Paradise Reseeding Plan
Butte County, California

October 27, 2021

Prepared for

Town Of Paradise

by

River Partners

Table of Contents

EXECUTIVE SUMMARY

In November of 2018, the Camp Fire burned more than 150,000 acres in Butte County including the majority of the Town of Paradise. It was the deadliest and most destructive wildfire in California's history and resulted in disaster declarations. As the result of a Presidential Disaster Declaration, FEMA's Hazard Mitigation Grant Program (HMGP) funds plans and projects that reduce the effects of future natural disasters. In California, these funds are administered by the California Office of Emergency Services (Cal OES) HMGP Unit.

Advance Assistance provides early funding to accelerate the identification and implementation of mitigation activities. Applicants and sub-applicants may use Advance Assistance to develop mitigation strategies and obtain data to prioritize, select and develop complete mitigation applications in a timely manner, resulting in either an improvement in the capability to identify appropriate mitigation projects or in the development of an application-ready mitigation project.

The Town of Paradise received Advance Assistance funding to prepare a reseeding plan for public property within the Town including rights-of-way and other Town property. The plan identifies reseeding locations, plant species to be used, exotic vegetation control requirements, schedules, maintenance, monitoring and costs, with the objective of minimizing erosion, establishing native vegetation that promotes recovery and resilience and minimizing fire fuels. River Partners was selected as a consultant to develop the plan.

A key component of the project is to involve the community in plan development and to incorporate their input when feasible. Public outreach work included a comprehensive survey taken by more than 150 participants, solicitation of feedback at the Town of Paradise Party in Park and obtaining input on the reseeding approach from a panel of regional habitat restoration experts. The top three priorities for the reseeding plan from the survey participants in order included "supports wildlife and pollinators", "fire prevention/mitigation" and "native species".

Consultation with subject matter experts was important during plan development. Over the months of May and June 2021, several meetings took place with Town staff and external partners to ensure that the plan considered related planning efforts and reflected the most up-to-date science on wildfire recovery and fire residency. Below is a summary of consultation efforts:

Town of Paradise kickoff, May 27, 2021: Preliminary meeting to inform and solicit feedback from essential Town personnel including the Town Manager, Disaster Recovery Manager, and others.

Public Works and FEMA (Federal Emergency Management Agency) Advanced Assistance, June 8, 2021: Meeting to better understand the funding process and FEMA/CalOES requirements for advance assistance program. Director of Public Works explained reseeding constraints from a long-term maintenance perspective.

External partners, June 9, 2021: Non-profit leaders, academics, tribal representatives, and sister agency partners in attendance. The objective was to understand related planning activities and

gather partner perspectives on how best to reseed Paradise to meet the various objectives of the project.

Paradise Forest Health Tour, June 11, 2021: Area site visit led by Butte County Fire Safe Council and Paradise Recreation and Parks District to see ongoing fire safety/fuels management projects in and around Paradise.

Based on the input received and the expertise of River Partners restoration ecologists it was a comprehensive reseeding plan was developed. The reseeding approach involves implementation of an intensive 2-year weed control program prior to seeding to give the target native herbaceous vegetation a competitive advantage over robust non-native vegetation that has recruited onto the reseeding sites following the Camp Fire. Once the weedy vegetation has been controlled, the areas with compacted soil surfaces will be loosened to create a seed bed that will allow the seeded vegetation to root-in. The seed will be applied via hydroseeding. Two seed mixes – one dominated by native grasses and one with a mixed of native grasses and forbs will be used. The seed mixes will be composed of plant material of known genetic origin that will be procured via seed increase contract grows from regionally collected wildland stock seed (preferred method) or alternatively via procurement of commercially available seed whose origin is from a wider geographic area within northern California. A 3-year vegetation establishment maintenance program coupled with a vegetation monitoring program that serves to both assess success as well guide maintenance activities.

Acknowledgements

This plan was developed with input from the following experts and community leaders and would not have been possible without their deep knowledge and dedication to the recovery of the Town of Paradise.

Name	Affiliation
Katie Simmons	Town of Paradise
Natasha Beehner	Town of Paradise
Marc Mattox	Town of Paradise
Dan Efseaff	Paradise Recreation and Parks District
Calli-Jane DeAnda	Butte County Fire Safe Council
Taylor Nilsson	Butte County Fire Safe Council
Wolfy Rougle	Butte County Resource Conservation District
He-Lo Ramirez	Mechoopda Indian Tribe and Big Chico Creek Ecological Reserve
Isaiah Meders	Mechoopda Indian Tribe Tribal Council
Eli Goodsell	Big Chico Creek Ecological Reserve
Andrea Williams	California Native Plant Society

The plan was prepared by River Partners with support from the Big Chico Creek Ecological Reserve and California State University, Chico.

Name	Affiliation
Alex Williams, Project Manager	River Partners
Michael Rogner, Senior Restoration Ecologist	River Partners
Pat Reynolds, Sacramento Valley Regional Director	River Partners
Michael Garcia, Restoration Biologist	River Partners
Kim Armstrong, Restoration Biologist	River Partners
Anna Schwyter, Restoration Ecologist	River Partners
Eli Goodsell, Director	Big Chico Creek Ecological Reserve
He-Lo Ramirez	Big Chico Creek Ecological Reserve
Erik Fintel	CSU, Chico – Geographical Information Center

Related Planning Efforts

CAL FIRE Vegetation Management Program (VMP)

Butte County Fire Safe Council: Paradise Forest Management Plan (https://storymaps.arcgis.com/stories/58c51c60d2ab477b8f957478b95cf2fb)

Butte County Community Wildfire Protection Plan (https://buttecounty.sacriver.org/object/8351)

ENVIRONMENTAL SETTING

Location

The Town of Paradise is located approximately 12 road miles northeast of the city of Chico in Butte County, California. (Figure 1). The scope of the reseeding plan is limited to Town owned and managed properties. Appendix B shows the limits of seeding covered in this plan. The entire footprint of seeding is approximately 259 acres

Climate

Butte County has a Mediterranean climate with cool, wet winters and hot, dry summers. Precipitation is normally in the form of rain, ranging from approximately 20 to 80 inches per year, with snow in the higher elevations. The average high temperature for January is 55 degrees and for July is 96 degrees, with many days in which temperatures reach over 100 degrees.

The predominant summer weather pattern includes high to very high temperatures, low humidity and light to moderate south winds associated with high pressure weather gradients. Occasionally during the summer, dry weather fronts will approach northern California bringing increased wind speeds from the south on approach, then changing direction to northwest winds after passing the area.

Each year, especially in the autumn months, north wind events bring high temperatures, very low humidity, and strong winds. These north wind events usually produce red flag warning conditions and provide the highest potential for extreme fire behavior. With the fuels already at their driest moisture content, north winds can create a severe fire weather situation.

Lightning is cyclic and is a minor occurrence. However, there have been lightning storms that have started numerous, damaging fires. The 1999 Butte Lightning Complex burned 33,000 acres. The 2008 Butte Lightning Complex destroyed or damaged over 100 structures and 59,000 acres.

Butte County has a significant history of large fire occurrences. Over 500,000 acres have burned during the past fifty years. In 1990, the Campbell fire scorched 131,000 acres. The Poe fire burned 8,333 acres and destroyed 50 homes in Concow/Yankee Hill in 2001. More recently, the 2008 Humboldt fire burned over 23,000 acres and 351 structures near Paradise. Wildfire history is a significant factor of the pre-fire management planning process. Identifying where fires have occurred can help managers determine the most beneficial locations for pre-fire management projects. (State of California, OSFM, 2020).

