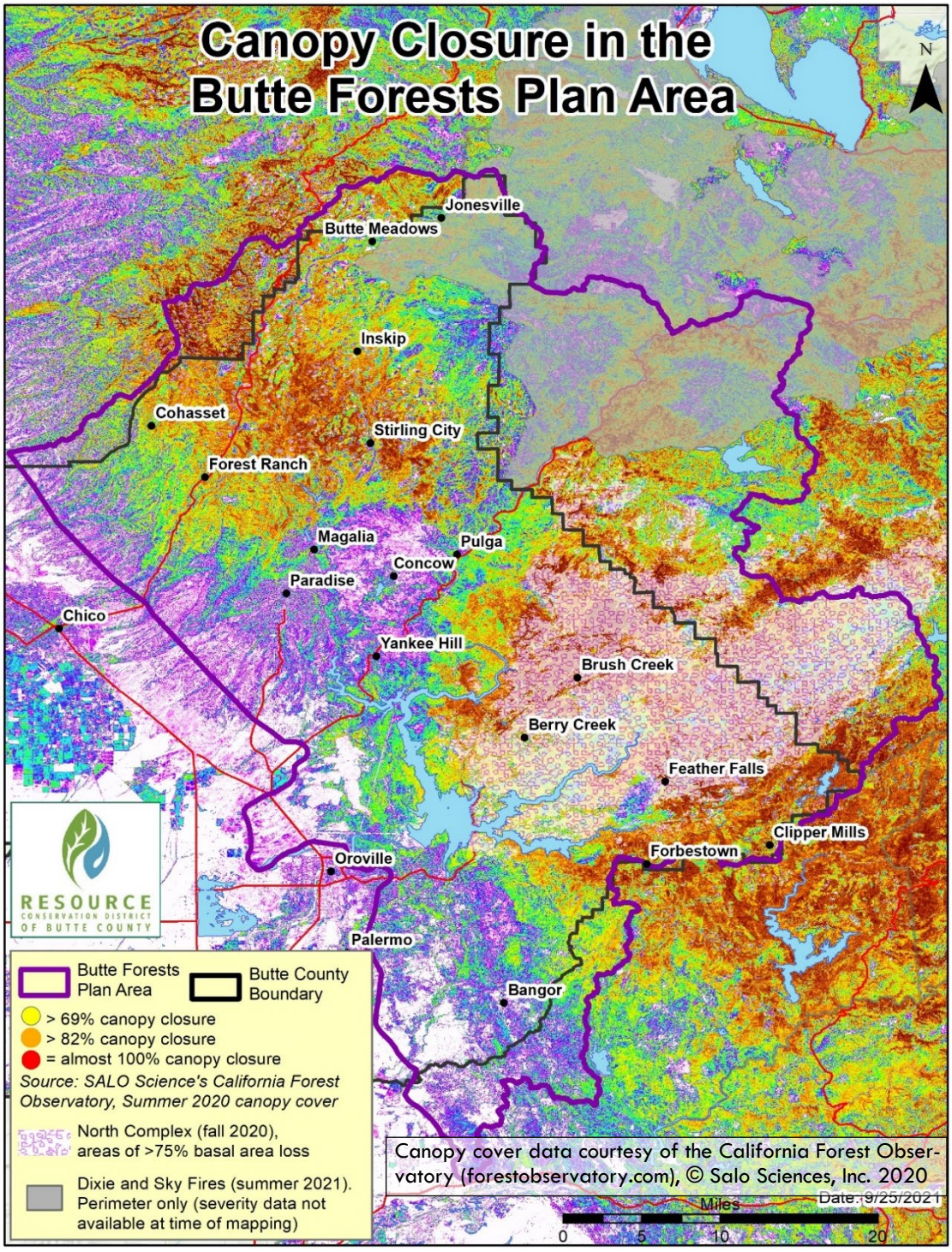
[14] BOF 2006

[15] Don Hankins pers. comm.

[16] BOF 2006

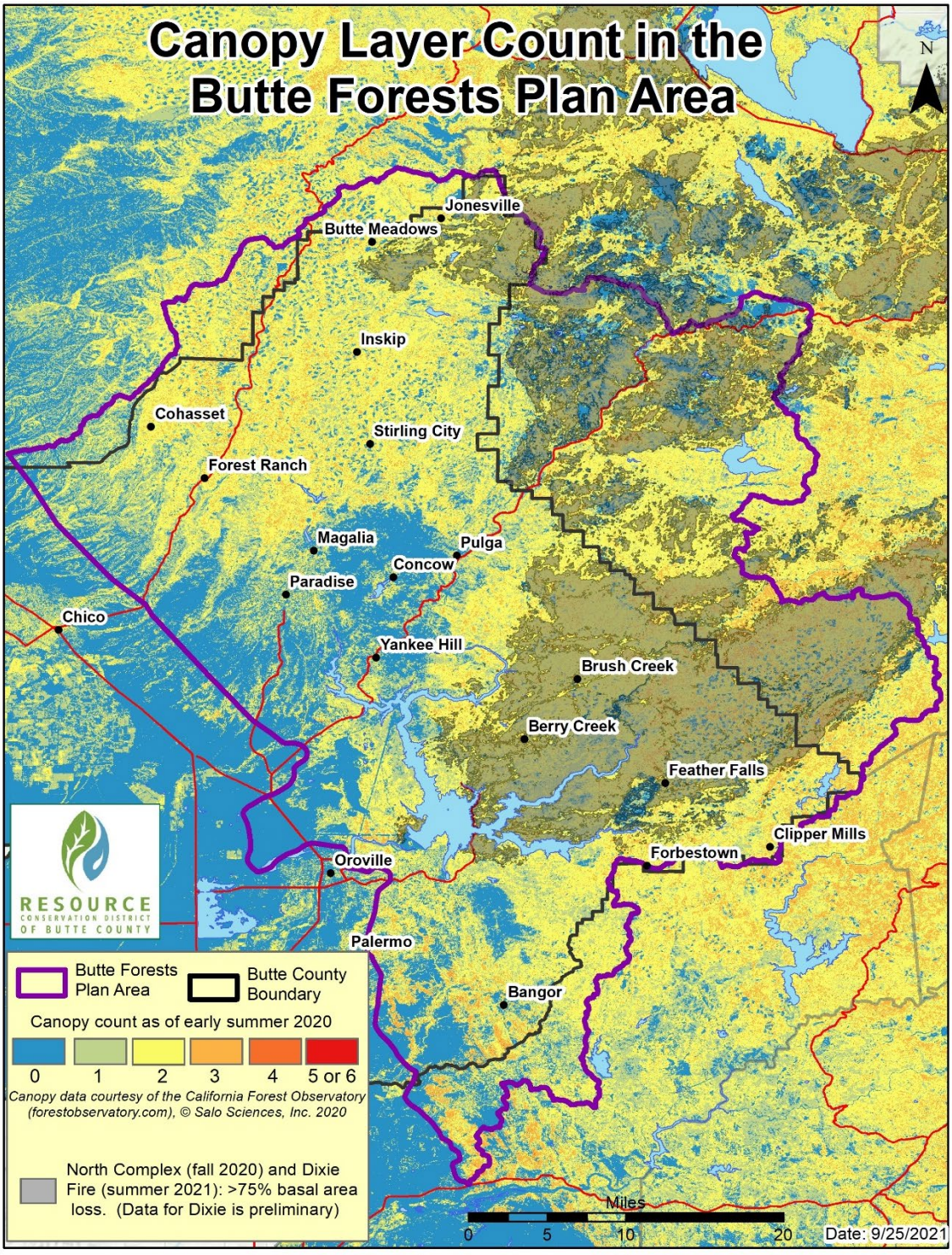
[17] Don Hankins pers. comm. For a photo series to "tune up your eyes" regarding what 2 T/ac of surface fuel loading really looks like, see this classic 1979 Forest Service photo series. 2 T/ac is not a lot of litter!

MAP 5: CANOPY CLOSURE IN THE BUTTE FORESTS PLAN AREA



SALO Science's Canopy Cover data is based on 10m Sentinel Satellite imagery processed using machine-learning algorithms trained using detailed LiDAR point-cloud data. Deer Creek Resources staff has ground-truthed SALO's data in the South Lassen Watersheds Group area, spending about 10 days in the field, collecting 100 canopy cover plots using a spherical densiometer. Their field assessment found SALO's canopy cover data to be "relatively accurate" and far better than LANDFIRE (DCR 2021). SALO's data is an annual snapshot, updated every fall based on early summer's imagery, so the 2020 fire season will be reflected in the fall 2021 update.

MAP 6: CANOPY LAYER COUNT IN THE BUTTE FORESTS PLAN AREA



Another data product derived from LiDAR and imagery interpreted by LiDAR-trained computers, the Canopy Layer Count simply counts how many plant canopies are between the ground and the sky. Grassland and rocky areas will usually be 0. As far as the BCRCD knows, this data has not been locally ground-truthed.

1.2 HAZARD TREE REMOVAL IS A RESILIENCE TACTIC

High-severity fires in 2018, 2020, and 2021 left literally millions of standing dead trees in our area, including hundreds of thousands that are within falling distance of a road, structure or trail. These trees are not just fall hazards; they are also 1000-hour fuels that will smolder for days after any fire, making both fire suppression and prescribed fire much more difficult for the foreseeable future. Snags and large downed logs are a normal part of any forest, but it is not normal for a forest to receive such a huge volume of them at once. Possible tactics to address this issue include:

- Continue to make FEMA, CalOES, NRCS, etc aware of the magnitude and significance of the problem (this has been done but there just is not enough money available to begin to treat the problem)
- Pursue biomass strategies that can convert large, no-value logs into some output with some value, however small, such as energy, biochar or even firewood (partners, esp. the Fire Safe Council, have been looking into this since the fires but the cost of harvesting and transporting large logs is so high, and now after 2021 fire season the statewide log glut is even bigger than before)
- Instead of trying to burn or dispose of logs, consider burying them. On sites where ground disturbance is acceptable, burying logs can effectively sequester their carbon for centuries. This tactic also provides opportunities to anchor logs (or their berms) in place to create excellent establishment sites for young seedlings. This technique has been successfully trialed (using e.g. a mini-excavator) by Friends of Butte Creek on a restoration project in Butte Creek Canyon.
- USFS is developing a regional (i.e., California-wide) EA for hazard tree removal, the R5 Post Disturbance Hazardous Tree Management Project. Once it is finished, hazard trees could be removed more quickly along FS roads if FS budgets are increased in coming years.

1.3 TREAT REFORESTATION AS A FIRE MITIGATION STRATEGY

When forested areas burn sufficiently hot and large enough to require replanting, we have an opportunity to shape what the next forest will look like. And that means an opportunity to shape what the next fire will look like. When we plant the next forest, we are really planting the next fire.

There is significant pressure from reforestation nonprofits to replant conifers because conifer seedlings are cheap, easy to obtain, and supported by a vast supply and distribution chain thanks to their economic importance. These things are not true of hardwood seedlings, but we know that in many parts of our region, fire- and climate-resilience requires a shift toward hardwood dominance. Possible tactics to address this issue include:

- Continue to educate reforestation funders (i.e., American Forests, American Forest Foundation, Arbor Day Foundation, One Tree Planted, Reforest'Action, etc) about the need for hardwoods and the unique requirements/costs associated with them (BCRCD has been doing this since the Camp Fire)
- Continue to work with foresters and land managers at all levels to encourage less-dense, spatially heterogenous replanting patterns (with the awareness that planting at lower densities may have tradeoffs such as higher reliance on herbicides to suppress brush). Many land managers are

becoming more likely to plant lower densities and use cluster plantings rather than homogeneous/ grid patterns

- In areas with good hardwood regeneration after 2 years, consider abandoning any plans to replant, and instead focus resources on "releasing" (= reducing brush competition around) the oaks and other hardwoods that are already there
- Consider being more selective about where to replant conifers. As the climate gets warmer and drier, sites that were once considered viable timber ground won't be anymore. On any given replanting unit, identify the refugia where conifers will have the best shot (e.g., deepest soils, north- and east-facing aspects, mesic microsites) and invest your limited resources for nurturing conifers on those sites. On sites that are more likely to be marginal for conifers, consider investing instead in hardwood release and shrub control.

1.4 THE PYROSILVICULTURE PERSPECTIVE: FIRE AND TIMBER AREN'T MUTUALLY EXCLUSIVE

To continue to provide the jobs and working landscapes the timber industry contributes to our communities, timberlands can and should continue to become more fire-resilient[18]. Sierra Pacific Industries (SPI), which owns about 20% of the forests in the Butte Forests Plan area, participates in collaborative meetings around Butte County and has designed and implemented many fuels reduction treatments in collaboration with Plumas National Forest, the Fire Safe Council, Butte County RCD, CAL FIRE, and others. SPI already implements virtually every forest health treatment except prescribed fire. While it has long been on the record as unwilling to apply prescribed fire on its own lands as long as the company holds the liability, SPI is open to having CAL FIRE apply prescribed fire and assume liability. Future policy solutions that limit a private lighter's liability could lead to more prescribed fire being applied on industrial lands, reducing industrial timber lands' vulnerability to wildfire.

For a century, the perceived need to protect timber lands from fire has been used to justify near-total fire exclusion in the Sierras. However, it is possible to manage productive timberlands in coexistence with fire. For example, managers in the Southeastern U.S. apply far more prescribed fire *while also harvesting more board-feet of timber* annually than managers in the West[19]. As another example, the Walker family, which operates Red River Lumber Co., burned their Almanor Basin lands regularly through the 1920s and advocated against fire suppression, which Clinton Walker described as a strangling "tourniquet" on good timber management, well into the 1930s[20].

If fire suppression agencies were under less pressure to *suppress* all fires near industrial timber plantations, they could focus instead on *managing* fire to promote future resilience and get good work done. And because many old-growth species of concern, including California Spotted Owls, prefer areas that burn extensively at low-to-mixed intensity[21], pyrosilviculture holds promise for resolving the remaining contradictions between wildlife habitat and timberland productivity.

Pyrosilviculture is an emergent forestry perspective that integrates prescribed or managed fire with the objective of timber production. This can include using prescribed fire to meet management objectives (such as to perform a precommercial thin), but it can also mean designing nonfire silvicultural treatments

[18] North *et al*. 2021

[19] Melvin 2018; Oswalt 2019

[20] Stephens 2018.

[21] Kramer *et al*. 2021

explicitly in order to optimize the incorporation of prescribed fire, or the tolerance of wildfire, in the future[22]. For example:

- Tree breeding programs can select for traits that help trees survive fire at a younger age.
- Mechanical thinnings can be designed to leave fuel (slash) on the ground arranged in a pattern that promotes desirable fire behavior, so the next lightning strike can deliver a maintenance treatment rather than a bankruptcy proceeding.
- (More) Dedicated Rx fire crews can be stationed around the State and spend 100% of their time on implementing Rx fire in and around timber plantations (or prepping timberlands for fire). Over time, this would significantly reduce the cost and risk of suppression activities while contributing to community safety by moderating fire behavior. A previous prescribed fire can be even more effective in moderating wildfire behavior than suppression itself[23].
- Improved liability solutions, such as a gross negligence standard for qualified burners, a State-operated liability pool, or statutory limits on damages from fires ignited for a public purpose, would increase timberland owners' willingness to put fire on their ground. Some of these fixes are being reviewed by the State legislature as this plan goes to press[24].

[22] York *et al.* 2020a

[23] Harris *et al.* 2021.

[24] SB 332 was originally conceived to provide a gross negligence standard to qualified burners; as passed, it doesn't do that but does limit burners' liability for suppression costs, which removes the largest potential out-of-pocket cost for a private burner. Also recently passed is a Prescribed Fire Claims Fund budget allocation, a preliminary movement toward developing a State-operated liability pool, as originally called for in AB 2091 (2018).

2. THE NEXT FOREST IS A MOSAIC

Healthy forests are more open than today's forests, but that doesn't mean they are uniformly open. Most collaborators emphasized that healthy forests should have lots of variety – clumps, patches, and edges. That could mean some areas stay quite dense, especially around springs and in canyon bottoms, even as other areas have larger open areas than we have been used to seeing in the last century.

Healthy forests will contain groves of old trees, young trees, medium-aged trees, and even dead trees, as well as large openings and dense clumps of brush. This should be true even at a fine scale (across a few acres[25]). Foresters say that clumpy-gappy forests are *heterogeneous* and that fires here tend to be *self-limiting*. By contrast, unhealthy forests are often more *homogeneous* (all the same), so when they burn, the fire is the same high intensity across the whole landscape[26].

Mosaic structure is desirable at all scales. Zooming in for a lizard's-eye view, even forest floor fuel structure should be clumpy-gappy, not homogeneous. (Picture clumps of bunchgrass with bare soil between them, instead of a continuous carpet of annual grasses or interlocking shrubs). Zooming out for a hawk's-eye view, the landscape would look like a patchwork quilt of wooded and open areas.

When you burn a mosaic of fuel, you get a mosaic of fire effects. This mosaic of fire effects, resulting from variability in fire intensity across a landscape, is called pyrodiversity. Pyrodiversity and biodiversity tend to reinforce each other in a virtuous cycle.

Maintaining a healthy landscape mosaic is very difficult without at least some grazing/browsing (see #5) and without a greatly improved capacity for cross-boundary projects (see #9).

