Midpeninsula Regional Open Space District

R-20-90
Meeting 20-17
August 12, 2020

AGENDA ITEM 5

AGENDA ITEM

Integrated Pest Management Program 2019 Calendar Year Report

GENERAL MANAGER'S RECOMMENDATIONS

Accept the Integrated Pest Management Program 2019 Calendar Year Report. No Board action required.

SUMMARY

On December 10, 2014 (R-14-34), the Board of Directors (Board) of the Midpeninsula Regional Open Space District (District) adopted the Final Environmental Impact Report (FEIR) for the Integrated Pest Management (IPM) Program (Program) and approved the IPM Guidance Manual and Policy. The District amended the Program in January 2019 through an Addendum to the FEIR (R-19-11). The Program requires a comprehensive annual report of past pest control activities, both chemical and non-chemical, on District lands. This report presents the results of the fifth year of pest management activities prescribed under the Program. The District treated 68 species, including 20 state-listed noxious weeds (plants defined as a pest by state law or regulation) using a variety of treatment methods. The total number of hours for IPM/resource management work increased by approximately 2,000 hours from 2018 due to a continued increase in contractor and volunteer hours. Herbicide use in IPM has decreased significantly from 2017 levels. No changes to the IPM program are recommended at this time. In response to COVID-19 and consistent with temporary emergency use of pesticides per the IPM, the District began in 2020 to use industry-accepted disinfectant that is classified as a pesticide to clean high touch surfaces in offices and vehicles. The use of this product is expected to continue for the duration of the pandemic, and the District will evaluate whether to return to the Board of Directors at a later date with a recommendation to add the product to the District's List of Approved Pesticides.

BACKGROUND

IPM is a long-term, science-based, decision-making system that uses specific methodologies to manage damage from pests. The goal of the District's IPM Program is to control pests by consistent implementation of IPM principles to protect and restore the natural environment and provide for human safety and enjoyment while visiting and working on District lands. The District defines pests in its Resource Management Policies as "animals or plants that proliferate beyond natural control and interfere with natural processes, which would otherwise occur on open space lands". Moreover, the District defines target pests as "plant or animal species that have a negative impact on other organisms or the surrounding environment and are targeted for treatment". Meeting IPM objectives requires monitoring site conditions before, during, and after treatment as well as revising methods as necessary per adaptive management principles.

As a component of the IPM Program, District staff is required to present the Annual Report to the full Board. The Annual Report includes the following information for IPM-related work completed during the prior calendar year:

- Summary of pest problems encountered, and a comparison to past years;
- Summary of pest control treatments used;
- Qualitative assessment on the effectiveness of the pest control program, and suggestions for increasing future effectiveness;
- Summary of pesticide use;
- Summary of public notifications and public inquiries about IPM on District lands; and
- Assessment of compliance with the Guidance Manual.

The attached 2019 Annual Report (Attachment 1) is the fifth annual report prepared for the Program and describes the quantitative IPM activities undertaken in 2019, as well as a qualitative assessment of the Program. IPM Annual Reports from 2015 (R-16-120), 2016 (R-17-50), 2017 (R-18-81), and 2018 (R-19-90) are available for review. Listed below are the fifth-year highlights of the Program.

DISCUSSION

Summary of Pest Problems and Comparison to Past Years

Of the more than 300 non-native species known to occur within District boundaries, the District targeted 68 invasive plant species for natural resource protection and long-term management. These species have the potential to invade natural areas, displace native species, and reduce biodiversity**.** The State of California considers 20 of these species as noxious weeds. The District's IPM Coordination Team identified twenty (20) new pest control projects as a high priority for treatment on District lands. All twenty new projects began in 2019.

The total number of hours for IPM-related work (Table 1) has increased by 20% from 2015 levels. Field staff hours have fluctuated since 2015 depending on other annual competing priorities, including the number of scheduled Measure AA capital improvement projects under construction. Volunteer and contractor hours have increased substantially since 2015. The hiring of a second Volunteer Program Lead in 2018 increased the capacity of volunteers for IPM projects. Increased contractor hours are primarily due to large scale, Measure AA project-related restoration and/or mitigation work. In addition, a five-year Memorandum of Understanding (MOU) grant agreement with Santa Clara Valley Water District (Valley Water) (R-17-79) provided substantial funding for IPM related work at Bear Creek Redwoods Open Space Preserve. In 2019, 323 contractor hours were spent removing invasive plant species at mitigation sites. Mitigation is required when a District project may cause potential impacts to natural areas and requires additional staff resources for restoration planning, site preparation, planting, site maintenance, and up to 10 years of follow-up monitoring.