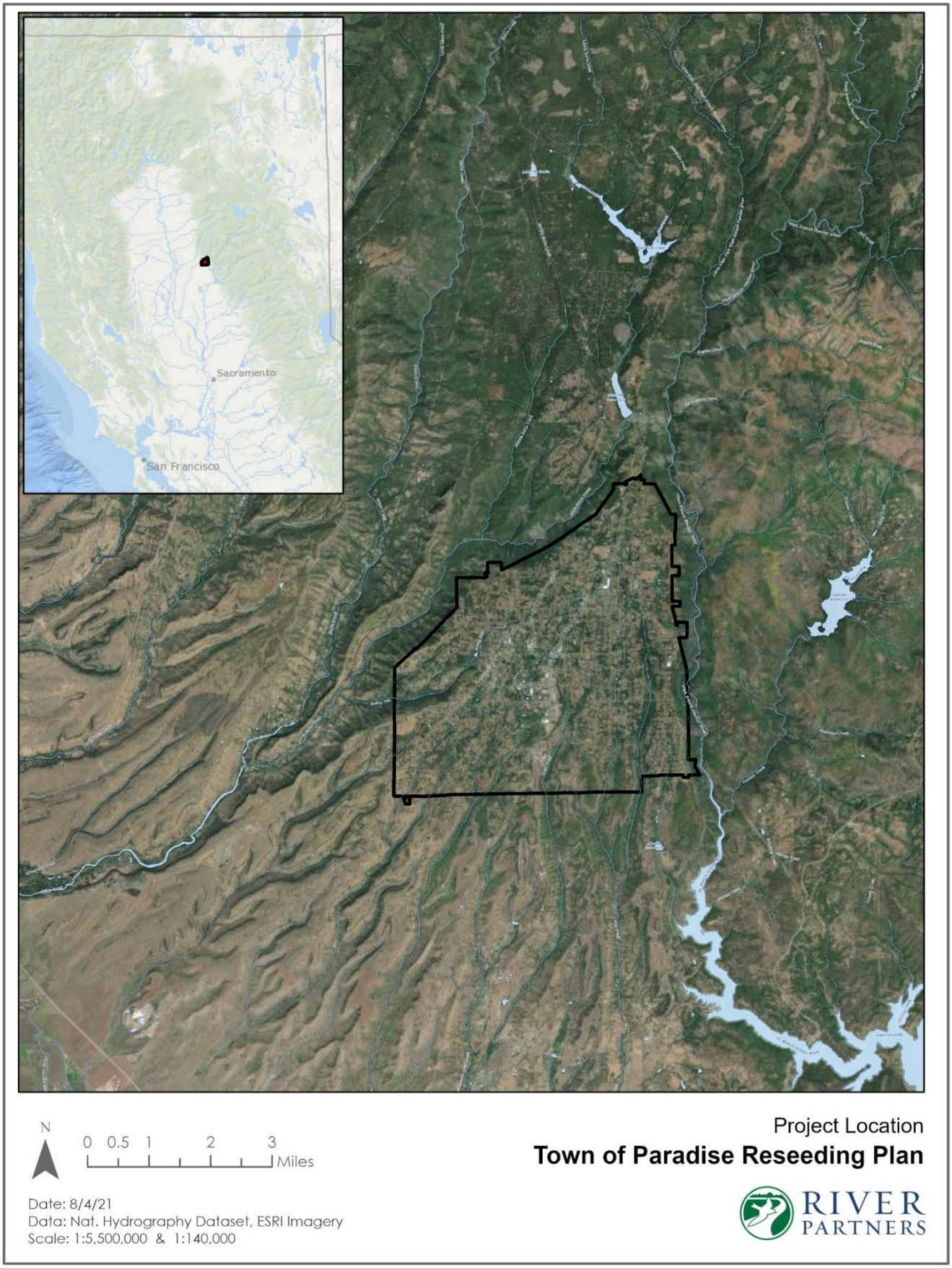


Figure 1. Town of Paradise, California, USA.

Soils

There is a range of soil types in the Paradise Ridge area in the Alfisol soil order interspersed with rock outcroppings (Table 1, Figure 2). Alfisols are soils formed under forest conditions and have a subsurface accumulation of clays and high native fertility. The dominant soil type is Paradiso loam in the upper elevations. The lower elevations contain predominantly Rockstripe complex soils. Although these soils are mapped in the town of Paradise, developed land such as the town's right of ways and private property with structures are heavily altered by human activity and should not be expected reflect all characteristics of native soils. Human activity can affect soil conditions in the following ways: compaction (leading to lower infiltration rates, higher runoff rates, and deteriorated soil structure, which in turn decrease favorable conditions for revegetation), anthropic subsoil (engineered fill, road base), and the introduction of pollutants from roadways and vehicles.

Table 1. Dominant soil map units within Town of Paradise, CA (USDA Web Soil Survey).

Map unit name	Acres	Percent of Area
Paradiso loam	7,939.50	69%
Ultic Haploxeralfs, mesic-Rockstripe complex	2883.1	25%
Other	744	6%
Total	11,566.6	100%

The burn severity map provided by Calfire shows low soil burn severity (SBS) in and around town, indicating that fire has not altered soil conditions. If SBS was severe, soil conditions to monitor before reseeding include water repellency, loss of organic matter and nutrients, and ph. Fire can cause soil to become more acidic, making seed establishment less successful.

We are confident in the results of the WERT (Watershed Emergency Response Team) Final Report, and do not deem it necessary to retest soil in town rights-of-way for reseeding recommendations. As the areas of concern were identified to have low to no SBS, we conclude revegetation will be successful without further soil testing. Natural recruitment of non-native vegetation within the burned areas supports this conclusion.

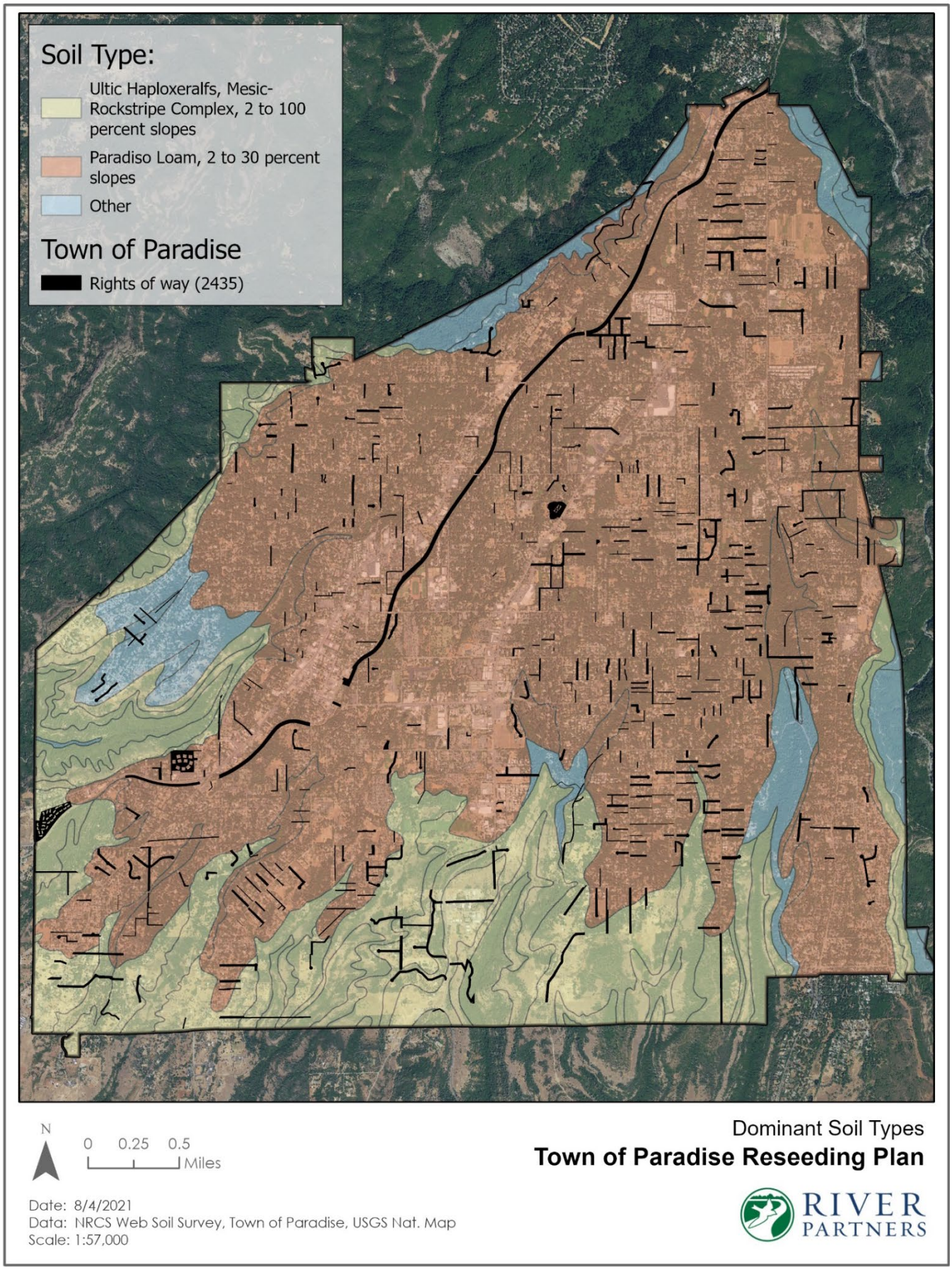


Figure 2. Map depicting dominant soil map units in the town of Paradise.

Vegetation

A variety of vegetative communities are found within the Town of Paradise. The dominant communities are grassland, chaparral, oak woodland, and mixed-conifer woodland. The lowest elevations of Paradise are dominated by either blue oak woodland, consisting primarily of blue oaks (*Quercus douglasii*) and non-native annual grasses, or chaparral, which contains various manzanita (*Arctostaphylos spp*.), buckbrush (*Ceanothus cuneatus*), toyon (*Heteromeles arbutifolia*), California bay laurel (*Umbellularia californica*), western redbud (*Cercis occidentalis*), scrub oak (*Quercus berberidifolia*), and poison oak (*Toxicodendron diversilobum*). Slightly higher you will find a black oak (*Quercus kelloggii*) and ponderosa pine (*Pinus ponderosa*) overstory with chaparral species, such as buckbrush, deer brush (*Ceanothus integerrimus),* live oak (*Quercus chrysolepis*), and manzanita in the understory. The highest elevations in Paradise are comprised of a forest of ponderosa pine (*Pinus ponderosa*), Douglas fir (*Pseudotsuga menziesii),* big leaf maple (*Acer macrophyllum*), black oak, Pacific dogwood (*Cornus nuttallii*), toyon, manzanita, and deer brush. The upper elevations of Magalia and Stirling City have a Sierran mixed conifer overstory including Douglas fir, ponderosa pine, sugar pine (*Pinus lambertiana*), white fir (*Abies concolor*), and incense-cedar (*Calocedrus decurrens*).

Invasive plants were present in Paradise before the fire. Non-native annual grasses dominated the understory in the blue oak woodland at lower elevations and could be found throughout Paradise in areas with less canopy coverage. Chinese tree of heaven (*Ailanthus altissima*) was planted as an ornamental and could be found throughout much of Paradise. Its seeds are wind dispersed, allowing it to colonize areas away from where it was originally planted. French broom (*Genista monspessulana*) was ubiquitous pre-fire at lower elevations with Scotch broom (*Cytisus scoparius*) dominating the higher elevations of Paradise and into Magalia. Himalayan blackberry (*Rubus armeniacus*) can be found growing at all elevations and is most common in areas near water (creeks, seasonal drainages).