2.1 PROMOTE SPATIAL HETEROGENEITY

Forests that are maintained with frequent, low-intensity fire have a characteristic structure[27]. They are a mosaic of individuals, clumps, and openings. (If a tree's crown overlaps with any other tree's crown, it's part of a clump. If not, it's an individual.) This characteristic and self-reinforcing pattern is known as "ICO" structure or "clumpy-gappy" structure. By contrast, unhealthy modern forests tend to be more like a continuous blanket of trees.

Spatial heterogeneity, once established at a resilient density, is reinforced by each successive fire as long as fire return and climate stay within a normal range of variation. In addition to being more fire-resilient, ICO forests are more drought-resilient[28] and more biodiverse (because of their high density of microclimate niches)[29].

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[25] Hankins 2021a

[26] PPIC 2020.

[27] Larson and Churchill 2012

[28] Murphy *et al.* 2021; Knapp *et al.* 2021

[29] Stevens *et al.* 2015; Norris *et al* 2012

2.2 PROMOTE TEMPORAL HETEROGENEITY

The patchy, mosaic patttern of fire in resilient forests creates and reinforces **diversity in age classes** of vegetation. Every time a hot spot flares up during a wildfire and burns at high intensity over a small patch of forest, an opening is created. A patch of trees or shrubs is killed – perhaps ten or twenty acres -- but new seedlings quickly take hold in the fertile, sunny opening. Five or ten years later, the same thing happens not far away in a different part of the forest. Soon, the forest is a patchwork quilt of brand-new openings, patches of young shrubs, thickets of adolescent trees or reprouts, patches of decadent chaparral species reaching the end of their life cycle, clumps of mature trees, and sunny stands of very old large trees. This age class mosaic is repeated across the whole landscape in small cells of less than an acre to a hundred acres.

These different age classes exist in dynamic equilibrium, "like little lights blinking on and off across the landscape over time"[30]. This temporal or age-class heterogenity promotes, and is reinforced by, pyrodiversity, since different age classes of vegetation hold moisture differently and burn differently. Age-class heterogeneity also promotes biodiversity because more species can occupy a landscape when it provides access to a wide diversity of resources at once (e.g. flowering young shrubs for nectar, large old trees with cavities for nesting, decaying old wood to find grubs in, etc). This biodiversity, in turn, reinforces age-class diversity as large herds of herbivores prune shrubs haphazardly (before being hastened along by wolves), wood-boring insects selectively kill individual trees in a clump (while being kept in check by songbirds and woodpeckers), and jays and rodents compete with each other to bury tree seeds in ever harder-to-find spots.

Historically, high-severity wildfire hotspots, and the openings they created, were common but usually not very large (20 acres or less)[31].

2.3 PROMOTE SPECIES HETEROGENEITY

Landscape-scale fire suppression has not just left too many trees, with too little generational diversity. It has also given an unfair advantage to certain shade-tolerant, relatively fire-intolerant species. The best-known examples are Douglas fir, white fir, incense-cedar, and live oak. To restore healthy forests, humans now need to end that unfair advantage and selectively favor sun-loving, fire-tolerant species such as most oaks, madrone, elder, redbud, and ponderosa and sugar pine. Most forest management plans today specify, at a minimum, that most or all oaks should be retained. However, projects can go further by prescribing:

- oak *release* (i.e., aggressive thinning around young or suppressed oaks to help them grow as fast as possible and develop into very large and productive legacy-type oaks),
- understory reseeding (if grasses do not re-establish on their own after the canopy is opened up, native grasses and forbs could be oversown to promote an understory that carries fire in a desirable, oak-promoting way)
- Specify appropriate shrub cover. Without nurse shrubs, most native oaks do not successfully regenerate from seed, and shrubs are critical to the life cycles of many wildlife species.

[30] Don Hankins pers. comm.

[31] North 2019.

- Integrate prescriptions from a TEK or tribal forestry program. To the extent that pre-1850 forests are considered today's model for resilience, "resilient forests" and "forests managed for Tribal objectives" are two ways of saying the same thing. Tribal forestry programs usually focus on promoting high-productivity oaks, improving and expanding meadows, keeping canopy closure less than 50% in most places[32], and promoting manageable, frequently burned populations of select native shrubs[33], all of which would significantly improve resilience in most areas of Butte County.

[32] Long, J., & R. Goode 2021

[33] Margo Robbins pers. comm.

3. THE NEXT FOREST WILL LIVE IN THE NEXT CLIMATE

The climate of the twentieth century is not the climate a tree planted today will grow up in. Climate trends strongly suggest Butte County could get considerably hotter and drier, with many more snow-free days. More of our precipitation will fall as rain, and we could experience more floods. We will see new forest pests that never lived here before. Vegetation communities are likely to shift uphill at least 500-1000' by about 2050[34], which would make most of Paradise Ridge a blue oak savannah. Our forests won't change overnight, but after a disturbance like a big fire, we have decisions to make about what to replant. Knowing what we know about likely climate change, it would be irresponsible of us to replant exactly the same species in the same place and expect them to do well.

Each year of the last decade has brought new records – record low fuel moistures, record long dry spells, record early flowerings for many species, and record high single-day rainfalls as well. If we are being honest with ourselves, our "next" climate is already here.

3.1 PLANT TREES – NOT TOO MANY – MOSTLY OAKS

Climate change will dramatically shrink the ranges of some species, like sugar pine and Douglas fir. However, other species will be net winners. These winners include many hardwoods, such as blue, black, and valley oaks, plus low-elevation Butte County conifers including ponderosa, incense cedar, and gray pine[35]. **Climate-resilient reforestation** means only replanting trees in sites where they're likely to do well over the *next* 150 years, not where they did well over the *last* 150 years. It also means investing in all layers of the forest (including the grasses, forbs, and shrubs of the understory) to cultivate forest structure that is consistent with desirable fire behavior. It helps to remember that any time we plant vegetation, we are also planting fire.

Many areas will never need to be replanted after fire. They do fine on their own. However, after particularly large high-severity fires such as the North Complex, or after massive hazard tree removal campaigns like post-Camp Fire, some areas will need to be replanted. After the Camp Fire, BCRCD convened a technical advisory committee of local foresters, land managers and ecologists to advise and develop the RCD's climate-resilient reforestation strategy. This technical advisory process revealed the importance of moving away from a conifer-dominated reforestation model, which is still supported by most reforestation nonprofits, and toward a more hardwood-dominated model. The BCRCD's climate-resilient reforestation strategy, which is being applied to Butte County wildlands through projects like the Emergency Forest Restoration Program and the Concow Resilience Project, recognizes that what was a pine forest in 1970 could need to be an oak woodland in 2070.

That vegetation community shift is not, inherently, a problem. If the community accepts that its identity could change from a pine forest town to an oak woodland town, and if the oak woodland continues to deliever ecosystem service like water filtration, a livable fire regime, biodiversity, and subsistence, then it may make more sense to work with the transition toward an oak-dominated future than to work against it.

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[34] Stewart *et al.* 2021.

[35] Thorne *et al.* 2017b.

Embracing that concept, the BCRCD's post-wildfire climate-resilient reforestation strategy is sometimes summed up for the media as "plant trees – not too many – mostly oaks." However, that summary requires two modifications. First, oaks rarely need to be planted. Just caring for resprouting individuals, while reducing competing brush and invasive grasses/shrubs, is usually enough to regenerate a healthy oak woodland, even after very high-severity fire. (Resprouts grow big much faster than trees planted from acorns, anyway.) Second, planting trees alone is not a reforestation strategy. Grasses, some keystone shrub species (e.g. redbud, elderberry, currants, rose), and other native plants and fungi are needed to make the group of trees a forest. Flowering hardwoods, in particular, are critical for supporting vibrant populations of songbirds, pollinators and other vibrant wildlife. Grasses and shrubs almost always regenerate on their own after fire, but if they don't do so after several years, human assistance is appropriate.

Trees planted near structures need to be carefully selected for their size and the fuel type (e.g. dead leaves, needles) they will produce. If a residence has a large tree close enough and tall enough to shade it, then that means the residence's roof valleys, gutters, and 5' non-combustible zone will need to be cleaned of accumulated fuel several times a year. Lists of recommended tree species can be obtained from the Butte RCD, Butte County Fire Safe Council, CAL FIRE, or Paradise Garden Club, among other sources. Floral Native Nursery in Chico and several other nurseries will sell small (or large) quantities of native trees directly to homeowners or neighborhoods. If a neighborhood wants to plant more than a few trees, a potential strategy is to band together with the help of a local nursery plus a fiscal sponsor (e.g. the RCD, a local fire safe council or other non-profit, or a scouting troop) and stage an Arbor Day Foundation-sponsored tree planting event. Such events should be planned at least six months in advance, preferably twelve. The steps are: Make contact with ADF or a partner group; develop a budget (the primary factor will be the size of trees you want to plant and have reserved at a nursery); wait for ADF or partner group to verify funding from themselves or a corporate sponsor; develop and sign an agreement; identify enough homes with good planting sites where trees can be watered (each tree recipient will need to sign a pledge) and where planting a tree will not interfere with defensible space; collect enough volunteers to stage the event; and adequately document the event to receive the funding).

3.2 SUSTAIN CONIFER FORESTS, BY ADAPTING THE WAY WE PLANT THEM

The fact that most conifer species will be more stressed than oaks by climate change is not a reason to stop planting conifers, which are extremely important members of our woodland communities. Rather, it is a reason to think more strategically about where we plant them so we can continue to share the land with them for as many generations as possible.

To do this, land managers can consider being more selective about where to replant conifers. As the climate gets warmer and drier, sites that were once considered viable timber ground won't be anymore. On any given replanting unit, foresters can identify the refugia where conifers will have the best shot (e.g., deepest soils, north- and east-facing aspects, mesic microsites) and invest their limited resources for nurturing conifers there to get the best return on investments. On sites that are more likely to be marginal for conifers, foresters can choose to do nothing, or else invest in hardwood release and shrub control.

Traditionally, conifers have been replanted at about 300 trees per acre, even though a healthy Sierran conifer forest has no more than 90 conifer trees per acre at maturity. Foresters overplant because they assume some trees will die along the way and because they hope the growing conifers will shade out competing brush. However, with improvements in tree genetics and planting techniques, more conifers have been surviving their first decade of life, which results in overstocked stands of young trees. Unless there is money and time to thin these stands (which there often isn't, especially on non-industrial lands), these overstocked stands become vulnerable to drought and severe wildfire. It would be ideal to plant at lower densities from the beginning, but still control competing brush. This is not easy and usually relies on at least some herbicide application. Tactics to address this issue could include:

- Invest more in site prep and release, accept increases in the per-acre cost of planting, and assume the stand will not be revisited after the first 5 years. The goal of the first 5 years of work would be to produce a stand that can endure a wildfire and still experience only acceptable mortality (e.g., 20%). Front-loading forestry costs into the first 5 years of a stand's life potentially brings them within a grant time horizon. If reforestation becomes more expensive, it will need to be even more strategic and funders will need to be educated about the justification for the higher upfront cost (i.e., paying more upfront reduces the risk of losing the entire stand to wildfire).
- Continue to develop, test and refine spatially heterogenous planting patterns instead of the traditional grid pattern. Train more planters to recognize microsites where trees could weather extended droughts or heat waves.
- Continue to identify and develop prescriptions for safer herbicides and more selective modes of application, and communicate the risks and benefits of modern selective herbicide application clearly to the public.
- When selecting species, choose the more drought- and fire-tolerant species. When planting a tree species at the warm edge of its range (for example, planting Douglas fir at 2000'), carefully consider if the investment is likely to be worth the return. Consider selecting seed from warmer/drier seedlots (see below), and consider some assisted migration (e.g. experimenting with planting Sierra sequoias, an exceptionally fire-resilient conifer, in Butte County even though they are not considered native this far north).

3.3 BE PROACTIVE BY SAVING NATIVE SEED FROM WARMER, DRIER PLACES

Traditionally, trees were replanted only from seed harvested within the same "seed zone" (territories about the size of a small county) and the same elevation band. As the reality of climate change sank in, foresters began planting seed harvested 500' downhill from the new planting site, but still within the same seed zone. Today, with climate apparently changing much faster than trees can "move," does it make sense to source seed from even further afield (e.g., 1 or 2 seed zones to the south, as well as from more than 500' downhill when possible)?

Intuitively, it would seem that seed from a hotter/drier area would be better-adapted to hotter/drier conditions. While we still don't perfectly understand how much of a tree's success in stressful conditions is genetic, many stakeholders (including the BLM, RCD, and USFS) feel it makes sense to experiment with planting a wider range of seed to increase a struggling forest's chance of success. Tactics could include:

- Continue to support research into the genetic/provenance basis for tree resilience (e.g. PSW provenance trials integrated into Concow Resilience Project)
- Continue to educate funders and nursery operators about why you are asking for seed from farther away than usual (otherwise, they may "correct" your order!)
- There is a critical statewide shortage of conifer seed from low elevations. Participate in Board of Forestry and other initiatives to identify seed needs and prioritize collections from warmer/drier populations.
- By 2050, in much of Butte County the only resilient conifer species below 2000' could end up being gray pine (to:ni; *Pinus sabiniana*). This particularly flammable tree is not desirable near homes and structures, but is an important part of the foothill ecosystem and, while not a great timber species, does produce straight poles until about age 30-50. It can also be used for truck peds and even railroad ties. These facts should help any perception of this tree as "worthless."
- One Indigenous land manager shared that she wouldn't consider planting seed from other parts of California to be sustaining the same native forests her tribe has lived in relationship with since the beginning of time. When moving seeds around, consider whether it's possible to source seeds from within the same tribal territory as the planting site. If that's not possible, what about keeping them within the same multi-tribal trading area?

3.4 HELP MEET CALIFORNIA'S CLIMATE GOALS THROUGH REFORESTATION & MEADOW PROJECTS

California likely cannot meet its greenhouse gas emissions reduction goals without reversing negative trends in forest health[36]. Although it may seem counterintuitive, removing trees from a forest (especially small trees) can dramatically improve the forest's ability to store carbon.[37] This is true not just of mechanical thinning but also of prescribed/cultural fire and light wildfire[38].

REFORESTATION

Reforestation, however, is the most carbon-storing forest treatment of all. For many years, California has funded forest health projects out of carbon cap-and-trade auction proceeds, compelling grant applicants to prove that their projects would result in net greenhouse gas reductions. In practice, this usually meant that projects were not competitive unless they included some reforestation in addition to thinning. Reforestation efforts probably should not be counted for carbon accounting purposes if the forests would naturally regrow without human help. A map showing high-severity burn areas >100 acres is shown in Map 7. These areas have low probability of forest regeneration without human help. (Areas of 75-100% basal area reduction, in areas above 3000', were chosen. Areas below 3000' will probably regenerate as hardwood resprout forests without human help).

[36] FCAT 2018

[37] Hurteau and North 2009, Gonzalez *et al.* 2015

[38] Wiedinmeyer and Hurteau 2010.

MEADOW RESTORATION

Meadows are incredible sinks of carbon: Though meadows cover only 2% of the Sierra Nevada landscape, they may contain roughly 1/3 of the landscape's soil organic carbon[39]. Fens, which are a special type of spring-fed meadows, are particularly rich carbon sinks composed of peat soils which are almost like pure carbon several feet deep[40]. Once a meadows is incised or degraded, it can bleed carbon into the atmosphere, becoming a net emitter. However when a damaged meadow is restored, it can begin storing carbon again immediately, with significant increases over 15 years. A study of seven Northern Sierran meadows restored in the last 15 years showed an average of 20 percent more soil carbon over their unrestored counterparts, with one site recording an increase of over 80 percent.[41]

The Sierra-Cascade region as a whole contains some 278,000 acres of meadow habitat, scattered across over 18,780 distinct meadows and fens[42]. The Butte Forests Plan area contains about 1,794 acres of meadow habitat scattered across 219 meadows and fens, most extremely small (half are just 4 acres or less). (See Map 8.) Many of these meadows, especially in the upper Butte Creek watershed, are being restored in 2021-22 through work done by Point Blue Conservation Science, Lassen National Forest, CDFW, BCRCD, and partners.