Table 1: Comparison of Hours by Crew Type and Year

Year	Staff	Contractor	Volunteer	Total
2015	5,431	2,132	1,736	9,299
2016	Unknown[1]	1,659	2,883	4,542
2017	623	2,907	2,559	6,089
2018	1,767	5,197	3,520	10,484

[1] Staff hours were not recorded into the Weed Database or CalFlora as this was a transitional year from one database to another.

Year	Staff	Contractor	Volunteer	Total
2019	1,502	6,421	4,261	12,184

Summary of District Pest Control Treatments
Table 2 presents a summary of hours for each treatment method expended by staff, contractors, and volunteers in 2019.

Table 2: Treatment Methods by Crew Type[2] for 2019

Treatment Method	Hours Staff	Hours Contractor	Hours Volunteer	Total	% of Total
Brush Cut / Mow	108	576	-	**684**	**6 %**
Cut	197	183	530	**910**	**7 %**
Dig	183	265	258	**706**	**6 %**
Herbicide	34	302	-	**336**	**3 %**
Pull	980	5,095	3,473	**9,548**	**78 %**
TOTAL	**1,502**	**6,421**	**4,261**	**12,184**	
% of Total	**12 %**	**53 %**	**35 %**		

Manual weed pulling remains the most common treatment method at 78% of all hours; herbicide use accounted for only 3% of all hours. Herbicide hours were low in 2019 because of the implementation of the Valley Water MOU, which focused on manual treatment methods. In addition, some past herbicide projects have effectively reduced the cover of the target invasive species enough that follow up manual control is feasible. In a typical year, herbicide use accounts for approximately 10% of labor hours and may have periods of increased use as new projects are initiated.

During the creation of the IPM Annual Plan, treatment methods are evaluated using the best available science in weed management. The IPM Annual Plan, which is finalized in January of each year, lays out the work plan for the new calendar year. Treatment methods have shifted across the five years of the Program, with the largest change in the reduction of hours spent applying herbicide (reduced from 60.8% to 3 %, with a relative reduction of 57.8%) and the largest increase in the percentage of hours spent hand pulling (increased from 35.5% to 78%, with a relative increase of 42.5%).

Pest Control Program Effectiveness
Structural pest control in 2019 (e.g. Administrative Office, preserve restrooms) was limited to one of six approved pesticides for buildings, all of which are "Caution" labeled (as opposed to "Warning" or "Danger" labels), and therefore pose a reduced risk to workers or occupants of treated buildings.

Non-Structural Pest Control of high priority invasive plants in natural areas using both herbicidal and non-herbicidal methods is conducted to protect and restore native vegetation at preserves by eliminating or controlling the spread of competing invasive vegetation. The District has set a goal to reduce the per-acre usage of herbicides over time at individual sites and acknowledges that in some instances, use of herbicide may initially increase followed by a reduction in

[2] Treatment hours are for Natural and Rangeland areas only, as brushing/mowing of roads, trails, defensible space, or emergency landing zones changes minimally from year to year.

herbicide use once the pest is eliminated or reduced to a level that can be effectively managed with non-herbicidal methods.

Pesticide Use
Staff, contractors, and tenants report pesticide use on District lands to the IPM Coordinator. Table 3 summarizes the known use of pesticides on District lands, excluding PG&E and the Spartina Project, who are excluded from the District's IPM Program and have separate CEQA documentation. County Agricultural Departments require PG&E and the Spartina Project to report pesticide use directly to the County. District staff reviews all proposed PG&E work and the use of herbicide is limited to the approved pesticide list under the Program. PG&E adheres to the District's herbicide Best Management Practices (BMP) and mitigation measures.