Vegetation is grouped into three general fuel types: grass, brush, and timber. There are several factors such as fuel type and size, loading (tons/acre), arrangement (vertical & horizontal), chemical composition, and dead and live fuel moisture that contribute to the flammability characteristics of vegetation.

The valley and lower foothills, up to approximately 1000’ elevation, are covered by the grass fuel type. This fuel type is comprised of fine dead annual non-native grasses and leaf litter which is the main carrier of fire. Fires in this fuel type react dramatically to changes in weather, particularly low relative humidity, and high wind speed. Grassland fires can be very difficult to control during gusty wind conditions and often spread over a large area quickly, threatening life and property.

The mid-foothill and lower mountain areas, between 1000’ and 2000’ elevation, are dominated by brush. Fire in this fuel type can burn readily, especially later in the summer as live fuel moistures drop to critical levels. Brush fuel, unlike grass fuel, does not react readily to changes in relative humidity. Brush fires can be difficult to control under normal summer burning

conditions when their fuel moistures reach critical levels and become very difficult to control on steep topography and when subjected to strong winds.

The mountainous areas above 2000' elevation is generally covered by the timber fuel type. Timber fires burn readily, especially if they occur in overstocked stands, in stands with down dead material, and/or later in the summer as live fuel moistures drop. Timber fires can be difficult to control under normal summer burning conditions, but they become very difficult to control on steep topography and when subjected to strong winds (State of California, OSFM, 2020).

Current Conditions. Several sites were visited to determine the current condition of vegetation types found at various elevations and burn severity in Paradise post-fire. Sites were selected based on elevation, burn severity, access, and development. We selected the sites most representative of vegetation within the Town of Paradise.

Low elevation – low burn severity. Two sites were visited between 1460ft (Figure 3) and 1640ft. These sites are dominated by toyon, California bay laurel, scrub oak, and manzanita species. The large tree strata, consisting primarily of black oak and foothill pine (*Pinus sabiniana*), was largely burned but still alive. Also growing on these sites are Yerba Santa (*Eriodictyon californicum*), poison oak, buckbrush, deer brush, and California pitcher sage (*Lepechinia calycina*). Stump resprouts are common throughout these sites. Invasive species found include Himalayan blackberry, poke weed (*Phytolacca americana*), Scotch broom, French broom, yellow star thistle (*Centaurea solstitialis*), woolly mullein (*Verbascum thapsus*), and Chinese tree of heaven.

Figure 3. Off Morgan Ridge Rd, 1460ft. Low elevation, low burn severity.

Low elevation – moderate burn severity. Two sites were visited between 1580ft and 1610ft (Figure 4). These sites are dominated by toyon, western redbud, California bay laurel, scrub oak, black oak, and manzanita species that have mostly stump resprouted following the fire. The large tree strata are dominated by black oak, much of which has resprouted, and dead foothill pine. These sites also support gum plant (*Grindelia spp.*), buckbrush, deer brush, poison oak, coyote brush (*Baccharis pilularis*), California pitcher sage, and blue wild rye (*Elymus glaucus*). Invasives found on these sites include French broom, star thistle, Himalayan blackberry, bull thistle (*Cirsium vulgare*) and poke weed.

Figure 4. Off Edgewood Lane, 1610ft. Low elevation, moderate burn severity.

High elevation – low burn severity. One site was visited at 1920ft (Figure 5). This site was dominated by ponderosa pine and black oak, most of which did not burn and survived the fire. Understory species include blue wild rye, poison oak and scrub oak. Most of the understory at this location was dominated by invasive species. These include Himalayan blackberry, star thistle, woolly mullein, lots of French broom, edible fig (*Ficus carica*), poke weed, and black locust (*Robinia pseudoacacia*).

Figure 5. Eastwood Professional Park off Pentz Road (across from the hospital), 1920ft. High elevation, low burn severity.

High elevation – moderate burn severity. One site was visited at 2220ft (Figure 6). This site was dominated by ponderosa pine, black oak, big leaf maple, and toyon. Most of the large trees burned except for a few ponderosa pines. The black oak, big leaf maple and toyon have all resprouted from stumps. The site also includes Pacific dogwood, bush poppy (*Dendromecon rigida*), manzanita species, deer brush, ferns, cottonwood *(Populus fremontii),* phacelia (*Phacelia spp.*), and wild grape (*Vitis californica*). Invasives include Himalayan blackberry, star thistle, poke weed, and French broom.

Figure 6. End of Chapman Lane off Dean Road, 2220ft. High elevation, moderate burn severity.

General Observations. The sites with low burn severity saw most of the understory burned with only some mortality among overstory trees. Sites with moderate burn severity had high to total mortality in overstory trees. Many of the dominant plants have stump resprouted. These include black oak, scrub oak, California bay laurel, toyon, big leaf maple, and manzanitas. The areas observed are becoming very densely covered in resprouts and understory species. Blue wild rye was observed on almost every site and may have expanded after the fires as it thrives when overgrown canopies are removed or opened-up. A few of the sites had blue oak woodland surrounding the chaparral. We noticed that most of the blue oaks were intact on these areas with minimal death of oaks and grey pine (Figure 7).

As is normal following a fire, the sites, and most of Paradise, contain a high number of invasive species. The most dominant of those was French broom. Scotch broom, Chinese tree of heaven, Himalayan blackberry, poke weed, and star thistle. Other invasives, though not as prevalent, include catalpa, pink silk tree, black locust, and edible fig. If left unchecked, these species could outcompete native species in Paradise, primarily French and Scotch broom. Broom species are a significant fuel for fire, so the removal and maintenance of these species is critical for addressing future fuel-load issues.

Figure 7. Blue oak woodland adjacent to burnt chaparral, Dudley Lane, 1580ft.

Predicted Post Fire Successional Trajectory

Many areas will experience a quick regrowth of brush. Higher severity burn areas will experiences a significantly faster regrowth of brush than lower severity areas, not accounting for differences in aspect. Lower burn severity areas will have less solar radiation reaching re-sprouting brush due to the surviving overstory tree canopy. Low severity burn areas will conceivably have less re-sprouting in general, due to an assumed lower density of brush before the fire. High severity burn areas will have little to no shading canopy and will have rapid brush growth (Crotteau et al., 2013; Longbrake & McCarthy, 2001; Resco et al., 2020).

Initially re-sprouting brush species will begin to dominate due to their energy stored below ground to kickstart the regrowth. Some species are also adapted to have a flush of seedlings after a fire for a variety of reasons, such as manzanita, ceanothus, grey pine, and especially the broom species (Keeley, 1987; Stevens & Latimer 2015). They may not be able to out compete already established re-sprouts during the initial germination phase but will fill in the areas between re-sprouts and can colonize new areas that were not brushy before the fire (Pilon et al., 2020). As succession progresses a host of ecological interactions will determine which species establish at each stage, but generally, fast growing and sun loving brush species such as manzanita, ceanothus, and broom will dominate early succession (Crotteau et al., 2013; Resco et al., 2020). Larger shrubland species such as live oaks and bays may overtop these sun loving species and become the dominate overstory. Some of the manzanita and ceanothus could die due to shade stress, creating a decadent understory of dead fuel. This assumption is not absolute as this

evidence in regional fire footprints (Woodland Fire, 1999) that these brush and tree species may remain codominant in height for over 20 years.

Eventually these fuel conditions will likely result in another high intensity fire. Many deciduous oaks, such a Black, Blue, and Valley oak will re-sprout after a fire, but may not survive long term if these high intensity fires continue. This could transform what was once oak woodland into a more pseudo-chaparral scrubland. At higher elevations Ponderosa pines may suffer a similar fate due their similarly poor shade tolerance, likely transforming pine forest into chaparral like habitat (Crotteau et al., 2013; Goforth & Minnich, 2008). Either result will likely lead to future high intensity fires.

Areas with invasive plants will see likely see these plants take over particularly in the short term, since most invasive are adapted to respond will to disturbance (Franklin, 2009). Particularly the broom, though blackberry will take over wetter areas in which it becomes established, and star thistle will do the same in meadows. A few invasive species many decrease as time goes on as they are more well adapted to take over quickly after a disturbance but will be outcompeted by later successional species. Many other invasive plants will become established and continue to spread but may be more limited than the broom. Broom will likely be the invasive that becomes the biggest issue post fire and the invasive most promoted by the fire due to its ability to re-sprout and its seeds being promoted to germinate by fire (Alexander & D'Antonio, 2003). The species of broom will vary depending on the conditions on site, but both species should be expected to take over significant amount of habitat if left unchecked.

The 1999 Woodland Fire in Forest Ranch can provide a reference for some of these successional trends, particularly the lower elevation areas. Many of the areas that burned with high intensity fire in 1999 have been transformed into brush fields even if they supported large Ponderosa Pine and Black Oak forests before the fire. Even though the Black Oaks have re-sprouted and the Pines have come back from seed, the increased sunlight due to the loss of the canopy structure has caused all the space between these trees to be filled in with brush species. The brush is also usually just as tall as these tree species, creating a nearly solid wall of fuel primed for another high intensity fire. Areas without major tree mortality generally have considerably less regrowth. The areas where there hasn't been in management work are still somewhat overgrown and at a slight risk of high intensity fire due to the 20 years without fire being far greater than the natural fire return interval for that habitat, but it is far worse in areas that lost their overstory canopy.