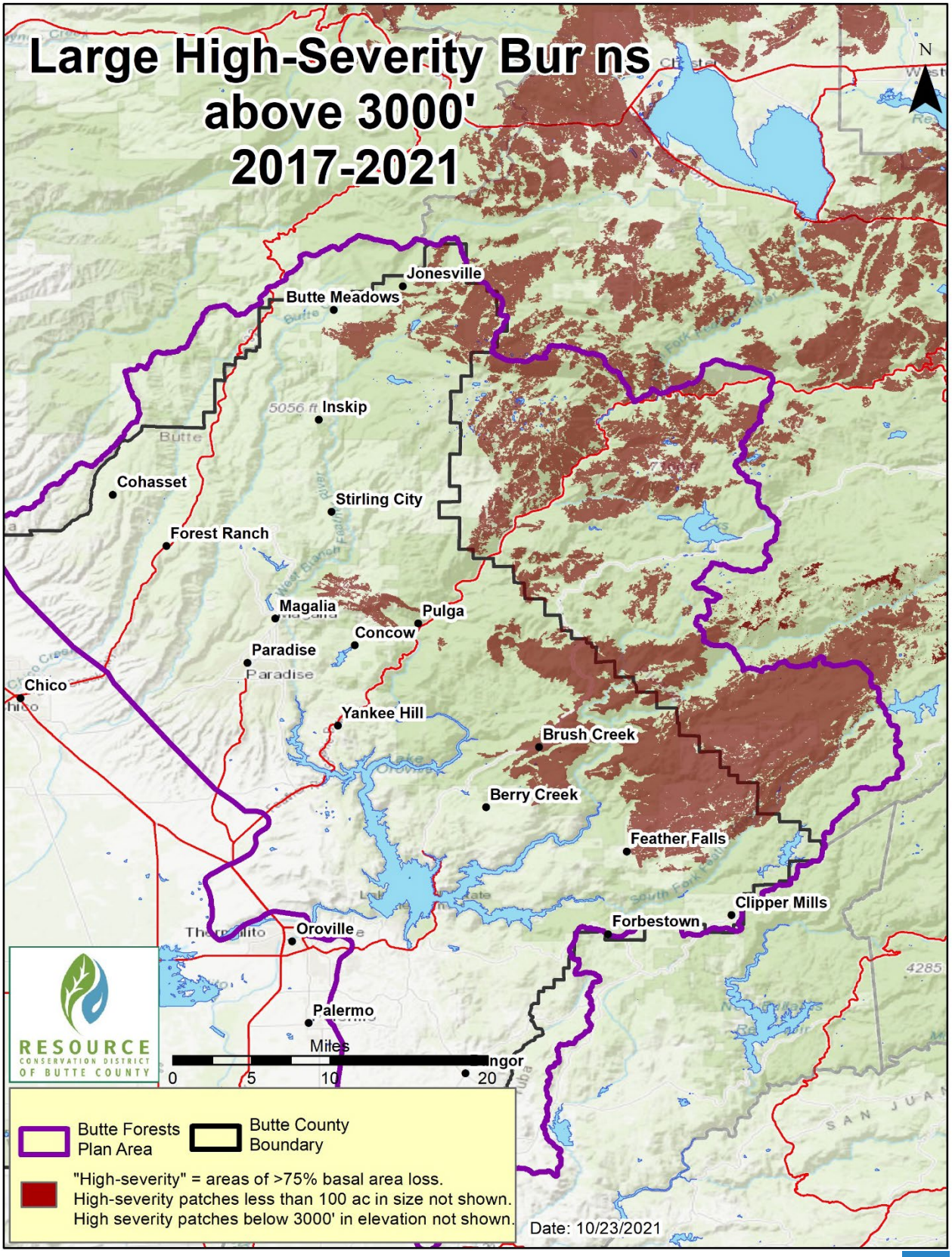
[39] Sierra Meadows Partnership 2018

[40] Drexler *et al*. 2015.

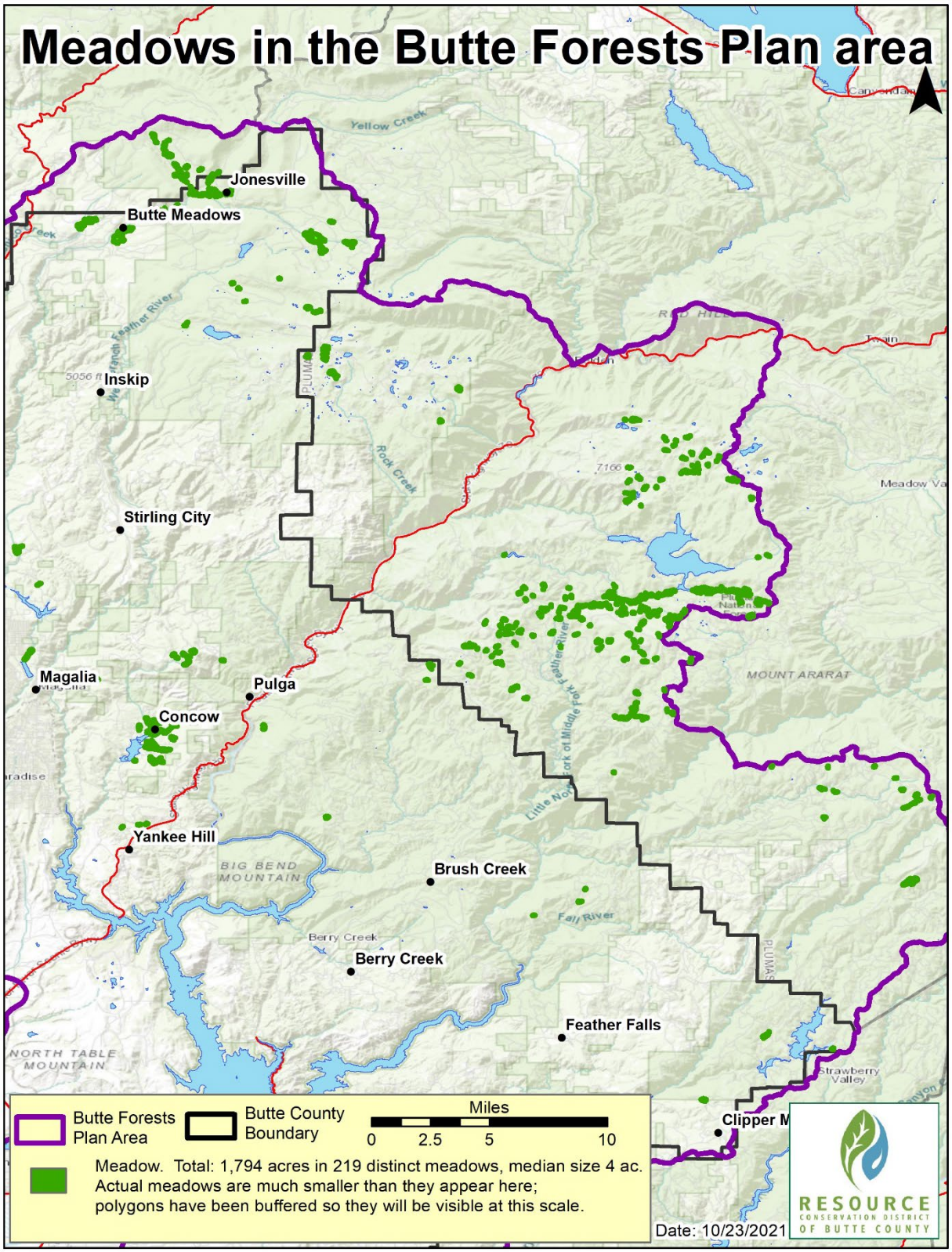
[41] Little 2017

[42] UC Davis, Center for Watershed Sciences & USDA Forest Service, Pacific Southwest Region, 2017.

MAP 7: HIGH-SEVERITY BURN AREAS WITH LOW CHANCES OF CONIFER REGENERATION



MAP 8: MEADOWS IN THE BUTTE FORESTS PLAN AREA.



Source: UC Davis, Center for Watershed Sciences & USDA Forest Service, Pacific Southwest Region, 2017. Sierra Nevada Multi-Source Meadow Polygons Compilation (v 2.0).Vallejo, CA, Regional Office: USDA Forest Service. 2017. http://meadows.ucdavis.edu/

3.5 PROMOTE BIODIVERSITY BY MAPPING AND CONSERVING CLIMATE REFUGIA

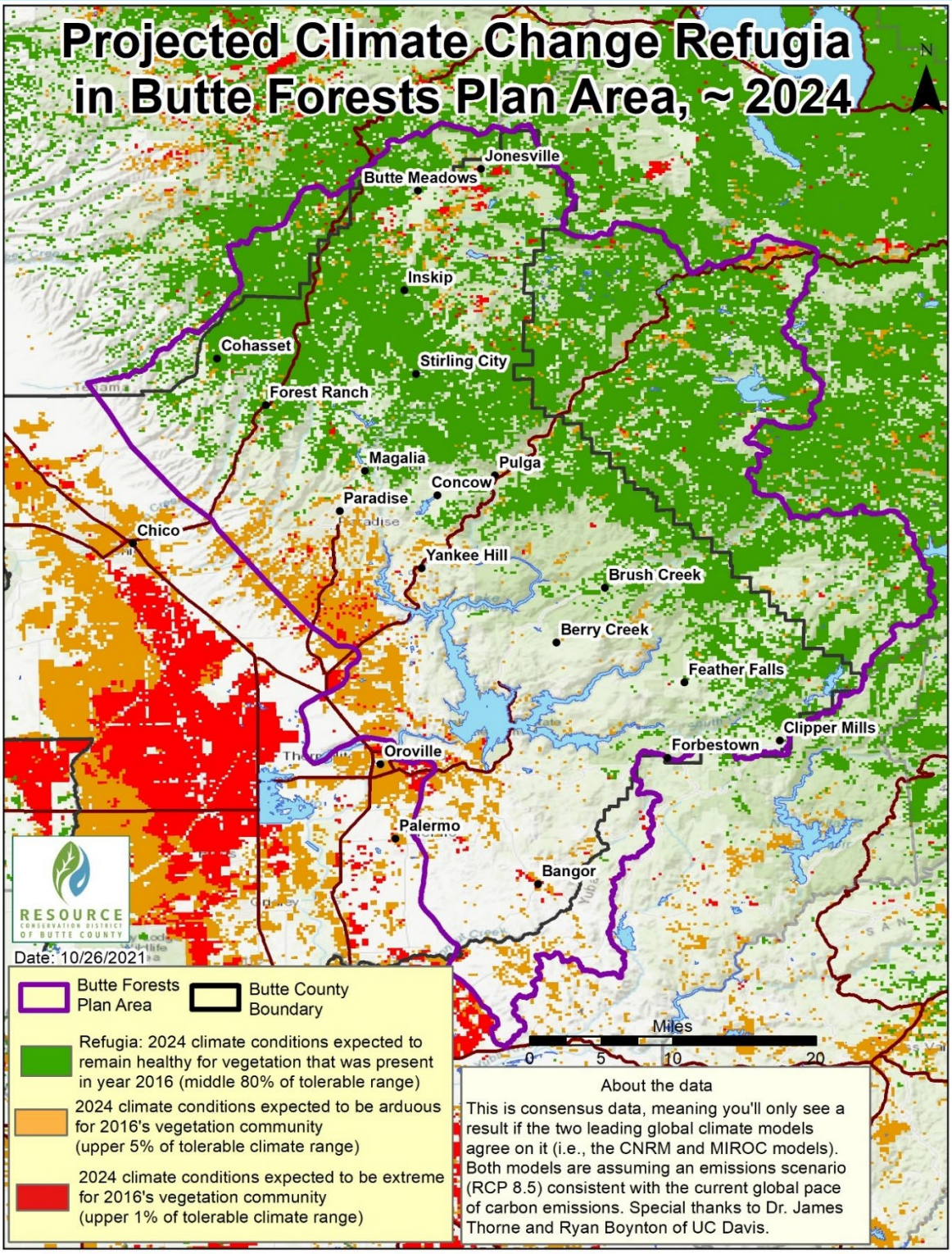
Not all parts of California or Butte County will experience climate change in the same way. Some places will experience less change, or slower change, than others. Wet meadows, north-facing slopes, and the bottoms of dark, shady river canyons are already natural refugia (sanctuaries) for certain species that need more water, longer winters, and/or less fire than the average Sierran species. Species like frogs, salamanders, meadow-nesting songbirds, and benthic macroinvertebrates (like owlflies and dragonflies) could in the future be more and more confined to climate refugia.

As the climate warms and possibly gets drier, these refugia will become even more important to species whose range may shrink[43]. The largest refugium in the planning area is the High Lakes/Butte Creek headwaters area. Much of this area burned, at varying intensities, in the Dixie and Sky fires (Map 7 shows where the burns were high-severity). See maps 9-11 for more about where refugium areas could endure across the Butte Forests Plan area.

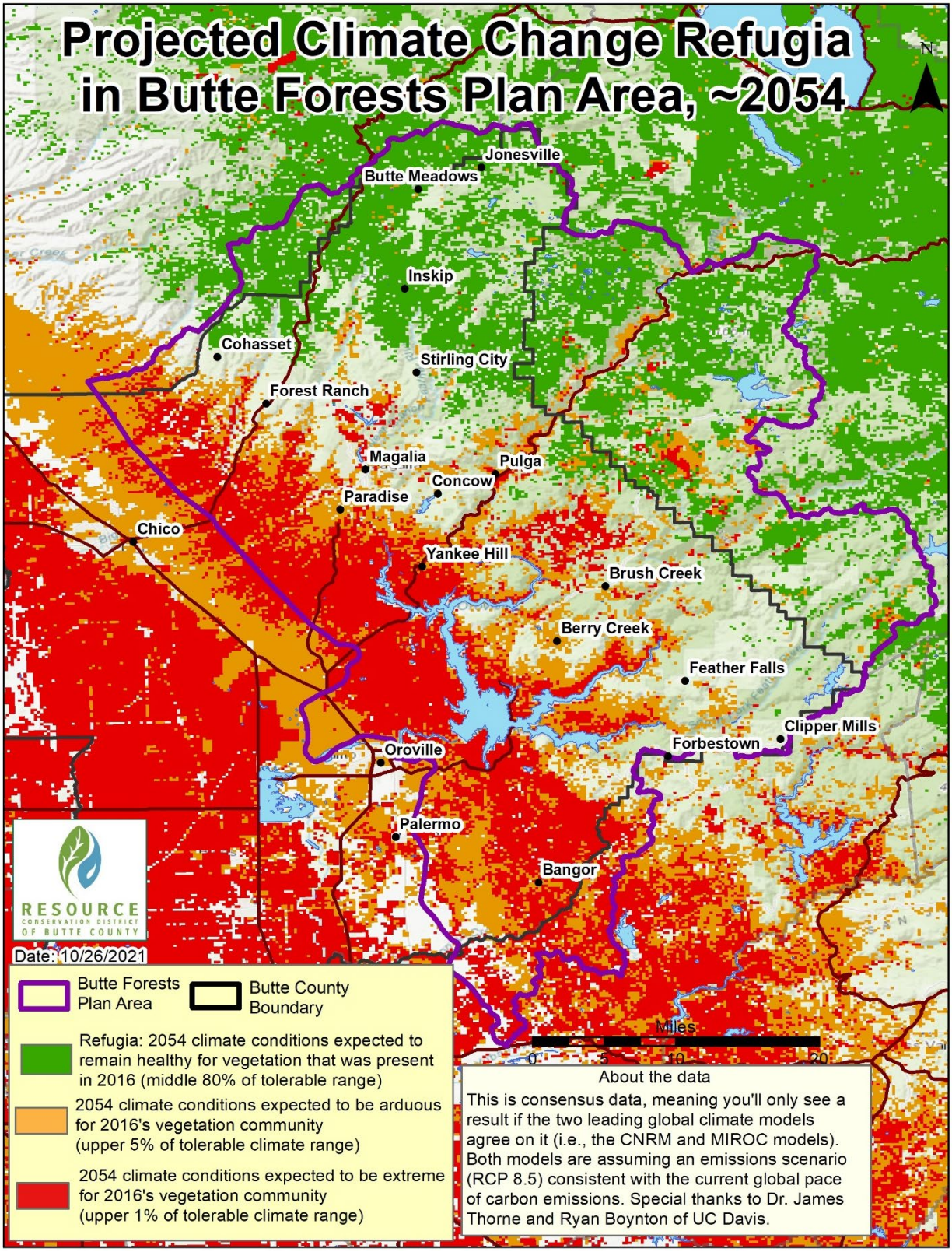
It should be noted that "conserving" refugia does not mean leaving them alone; in many cases, refugia in the project area need fire (or need fire immediately adjacent) in order to continue to function.

[43] Morelli et al. 2020; Thorne et al 2020.