Table 3: Pesticide Use on District Lands

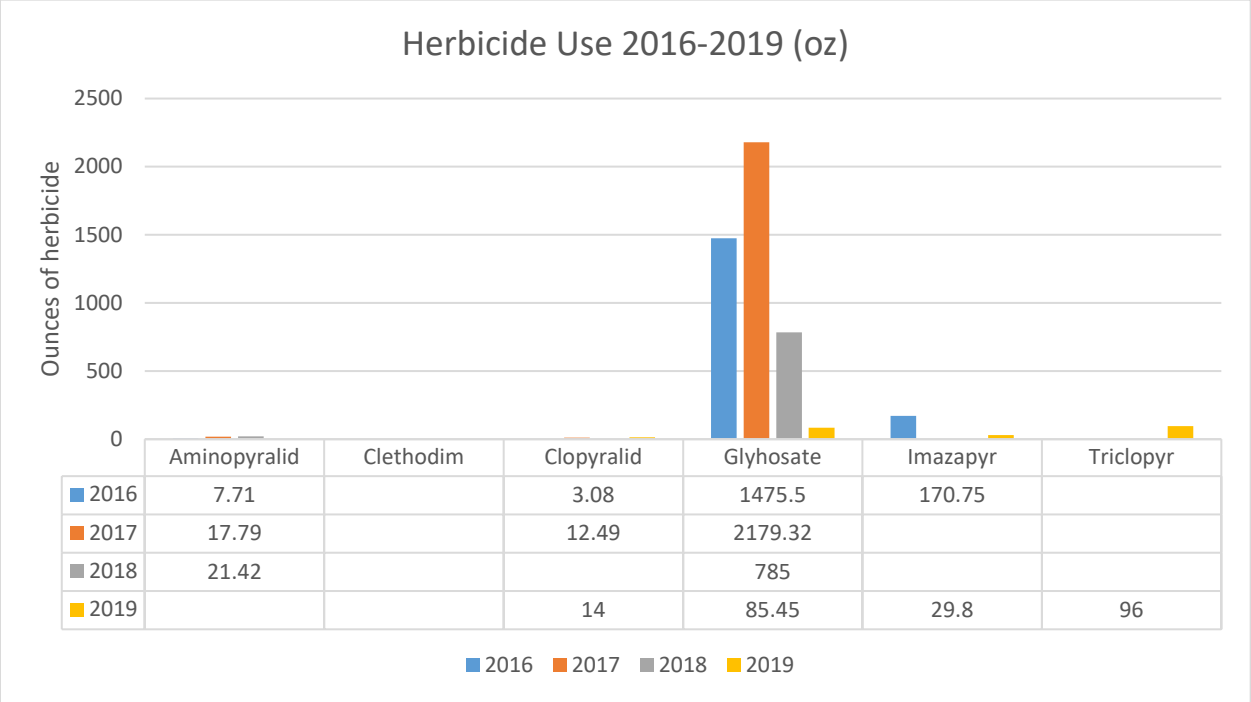
Pesticide	*Trade Name*	*Active Ingredient*	*Amount Used (ounces)*	*Gross Acres Treated*	*Ounces/Acre*
Fungicide	Reliant	Potassium salts of phosphorus acid	4,608	-	-
Herbicide	Milestone	Aminopyralid	-	-	-
	Envoy Plus	Clethodim	-	-	-
	Transline	Clopyralid	14	10.8	1.3
	Roundup Custom	Glyphosate	28	73.5	0.4
	Roundup ProMax	Glyphosate	59.5	44.7	1.3
	Polaris	Imazapyr	29.8	0.98	30.4
	Capstone	Triclopyr + aminopyralid	94	1.05	89.5
	Garlon 4 Ultra	Triclopyr	2	trace	-
Insecticide		Prallethrin	113.5	-	-
Rodenticide		Cholecalciferol	-	-	-

Recommended application rates, as specified on the product label, vary by Active Ingredient (AI) and formulation of any particular pesticide product. For example, the specified application rate for Roundup® (glyphosate as the AI) ranges from 32 to 160 ounces (oz) per acre. The specified application rate for Milestone (aminopyralid as the AI) ranges from three to seven ounces per acre. Note that a Department of Pesticide Regulation's licensed Pest Control Advisor (PCA) provides the actual application rates per the District's BMPs and is available for consultation as an Invasive Species and Restoration Biologist.

Figure 1 (below) presents an analysis of herbicide used to control invasive plant species over the course of the IPM Program. Overall, herbicide use declined significantly in 2019, and it is the first year since the IPM program began that glyphosate is not the most abundant herbicide AI that was used. With the addition of Capstone (aminopyralid + triclopyr as AI) to the District's Approved Pesticide List, staff and contractors were able to displace a significant amount of glyphosate use. Herbicide use has decreased from its peak in 2017 when the District was conducting intensive invasive species work to prepare and open Bear Creek Redwoods Open

Space Preserve (OSP) to public use. This initial knockdown period within the Phase I area has largely transitioned to manual and mechanical treatment methods due to a drastic decrease in percent cover in previously treated areas.