One factor is missing from the 1999 Woodland Fire that is a major factor in the Camp Fire burn scar is the invasive plants, particularly the Broom. While the Woodland Fire footprint has plenty of invasive plants, due to the work of the B.E.E.P. (Broom Education and Eradication Program), there are no major Broom patches left in the fire scar. However, without aggressive management in the Camp Fire footprint the broom will likely become extremely problematic. While it is not hare to look around California and find plentiful Broom infestations, one good example comes the Blodgett Forest Research Station outside of Georgetown, CA. Georgetown is a similar elevation to Magalia, so it can serve as a decent model for the higher elevation portions of the Camp Fire. Based a study done at Blodgett, it was found that broom, particularly Scotch Broom, grows in areas with gaps in the canopy considerably better than areas with an intact

canopy. These gaps are exactly what you would find in high intensity burn areas. In addition, that study found that Scotch broom colonizes areas better after fires than without fire. Finally, it found that reduced snowfall resulted in better Scotch Broom growth, meaning that the warming temperatures associated with climate change could worsen broom invasion, especially at higher elevations (Stevens & Latimer, 2015).

Demographics and Land Use

Incorporated in 1979, the Town of Paradise is nestled in the foothills of Northern California's Sierra Nevada Mountains and sits astride a ridge top with elevations ranging from 1,200 to 2,400 feet above sea level. The Town encompasses 18.6 square miles area. Prior to incorporation, the Town was a county mountain community with older construction of light commercial and industrial and a predominantly residential character. Most of the dwelling units in the Town are single-family units. Multi-family units, at densities ranging from 8 to 12 units per acre, are found primarily in central Paradise, near commercial areas and along major arterial streets. The town contains little industrial development. Agricultural uses, including vineyards, orchards, and grazing land, are located primarily in the southern third of the town.

The population of Paradise, California has declined significantly since the 2018 Camp Fire that destroyed nearly every building in town. The 2010 census recorded 26,800 residents in the Town of Paradise. The California Department of Finance estimated the population on January 1, 2019, was 4,590.

The Northwestern Maidu, since time immemorial, have resided along the drainages and lands now encompassing what is now known as the foothills of Butte County. The Northwestern Maidu thrived in Butte County utilizing a mixture of technologies, strategies, and land stewardship practices associated with a "hunting and gathering" economy. Once abundant fauna such as elk, pronghorn antelope, deer, waterfowl, salmonids, and rabbits would be harvested for subsistence. Flora and landscapes traditionally would be actively managed to increase biodiversity, which in turn increased the amount of food, fiber, and medicine produced by the land. This land management/stewardship was conducted by utilizing a mixture of coppicing, pruning, and burning practices to achieve a mosaic of habitat types that were open and easily accessible. This was achieved primarily using cultural fire to maintain healthy ecosystems. This would be achieved by applying prescribed fire at varying frequencies and intensities at the landscape scale with the explicit intention of maintaining specific vegetation types and habitats. This mosaic pattern achieved through pyro-diversity not only increased biodiversity, but also created a heterogeneous landscape with low-fuel loads and fuel discontinuity which made habitation pleasant.

The historic plant community was more heterogeneous than today's plant community. In contrast to today's dense homogenous conifer forests that dominate the foothills of Butte County the historic plant community would have been more oak dominate with a mixture of meadow/grasslands, shrubs, and conifers. Evidence for historic predominately oak woodland habitat in the Paradise area is made evident by the plethora of grinding stones located across the Camp Fire footprint post-fire. Acorns are a staple food source for a majority of California Indians, and before colonization oaks would have been one of the most, if not the most

important, source of food. Grinding stones are used for processing acorns into acorn flour, and as such a plethora of them in one area is indicative of large oak woodlands as grinding stones are made near oak woodland habitat. These oak woodlands would have been maintained annually with fire to reduce pest populations, increase oak health, and reduce fuel loading. One incentive for this land management was that oaks in an open oak woodland produce more acorns per tree than oaks in crowded dense woodlands. Meadows/grasslands would also be maintained with fire to discourage the encroachment of conifers while also promoting the growth of desirable grasses and forbs such as edible geophytes colloquially known as "Indian potato/onion". Chaparral habitats would be maintained with fire and pruning/coppicing to increase accessibility to chaparral products, such as the fruits of manzanitas and chokecherries, by creating trails through the chaparral and intermixing grasslands within chaparral habitat to create a mosaic of shrubs and grasses/forbs. This prevented homogenous dense walls of chaparral from forming, which decreased fuel-loading and fuel continuity, while also making desirable plant products accessible for humans and other wildlife.

Paradise Reseeding Plan Community Engagement

Community engagement was an important component in the creation of the reseeding plan. In June of 2021, a survey was developed to gain community input in the plan. The survey was promoted on the Town of Paradise website and amplified through the Paradise Recreation and Park District, CSU, Chico Ecological Reserves, and the Regenerating Paradise social media accounts. Paper surveys were also provided at the Party in the Park event in Paradise on July 28th, 2018, where an estimated 25 residents were educated about the project. One hundred and fifty-nine total survey responses were received, which is comparable to past community surveys post Camp Fire and is a good response rate for the current population of the town. Complete results (with the omission of contact information) of the survey can be found in Appendix A. Some important findings from the survey include:

- 77.4% of participants were current property owners within the town of Paradise.
- The top three priorities for survey participants in order:
  1. Supports wildlife and pollinators
  2. Fire prevention/mitigation
  3. Native species
- 83.6% of respondents were very willing or somewhat willing to participate in removing invasive species on their private property.
  - 8.8% of respondents were willing with financial incentive.
- 76.6% of participants would support low intensity prescribed burns conducted by fire professionals for the management of invasive plants and to reduce hazardous fire fuels.
  - 17.6% of participants were not sure but may support prescribed burns if provided more information.
- 78.6% of participants would support access for tribal members to steward and gather culturally significant plants.
  - 15.1% of participants were not sure but may support with more information.
- 69.8% of participants were willing to commit to some level of volunteering for native species planting and invasive species removal.

- Participants top challenges to replanting in Paradise in order:
  1. Neighbor's invasive weeds
  2. Money
  3. Lack of residence
- 88.1% of participants indicated that they would likely refer to the Paradise Reseeding Plan when deciding what to plan on their private property.

In addition to public surveys, River Partners compiled a panel of local and regional experts to review the draft Paradise Reseeding Plan and provide input. Participants included:

Wolfy Rougle – Forest Health Watershed Coordinator, Butte County Resource Conservation District

He-Lo Ramirez – Biologist and Reserve Cultural Steward, CSU, Chico Ecological Reserves

Isiah Meders – Mechoopda Tribal Council Member

Andrea Williams, Director of Biodiversity Initiatives, California Native Plant Society

RESEEDING PLAN

Per the GIS (Geographic Information System) analysis for the project (Appendix B), approximately 307 acres of Town of Paradise owned lands will be reseeded. This analysis was lead by the University of California at Chico Geographic Information Center with assistance from River Partners. The reseeding will occur over a wide geographic area and will include roadsides, vacant parcels, drainages, and others. A combination of techniques was used to determine the acres that would be seeded. For publicly owned roadways, Town of Paradise provided Computer Assisted Design (CAD) files were converted to GIS. At the instructions of the Town of Paradise, the GIS calculated public roadway acres was then reduced by the 310 acres that represent the estimated paved surfaces. The resultant total acres were then multiplied by .5 to account for curbs, gutters, and other areas not to be seeded. For all other publicly owned parcels, Town of Paradise provided polygons were edited via a visual assessment of high-resolution satellite imagery beneath the polygons to precisely identify impervious unsuitable for vegetative growth. These identified areas were individually delineated and cut from each polygon at a proximate scale of 1:400. After the meticulous editing was complete, 148 acres of unsuitable land was removed, and a total of 307 acres across approximately 5000 individual polygons remain to represent the entirety of the reseeding potential of publicly owned lands in the Town of Paradise.

These were the best tools available to determine the location and acreage of seeded areas and provide a reasonably accurate estimation of the areas to be seeded. However, the accuracy of these estimations is limited by the resolution and age of the imagery and the initial alignment of the two-dimensional polygons on a three-dimensional surface as well as the estimation of impervious surfaces along public roadways. It should also be noted that the National Agriculture Imagery Program provides the imagery that the final maps were published with, and the polygons were edited primarily with the consideration of a higher resolution proprietary imagery. These two sources do not precisely align, but the polygons were edited with consideration of both.

The successful establishment of native herbaceous vegetation within the seeded areas will require aggressive weed control, seed bed preparation, appropriately applied seed of known genetic origin and maintenance. Each of these requirements is described in detail below.

General Benefits of Implementation of Reseeding Plan

The Town of Paradise Fire and Public Works Departments have concerns about implementation of a reseeding plan that has the potential to generate fuel that could feed future fires. The goal of the reseeding plan is to establish native herbaceous vegetation along roadsides to control erosion and substantially improve habitat values without producing significant fuel loads. Development

of native herbaceous vegetation as described in this plan will serve to both substantially reduce or eliminate highly flammable invasive non-native species like Scotch broom that could otherwise invade the reseeding areas. However, it will create modest fuel when compared to bare soil areas that provide little to no habitat value and little to no erosion protection. Thus, the establishment of native herbaceous vegetation will significantly reduce fuels as compared to the non-native invasive species that could establish. However, this approach will not eliminate fuel entirely as is the case when vegetation is controlled to bare soil levels. On balance, the significant increase in habitat values, potential to reduce fuels as compared to invasive species and the sediment/erosion reduction significantly outweighs the potential risk of slightly increasing fuel loads when compared to bare soil.