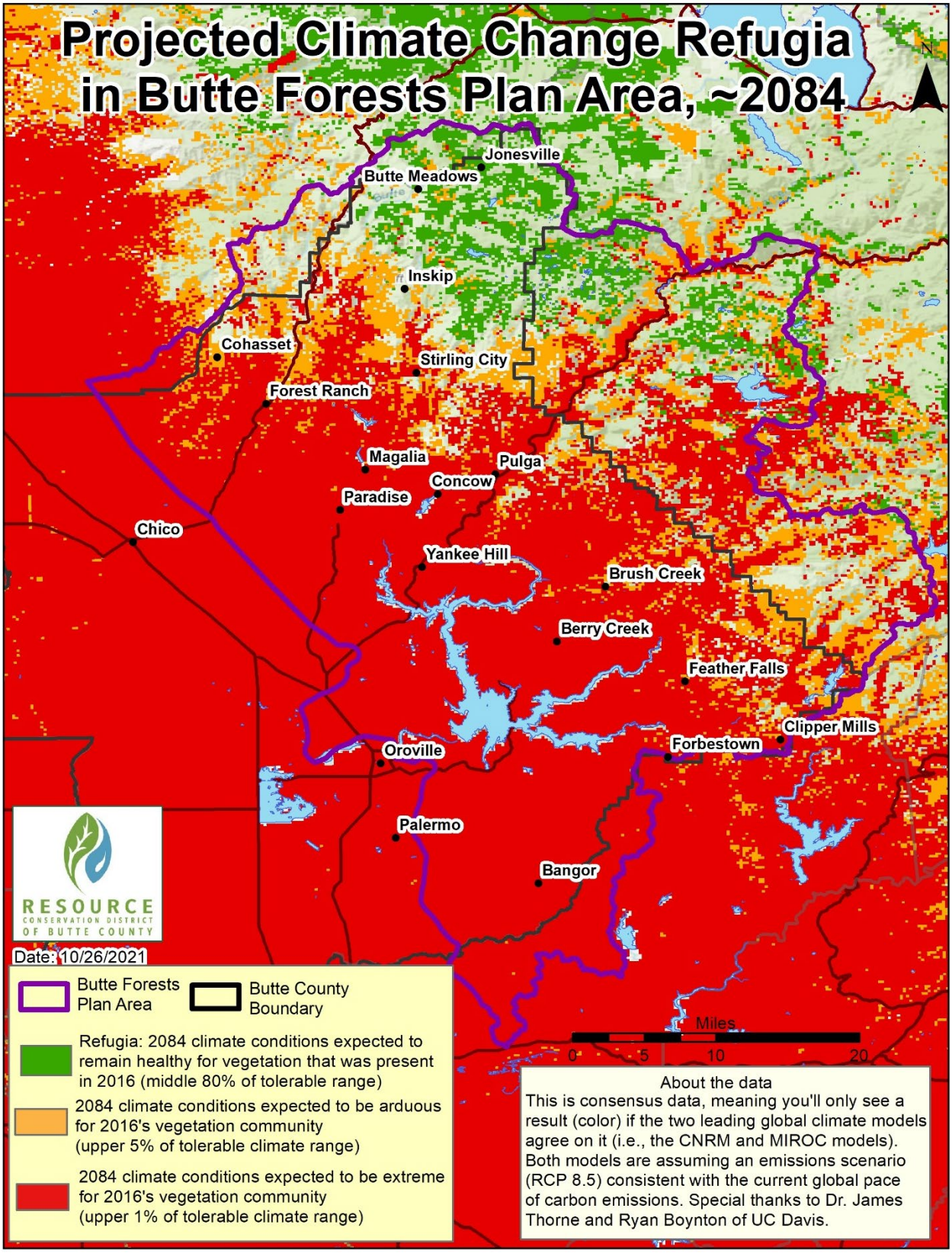
MAPS 9-11: CONSENSUS CLIMATE REFUGIA / AREAS OF HIGH EXPOSURE, 2024-2084



Source: Thorne, J.H., et al. 2020. Vegetation refugia can inform climate-adaptive land management under global warming. *Frontiers in Ecology and the Environment* 18(5): 281–287. https://doi.org/10.1002/fee.2208 For more information, contact Dr. Jim Thorne or Ryan Boynton



Source: Thorne, J.H., et al. 2020. Vegetation refugia can inform climate-adaptive land management under global warming. *Frontiers in Ecology and the Environment* 18(5): 281–287. https://doi.org/10.1002/fee.2208 For more information, contact Dr. Jim Thorne or Ryan Boynton


Projected Climate Change Refugia
in Butte Forests Plan Area, ~2084
N
Jonesville
Butte Meadows
Inskip
Cohasset
Stirling City
Forest Ranch
Magalia
Pulga
Concow
Paradise
Chico
Yankee Hill
Brush Creek
Berry Creek
Feather Falls
Clipper Mills
Forbestown
Oroville
Palermo
Bangor
RESOURCE
CONSERVATION DISTRICT
OF BUTTE COUNTY
Date: 10/26/2021
Butte Forests Plan Area
Butte County Boundary
Refugia: 2084 climate conditions expected to remain healthy for vegetation that was present in 2016 (middle 80% of tolerable range)
2084 climate conditions expected to be arduous for 2016's vegetation community (upper 5% of tolerable climate range)
2084 climate conditions expected to be extreme for 2016's vegetation community (upper 1% of tolerable climate range)
Miles
0
5
10
20
About the data
This is consensus data, meaning you'll only see a result (color) if the two leading global climate models agree on it (i.e., the CNRM and MIROC models). Both models are assuming an emissions scenario (RCP 8.5) consistent with the current global pace of carbon emissions. Special thanks to Dr. James Thorne and Ryan Boynton of UC Davis.

4. THE NEXT FOREST HAS GOOD WATER QUALITY AND QUANTITY

Multiple contributors emphasized that a forest's health should be measured in large part by the health of its rivers, lakes, springs and aquifers. Future generations have the same right to inherit the same abundant and healthy populations of frogs and salamanders, river turtles, waterbirds, salmon and trout that past generations enjoyed. Moreover, a primary justification of the State of California's budgetary investment in forest health work in Butte County is that our source watershed forested areas help supply drinking and irrigation water for 23,000,000 Californians.

Closer to home, residents note that old maps of Butte County show springs and cabin sites where the ground isn't even damp today. Why did the springs dry up? Climate change and groundwater pumping are important factors, but forest density likely plays a role too. Reducing the number of "straws" in the watershed should mean trees are less drought-stressed[44] and more water flows out through the rivers and down through the aquifers[45]. Days or even hours after a fire, locals have reported seeing water suddenly emerge from the blackened land[46]. And Native fire practitioners often emphasize that fire can bring rain, when it is lit in the right way[47]. Forests need to be managed for more than just maximizing water yield, but water quantity (and quality!) are important data to track before and after fires. The following are key actions emphasized by partners in the last two years.

4.1 RECOGNIZE NATIVE/CULTURAL PLANT COMMUNITIES' ROLE IN HYDROLOGICAL SYSTEM

As Butte County returns to its normal fire regime, and possibly even experiences extra fire due to climate change, the land might yield more surface water per inch of precipitation, compared to what has been considered normal over the last 50 years. For example, a wildfire that reduces vegetation by 38-50% across a drainage's catchment basin can translate to a 55-67% increase in runoff[48]. This surge in runoff could become even greater in the context of 21st-century storms, which, according to most climate models, will be rarer but warmer, wetter and more commonly high-intensity than 20th-century rain events. This increased flow could contribute to flooding. If individual storms become higher-intensity (i.e., we receive more of our rain in fewer days), flooding can happen even if total *annual* precipitation decreases.

After a fire, sediment enters creeks. The ecosystem has evolved with this factor, so salmonids and other native species must have adapted to at least occasional significant pulses of sediment in the first storms of fall. Nonetheless, native species have many additional stressors now that they did not have two centuries ago, and our society has a regulatory environment structured around punishing actors whose projects release sediment. Increased sediment flow could lead to fisheries problems and regulatory costs.

Bigger riparian buffers may be needed, possibly including pulling development back farther out of river corridors (which could become floodplains even if they have not been for most of the twentieth century). Many culturally important plants are also ideal erosion control and flood buffer plants, e.g. white root (*Carex barbarae*) or munmuni (*Artemisia douglasii*). Certain floodplain trees such as willow and

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[44] North, Hurteau, and Innes 2009.

[45] STS 2017, Saksa *et al*. 2019.

[46] Daley 2020.

[47] Don Hankins pers. comm; Ali Meders-Knight pers. comm.

[48] Saksa *et al*. 2019

oak can serve as phreatophytes (plants who lift water from deep down and share it with associated plants in the floodplain during dry spells). Because local Tribes have been living beside and engineering riparian buffers for centuries, they are in a special position to lead riparian corridor restoration. This principle is already being demonstrated by the Mechoopda Tribe's partnership with the U.S. Army Corps of Engineers to restore riparian functionality on Clear Creek.

4.2 FIND WAYS TO VALUE AND LEVERAGE ECOLOGICAL SERVICES LIKE WATER YIELD

There is never enough money to get forest thinning done. In some watersheds outside Butte County, forest thinning projects have actually been financed by downstream water users, based on their trust that they will get more water once the project is finished[49]. Yet forest thinning projects in Butte County have not yet been financed this way, even though most of Butte County drains either to Lake Oroville, the drinking water and irrigation water source for 23 million Californians, or to Butte Creek, an extremely important Chinook salmon stream that also provides irrigation water to much of Northern California's rice industry and other farms. "Restoration bonds" may be worth looking into for significant upper watershed thinning projects and or/ biomass capacity initiatives.

4.3 MORE RESEARCH INTO NATURAL FILTRATION ABILITIES OF CHARCOAL

After a wildfire, we can expect to see significant pulses of sediment and nitrogen into creeks. When fires burn through communities and destroy homes, vehicles and infrastructure, then they should also release toxic metals and volatile organic compounds (VOCs). Yet the charcoal produced by fire also has a natural ability to filter runoff, possibly accounting for the surprisingly non-toxic results from extensive water quality monitoring after the Camp Fire[50]. The filtration functions of pyrogenic carbon deposited *in situ* in watersheds post-wildfire is not very well understood, or at least not very well documented in scientific literature yet[51]. More documentation of these effects could lower permitting costs, and remove some implementation barriers, for prescribed fire projects that are more extensive or are designed to consume more fuel.

[49] For example, Blue Forest Conservation's Yuba Forest Project is a 15,000-acre forest thinning project on Federal lands financed by $4 million in private investment capital, a "forest restoration bond" which will be repaid over time by water sales revenues received by the Yuba Water Agency (a public water district). Source: https://www.blueforest.org/the-yuba-project

[50] Matiasek 2021.

[51] Indigenous fire practitioners might remark that Native communities have been aware of charcoal's water-protecting qualities for a long time, and that Native burners less often anticipate negative water quality impacts from cultural burning, compared to non-Native observers.

5. THE NEXT FOREST HAS PLENTY OF HERBIVORES

After the Camp Fire, a recurring theme at community collaborative meetings and listening sessions was that people wanted to see more grazing and browsing animals (herbivores) on the land. Herbivory is the Sierra Nevada's *other* keystone disturbance (besides fire), and it is difficult to restore one without the other. Herbivory and fire work synergistically together. Fire promotes a flush of nutrient-dense browse or pasture that attracts herbiviores, and herbivores perform a light "maintenance burn" between fire returns.

While community and agency enthusiasm for herbivores is strong, not everyone agrees on which herbivores to invest in or how.

- Goats are a popular maintenance tool with wide cultural appeal, and are the closest domestic analogue to deer. However, they are most effective in the first season or two after a fire, and require predator protection.
- Cows can physically crush brush and are much more predator-resistent than goats, but not everyone is comfortable with turning these large animals out into wildlands where they cannot be fenced out of sensitive areas.
- Overall, Tribal leaders consulted for this plan tended to be much less positive toward grazing, especially cattle grazing, compared to people more identified with settler culture. One Tribal EPA director described cattle grazing this way: "counterproductive to forest health, grazing causes damage habitats, destroys native plants and causes soil erosion and allows invasive plants to thrive" and recommended limiting grazing to areas already full of invasive plants. Historically, cattle in Butte County forestlands (and indeed across the West) have neither been intensively managed nor kept on the move by healthy populations of wild predators. Unmanaged cattle will concentrate in the areas they prefer (like wetlands). This has caused adverse effects across the West.
- Sheep generally eat less woody browse than goats; however, some breeds are more adapted to forest grazing than others. Like goats, they require significant protection from predators.
- Native ungulates like deer, elk and the currently absent pronghorn antelope evolved to benefit from and perpetuate pyrodiversity with their browsing or grazing habits (reinforced by predator pressure that is now all but extirpated). However, they are only effective on a landscape scale when they exist as large herds that move regularly. Rebuilding those herds, and restoring their landscape-cycle migratory patterns, requires the social and political commitment to set aside and tend (i.e., tolerate fire and predators in) a large area of suitable habitat.

5.1 UNDERSTAND AN AREA'S RIGHTFUL HERBIVORE RETURN INTERVAL (HRI) & RE-ESTABLISH CYCLICAL MIGRATIONS OF HERBIVORES

In many ways, reintroducing grazing on a landscape scale requires commitments and changes similar to reintroducing fire. Like fire, herbivores can't stay in the same place, but need to move around in order to be good for the land. Prior to settlement, herbivores were:

- pushed across the landscape by predators (especially wolves),
- pulled across the landscape by fire (because herbivores strongly prefer and will travel long distances to find recently burned, resprouting areas), and
- not limited in their migrations by roads or fences.

For example, the East Tehama Deer Herd, California's largest deer herd, historically migrated an average of at least 40-50 miles each way between their summer and winter ranges[52], following resprouting forage from relatively recent burns. However, that herd has declined about 80% since the 1960s[53], largely due to fire suppression[54]. To restore the benefits provided by herbivorous herds of this size, it would first be necessary to restore the fires, predator pressure, and freedom of movement they evolved with. If humans are not willing to tolerate pre-settlement levels of predator pressure, then we would need to be willing to assume the the ecological function of predators, i.e., hire full-time human attendants to push the herds around the region.

Immigrant herders who arrived in the 1800s largely replaced the deer, elk and antelope herds with their own cow and sheep herds, in many ways following similar migration patterns (at least at first). It is possible to re-establish one or more large herds that move in a hooplike pattern around the Butte County area, but it may require ongoing funding because it may no longer be economical to operate a migratory herd in a way that respects environmental, labor, and private property expectations in 2025. The Butte County Fire Safe Council is working to establish a cyclical sheep or goat grazing loop around Paradise Ridge in areas too steep or risky to maintain with prescribed fire. Their "Paradise Grazing Management Plan" outlines a 6,086-acre grazing area that would be regrazed every 5 years. With current funding, 1,041 acres can be grazed over 2.5 years. More funding is being sought. It takes $300-$500 to graze an acre with goats in 2021.

5.2 THE MOST IMPORTANT HERBIVORE MIGHT NOT HAVE HOOVES

No discussion of missing herbivores in the Sierras is complete without discussing beavers[55]. Their ecosystem engineering work is so critical, and their numbers so low compared to their historical abundance, that California spends millions of dollars a year building and maintaining "beaver dam analogues" in meadows. "BDAs" are human-built structures, usually made out of willow and other woody materials, intended to restore the historical hydrological function of meadows that have become incised or degraded. (In 2021-22, multiple BDAs are being added to meadows in the Upper Butte Creek watershed and out in Plumas County.) Beavers and their dams:

- can restore meadows from tree encroachment, improving habitat for hundreds of meadow-dependent species
- can help headwaters zones store more water for longer, like a sponge that slowly releases cold water downstream over the course of a summer
- can help meadows and fens store more carbon and be less susceptible to wildfire
- can create refugia for amphibians and other riparian species
- contribute to pyrodiversity (mosaic burns) by creating fire-resistent wetlands scattered across a landscape

CDFW does not issue permits for the relocation of beavers, so people who want beavers on their land are not legally able to match with landowners who want to remove beavers. Instead, those who want

[52] Hill & Figura 2020

[53] Wertz 2001

[54] CDFG 1998

[55] This insight comes from Enterprise Rancheria's Environmental Protection Agency director, Debie Rasmussen.

more beavers on the land just have to try to create good habitat conditions and wait. To many people interviewed for this plan, this seems like a flaw in wildlife management policy in California. If this flaw is fixed in the future or if exceptions can be worked out (e.g., on Tribal trust lands?), deliberate beaver restoration projects would have plenty of proponents and excellent sites already identified in Butte County.

GOALS AND KEY ACTIONS, PART II: HOW WE'LL GET THERE

6. WE'LL TRANSITION FROM PROJECTS TO PROGRAMS

Some forests have a shorter fire return interval and others have a longer fire return interval. But a forest's need for fire (or fire surrogates) never goes away; the forest is never "done burning". Therefore, we are never done working in our forests. Like raising children or operating a farm, forest resilience work is what economists call reproductive labor: work that must be re-done day after day, year after year.

In the past, agencies often thought of fuels reduction work as a series of projects. Each project required its own environmental document[56] under CEQA or NEPA (or both), which could take months or years to complete. When a project was completed, it was often thought of as finished, even though vegetation continued to re-grow. Most land managers keenly recognized the need for post-project maintenance, but it was often very difficult to find the funding or environmental documentation to support maintenance re-entries. Without maintenance, projects disappear from the landscape. Increasing the pace and scale of treatment requires thinking of forest resilience work, not as a series of projects, but as a ***program of work***, with an established and adequately funded schedule of maintenance based on the land's fire return intervals[57].

To successfully implement a ***program of work***, we must design environmental documents that permit us to meet those needs over the long term while complying with local, State, and Federal laws. **Programmatic** environmental documents (i.e., programmatic EIRs) are a preferred choice for doing this. (CEQA does not provide a programmatic MND option.) CAL FIRE's CalVTPEIR and the City of Chico's Vegetative Fuels Management Plan PEIR are existing tools that can be used in the State Responsibility area and inside Chico (respectively) to authorize vegetation management work. Categorical exemptions from CEQA are also extremely valuable tools for low-impact projects. Lead agencies have considerable flexibility in establishing their own categories of exemptions.

6.1 CRAFT PROGRAMMATIC DOCUMENTS THAT ALLOW LANDS TO BE ADDED LATER

A recurring issue with WUI planning is that some landowners always decline to participate in projects at first, preferring to wait and see how it goes on their neighbors' lands. Once they see the work being done next door, they usually change their minds and want to participate. But, by then, it is too late to include them in the project because they did not participate in the initial round of environmental review.

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[56] **"Environmental document"** here means a CEQA or NEPA document. While the term "environmental" makes most people think of animals and plants, both the CEQA and NEPA compliance processes include many other components such as historic preservation rules, interagency consultation requirements, notifications to private property owners and responsible agencies, and required public comment periods. The types of CEQA documents, from least time-consuming to most involved, are: notice of exemption (NOE), negative declaration (ND), mitigated negative declaration (MND) and environmental impact report (EIR). The types of NEPA documents, from least time-consuming to most involved, are: categorical exclusion (CE or CatEx), environmental assessment (EA) or environmental impact statement (EIS).

[57] For an example, see the Butte County Fire Safe Council's *WUI Action Plan Program of Work*.

Landowner hesitancy, and the difficulty of accomodating it under the law, contributes at least as much to project delays as any strictly "environmental" issue does. Programmatic NEPA and CEQA documents should cover periods of at least 40 years and should provide a clear process for adding additional lands later.

6.2 LEAD AGENCIES: FLEX YOUR POWER TO ESTABLISH YOUR OWN CEQA EXEMPTIONS.

CEQA may appear to only offer certain narrow exemptions, but it was designed to be flexible and customizable by individual agencies. As long as they are willing to justify and defend them, agencies have considerable latitude (perhaps more than most realize) in developing their own processes for implementing CEQA. Specifically, CEQA guidelines §15022 states:

> (a) Each public agency shall adopt objectives, criteria, and specific procedures consistent with CEQA and these Guidelines for administering its responsibilities under CEQA, including the orderly evaluation of projects and preparation of environmental documents. The implementing procedures should contain at least provisions for:
>
> (1) Identifying the activities that are exempt from CEQA. These procedures should contain:
>
> (A) Provisions for evaluating a proposed activity to determine if there is no possibility that the activity may have a significant effect on the environment.
>
> (B) A list of projects or permits over which the public agency has only ministerial authority.
>
> (C) A list of specific activities which the public agency has found to be within the categorical exemptions established by these guidelines.

The County of Butte, municipal planning agencies, special districts such as the RCD, and other agencies could take advantage of this flexibility to create ordinances that reduce the environmental review burden for certain types of projects (e.g. prescribed fire, hazard tree removal).

It is worth noting here that if a project qualifies for a notice of exemption (NOE), it is also exempt from AB 52, which is California's main mechanism for ensuring local agencies consult with Tribes. Missed Tribal consultation can cause a lot of problems during and after implementation if cultural resources are damaged that could have easily been avoided with some consultation beforehand. Therefore, as lead agencies develop their own specific procedures under §15022, it's recommended they also develop consistent processes for notifying Tribes and making consultation available even on NOE projects.

6.3 MAINTAIN A COUNTYWIDE/REGIONAL DATABASE PRODUCING A MULTI-DECADE SCHEDULE OF WORK.

Regardless of geographic extent or time horizon, all programs of work are built the same way. The only necessary ingredients are:

1.) A database (preferably linked to a map) listing each project and the year it was completed or will be completed, and

2.) A field in that database showing each project's maintenance interval.

Once those things are established, a schedule of work can be produced running as far into the future as is desired. This is how the maps in Part II were created. Although they are a useful start, Butte County needs a permanent, institutionalized database of resilience projects. This requires a close-to-full-time GIS position to tend and update it.

The Butte County Data Portal, developed by the Sacamento River Watershed Program (SRWP) and 34 North, provided one tool to do this, although it still needs some fixes and it would take more training to train partners to use the unique system. Another alternative would be to create an ArcGIS online map serving the same functions. ArcGIS Online uses the same software used by the Forest Service, BLM, County of Butte, CAL FIRE, City of Chico, etc. (SRWP/34 North's portal utilizes OpenNRM, a different although mostly interoperable software platform.) To see what a functioning online project tracking map looks like on ArcGIS Online, readers can visit the map created by Megan Layhee/CHIPS and partners for the Amador-Calaveras Consensus Group.

To be usable on a day-to-day, year-to-year basis, the portal or other GIS solution would need the following:

- Ongoing funding for a locally hosted support position to continue to solve issues, keep data accurate (including dates for the thousands of projects that do not currently have any implementation year associated with them), and regularly remind partners to contribute data. BCFSC and BCRCD have some funding to support the first year of a part-time position to do this;
- All Federal planning and implementation projects should be viewable in the portal (less than 10% of Federal project units are currently visible in the Portal's master projects layer);
- Wildfire footprints should be integrated into the all-projects master layer, with high-severity patches and low-severity underburns listed as distinct records in the database;
- Each project should have a maintenance date (e.g., 10 years from the completion date) based on the area's rightful fire return interval, as determined by the collaborative. (Land managers can specify an earlier maintenance date if their objectives require it.)
- A strong MOU/agreement that provides ways for organizations to protect and retain ownership of their data, as well as to protect landowner personal identifying information (PII) as is required by some public funding sources.

Any organization (or coalition of government agencies, e.g. BCAG) could theoretically sponsor this position, but the County is in some ways an ideal host site for this position because it already has a sophisticated and accurate GIS data server that is updated almost nightly (so parcel ownership data never goes out of date). County GIS employees have access to confidential data (e.g. assessor's data) and the CAL FIRE Pre-Fire Planner, who works in the same building and shares the same server/data drives. A full-time County resilience planner would be also have access to Public Works GIS data and could track and report resilience data sought by the State (e.g. by the Wildfire and Forest Resilience Task Force), increasing the County's eligibility for continued funding.

It is recognized that the County of Butte may not have capacity to take on this project at this time, so other local partners (BCFSC and BCRCD) have secured some funding to fill the need and will continue to seek more.

6.4 CONTINUE TO LOCALLY REVISE BUTTE'S "RIGHTFUL FIRE RETURN INTERVALS"

Our understanding of how often a given area was burned in the past to stay "resilient" is hazy at best. Statewide data on fire return intervals (e.g., the USFS/R5 FRID data) is general and may not be very accurate for Butte County. For example, a ten-year or thirteen-year FRI for Concow is visibly too long, according to most residents who responded, and several Tribal leaders interviewed for this plan stated that much of the Butte County area should be burned "every year". Although we can and should continue to study our area's fire history, we will probably never fully reconstruct all the lost fire knowledge of Indigenous, or even early settler, residents. And regardless of what the past was like, 21st-century changes in climate and land use will continue to change our fire patterns into the future. To keep up with the amount of fire or fire surrogate treatment the land needs, we should work as a collaborative to continue to set, and re-set, treatment return goals. We should base our successive approximations not only on our memories of what worked well in the past but also on our observations of how contemporary plant and animal communities are responding to fire (or firelessness). Desired treatment return intervals are best stored as simply another GIS layer in a projects tracking map, where they can be edited and updated as needed.

7. WE'LL BUILD UP TRIBES' CAPACITY TO LEAD ON LAND MANAGEMENT

Most of the time, when forest health working groups meet in Butte County, the lands' original stewards are not even in the room. Yet Tribes have unique knowledge, motivation, authority, and institutional potential to lead on land management issues. Most natural resources managers now realize that Native land care techniques were (and remain) far more sophisticated and effective than they were ever given credit for, and hunger for T.E.K. is strong[58]. Local agencies and land managers frequently express dismay that Tribes do not have more capacity to engage in forest health collaboration, and express interest in overcoming the historical and structural barriers to more Indigenous leadership on forestry issues.

People indigenous to Butte County were the targets of a systematic genocide that was explicitly sponsored by the State of California[59]. Today, Tribally held lands (actually, lands held by the U.S. government "in trust" for Tribes) account for less than one-tenth of one percent of the Butte Forests Plan area. Removing Native people from the land had serious consequences for forest health because it went hand in hand with (and probably could not have been accomplished without) the fire suppression that characterized the 20th century and has caused so much damage to California's landscapes. Removing Native cultural fire traditions had serious repercussions for the health of the forest, repercussions the State of California now explicitly acknowledges and will spend billions to try to reverse[60].

It is unpleasant to learn the accurate history of California, but it does provide some perspective on current events. Settlers[61] may never be able to view the land quite like a person of Indigenous descent, but time spent learning the history of the lands we propose to care for is never wasted.

Symbolic acts like land acknowledgements, building more plaques and historical markers, and reinstating Native names on maps don't constitute restitution for past wrongs, but they are valuable tools for education. Developing meaningful land management agreements, employing Tribal individuals or enterprises to implement or monitor programs, and partnering with Tribes on initiatives such as biomass or workforce development go farther in building up Tribal capacity. Tribes will make their own sovereign decisions about how and when they want to engage in land management projects, but everyone else in the resilience community can still play a supporting role in rebuilding Tribal capacity.

What follows are some suggestions for investing in Tribal land management capacity, sourced from many hours of conversations with local Tribal staff and enrolled members. Any mistaken statements are the author's error and will be gladly corrected on request.

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[58] T.E.K. stands for tradional ecological knowledge and refers to Indigenous cultures' detailed knowledge of plants, animals, natural phenomena, and appropriate survival technologies as part of a holistic knowledge or "world view" which parallels the scientific discipline of ecology.

[59] Burnett 1851.

[60] FMTF 2021.

[61] **"Settler"** is a non-pejorative term used to describe any non-Native person who participates in or benefits from the settlement project (e.g., enforceable private property rights, County, State and Federal administrative authority over land use and access, railroads, dams, hydroelectricity, etc.), regardless of whether that person's ancestors actually "settled" California.

7.1 RESPECT TRIBAL TERRITORIES AND KNOW THE MINIMUM ABOUT TRIBAL POLITICS

There are almost 200 organized Tribes with territory in California. (110 are federally recognized, and another 80 or so are currently petitioning to be federally recognized. Being non-federally-recognized does not mean a Tribe is less valid or legitimate than a federally recognized tribe, but it does usually mean it has fewer resources.)

Of these almost 200 Tribes with territory in California, the six with territory in what is now Butte County are: Mechoopda Indian Tribe of Chico Rancheria, Konkow Valley Band of Maidu Indians, Enterprise Rancheria of Maidu Indians of California, Mooretown Rancheria of Maidu Indians of California, Maidu Band of Strawberry Valley Rancheria, and Berry Creek Rancheria of Maidu Indians of California (Tyme Maidu). The Mountain Maidu, whose homeland is centered on what is now Plumas County, also have cultural resources and connections in Butte County. Not all Mountain Maidu individuals (or Native individuals in general) belong to a Tribe; the Maidu Summit Consortium, a nonprofit group, sometimes acts as the collective voice of many Mountain Maidu people although not every Mountain Maidu group has chosen to join the MSC. Even the Washoe Tribe and Susanville Rancheria, which might seem geographically remote from Butte County, have members with ancestral and cultural ties to the area, which is why the Feather River Ranger District always contacts these tribes during the Section 106 tribal consultation process, even for Butte County projects. Many non-Native people may not realize that each Native individual can only be enrolled in a single Tribe (by U.S. law), even though they may have relatives and ancestors in multiple Tribes.

Butte County is a big place. Just because a Tribe is native to what is now called Butte County, that does not mean it has traditional territory in the particular project area you are discussing at any given time. Agencies and NGOs tend to see all tribes as having equal right to influence any project, an assumption reinforced by NAHC and NHPA[62] rules that require agencies to contact a fixed and long list of Tribes for any project in a large administrative area. However, Tribes do not necessarily see it this way.

When an agency needs Tribal assistance with monitoring or project implementation, it's usually much more convenient to contract with a single Tribe even though multiple Tribes may have members with a claim on the area. The contracting agency will usually not intend (or be aware of) any disrespect toward other Tribes, yet it can feel extremely violating to a Tribal member to see sensitive monitoring work done in their territory exclusively by a different Tribe. Non-Tribal agencies and NGOs can't resolve every conflict between Tribes, and should not try, but they can at least make an extra effort to make sure every Tribe has the opportunity to access contracts and consultations that affect its territory.

Often referenced in this context are maps depicting Tribal territories, such as the NAHC's Digital Atlas of California Native Americans. While valuable education tools, none of these maps have been reviewed and accepted by every Tribe they depict (and they carry disclaimers to this effect). They are no substitute for the government-to-government consultation processes required by CEQA and NEPA/NHPA.

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[62] **NAHC** = Native American Heritage Commission, the State of California entity that maintains maps of each Tribe's "area of traditional and cultural affiliation" and tells lead agencies which Tribes they must contact in order to comply with AB 52, i.e. during the CEQA process. **NHPA** = the National Historic Preservation Act, whose Section 106 spells out the Tribal consultation requirements that need to be followed on Federal projects, i.e. concurrent with the NEPA process.

Even though agencies always have to offer consultation to any tribe on the NAHC list, it's okay to develop a particularly close working relationship with one Tribe that has a lot of cultural resources on land where you work. Agencies could find it simplest in the long run to sit down and develop an agreement or MOU that spells out what resources and rights the Tribe considers most important and how to best protect them during forest management activities. This will help ensure the agency-Tribe relationship does not break down in case of turnover or budget cuts.

The suggestions above came from members of the Mechoopda Tribe, Konkow Valley Band of Maidu Indians, and Tyme Maidu/Berry Creek Rancheria.

7.2 IMPROVE TRIBAL CONSULTATION AS IT IS PRACTICED UNDER CEQA/NEPA

It is possible to meet the letter of CEQA and still leave Tribes uninformed about projects. However, early and meaningful Tribal consultation can be helpful for all parties because:

- Tribes are in an ideal position to give feedback on what species should be integrated into restoration palettes to increase Tribal access to plant resources as well as maximize overall watershed resilience
- Early and meaningful consultation reduces the risk of legal challenges and having a project stopped at the eleventh hour
- Funders, especially State funders, are increasingly concerned about grantees' relationships with Tribes and increasingly check to make sure grantees are meeting the spirit of CEQA as well as the letter

To improve communication with Tribes, the following steps are suggested:

- Consult with Tribes even when not required under CEQA (i.e., when using NOEs, Notices of Exemption). Agencies can do a lot of meaningful work under an NOE nowadays, and an NOE does not require Tribal consultation under AB 52. However, technically an NOE should not be used if there is a chance of a significant impact to a Tribal cultural resource, and there is no sure way to know if this chance exists …except by engaging in Tribal conultation. Remember, Tribes may maintain inventories of cultural resources that no other agency can access directly, not even the State or the NEIC. *This advice was offered by the Konkow Valley Band of Maidu Indians*
- Rather than inform Tribes about a project late in the process, include Tribes from the very beginning (i.e. during scoping or even before), and allow them to decide what their level of involvement will be. Make an extra effort to get a response from someone at the Tribe. (For example, if you don't get a response from the THPO, ask around and see if there is an environmental coordinator or a Council member who deals with environmental issues you can talk to.) Some Tribes prefer to have their THPO, who is responsible for protecting Tribal artifacts, also deal with natural resources issues (i.e., living cultural resources). Other Tribes are choosing to build two separate consultation tracks, one for artifacts and one for living resources. A Tribe's consultation workflow might have changed since the last time you worked with them, so be flexible and allow plenty of time. *This advice was offered by Mechoopda, Berry Creek, and Nomlaki staff or tribal members*
- **Be persistent:** Even if you never get a response, don't interpret it as rejection and don't let it deter you from asking again on the next project. Although the Tribe simply may not have the capacity

to participate in planning or implementation on the first project you contact them about, that doesn't mean they won't be able to participate on the next one or the one after that – and the only way to find out is to ask them. *This advice was offered by Mechoopda, Berry Creek, and Nomlaki staff or tribal members*

- Consider creating a "Tribal Forestry Contract"-style MOU with each Tribe that has territory your agency works in. Such an MOU would spell out how and when the Tribe likes to be contacted; this would avoid confusion and anxiety for agency partners. These MOUs could even list some programmatic best management practices agencies could follow to stay on the right side of Tribal guidelines. This pre-planning would substantially reduce uncertainty for agencies and ultimately allow for faster project planning. *This suggestion was offfered by Mechoopda staff/tribal members.* However, this wouldn't change an agency's ongoing legal responsibility to notify every Tribe on the NAHC/NHPA contact list for the project area.
- If using contractors for environmental review or implementation, build early Tribal consultation into their scope of work and/or provide financial incentives to meet an elevated standard of tribal consultation. *This suggestion was offfered by Mechoopda staff/tribal members*
- Offer to set up regular meetings with Tribal representatives where you just get together and discuss things you are working on and identify areas of collaboration. If the Tribe has no time for this or doesn't get back to you, there's no reason you can't offer again after a few months. *This suggestion was offfered by Mechoopda staff*

7.3 HELP INVEST IN TRIBAL WORKFORCE DEVELOPMENT

It is difficult for any agency to build up a restoration workforce. Requirements such as high workers' comp costs or reimbursement-only contracts hit small Tribes especially hard. As grant writers, forest health organizations can commit to writing some funding for Tribes into each project. Each Tribe with territory in the project area should be approached with this opportunity, and asked whether and how they would like to be written in. The only way to find out a Tribe's forest health contracting goals is to ask, and to ask repeatedly.

Tribal contracts on a forest health project could range from a $5,000 contract to monitor a small cultural site, to a $50,000 agreement to develop a TEK-based firewise landscaping outreach program, to a $500,000 implementation contract, and beyond. Even small contracts can still be very helpful if they allow a Tribe to plan ahead and develop skills and workforce capacities it did not have before. Keep in mind that a Tribal enterprise may or may not actually be hosted by the Tribal government; for example, as of this writing the Mechoopda forest health crew can't be employed through Tribal government but rather uses experienced forest health contractor CHIPS (Calaveras Healthy Impact Product Solutions) as its fiscal sponsor.