Benefits to Pollinating Insects

Implementation of the reseeding plan will have important benefits for pollinating insects. Both seed mixes include native grasses which commonly serve as host plants for moths and butterflies and as a result are a key element of the lifecycle for these important species. Native grasses also provide overwinter and nesting habitat for native bees including ground nesting bumblebees.

The 5 native wildflower species, which are an important component of the grass and forb mix, will provide pollen and nectar resources for a wide variety of pollinating insects including bees and butterflies. The mixes include species that flower in the early, middle and late parts of the growing season helping to ensure pollinator resources are provided over a long period of time. The seed mixes do not include milkweed (*Asclepias spp.*), the host plant of the Monarch butterfly (*Danaus plexippus*) because of the high cost of milkweed seed and the difficulty establishing these species. To provide habitat that is specific to Monarchs, focus plantings that include both milkweed and Monarch nectar plants could be established separately in sites that are most favorable to the species requirements and in areas that will be given intensive maintenance.

Site Preparation

Invasive Species Control. The Camp Fire resulted in the establishment of large stands of invasive non-native plant species as described in the Predicted Post Fire Successional Trajectory and vegetation sections above. This includes near impenetrable stands of Scotch broom and French broom in some locations that currently preclude the establishment of native species and have created high fuel loads that increase the chances of future catastrophic fires. A significant and sustained weed control effort will be required to create conditions that allow for the successful establishment of the target native herbaceous species. To be effective, the control methods will need to include an assortment of modalities including chemical and physical methods. To achieve the weed-free conditions necessary for the successful establishment of native herbaceous vegetation, an intensive 2-year eradication program will be needed to reduce the seedbank sufficiently enough to allow the target native species to establish and compete. This will then allow the long-term maintenance activities to focus on spot treatment of small, isolated stands of invasive species and new material that recruits onto the site. Treatments will

include the removal of stubble of remanent vegetative materials so that near bare soil conditions are achieved prior to planting. In addition, if time and resources allow, the seed areas would be irrigated in the late- summer early- fall period (September) in the weeks preceding the fall seeding. This last flush of weeds would then be treated before seeding.

In the absence of an aggressive and sustained weed control program implemented prior to seeding, the chances for long-term establishment of native herbaceous vegetation are low (Reynolds, 2020). Both the initial control measures and long-term maintenance would include avoidance of select high value regenerating and surviving native species such as soap root and seedling and resprouting native oaks. The combination of an aggressive pre-seeding weed control program, avoidance of high value naturally recruited native species and post seeding maintenance should result in long-term establishment of resilient vegetation dominated by native herbaceous species.

Seed Bed Preparation. After weeds have been controlled and thatch and stubble removed, a seed bed must be prepared to facilitate good seed-soil contact in areas that do not have at least a friable soil surface. There is a wide diversity of soil surfaces that will be seeded ranging from areas that have loose soil that can be seeded as-is to areas with highly compacted soils that will need to be loosened to allow the germinated seed to root-in and establish. An assessment of the areas to be seeded will be made prior to seeding and treated as necessary to create suitable soil conditions. For the purposes of this plan, it is assumed that 75% of the seeded areas will require seed bed preparation and the methods used will range from running a harrow over the surface in areas where an ATV or tractor can access the sites to use of metal rakes in areas where mechanized equipment cannot access. It will be up to the ways and means of the seeding contractor to determine the most efficient way to create appropriate seed bed conditions.

SEED DESIGN AND SOURCING

The identification of a suitable plant palette is key to achieving the objectives of the plan. An appropriate native seed mix will be well-adapted to local conditions and will provide benefits that non-native weeds or bare ground cannot. Native, locally adapted perennial species of known genetic origin are often more drought tolerant and can maintain higher moisture levels later in the season than non-native annual species. Native plants create more diverse plant communities, unlike non-native weeds which tend to form homogeneous communities that are susceptible to pests or disease. Their deeper root systems (as compared to weedy annuals) provide better soil stability and promote water infiltration while reducing soil erosion. They benefit local ecosystems, and often have cultural significance. They are also important to wildlife as native wildlife species have co-evolved with native plant species generally making them more suitable for local wildlife resources. For example, the flowers of forb species provide floral resources for pollinators like bees and butterflies while their seed provides food for birds. Similarly, native grasses species serve as host plants for native moths and butterflies and their foliage can provide forage for native herbivores. Finally, native bunchgrass species (e.g., *Stipa pulchra, Elymus glaucus*) create a naturally heterogeneous patchwork arrangement of fuels, wherein discrete

clumps of flashy grass fuels are interspersed with irregular, puzzle-piece-like patches of bare soil. In contrast to the continuous, homogeneous fuel structure of annual grasslands, perennial grasslands are more consistent with patchy and lower-intensity fire regimes.

The seed mix design for this plan took into consideration many elements including what native species naturally occur in the region, what native species are already present, what species are likely to be sustainable in the long-term, and what species have a strong track-record of successful establishment in habitat restoration projects. This initial list was then reviewed in the context of commercial availability of ecotypes (seed of known genetic origin) from the general region and the ability to produce the seed via seed increase contract grows to ensure that procurement was feasible. Use of seed of known genetic origin, even if not from the immediate vicinity because of lack of commercial availability, has a much better chance of long-term establishment as they will in most cases be better adapted to the area's soils, geology, climate, elevation, pests, disease, and other local characteristics than seed of unknown origin, commonly referred to as "variety not stated" (VNS) (Reynolds, 2020). VNS seed can originate from anywhere and is subject to unlimited growing generations. Use of VNS seed can not only be less successful but can also result in maladaptation of existing native stands adjacent to seeded sites (Mackay et al., 2004). Maladaptation may occur because the seed material hybridizes with existing native stands, altering the genetics of natural populations in the vicinity. Thus, to the extent possible, it is important to use best-fit ecotypes when designing habitat restoration sites and if possible, obtaining the most local material possible via seed amplification contract grows from stock seed collect and in and near the Town of Paradise.

Use of PLS in Application Rates

The application rates for the seed used on the project will be measured using Pure Live Seed (PLS) pounds as opposed to bulk pounds. PLS more accurately measures seed viability as compared to bulk pounds (the other means by which seed weight is measured). PLS only counts the target live seed (the quantity of living seed of the species you are purchasing) in the weight. Unlike bulk pounds, PLS pounds exclude chaff, dirt, dead seed, and non-target seed from the overall weight. Use of PLS allows the seed design to be based on a relatively accurate number of live seeds per square foot, which is the most precise way to design native seed mixes (Reynolds, 2020). The use of PLS also guarantees that the same number of viable seeds per acre is planted even though different seed lots with varying quality may be used (Houck, 2009).

Seed Mixes

Two seed mixes were prepared for the project. The first mix (Table 2) is dominated by native grasses and includes only one forb – a native clover to help fix nitrogen and naturally build soil nutrients. This mix is more of a workhorse that will provide good erosion protection and potentially higher cover values but lacks the higher habitat values associated with the mix of grasses and forbs. The second mix (Table 3) includes a combination of native grasses and forbs that will provide good erosion protection along with higher habitat values. The forb component in this mix will add diversity and flowering plants which will benefit a wider array of organisms, including pollinators. The primary species in both seed mix is blue wildrye, a native grass species that has a wide ecological tolerance (can grow in wet and dry areas) making it suitable

for the range of conditions that are present within the footprint of seeding. It is also the common native grass observed in the Town of Paradise during surveys further indicating utility in the seed mixes. Both mixes also include meadow barley (*Hordeum brachyantherum)*, a species that will serve as a nurse crop to help establish the slower growing and longer-lived species like purple needlegrass (*Stipa pulchra)* which will become more dominate, particularly in the drier areas, after 2-3 growing seasons.

The two mixes and their application rates are shown in Tables 2 and 3 below. For the purposes of this plan, it was assumed that the grass dominated mix would be used in more isolated locales while the grass and forb mix would be included along more visible locations including the along main roads and bike trails. It is assumed that each of the seed mixes would be used in approximately equal (50% each) proportions.

Table 2. Grass Dominated Seed Mix

Scientific Name	Common Name	Approximate Live Seeds/PLS Lb.	Approximate Live Seeds/Ft^2	PLS Lb./acre
Bromus carinatus	California brome	72,000	10	6
Elymus glaucus	Blue wildrye	122,000	34	12
Hordeum brachyantherum	Meadow barley	95,000	9	4
Stipa pulchra	Purple needlegrass	65,000	9	6
Trifolium obtusiflorum or Trifolium wildenovii	Native clover	250,000	17	3
Total			79	31

Table 3. Grass and Forb Seed Mix

Scientific Name	Common Name	Approximate Live Seeds/PLS Lb.	Approximate Live Seeds/Ft^2	PLS Lb./acre
Bromus carinatus	California brome	72,000	10	6
Elymus glaucus	Blue wildrye	122,000	34	12
Hordeum brachyantherum	Meadow barley	95,000	9	4

Stipa pulchra	Purple needlegrass	65,000	9	6
Trifolium obtusiflorum or Trifolium wildenovii	Native clover	250,000	17	3
Achillea millifolium	Yarrow	3,000,000	14	0.2
Grindelia camporum	Valley gum plant	250,000	6	1
Lupinus microcarpus densiflourous	Chick lupine	12,500	<1	1
Eschscholzia californica	California poppy	350,000	8	1
Total			106	34.2

Seed Origin. Seed must be of Northern California genetic origin from within a region spanning the eastern half of the outer coast range, across the Sacramento Valley to the western middle foothills of the Sierra Nevada.