If you are a land manager, consider exploring goods for services contracts in which the Tribe can remove materials (i.e. seeds it can use or sell) in exchange for doing forest health work/ land-tending.

Tribal workforce development can happen inside the Tribe or inside your organization. The CSU, Chico Ecological Reserves, which operates in Mechoopda territory, chose to hire a Mechoopda tribal member to serve as a cultural steward and Tribal liaison. This model could be replicated by other land managers.

Fire suppression and suppression repair are particularly important times to engage with Tribes. During a large wildfire, thousands of miles of dozer line may be constructed, creating thousands of acres of ground disturbance. Much dozer action will be along ridges and meadows because those are good places to stop fires, but that is also where many of the most important Native cultural resources are. During wildfires and suppression repair, communities get an unprecedented chance to reshape the landscape in potentially negative or positive ways. Many Tribes have said they want to be consulted much more intensively during suppression and the repair phase. Through mutual aid structures such as ISWI (Intertribal Stewardship Workforce Initiative), even small Tribes can gain the capacity to access post-suppression contracts (e.g. hazard tree removal, suppression repair) in their territories.

7.4 USE MORE NATIVE NAMES

When encouraged to do so by Native individuals and Tribes, settler individuals and agencies can use Native names for Butte County plants and places. This exercise may seem symbolic and it is, since words are symbols. Among other things, the symbols we call words encode information about who holds the authority to name the elements of our physical world.

As an example of using Native names, anyone in Butte County can say **c'awk'awi** (say Chuck-AH-wee) for *Quercus douglasii* or blue oak; **munmuni** (moon-MOON-ee) for *Artemisia douglasii*[63] or mugwort; and **To:ni** (prounounced just like the name Tony) for gray pine a.k.a. *Pinus sabiniana*.

Place names, too, can change over time. The modern name "Jarbo Gap" apparently recalls a local settler named Benjamin A. Jarboe[64], not the Walter Jarboe who claimed responsibility for killing almost 300 Native men, women and children in Mendocino County in 1859[65]. Even so, the name could be considered insensitive at best, and the landscape feature has a much longer history as **Helim My'num Py'lum** (say hell-em moon-oom pool-um). In Konkow Maidu, this means "strong winds gap".

These suggestions come from enrolled members of the Mechoopda Tribe and of the Konkow Valley Band of Maidu.

[63] Both these species names honor the same man, the Scottish-born David Douglas who was the first botanist to describe certain Western plants in English.

[64] Oroville Daily Mercury 1916

[65] Jarboe 1860.

8. WE'LL DEVELOP BIOMASS CAPACITY

Compared to regions that can send low-diameter woody thinned materials to biomass facilities, Butte County is at a competitive disadvantage. Without the partial subsidy provided by biomass facilities, forest thinning here can easily cost $3,000-$4,000 an acre (as of 2021) or more. Moreover, without the option to dispose of woody material by sending it to a biomass facility, foresters have the choice to either leave it on the ground (which does not really reduce fuels, only rearranges them) or burn it in the woods (which usually results in higher total emissions than burning it in a biomass facility).

The presence of a biomass plant has a track record of promoting landscape-scale resilience in the southern Cascades. For example,

> A large co-generation power plant in Westwood provided a market for wood chips from the mid 1980s until the early 2000s. Clean-energy subsidies during this time period made it economical to thin the forests out to a radius of about 50 miles from the plant, and the plant burned up to 270 tons of biomass a day. Having a biomass plant in the region resulted in lasting wildfire resiliency benefits – most of the private lands in the flatter areas around Westwood have maintained canopy closure levels which have kept the relative hazard of major crown fires low. Since the closure of the Westwood biomass plant, private landowners in the region have continued to use mechanical thinning to remove understory biomass from the flatter areas of the forests, but the pace of these operations has declined without the subsidies in place.[66]

However, even long-established biomass facilities still rely on direct or indirect subsidies to economically accept and process forestry thinnings, which are the most expensive type of potential biomass feedstock to harvest, ship and process[67]. A huge array of resources for understanding the various types of biomass utilization options (including both wood-to-energy and innovative wood products manufacturing) is maintained here.

8.1. BUILD LARGE BIOMASS FACILITIES (THREE ARE IN THE PLANNING PHASES)

Since 2018, Butte County Fire Safe Council has been working to bring a large biomass facility to Butte County. BCFSC is working simultaneously on developing two potential biomass facilities. One facility (SGH2) would be based south of Chico (on one of three 10-20 acres sites that have been identified near the Neal Rd landfill) and would utilize a plasma gasification technology to produce liquid hydrogen that would then be shipped to the Bay Area to be sold as a transportation fuel. A plant using this same technology is currently being built in Lancaster, CA. This facility's developers have some financial backing but continue to seek supplemental funding through grants; its estimated total cost is $130M and its processing capacity at maturity would be 42,000 BDT (bone-dry tons) of biomass per year.

The second potential biomass facility (Yosemite Clean) is being contemplated for a 30-acre site in south Oroville. It would be a new build, not a retrofit of any existing mill site. It would utilize a

[66] Excerpt is from Deer Creek Resources 2021.

[67] Morris 2000.

gasification technology to produce both natural gas and hydrogen. This facility's developers have not yet secured financial backing for their endeavor and are actively seeking grants as well. This facility's estimated total cost is $180M and its processing capacity at maturity would be 105,000 BDT/year.

Currently, vegetation management projects or need in the catchment area of the two proposed plants is at 700,000 BDT/year. If everything goes perfectly, the Chico facility could be online in 2024[68]. There are about 15 BDT in a truckload of green material, so divide BDT by 15 to get the number of truck trips to each facility.

A neighboring initiative, the Camptonville Community Partnership, is based just over the Butte County line in Yuba County near New Bullards Bar Dam Reservoir. It is seeking to develop a 5MW biomass-to-energy facility with a co-located innovative wood products business campus, or "Forest Biomass Business Center".

8.2 SMALLER, DECENTRALIZED BIOMASS SOLUTIONS CAN BE PURSUED SIMULTANEOUSLY

After the Camp Fire, many collaborators and community members expressed a desire for smaller, possibly even mobile biomass solutions that could support small community grids. Rather than replace the need for rural communities to be tied to the PG&E distribution grid (as satisfying as that would be), these community-scale biomass units would more likely be grid-tied and capable of moving from community to community as soon as forests are thinned out within a certain radius. A mobile facility might move once every 18-36 months. Similar to a herd of grazers, mobile crews of biomass harvesters would be working in and around one community for a season or two, then move on to the next. University of California Ag and Natural Resources Extension (UCANR) maintains a helpful "Modular/Mobile Wood Processing Technologies" list. This allows communities to compare the relative capacities, costs, and tradeoffs associated with each option.

[68] BCFSC 2021.

9. WE'LL BECOME EXPERTS AT CROSS-BOUNDARY PROJECTS

Wildlife, water, and fire don't respect jurisdictional boundaries, but we live in a world where stepping across an imaginary, invisible line can have life-changing consequences. Cross-boundary projects are still much rarer than cross-boundary floods or wildfires. However, it's not because people don't want to work together. Rather, it's usually because all the agencies involved -- CAL FIRE, USFS, BLM, SPI, consultants, Tribes, local districts -- all have different frameworks, timelines, and assumptions. All protect resources in slightly different ways and don't always know how to read (much less write) one another's documents. This, along with agencies severely understaffed in resource specialists and contracting staff, is a main cause of the "planning bottleneck".

Even so, State agencies are urging partners to treat more cross-boundary acres each year, and Federal agencies are urging staff to continually do more with less (i.e., work more with partners and neighbors to get work done). As projects get bigger while also involving more partners, more of us will need to become "multilingual" in the languages of multiple agencies.

9.1 GROW A SHARED STEWARDSHIP WORKFORCE

Large agencies have big budgets and big responsibilities, but they don't always have big staffs to dedicate to collaboration. Therefore, it's up to California's ragtag army of "partners" (RCDs, Fire Safe Councils, Tribal crews, watershed centers, etc) to train and retain more conservation professsionals who are fluent in the languages of multiple agencies. Footsoldiers in the shared stewardship army need familiarity with the Forest Practice Rules, private-lands burn permit policy, NEPA and NHPA, CEQA and AB 52, and the various programmatic agreements different agencies hold with the big regulators such as the Water Boards and USFWS. To build this workforce, partners can:

- Sign up for free webinars and calls provided by the Forest Service' Region 5's Shared Stewardship program. These calls can often help demystify the many different agreements it's possible to develop with the Forest Service.
- Likewise, take advantage of webinars offered on CalVTPEIR and other streamlined permitting solutions.
- Consider becoming a host site for AmeriCorps-style volunteers like Grizzly Corps, Sierra Corps, or Civic Spark. These programs share the cost of hiring a young professional who could take on a shared stewardship project and can become your agency's expert on other agencies! Some groups, such as the Sierra Institute in 2021, have even written workforce development grants to effectively create their own subsidized shared stewardship workforce.
- Continue to identify staffing bottlenecks and elevate the concerns to State and Federal decisionmakers who can do something about them. For example, preliminary research into restoration bottlenecks in the Tahoe-Central Sierra area found that "innovative financing, state grant funding, and new partnerships and collaborations can support increased pace and scale, but need to be accompanied by rebuilding public agency capacity; specifically: reversing downward trend in USFS staffing, esp. at district level."[69]

[69] Nelson et al 2021.

When discussing this topic, several collaborators have observed that during a wildfire or flood (when, of course, many regulations suddenly evaporate), everyone seems to find their places and work in a well-managed team. Can cross-boundary projects one day be managed with the same efficiency?

10. WE'LL CREATE A RURAL CULTURE THAT'S FIRE-POSITIVE

For a century, our rural cultures have been oriented around avoiding and suppressing fire. Now, we need to rebuild many of the same skills we just lost – including traditions of deliberate fire-lighting associated with ranching, logging, and Indigenous practice.

10.1 ADVOCATE FOR SUSTAINED BASELINE FUNDING (CAPACITY GAPS LIST)

We can't change our culture without boots on the ground to educate, lay out burn and thinning units, and do the work. All resilience organizations in Butte County face serious capacity challenges. Since the Camp Fire, many resilience organizations have been able to scale up dramatically using one-time grant funding. However, while much has been accomplished with this infusion of funding, even more would have been accomplished without the following constraints:

- Most grants require matching funds, which must be constantly tracked and kept audit-ready, especially if the match is in-kind, such as volunteer hours (which is often the only way low-income, rural grassroots organizations can show match).
- Grants usually only last for 1 to 3 years, forcing us to spend time constantly applying for more grants, re-describing our communities and projects over and over again in slightly different terms to meet the slightly different formats of different grantors. This erases momentum and takes time away from doing our work.
- The "grant treadmill" means that jobs in the resilience sector are more uncertain than in the private sector or federal agencies. People looking for long-term job security will readily leave grant-funded organizations for permanently funded jobs. Therefore, resilience organizations constantly lose staff through turnover.
- Grants seldom fund research or monitoring, missing opportunities for integrating on-the-ground resilience work with much-needed understanding of foothill forests' unique fire dynamics, climate change dynamics, and hydrological processes. The low-elevation and foothill areas of the Sierras are much less well-studied than prime timber elevations, yet it is in the low-elevation forests that most Sierra Nevada residents live.
- More grants are available for implementation than planning, so areas that have not already completed large-scale CEQA-NEPA are at a severe disadvantage when applying for funding. Areas that experience frequent devastating wildfires are less likely to have been able to focus on developing these documents in advance. Moreover, if CEQA/NEPA is successfully developed for a project area "in the green," and it burns, most of that planning work has been wasted.
- Many of the counties with the most severe and recurring wildfire problems, such as Butte, are chronically underfunded because they lose significant tax revenue to wildfires yet also lack the very large Federal acreages that could fund resilience positions using e.g. Secure Rural Schools Act funds. The local government known as the County of Butte has hundreds of unfilled positions.

To remedy these capacity challenges, the following fixes have been proposed by Butte County collaborators:

1. Whenever possible, funders should stop requiring match, particularly cash match[70].

[70] RVCC 2021.

2. Funders should design longer-term, block-style grants that fund entire programs of work. State and federal budgetary processes should be revised to facilitate this. These ten-year funding allocations should be usable for not just implementation but also planning/environmental review and research, based on local need.
3. More funding should be directed toward the development of programmatic environmental documents that authorize one suite of resilience actions if a project area remains green *and a different suite of actions* if it burns (e.g., conditions-based NEPA). Local RCDs, Fire Safe Councils, and especially Tribes have a key role to play in developing these documents. The State and Forest Service should provide comprehensive technical assistance to community-based organizations struggling to streamline CEQA and NEPA for their needs. For example, the Shared Stewardship program could be scaled up dramatically, and the popular Sierra Corps program that sends young environmental professionals to work cheaply for forest collaboratives could be expanded.
4. **Capacity gap: Baseline Funding** The State should allocate baseline funding for every Resource Conservation District, Fire Safe Council, and Tribe in California. At a minimum, baseline funding should support one or two staff positions focused on accomplishing the deliverables of a relevant State plan, such as the 2021 Wildfire and Forest Resilience Action Plan. By placing even a single multibillion-dollar utility company wildfire settlement in an endowment instead of spending it, the State could easily provide this baseline funding using the interest, thereby creating thousands of steady jobs in the resilience sector in perpetuity.
5. **Capacity gap: County-level Resilience Officer** Every WUI county should have at least one state-funded resilience officer who focuses exclusively on tracking progress toward the deliverables of the county's forest health plan. This tracking should be spatially explicit and constantly updated, so this role should have a strong geospatial component. Counties are ideal entities to host this type of geospatial resilience tracker because they have the most up-to-date data regarding parcel ownership, wells, nuisance/weed abatement, and easements. Butte County has a data portal for tracking forest health treatments, but it needs to be regularly updated with real-world information so it can stay useful. Alternatively, it could be replaced by an ArcGIS Online-based solution. (This is the same item as key action 6.3.)
6. **Capacity gap: Field Coordinators** Each foothill community should also have its own fire adapation coordinator. This person would live in the community, be employed by an organization like the Fire Safe Council (or possibly joint-funded by a mix of organizations), and would mentor residents on making their homes more fire-safe, maintaining FireWise Community status, applying prescribed fire and thinning treatments to their land, developing forestry skills at all ages, and applying for incentives funding when it is available. This individual could also project-manage grant-funded projects in the community, like evacuation route thinning projects.
7. **Capacity gap: Other Permanent Positions Needed At Build-Out** To scale up our area's program of work to our target of 58,000 acres per year, in addition to the above we also estimate we need the following positions filled:
    - At least one additional 10-20 person red-carded dedicated Rx burn and burn prep crew. Funding source could be State or federal
    - Each IDT seat needs to be filled at each Ranger District (this includes a District Planner for each District). Funding source would normally be federal but State may wish to find a way to supplement Federal hiring in Region 5
    - At least three full-time NRCS conservation planners at all times (current staffing levels fluctuate). Funding source would normally be federal but State may wish to find a way to supplement Federal hiring in California

- At least 16 forestry and fire project managers across BCCER, BCFSC, and BCRCD (current staffing levels = about 8) and most or all should be able to do cross-boundary projects across federal and private lands. Funding would be grant- or block grant-based, a mix of State, Federal, and possibly private funds.
- Additional CDFW biologist in Region 2 (North Central Region) would be very helpful in increasing pace of permitting. Funding source: State
- Biomass harvesting crew. Funding source: Revenue from future biomass plant, possibly supplemented by grants.

Fortunately, the State seems to be on the same page and statewide leaders have publicly said they would like to see many of these changes made. Match is already much less emphasized in State grants (although it remains dispiritingly important in Federal grants and agreements) and the Regional Forest and Fire Capacity Program (RFFCP) is being scaled up dramatically. Butte County RCD, in partnership with the Fire Safe Council, the Northern California Regional Land Trust, and three Tribes, has been recommended for funding for a capacity-building proposal (funding expected Jan 2022) for the early-action round of new RFFCP funding through the Sierra Nevada Conservancy. A proposal for staff to fill the County-scale resilience officer position, as described above, was partially funded through this proposal. The staff would be hosted at BCFSC/BCRCD. BCFSC also was awarded a two-year "County Coordinator" grant from the California Fire Safe Council.

10.2 GET VULNERABLE COMMUNITIES AND INDIVIDUALS "SMOKE READY"

Far more people die from wildfire smoke-related causes each year than from wildfires themselves[71]. If we do the work we plan to do, Butte County residents will inhale less smoke in future years than they did in 2018 or 2020. However, light intermittent smoke will become a part of daily life, and smoke can be hazardous to public health even in small concentrations[72]. Communities and residents can consult the EPA's "Smoke Ready Toolbox" for steps they can take to make themselves more smoke-ready *before* a wildfire or large prescribed fire happens. To minimize the negative human health impacts of giving the land the amount of fire it needs:

1. County and other organizations can pursue programs to give away free air purifiers to vulnerable individuals. Those who accept the free purifiers should be asked to install an app on their phone that tracks air quality and notifies them when to turn on the purifier – and when to change the filter. Forest health organizations or land managers that assist in securing the funds or distributing the air purifiers can be considered to have performed smoke mitigation activities. In exchange, perhaps they could get air quality allowances that make it possible for them to burn on marginal burn days.
2. Clean-air shelters should be set up for the unhoused, and cooling shelters should be required to integrate air purification too (not merely provide shade).
3. Air purification is part of disaster readiness. Just like having a go bag for evacuations or a supply of fresh water in case the well pump breaks, residents should be encouraged to keep backup high

[71] Matz *et al.* 2020, Ye *et al.* 2021

[72] Kiser *et al.* 2021

efficiency filters, a portable air filtration unit that can filter air in a bedroom, or even simply a DIY box fan filter made by duct-taping a furnace filter to a box fan.