Seed Procurement. The seed requirements for the project are substantial. This seed can be obtained by either implementing a seed amplification contract grow to obtain very local ecotypes or by purchasing commercially available seed that is regionally local. The preferrable method would be a seed amplification contract grow but that determination has not been made and a combination of methods may be required. Both avenues of seed procurement are described below.

Seed Amplification Contract Grow to Procure Seed. Ideally, the seed used from the project would originate from the Town of Paradise and immediate vicinity. There are no current commercially available sources for seed in the immediate vicinity of Paradise, and wildland seed collection alone would not provide sufficient seed for the project. Thus, seed amplification contract grows would be required to provide the most local seed material. This approach would involve collection of wildland stock seed from the region and amplifying that seed at a native seed farm via a seed increase contract grow. The stock seed would be collected in the year proceeding planting at the seed farm and the seed increase process would start in the fall of the collection year. For most species, substantial yields can be obtained in the first year following planting. However, in some cases, it may require a second year to achieve substantial yields so two growing seasons may be required to produce adequate seed for the project.

Finding and collecting adequate stock seed is often a limited factoring in seed increases and is a resource intensive process. If enough stock seed cannot be collected to directly seed into production fields, that seed needs to be grown out in containers and then planted directly into the fields often doubling the cost of the grow out. Thus, collection of adequate stock seed is a critical component of cost-effectively growing native seed.

Commercial Purchase to Procure Seed. If a seed increase contract grow is deemed to be infeasible, the seed to be used for the Town of Paradise Reseeding Plan would have to come from commercially available seed originating from a moderately large region of Northern California. To ensure that enough seed is available, the seed origin requirements would be of northern California genetic origin spanning a region from the eastern half of the outer coast range, across the Sacramento Valley to the western middle foothills of the Sierra Nevada.

Seeding Methods. Three commonly used native species seeding methods are drill seeding, broadcast seeding, and hydroseeding. On large, flat sites with good equipment access, a native seed drill often produces the best results and requires the least amount of seed. However, most of the areas that will be seeded are along narrow roadsides with uneven surfaces making drill seeding impossible in most locales. Another option, broadcast seeding with a "belly grinder" or drop seeder could potentially be used on some of the sites but the varied topography and equipment accessibility makes this method impractical in most circumstances. Thus, on balance, given the varied topography and limitations on equipment that can be efficiently utilized, hydroseeding is the most practical method for the Town of Paradise seeding effort and is the assumed seeding method that would be used in this plan.

Seed will be applied to the site via hydroseeding application. The seed will be spread via hoses or directly from sprayers mounted on hydroseeding trucks with the specific method used for each site determined by the ways and means of a seeding contractor. It will include a 2-3 step process that includes seed, wood fiber mulch, fertilizer (if applicable), tackifier (resin adhesive to glue materials to slopes), and straw. The straw to be used will either be native grass straw or rice straw which tends to have less upland weed seed than other commercially available straw. Native grass straw provides the best potential outcome as it generally contains some native seeds. However, it is more expensive than rice straw and the supply is more limited. The straw would be applied at a rate of 3,000 pounds per acre.

The most effective time to apply native seed is typically in the fall (month of October) immediately prior to the onset of winter rains. Thus, October should be the target seeding window. However, complications associated with this large-scale seeding program will necessitate flexibility in the seeding window. Thus, the allowed seeding window for the project will be September-December, a period that will allow for effective seed establishment in most rainfall years while providing enough time to complete the seeding.

Vegetation Establishment Maintenance

Vegetation establishment maintenance will consist primarily of weed control and reseeding of areas that have not established sufficient native cover. Native seed, if properly applied to a well-prepared site, will not require supplemental irrigation. However, if extreme drought conditions continue, supplemental irrigation may be required to assist with plant establishment. The specific maintenance activities will be partially based on the evaluation of performance and maintenance needs as described in the long-term monitoring section below. Thus, an adaptive approach to vegetation establishment maintenance will be implemented.

Weed Control. If the 2-year pre-planting weed control program is successfully implemented, weed control during the maintenance period will be focused on spot treatment of weeds. This spot treatment will be most intensive during the first 1-2 years following seeding as the seeded material establishes. Once the native species are established, they will occupy a significant portion of the sites making it more difficult for weeds to establish. The remaining weed seed bank will also continue to be diminished with each passing year of maintenance giving the native species the competitive advantage they need to persist.

Reseeding. Reseeding will be required in some areas due to various factors like erosion or inadequate site preparation. For the purposes of this plan, it is assumed that 10% of the originally seeded areas will need to be seeded again at the end of the first year and 5% at the end of the second year. The seeding approach outlined in this plan will serve as the basis for reseeding but will be modified as necessary based on the lessons learned and the information gathered during the long-term monitoring.

Irrigation. Under normal rainfall conditions, the seeded areas will be established from natural rainfall. However, if severe drought conditions persist, supplemental irrigation would be required to establish the target native herbaceous vegetation.

Long-term Maintenance. The Town of Paradise will be responsible for long-term maintenance of vegetation once the 3-year vegetation establishment maintenance is complete. This work will primarily involve control of non-native plant species while protecting existing high value native species. This approach will include training maintenance crews about how to properly distinguish between native and non-native species. Reseeding is only anticipated in the plant establishment maintenance and would likely not be part of long-term maintenance.

Town of Paradise Community Education Program and Volunteer Opportunities

This reseeding plan will be made available to Town of Paradise community members to assist them in implementing successful and sustainable native vegetation establishment and maintenance work on private lands. The success of community members efforts will hinge at least partially on learning the importance of implementing an extensive pre-planting weed control program, planting with suitable native species, utilizing appropriate planting techniques and maintenance measures to establish the target native species as described in this plan. Lessons learned regarding implementation of this plan by the Town of Paradise will be shared with community members as appropriate to further assist with reaching successful native vegetation establishment outcomes on private lands.

The community outreach work that was part of this plan showed that community members have a very a strong interest in improving habitat values through the establishment of native vegetation. When possible, the Town of Paradise will assist community members in their desire to improve habitat values by providing opportunities to volunteer on habitat restoration projects on Town of Paradise owned properties. These projects would likely go beyond the reseeding work described in this plan including things like planting native container plants, planting additional species beyond those currently listed in this plan and including additional maintenance measures such as providing irrigation to the container plants installed.

VEGETATION ESTABLISHMENT MONITORING

Project Goals

The goal of the reseeding project is to establish herbaceous vegetation that is dominated (more than 50% of the relative vegetative cover) by native species. The established vegetation will be moderately dense with an average absolute cover of 50% or more and will serve to control erosion without creating the excessive fuel loads associated with the invasive vegetation that now dominates the vegetation that has naturally established following the Camp Fire. These goals are expected to be achieved by the end of the third year following the initial seeding.

Monitoring Methods

Monitoring of the seeded areas will be conducted over a 3-year period following the seeding. The monitoring will be primarily qualitative in nature and will be designed to assist with vegetation management decisions to achieve the goal of establishing moderately dense native herbaceous vegetation dominated by native species. This will be accomplished primarily via observational surveys conducted by walking and driving the footprint of the seeded areas annually in the late spring (late April to early June) timeframe. These surveys will include a general assessment of vegetative cover, species composition and soil stability and would be conducted by individuals with expertise in the flora of northern California combined with habitat restoration experience. The contractor who implements the project could provide these monitoring services if they can demonstrate they have the appropriate experience and expertise on their team. Stands of invasive non-native plant species will be documented for follow-up spot control and significant areas of bare soil and erosion will be noted for follow-up seeding, straw spreading and other treatments. Areas requiring following up maintenance will be noted on maps and further documented with photographs as needed.

The qualitative surveys will be supplemented with limited quantitative vegetation sampling. The approach will involve placement of quadrats (defined sampling units 1-meter square or less in size) to formally assess percent vegetative cover by species. The areas selected for this supplemental monitoring will be representative of the vegetative conditions in the vicinity. This sampling will be limited to no more than 250 quadrats placed over the entire 259 acres of anticipated seeding area.

Annual Monitoring Report

A summary report that documents the results of the qualitative surveys, photographs and quantitative sampling will be prepared annually for the first three years following seeding. The report will be designed to determine if progress is being made toward reaching the goals for the project and will help guide maintenance measures needed to achieve a successful outcome. This will include identification of substantial areas where native vegetation is not establishing well and will include recommendations for implementation of remedial actions measures such as additional weed control, improved seedbed preparation, reseeding, or related activities.

Regulatory Compliance

Implementation of the reseeding plan as described in this document will be consistent with the Town of Paradise's environmental compliance documents and standard practices.

Preparation of Reseeding Bid Package

Implementation of the reseeding plan will involve preparation of a bid package for seeding contractors to price out. The plan will rely on the design work described in this plan including areas to be seeded, seed mix (species and rates), seed bed preparation, planting methods, maintenance and related. However, it is assumed that some refinements to the footprint of seeding would be made at that time as some of the areas currently in the acreage to be seeded are very small and in some cases very remote so implementation of reseeding in these areas will provide little ecological improvement and would be much more costly on a per unit basis. Thus, areas like these, currently included in this plan, may be removed from the bid package. It is assumed that the bid package will include preparation of a predesign report, 65%, 100% and final design plans. In addition, detailed specifications will be prepared. The Town of Paradise will comment on each submittal and those comments would then be incorporated into each subsequent design.