4. Notification of planned smoke events could always be even better, and can focus on reinforcing messages about how people can improve the bubble of air quality immediately around them (avoid creating more indoor smoke, avoid drawing in outside air during a smoke event, make homemade box fan filters and aim them the optimal way, research your home's HVAC system to find out if there's a place to install an extra MERV-13 filter, etc). "Smoke hacks" like using an attached garage as an airlock or running a borrowed PM 2.5 filter along your window and door jambs to detect where smoke is seeping in[73] could be the topic of boosted posts and ads.
5. Everyone in California can download the California Smoke Spotter App. Created by CARB and available for Apple or Android, it notifies you when there's a prescribed fire in your area and what the smoke impacts are likely to be, so you can plan your day.
6. The network of sensors / monitors can continue to be improved so people can learn what the air quality conditions are near them in real-time and are able to react accordingly. PurpleAir is a popular network that could be dramatically expanded (especially into rural and canyon areas).
7. Air pollution control districts can consider removing anonymity from smoke complaints. This would allow burners to follow-up by contacting the neighbors who had concerns or were negatively impacted, and work with them to find solutions. The whole community knows the location and identity of the people who lit the fire, so why should it not be able to know the precise location where the smoke caused issues?

10.3 BUILD COMMUNITY-BASED BURN CAPACITY

For over a hundred years, fire in California has been the responsibility of a relatively small cadre of professionals. CAL FIRE and the Forest Service have been made responsible for lighting virtually all the fire required on California's 33,000,000 acres, while non-professionals have gradually lost the knowledge (and in many cases, functionally lost the ability) to care for the land with fire. Despite the skill and work ethic of California's fire professionals, professionals have fallen far short of delivering the needed amount of fire, because we asked them to take on a job that is simply too big for professionals alone to accomplish.

California and the USDA have set a goal of treating 1,000,000 acres of Californian forests per year by 2025, half on private lands and half on federal lands[74]. This target will be impossible to reach unless most of the acres are treated with prescribed fire. Over the last 35 years, statewide, CAL FIRE has been able to deliver about 14,600 acres of prescribed fire on private lands on average[75]. The Forest Service in California, for the last 16 years of good records, has burned about 24,600 acres per year[76].

The only way for California to reach its prescribed fire treatment goals is to add back in the way prescribed fire had always been implemented until the 20th century: ordinary people practicing fire skills passed on by their parents and neighbors. Rather than waiting helplessly for fire to happen to them, communities can and should take fire into their own hands and put good fire on the ground at the time and

[73] These "smoke hacks" come from Lerch 2021.

[74] USDA-State of California, 2020.

[75] CAL FIRE data is from 1982-2017. Scanlon and Quinn-Davidson, 2019.

[76] Forest Service data is for 2003-2019 and includes pile burning. FRAP 2019.

place it will do the most good. The psychological and quality-of-life benefits of taking control of fire are as profound as the public safety benefits. Moreover, if everyday community members are able to take responsibility for low-complexity maintenance burning around town, then professionals can focus on the technical, challenging burns that actually do require their elite skills.

To build community-based burn capacity, we will:

1. Continue to invest in the Butte Prescribed Burn Association (Butte PBA, currently a program of the Butte County Resource Conservation District) to build home-scale fire skills in ordinary people, provide neighbor-to-neighbor burn day support, and give technical assistence to landowners who have questions about when, where, whether, and how to care for their land with fire. Private, non-industrial landowners control at least 19% pof the forestland in California, and fully 48% of the forestland in Butte County, so their contributions are far from negligible, even if they start small.
2. Through MOUs and partnerships, other organizations can team up with those that are already putting fire on the ground. An example of this is that the Butte County Fire Safe Council started a "Rx Fire Committee" to collaborate with burners at BCCER and the PBA. This collaboration helps BCFSC-funded fuels reduction acres eventually get effective maintenance (through fire) and provides a mechanism for tracking all-lands progress under the WUI Program of Work.
3. Right now, most prescribed fire crews are actually also firefighting crews. This means prescribed fire is constantly competing with suppression for boots and dollars, and suppression always wins. Butte County (and all wildland counties) should have dedicated crews that only do prescribed fire. They could be trained on locally important cultural and ecological objectives. Instead of spending the summer deploying to suppress wildfire, they would spend it either traveling to implement prescribed fire in neighboring counties, or prepping prescribed fire units in their home county. If the State will not allocate funding for more of these desperately needed dedicated crews, local resilience organizations should pool their resources and fund them themselves. The Big Chico Creek Ecological Reserve land stewardship crew has potential to evolve into this type of crew.
4. CAL FIRE can continue to support community burners, including letting them lead when appropriate. While landowners are usually very grateful for CAL FIRE backup at their burns, communities' burn capacity won't expand much if we keep insisting CAL FIRE shows up to every burn that happens. At some point, landowners need to have the skills and the autonomy to burn on their own. However, many Butte County residents do not even realize they have the right to burn their property, much less that CAL FIRE actually wants them to do so. As a start, CAL FIRE BTU could more frequently give local volunteer fire departments the autonomy to take an engine out to support a PBA burn or independent landowner burn. Communities could also raise funds to purchase dedicated community burn Type 6 engines. A CAL FIRE staff education program would also be helpful so that all staff in BTU have the same understanding of burn permitting.
5. Landowners would benefit from an easy-to-read website that clearly states which permit CAL FIRE requires for which type of burn (perhaps using a flow chart or graphics). The website could have pictures or even a fillable template of each permit. This does not currently exist. However, CAL FIRE recently re-announced that an online burn permitting system is coming soon.
6. Currently, State law around burn permitting is enforced differently by different CAL FIRE units. Burners in many other counties (e.g., Lassen, Modoc, Humboldt, El Dorado) conduct broadcast burns

in the winter with no CAL FIRE permit at all, which is fully consistent with state law[77]. In Butte County, however, landowners are consistently told that a CAL FIRE burn permit is required 365 days a year. Taking the time to obtain a CAL FIRE permit has advantages as well as disadvantages. Units such as BTU that have more stringent requirements than the statewide standard may want to periodically review their policies to make sure they are not having an undesired chilling effect on landowner burning.

10.4 WORK WITH INSURERS AND THE STATE ON FINANCIAL INCENTIVES FOR FIREWISE CHOICES, INCLUDING LIABILITY REFORM

Virtually every WUI community and home in Butte County is at risk from wildfire; 3 communities in the area (Berry Creek, Tobin, and Robinson Mill) rank in the top 12 communities statewide for risk to potential structures[78]. Home hardening saves property and lives. Every home hardened also makes more acres of prescribed fire possible, because it reduces risk. (If a prescribed fire can burn across a neighbor's property without actually destroying any homes, liability for prescribed fire would be a much smaller hurdle than it is today). During development of this plan, several partners observed that even with low-cost or no-cost programs available to retrofit homes and develop defensible space, many homeowners don't participate.

Better financial incentives could increase particpation. For example, one Tribal member suggested a points-based system where residents could earn credits, from their insurer or the State, by improving their landscaping or forest health choices (including by hiring a Tribal crew to do the work). Since the credits could only be used for further home improvements, the landowner would have an incentive to keep up the momentum of forest work. A local nonprofit land manager suggested the State pay private landowners a fixed fee, like $1000 per acre, for both initial treatments and maintenance fire. Initial treatments cost a lot more than $1000 per acre, so the State would save money upfront; but maintenance fire costs much less, so landowners would have incentive to continue to invest in the equipment and skills to become proficient fire practitioners, recoup their initial investment, and keep their communities safer from wildfire at the same time.

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[77] Source: York *et al*. 2020b, Nick Goulette pers. comm., and California Public Resources Code §4423, which states: "A person shall not burn any brush, stumps, logs, fallen timber, fallows, slash, grass-covered land, brush-covered land, forest-covered land, or other flammable material, in any state responsibility area, area receiving fire protection by the department by contract, or upon federal lands administered by the United States Department of Agriculture or Department of the Interior, unless the person has a written permit from the department or its duly authorized representative or the authorized federal officer on federal lands administered by the United States Department of Agriculture or of the Interior and in strict accordance with the terms of the permit:

(a) At any time in Zone A.

(b) At any time in Zone B between May 1st and the date the director declares, by proclamation, that the hazardous fire conditions have abated for that year, or at any other time in Zone B during any year when the director has declared, by proclamation, that unusual fire hazard conditions exist in the area." Butte County is in Zone B (PRC §§ 4413-4).

[78] Pyrologix 2021

In fall 2021, the Town of Paradise is seeking a grant to develop a "Resiliency Plan and Community-Based Insurance Program Model" which would function as a type of self-insurance for the Paradise community. This could provide residents with alternatives to unattainably high private insurance premiums.

10.5 FOSTER A CULTURE OF VOLUNTEERISM THROUGH MENTORSHIP

With every wave of retirements, much important professional fire knowledge is lost from the community. A resilience organization could sponsor a "breakfast club" to connect knowledgeable retirees (mentors) with community members working in forest resilience as volunteers or new staffers just beginning their careers. Such a program would be particularly valuable in making newly arrived Americorps/Sierra Corps/Civic Spark members feel at home and teaching them the local context they need to succeed in their roles.

CONCLUSION: "IF YOU WANT RESILIENCE, PREPARE FOR RESILIENCE"

Almost no Californian alive today has seen, much less lived in, a forest that's in alignment with its rightful fire return interval. Therefore, as we navigate our way back toward forest health, there might be surprising challenges along the way. Skies could be smoky for more days of the year, and streams could flood more often due to higher post-fire water yield and sediment pulses. More work or expense might be expected of WUI homeowners, potentially putting rural living out of reach for some. The privacy offered by overgrown forests will be lost. Climate change will also be happening at the same time and could exacerbate the problems we expect and create ones we don't.

Most anyone would choose peace over war. However, the saying, "If you want peace, prepare for peace" challenges us to reflect that a world without war might not be easy or relaxing. On the contrary, achieving and maintaining it could require an incredible amount of preparation and sacrifice. Similarly, living without the war we wage each year on catastrophic wildfire will not be easy or relaxing either, but we think it will be worth it to have forged our peace with fire.

PROGRAM OF WORK, PART I: PACE AND SCALE

What is the actual pace and scale of work we would need to do to restore and maintain our forests and woodlands at healthy density? Based on the fire return assuumptions that inform this and the WUI Action Plan, we would figure about 58,000 acres within the Butte forested watersheds areas need to burn or be treated annually. If the fire return assumptions are actually too conservative, as several people have contended, or if major disturbances like the North Complex or climate change turn out to accelerate the pace we need to work at, then a lot more acres would need to be treated each year. (This Plan is designed to be updated. If we decided to re-treat every acre every ten years, we would be treating (or allowing to burn) 91,500 acres per year.)

To help partners visualize and track work done on the ground, we would need to pull together project perimeters from CalMAPPER, FACTS, Sierra Pacific Industries, and every other local land management agency and organization. This data was pulled together in the Butte County Data Portal but had serious gaps (for example, most Federal projects were missing and most projects are not labeled as to what year they were done or will be done). Fully updating and regularly maintining such a map is a key capacity need.

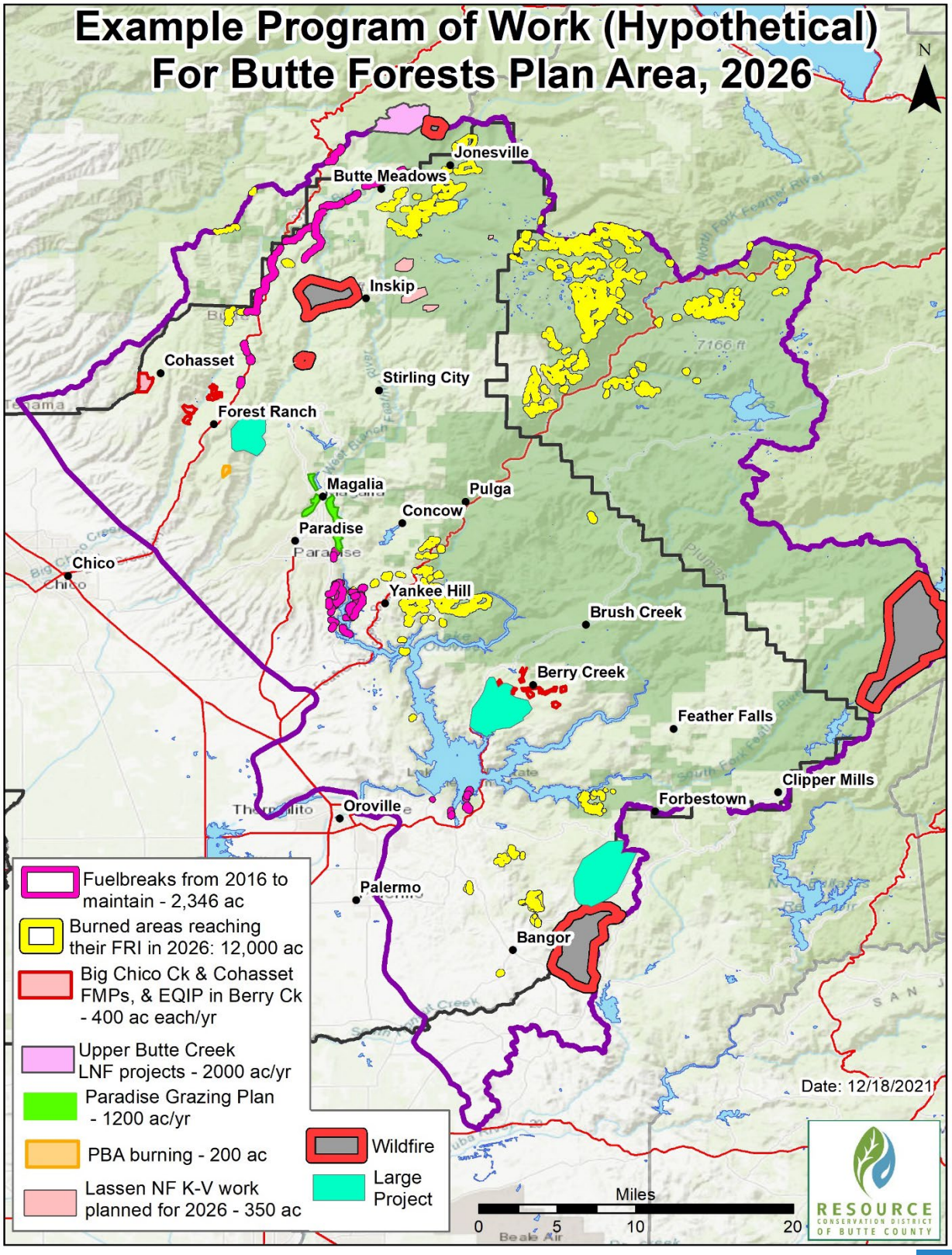
When that is done, then every project (or fire footprint) will be assigned an implementation year. (Projects that aren't complete yet will be assigned a planned completion year. Completed projects will be assigned a maintenance interval, so they will show up as maintenance projects every *n*th year.) Then it will be possible to select a future year and see all the maintenance and new work that is planned or needed for that year, along with whether permits and access agreements are still valid or need to be updated. As of spring 2022, the Butte County RCD and Fire Safe Council are working with the California Fire Safe Council to see if this mapping might best be done in ArcGIS Online.

To provide an example, here is a visualization of projects that might be scheduled for the year 2026. As this plan is being written, there is not sufficient funding or capacity in the area to attempt even a tiny fraction of this proposed work. However, the purpose of this plan is not to assess what we can do but what we should be doing. Therefore, to create this map, certain assumptions have been made.

- The map assumes wildfire perimeters are getting regularly re-treated with prescribed fire, according to their burn footprint's fire return interval. Therefore, we selected wildfires (and prescribed fires) that intersected with high-elevation forests around 1986-89 (none found), in Douglas-fir and white fir forests around 2000-2001, in chaparral around 2004-2006, in mixed conifer forest around 2013-14, in blue oak woodland around 2014-15, and in black oak-ponderosa around 2021. (Again, these fire return interval targets are from USFS FRID data and have not yet been revised by local experts such as residents and Tribal leaders.) This yielded 12,000 acres of reburn (albeit arranged in GIS snippets, not usable unit boundaries).
- The map assumes fuelbreaks and mechanical thinning projects will be re-treated every 10 years, so it shows all fuelbreaks and mechanical thinning projects done by CALFIRE/SPI in 2016. It assumes fuelbreaks are 300' wide if not otherwise specified. This yielded 2,346 acres of maintenance work.

- Almanor Ranger District activities with a "Planned" date of 2026 were added to the map (about 350 acres). Note: In 2025 and 2026, the Feather River Ranger District Collaborative's "Focus Areas" are slated to be the Little Grass Valley and Slate areas, respectively. These areas are outside the Butte Forest Plan area because the Little Grass Valley area is higher up in Plumas County and the Slate area is in the Yuba River watershed.
- In 2019-2023, partners invested or will invest significant resources in new programmatic environmental documents. The map assumes this planning investment will result in implementation of shovel-ready projects including about 400 acres a year of thinning in each of the Cohasset FMP area and Big Chico Creek FMP area, 1200 acres of grazing in the Paradise Grazing Management Plan area, and 2,000 acres of work in the Upper Butte Creek NEPA area.
- Map assumes additional 200 acres will be underburned by landowners through Butte Prescribed Burn Association (dispersed throughout WUI)
- Map assumes Berry Creek landowners will sign up for 400 acres' worth of mastication or other thinning through NRCS-EQIP. (The polygons have been randomly assigned around Berry Creek to show what 400 acres looks like, and aren't intended to represent particular landowners.)
- All these projects still add up to only 17,300 acres. To get to 29,000, blocs of treatment about 2,000-6,000 acres in size were randomly deployed around the map to provide a visual sense of how much treatment is needed. These are not actual planned projects. (Two to six thousand acres was chosen because this is about the size fundable through a single grant or VMP.)
- Random wildfires were placed around the county to comprise 29,000 additional acres of natural treatment. Don't worry, these fires didn't hurt anyone or destroy any structures because all of our local communities were so wildfire-ready!

MAP 8: (HYPOTHETICAL) 2026 PROGRAM OF WORK



- ESTIMATING THE COST OF INVESTMENT NEEDED

Position (Capacity Gaps)	# of positions	Average cost/position	Cost/yr
Baseline funding: 1.5 staff member for each RCD, FSC, and Tribe	7	$ 105,000.00	$ 735,000.00
State-funded County Resilience Officer for tracking progress toward State goals	1	$ 120,000.00	$ 120,000.00
Foothill community Fire Adaptation Coordinator/ Good Fire Coach	9	$ 105,000.00	$ 945,000.00
Dedicated Rx burn crew for both federal and private lands - includes a burn boss, plus a type 6 engine at $200,000 depreciated over 10 years	10	$ 117,000.00	$ 1,170,000.00
Subtotal for human resources			**$ 2,970,000.00**

Activity	Cost/acre	Acres/yr	Cost/yr
Mastication -rearrangement of fuels	$ 3,500.00	3,000	$ 10,500,000.00
Underburning - Assumes dedicated Rx burn crew is already funded	$ 200.00	8,000	$ 1,600,000.00
Grazing	$ 600.00	5,000	$ 3,000,000.00
Chipping and hauling for biomass	$ 500.00	9,000	$ 4,500,000.00
Pile burning in place (produce biochar) - Assumes dedicated Rx burn crew is already funded	$ 150.00	5,000	$ 750,000.00
Wildland fire management ǂ	$ 403.00	29,000	$ 11,687,000.00
Subtotal for per-acre mgmt costs		**59,000**	**$32,037,000.00**
		Total annual management budget	$ 35,007,000.00

ǂ Based on averaging (1) federal wildland suppression costs per acre (nationwide) from 2020, $224/ac, viewable at https://www.nifc.gov/fire-information/statistics/suppression-costs, and (2) CAL FIRE suppression budget allocated for FY 2020-21 ($2.473 billion; source: Legislative Analysts's Office, https://lao.ca.gov/Publications/Report/4285), divided by acres burned in 2020 (4.258M acres, source: CAL FIRE, https://www.fire.ca.gov/incidents/2020/).

PROGRAM OF WORK, PART II: PROJECTS LIST

The following list provides some larger projects (500-20,000 acre scale) that support the goals of increased capacity and forest resilience. Some projects already have planning complete or even partial implementation funding. Others need not only planning funding, but capacity investments to even make their planning possible. This list is meant to be updated and serves as an inventory of unmet needs local organizations can elevate to State and Federal funding agencies. This list was originally generated by partners in April 2020 in response to a Sierra-Eastside Regional Prioritization Group request, and has been revised from time to time since then.

Project Name	Acres	NEPA/CEQA required or completed	Coordinating agencies	Funding Need	Anticipated Start Year	Duration (Years)	Notes
Musty Buck VMP	5000	Needs CEQA	CAL FIRE	$ 200,000	2022	3	
Loafer Creek VMP	4000	Complete	CAL FIRE	$ 200,000	Burning started 2021	3	
Concow Pyrodiversity Project	3000	Completed	CAL FIRE-PNF	$200,000	2022	1	CEQA completion expected Jan 2022
DWR Fuel Load Management Plan	600	Completed	DWR	$ 1,600,000	2022	3	
WUI Chipper Program	600	Completed	BCFSC	$ 500,000	2022 (ongoing)	On-going	
Jonesville Forest Health and Recreation Project	16000	Needs NEPA and CEQA	BCRCD-LNF	$ 24,000,000	2024	15	Funding secured for NEPA-CEQA
Prescribed Burn Association education and burning	200/yr (scaling up to 1000/yr … someday!)	Completed	BCRCD	$250,000/year	2022 (ongoing)	On-going	CEQA usually n/a; can be done as needed
Big Chico Creek Forest Management Plan Implementation	10,000	1,500 acres completed. 3,000 acres in process. 5,500 acres to be done.	BCCER	$ 500,000 (annually)	2022	On-going	
SPI Shaded Fuel Breaks	400	Completed	SPI	$ 500,000	2022	3	

Bio Char Community Education and Fuels Reduction Project	50	Completed	BCFSC	$ 250,000	2022	3	
Eave/Vent Replacement and Education Project	0		BCFSC	$ 400,000	2022	3	
Camp Fire Hazard Tree Removal - Fuels Reduction	600		BCFSC	$ 1,000,000	2022	3	
Feather Falls Fuels Reduction Project	200	Needs CEQA	BCFSC	$ 500,000	2022	3	
Feather Falls Fuels Reduction Maintenance Project	100	Completed	BCFSC	$ 300,000	2022	3	
Berry Creek Fuels Reduction Phase II	200	Needs CEQA	BCFSC	$ 500,000	2022	3	
Forest Ranch Fuels Reduction Phase II	100	Needs CEQA	BCFSC	$ 500,000	2022	3	
Paradise Fuels Reduction Phase II	300	Completed	BCFSC	$ 500,000	2022	3	
Fobestown Fuels Reduction -Phase II	200	Completed	BCFSC	$ 500,000	2022	3	
Forbestown Fuels Reduction Maintenance Project	100	Completed	BCFSC	$ 500,000	2022	3	
Cohasset Fuels Reduction - Phase II	200	Need CEQA	BCFSC	$ 500,000	2022	3	
Mt Ida Fuels Reduction - Phase II	250	Need CEQA	BCFSC	$ 500,000	2022	3	
Yankee Hill and Concow Forest Health Project	300	Need CEQA	BCFSC	$ 700,000	2022	4	
Concow Restoration Project	300	Need CEQA	BCFSC	$ 700,000	2022	5	
Butte Biomass Facility	500	Needs NEPA and CEQA	BCFSC	$ 500,000	2022	3	

Butte County Collaborative - Facilitation	N/A	Exempt	BCFSC	$ 100,000	2022	per man ent	
Vegetation Management Plan Town of Paradise	N/A	Exempt	BCFSC	$ 80,000	2022	3	
Butte County WUI Programmatic Environmental Impact Report	N/A	Needs CEQA	BCFSC	$ 1,000,000	2022	3	$200,000 won for CEQA thru RFFCP
Forest Health Restoration Planning Tool - Data Portal/ArcGIS Online	N/A	Exempt	BCFSC-BCRCD	$60,000/year	2022	On-going	partners have ~$50,000 set aside for this over next 2-3 years
Bidwell Park Fuels Reduction	N/A	Completed	City of Chico	$ 1,000,000	2023	3	
		Subtotal	$ 37,630,000				

NEXT STEPS

- Continue to maintain and update the projects list and master projects layer. The master projects layer in ArcGIS Online should include, at a minimum, each project's year planned (or last year completed), maintenance interval, and status of environmental review/permitting.
- As master projects layer is updated, produce "program of work" maps for each of the next 10 years so permitting/authorization and funding can be proactively secured
- Continue to revise "Pace and Scale" assumptions as needed: i.e., the desired treatment return intervals for different subregions/forest types.
- Biannually, have partners review and update the Projects List, above.
- Continue to create metrics for all key actions in order to track success. For example:
    - % of projects in the GIS master projects layer scheduled and funded for maintenance (Key action 6.3)
    - Number of community members red-carded each year (Key action 10.3)
    - Number of CARX-certified burn bosses and cultural burners in each community (Key action 10.3)
    - Bone-dry tons of biomass harvested and turned into energy (Key actions 8.1 and 8.2)
    - Acres thinned from 90% down to 70% or less canopy closure (Key action 1.1)
    - Etc.

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APPENDIX A

The 10 goals for the next forest, and their 32 key actions, were developed and refined by Butte County Resource Conservation District staff, working with local and regional partners through the following collaborative meetings and processes. After August 2019, this work was funded by a grant from the CA Department of Conservation's Forest Health Watershed Coordinator Program.

Process	Dates	Participants/Partners
Within Butte County/Butte Forests Plan area		
Wildlands Task Force	4/24/19, 5/22/19, 6/26/19, 7/24/19, 8/28/2019, 10/30/2019, 2/26/20.	Steering committee: BCFSC, BCRCD. Large group: BLM, USFS, CAL FIRE/Butte County Fire, Sacramento River Watershed Group, Paradise Parks and Rec, Chico Parks, Feather River Recreation and Parks District, local Fire Safe Councils, SPI, rural community members
Butte County Collaborative Group (both steering committee and large group meetings)	**2019:** 10/14, 10/23, **2020:** 2/11 (CWPP Working Group); 2/24, 3/10, 3/19, 4/7, 4/16, 5/20, 5/21, 6/24, 7/6, 7/13, 7/17, 7/28, 8/20, 9/22, 10/15, 11/12	Steering committee: BCFSC, Sacramento River Watershed Group, BCRCD; large group: BLM, USFS, CAL FIRE/Butte County Fire, Paradise Parks and Rec, local Fire Safe Councils, SPI
Butte County Wildfire Safety Task Force	**2020:** 6/30, 10/15, 11/12, 12/10; **2021:** 4/5, 5/3, 6/7, 8/30, 11/1, 12/6. Butte Forests Plan outline circulated for review and feedback April 2021. 10 Principles presented for review and feedback June 2021.	BCFSC, BCRCD, Coordinating Committee/Forest Advisory Committee respresentation, Public Works, Development Services, Butte County Dept. of Water and Resource Conservation, CAL FIRE (Butte County Fire Dept)
Presentation to Butte County Board of Supervisors	BOS 11/19/19	BCFSC, BCRCD
Presenting to Butte County Forest Advisory Committee	9/27/21 and 11/22/21	BCRCD, FAC, FS partners
BCRCD's Climate-Resilient Reforestation technical advisory committee calls and "Reforestation for the Ridge" document development	8/20/19, 11/4/19, 4/2/20, 4/15/20, many other conversations over the time frame Nov 2018-spring 2020	Included small group and one-on-one consultation with the following experts: UCD ecologists Jim Thorne, Joe Stewart; CAL FIRE unit forester Dave Derby; CAL FIRE chief John Messina; Town of Paradise officials; foresters Glenn Lunak, Kieran O'Leary, Tim Keesey; CSUC Ecological Reserves leadership Don Hankins, Eli Goodsell; USFS ecologists incl. Kyle Merriam; UC-ANR Forestry advisors incl. Kate Wilkin, Ryan Tompkins
BCFSC WUI Action Plan development	Nov 2019-Dec 2021. 10 Principles presented to BCFSC board for review/feedback 6/2/21.	BCFSC, BCRCD

Community Wildfire Summits	12/6/18, 12/6/19, 12/1/21.	BCFSC, BCRCD, Sierra Institute, Mechoopda TEK specialists, Deer Creek GIS, CAL FIRE; others
BEC Community Forum on Wildfire and Climate	8/26/21	BEC, community members, BCFSC, BCRCD, Zeke Lunder, Don Hankins, Sandrine Matiasek
Camp Fire Climate Conversation	Aug-November 2020	American Forests, BLM, BCRCD, USFS, others; primarily focused on BLM lands
Butte Forest Health Handbook development	Late 2018-June 2021	BCFSC, BCRCD; Chico Traditional Ecological Stewardship Program; input from CSUC Ecological Reserves, USFS Ecology, UC ANR forestry advisors
City of Chico Vegetative Fuels Management Plan PEIR (intensive process focused on wildlands management in Big Chico Creek watershed)	June 2019-April 2021	City of Chico Parks Division, BCRCD, Dempsey Vegetation Management, Deer Creek Resources, Point Blue Conservation Science, Big Chico Creek Ecological Reserves/CSUCEF, BCFSC
Concow Resilience Project and Concow Pyrodiversity Project	Late 2018-present	BCRCD, FRRD (USFS), CAL FIRE, Konkow Valley Band of Maidu Indians, community members, SPI, American Forests, Sierra Forest Legacy, UCD/R5 ecologists
Engagement in the Camp Fire/Paradise Forest Mangement Plan (BCFSC), Cohasset Forest Management Plan (BCFSC), and Paradise Nature-Based Fire Resilience Project (PRPD/TNC/Conservation Biology Institute)	July 2020-August 2021	BCFSC, Paradise Parks and Recreation Department; Sierra Timber Services/Davy Resource Group; CAL FIRE, CSUCEF, The Nature Conservancy, Conservation Biology Insitute, Town of Paradise.
Feather River Ranger District Collaborative	9/19/2019, 12/11/2019, 2/19/20, 11/5/2020, 1/19/21	BCRCD, FRRD (USFS), CAL FIRE, community members, Tribal members, SPI, Butte County representatives, Sierra Forest Legacy, UCD/R5 ecologists, BCFSC
Various forest health capacity/ biomass capacity assessment meetings	8/6/19, 8/7/19, 9/5/2019, 1/17/20, 2/12/20, 4/16/20; ISWI (Intertribal Stewardship Workforce Initiative) 9/15/21	BCFSC, BCRCD, Sierra Institute, SNC, Biomass Committee/task force, Sacramento River Watershed Program, USFS, Mechoopda and other Tribes, etc
Tribal scoping/consultation and partner review (of 10 Principles and this Plan)	April-July 2021	Tribal review: Enterprise Rancheria, Mechoopda, Konkow Valley Band of Maidu Indians, Berry Creek; sought input from Mooretown but did not receive response; non-Tribal review: UC-ANR grazing specialist; BCCER forester; CAL FIRE unit forester; North Yuba partnership coordinator; FRRD Planner.

Partner final review of this Plan	Mid-Dec 2021-Jan 31, 2022	About 45 local partners/foresters/Tribes; 6 or 7 commented
GIS mtgs to develop new AGOL-based master projects tracking layer, as described in Part 2	8/25/21, 12/8/21, 12/16/21, 1/5/22, 1/27/22, 2/10/22 and ongoing	BCRCD, BCFSC, CAL FIRE, BCCER, County staff
Outside Butte County boundaries		
Engagement with neighboring forest health collaboratives (South Lassen Watershed Group bimonthly; regional Watershed Coordinators meetups about quarterly); engagement with SERPG	**SLWG meetings 2019:** 8/27, 10/29 12/5 (BCRCD signed SLWG MOU Dec. 2019), **2020:** 1/28, 3/31, 5/26, 7/28, 9/29, 12/1; **2021:** 1/26, 3/30, 5/25, 9/28, 12/7. **2022:** 1/25 **SERPG meetings 2020:** 4/10, 6/12, 7/10, 9/11, 10/9; **2021:** 1/8, 2/12, 3/12, 4/9, 5/14, 6/11, 8/13 (BCRCD served facilitation role Jan-Aug 2021); 9/10. **SCALE** 2/25/21, 11/3-4/21 **Ishi Wilderness Community Workshop** with Almanor Ranger District, USFS Ecology, SNC, Tehama County RCD, many local tribal representatives: 2/3/20 **Regional FHWC virtual meetups** 7/22/20, 10/14/20, 1/27/21, 2/17/21, 4/1/21	SLWG: Almanor Ranger District, Trout Unlimited, Tehama County RCD, Feather River RCD, Plumas Corps, Sierra Institute, Maidu Summit Consortium, Collins Pines, SPI; many others SERPG and SCALE: USFS Region 5, SNC, California Wildfire and Forest Resilience Task Force Leadership, many national forests across the Sierras; collaboratives including Amador-Calaveras Consensus Group, Yosemite-Stanislaus Solutions, Calaveras Healthy Impact Solutions; County leadership from across Sierras; SPI; many others Regional FHWC virtual meetups: FHWC represntation from Humboldt RCD, Sierra Institute, Symbiotic Restoration-Pit RCD, SYRCL/North Yuba Partnership, and Yosemite-Stanislaus Solutions
Research, literature review, and incorporation of Statewide guidance for forest health practitioners (e.g., 2018 California Forest Carbon Plan, 2021 Wildfire and Forest Resilience Action Plan)	Ongoing	See references