Project Schedule

The schedule for implementation of the major elements of the project are shown in Table 4 below. The schedule assumes that weed control and seed amplification efforts would be implemented starting in spring 2022 and conclude in fall 2024. The sites would be seeded in fall 2024 shortly after the conclusion of pre-planting weed control efforts. Maintenance and monitoring would occur in 2025-2027. This schedule may be modified depending upon the timing of FEMA funding.

Table 4. Timeline for reseeding plan implementation.

Task	2022	2023	2024	2025-2027
Collect stock seed for seed amplification	X			
Implement seed amplification	X	X	X	
Pre-planting weed control program	X	X		
Seeding			X	
Maintenance				X
Vegetation establishment monitoring				X

OTHER RESOURCES FOR COMMUNITY MEMBERS

https://www.fire.ca.gov/media/4996/readysetgo_plan.pdf

https://www.nfpa.org/Public-Education/Fire-causes-and-risks/Wildfire/Firewise-USA

https://www.ready.gov/wildfires

https://library.municode.com/ca/paradise/codes/code_of_ordinances?nodeId=TIT8HESA_CH8.58DESPHAFUMA_8.58.020PUIN

https://ucanr.edu/sites/bcmg/resources/firesafe/

A homeowner's guide to Firewise landscaping in Butte County – Butte County Fire Safe Council

California Fire Safe Council – Creating Defensible Space

REFERENCES

Alexander, J. M., & D'Antonio, C. M. (2003). Seed Bank Dynamics of French Broom in Coastal California Grasslands: Effects of Stand Age and Prescribed Burning on Control and Restoration. *Restoration Ecology*, *11*(2), 185–197.

Blumlet, M. A. (1991). Winter-deciduous versus evergreen habit in Mediterranean regions: a model. *Proceedings of the Symposium on Oak Woodlands and Hardwood Rangeland Management*, 194–197.

Crotteau, J. S., Morgan Varner, J., & Ritchie, M. W. (2013). Post-fire regeneration across a fire severity gradient in the southern Cascades. *Forest Ecology and Management*, *287*, 103–112.

Franklin, J. (2009). Vegetation dynamics and exotic plant invasion following high severity crown fire in a southern California conifer forest. *Plant Ecology*, *207*(2), 281–295.

Goforth, B. R., & Minnich, R. A. (2008). Densification, stand-replacement wildfire, and extirpation of mixed conifer forest in Cuyamaca Rancho State Park, southern California. *Forest Ecology and Management*, *256*(1–2), 36–45.

Houck, Morris J. (2009). Understanding Seeding Rates, Recommended Planting Rates, and Pure Live Seed (PLS). United States Department of Agriculture, Natural Resources Conservation Service, Alexandria, Louisiana. https://www.nrcs.usda.gov/Internet/FSE_PLANTMATERIALS/publications/lapmctn9045.pdf.

Keeley, J. E. (1987). Role of Fire in Seed Germination of Woody Taxa in California Chaparral. *Ecology*, *68*(2), 434–443.

Longbrake, A. C. W., & McCathey, B. C. (2001). Biomass Allocation and Resprouting Ability of Princess Tree (Paulownia tomentosa: Scrophulariaceae) Across a Light Gradient. *The American Midland Naturalist*, *146*(2), 388–403.

McKay, J.K., Christian, C.E., Harrison, S. and Rice, K.J. (2005), "How Local Is Local?"—A Review of Practical and Conceptual Issues in the Genetics of Restoration. Restoration Ecology, 13: 432-440. https://doi.org/10.1111/j.1526-100X.2005.00058.x.

Pilon, N. A. L., Cava, M. G. B., Hoffmann, W. A., Abreu, R. C. R., Fidelis, A., & Durigan, G. (2020). The diversity of post-fire regeneration strategies in the cerrado ground layer. *Journal of Ecology*, *109*(1), 154–166.

Resco De Dios, V., Arteaga, C., Peguero-Pina, J. J., Sancho-Knapik, D., Qin, H., Zveushe, O. K., Sun, W., Williams, D. G., Boer, M. M., Voltas, J., Moreno, J. M., Tissue, D. T., & Gil-Pelegrín, E. (2020). Hydraulic and photosynthetic limitations prevail over root non-structural carbohydrate reserves as drivers of resprouting in two Mediterranean oaks. *Plant, Cell & Environment*, *43*(8), 1944–1957.

Reynolds, Patrick. (2020), Using Seed in Habitat Restoration. Fremontia, Vol. 48, No. 1: 24-27. https://www.cnps.org/wp-content/uploads/2020/12/Fremontia-V48N1-Restoration-for-web.pdf.

State of California, Caltrans. (2021), Caltrans Erosion Control Toolbox. https://dot.ca.gov/programs/design/lap-erosion-control-design/tool-1-lap-erosion-control-toolbox.

State of California, Office of the State Fire Marshal (OSFM). (2020), Butte County Community Wildfire Protection Plan, 2020-2025. http://osfm.fire.ca.gov/media/xsap3zcr/2020-btu-fire-plan.pdf.

Stevens, J.T. and Latimer, A.M. (2015), Snowpack, fire, and forest disturbance: interactions affect montane invasions by non-native shrubs. Glob Change Biol, 21: 2379-2393. https://doi.org/10.1111/gcb.12824.

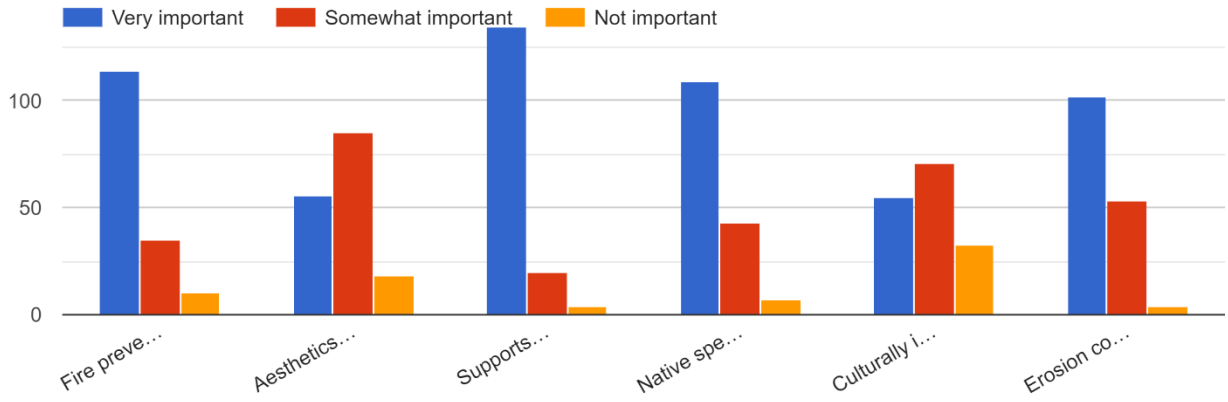
University of California, Agricultural and Natural Resources. (2018), California Watershed Emergency Response Team. Camp Fire Watershed Emergency Response Team Final Report. https://ucanr.edu/sites/Rangelands/files/304942.pdf.

APPENDICES

Appendix A. Community Engagement Survey

TOWN OF PARADISE
RESEEDING PLAN SURVEY

1. Please rank the following in terms of their importance to you when identifying plant species for reseeding public spaces:

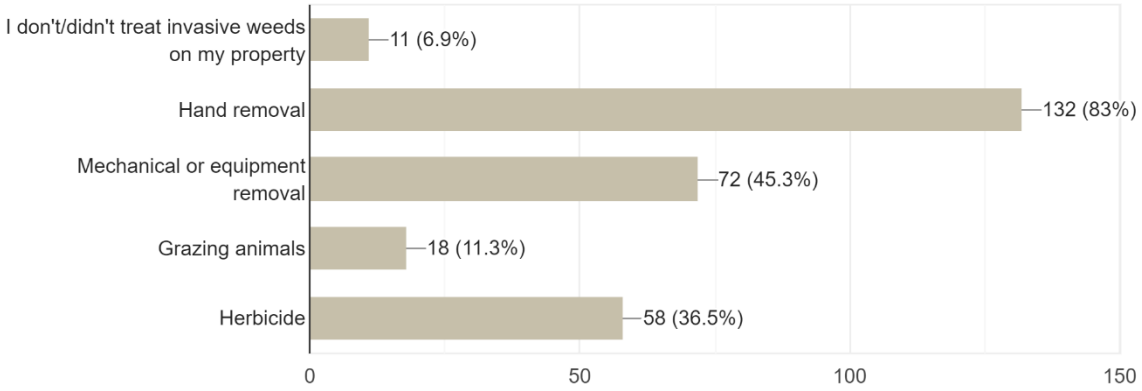


2. For successful reseeding, private property owners play a large role in managing invasive weeds on their individual properties as weeds don't resp...moving invasive species on your private property?

159 responses

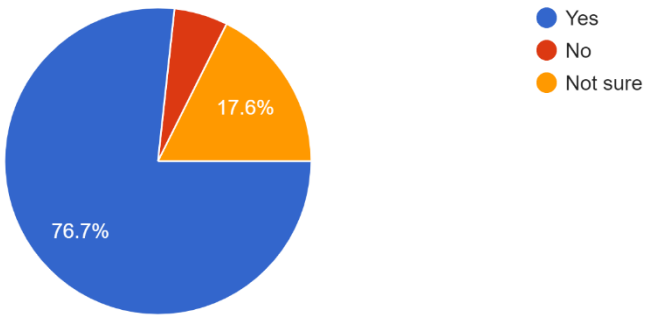
3. Do you (or have you) treat(ed) invasive weeds on your property in Paradise? If yes, what type of treatment do (or did) you use? (Select all that apply.)

159 responses



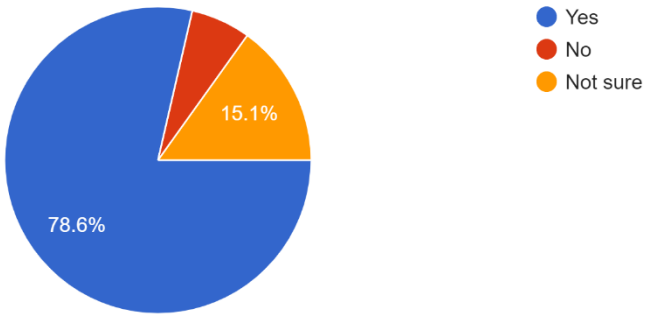
4. Would you support low intensity prescribed burns conducted by fire professionals for the management of invasive plants and to reduce hazardous fire fuels?

159 responses



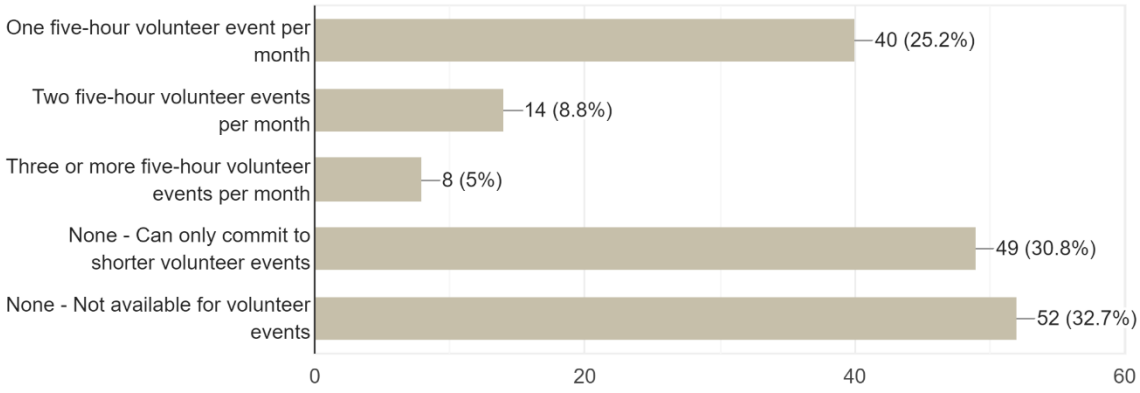
5. Would you support access for tribal members to steward and gather culturally significant plants on public lands in Paradise?

159 responses



6. Would you volunteer for a community planting or invasive weed removal event? If yes, how many five-hour volunteer planting or weed removal events would you be able to volunteer for per month?

159 responses



7. Any specific plant(s) that you recommend be considered when developing the Paradise Reseeding Plan?

Will probably need to be drought resistant!
PINE - evergreen - red wood trees are low maintenance and do not create waste
Drought resistant native plants
natives
bee friendly
Milkweed, elderberry, California Oak, Native california blackberry

Redwoods
Redwoods
Ponderosa pines, Ceanothus integerrimus, black oaks
Drought Tolerant Natives, Perennials, Pollinators for our Bees & Birds. Our soils would also benefit from plants with natural capabilities to repair and extract pollution, such as Sunflowers and Willows.
Conifers, dogwood, fruit and nut bearing trees and shrubs
too many to list..natives!
BIG! I'm not getting any younger, let's get this moving!
Native trees
I recommend native plants.
Mullein, Sage, Wild Rose, Elderberry, lupin, azaleas, manzanita, cedar, redwoods
Plants that will support bees.
redbud, ceanothus sp., native grasses, oak trees, apple trees
Oaks and maples. Not pine.
Poppies
Bulbine,candy apple succulent,lambs ear,feverfew
Trees
Milkweed
Redwoods
Toyon bush.
Green and colorful
Low water drought tolerant
Milkweed
Tall trees
Native flowering plants, mallow varieties, mountain lilacs, lavender
Milkweed, Matilija poppy, ca poppy, lupine, native oaks, native grasses,
Maples
Large shade trees
Not sure of name - yellow weed
Dog wood, elder berry, red bud
Fruit trees, cedars
Pine trees!!!
Fruit trees
Redwoods
drought tolerant
california poppies, oak trees
Redwoods and weeping willows ❤️ Soil and ground cover are more important than the plants .... those invasive weeds, like scotchbroom love our current soil. Working hard to change my own soil (with all that mulch from the downed trees) and replace it with beautiful plants.
Low water plants
Redwood and cedar
Douglas fir, ponderosa pine, other conifers
Dogwood Trees and redwood trees
Fruit tree's
Need shade and erosion control. Fast growing trees and native pines and firs. Need shade trees along Memorial trail.

We do custom mixes for all seeding kelloggs ag service. 624 3045. Over 40 years experience. Let's work together? Bill kellogg
fast growing trees
Crimson clover
Ponderosa Pine, redbud, dogwood, ceanothis, toyon, manzanita, Bush poppy, matilija poppy
Contact US forest service they have extensive experience receding fire Burns with native species. Also they have contractors available to provide the seeds. Hydroseeding is an excellent way to Revegetate if done with the right seed and technique.
Lavender, sage, oleander
Native trees
Azaleas
Redwood trees
Non-invasive
california poppy
sages, oleander
Trees! All trees around our place are gone and it is very HOT
Anything drought resistant
Flowers
Anything deer don't like to eat.
No bushes, more redwoods
Cedars
Unfamiliar to species
Redbud could be our town's tree: beautiful in spring and ediblebuds and flowers. Oak trees of course.
pines and oaks
redwoods, blue dicks
NO ivy!
Oak and Pine
Western Red Cedar, Western Redbud, Black Oak, Big Leaf Maple, Madrone,
Cherry trees
More trees
Lupine
Redbuds, dogwoods, vinca, St . John's Wort
Redwoods seem to recover well after Fire.
Cedars
Delphinium, lavender, sweet gum trees,lillies, mint, daisies
Small native trees such as: Toyon, Dogwood, Red Bud trees. Native flowers such as: irises, roses, poppies, lupines, bracken ferns, Cat's Ears, Johnny Jump-Ups, native azaelia, etc.
Crepe Myrtle, Dogwood, Redbud, Redwood trees
Whatever fits with other requirements, and is most fire resistant. Not too many pines, please!
Native plants that won’t carry fire through the canopy like pines.
Ponderosa Pines, Grey Pines, Black Oaks, Tan Oaks, Dutchman’s Pipevine, Ceanothus, Poppies, Penstemon
Drought tolerant
native perennial grasses, Monardella, native shrubs (Ceanothus, Cercis, Ribes, Hetereomeles) then also give them annuals like Nemophilia and Gilia for quick results and to help overcome all the non-native "putative native" poppies people plant.
Any native that is fire resistant, and a diversity of them for wildlife!

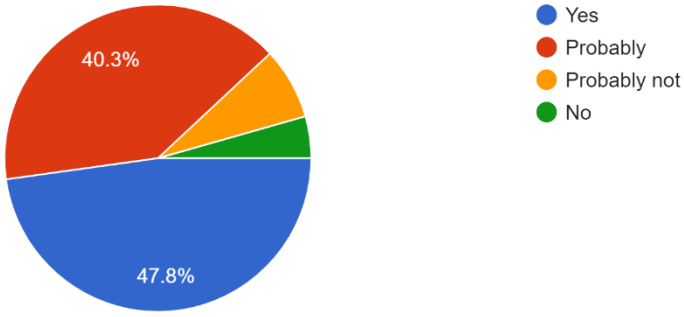
Oak
Blue oak trees
native, fire resistant, drought tolerant
Site specific native plants. If any plants are to be on long term irrigation, they should be low water food producing plants.
Native plants
Calochortus
Native! Some faves are sages, shrubs like manzanita and coffeeberry, native grasses
trees
CAN ADVISE ON SEEDING OLDEST SEED BUSINESS IN TOWN
Native plants only
Drought tolerant ones
Fire tolerant and those which contribute to seasonal enhancement.
Oaks, natives, medicinals, drought tolerate, soil building, nitogen fixing, and bee pollinating. Shade and fruit trees too.
Lupin
All native species of course. Oak, Grey pine, Redbud, yerba santa, manzanita and flowers
Indian Spice Plant,
Mugwort
No. But, really, I found many of these questions to be totally ridiculous. I do not care one whit about "culturally important species" or native species. Nor do I want to be *told* to care about them. I like lawns, I like green, I like people to have freedom of their own choices, not be dictated to.
Redwood trees because of there ability to survive fire and shade new plants.
Natives
Native species, rebuilding the land to it's natural state and maintaining undergrowth
Toyon
Ponderosa Pine
Dogwoods
Poppies
Native grasses in ROW, list of recommended plants and best practices for private landowners
Maples
I don't know of any, want to learn
scotch broom

8. What is the biggest challenge to successfully replanting Paradise?

159 responses

9. When completed, would you consult the Paradise Reseeding Plan when deciding what to plant on your private property?

159 responses



10. Do you currently own property in Paradise?

159 responses