Figure 1: Herbicide Use 2016-2019



	Aminopyralid	Clethodim	Clopyralid	Glyhosate	Imazapyr	Triclopyr
2016	7.71		3.08	1475.5	170.75	
2017	17.79		12.49	2179.32		
2018	21.42			785		
2019			14	85.45	29.8	96

Pulses of increased herbicide use should be expected in future years as new projects are initiated due to the District:

- Acquiring new lands with priority infestations;
- Taking action on new high priority fuel management areas; and
- Prioritizing new pest management sites on exiting lands.

However, a similar decline in herbicide use over subsequent years should follow as populations get under control and methods are shifted from chemical to manual treatment at specific sites.

Use of disinfectant pesticide VIREX II

Per the IPM program, in the event of an emergency (such as a human health disease outbreak), pesticides that are not included on the List of Approved Pesticides may be used for short periods. In these unusual situations the District will comply with required regulatory procedures, then will evaluate the emergency response pesticide use and determine if its IPM program needs to be modified to accommodate similar future emergencies. In 2020 to protect staff during the COVID-19 pandemic, the District is using the viral disinfectant Virex II (active ingredient didecyl dimethyl ammonium chloride) to clean offices, vehicles, and other high-touch surfaces. Virex II in its undiluted form is registered as a pesticide, and only trained staff who hold valid Qualified Applicator Certificates (QAC) with the CA Department of Pesticide Regulation (DPR) are authorized to mix the undiluted product. The District is only cleaning with the product in its diluted form, which is not regulated and is a widely used cleaning disinfectant. However, it is only available in concentrate, so trained staff first must dilute it for use as a disinfectant. District staff will continue to use Virex II to clean surfaces at regular intervals throughout the duration of

the pandemic. The District will evaluate whether this pesticide or other suitable pesticides authorized to use against the virus by the Department of Pesticide Regulations should be permanently added to the District's Approved Pesticide List.

Current IPM Research Underway

- *Non-Herbicidal Methods to Controlling Slender False Brome*
  The District, Resource Conservation District, and Santa Clara University partnered to assess the efficacy of several non-herbicidal treatment methods, including mechanical mowing and several types of mulch. Field experiments and data collection for non-herbicide control of Slender false brome were concluded in 2019, and a final report is expected in December 2020.

- *Tall Oatgrass*
  Tall oatgrass (*Arrhenatherum elatius*) occurs in dense monocultures in several grasslands throughout the District, possibly introduced as forage from earlier grazing operations. To restore biodiversity in these grasslands, the District plans to implement a treatment study in Long Ridge OSP in fiscal year 2020-21 to test the efficacy of a treatment method described in the academic journal *Applied Vegetation Science*. If trial treatments prove successful, this method will be expanded to infestations within Skyline Ridge OSP, Los Trancos OSP, and Monte Bello OSP.

- *Sudden Oak Death (SOD)*
  The District partnered with Phytosphere to test several potential treatment methods for Sudden Oak Death (SOD), including targeted Bay tree removal and fungicide applications. While unlikely to result in viable landscape-level treatment options, this is an important contribution to SOD science and may provide tools to protect significant heritage oaks and areas with high natural resource value. A final report is expected in December 2020. More details can be found in Attachment 3.

- *Literature Review*
  To assist with an understanding of the least harmful and most effective pesticides to use in the IPM Program, the District has entered a 4-year partnership with a UC Santa Cruz researcher to perform an annual literature review of the latest science surrounding the products on the District's List of Approved Pesticides. The scientific literature review focuses on land management with pesticides in natural areas or rangeland as it relates to human and environmental health. The District has received the 2015-2018 Pesticide Literature Review and Annotated Bibliography, which is now available to the public on the District's website. The District received the 2019 Review and an executive summary in June 2020.

FISCAL IMPACT

Receipt of the 2019 Annual IPM Report will not result in a direct fiscal impact. Implementation of the IPM Program occurs across several different departments, including Land and Facilities, Visitor Services, and Natural Resources. Each department separately budgets for pest management activities under the General Fund – Operating Budget.

BOARD COMMITTEE REVIEW

The IPM Policy directs the General Manager to present annual IPM Program reports to the Board. This report presents the annual review for the calendar year 2019.

PUBLIC NOTICE

Public notice was provided as required by the Brown Act. Public notice was also sent to 164 interested parties and tenants by postal or electronic mail.

CEQA COMPLIANCE

The Board approved the FEIR for the District's IPM Program on December 10, 2014 (R-14-148). The FEIR analyzed the vegetation management activities undertaken in 2019. On February 27, 2019, the Board unanimously voted to adopt a resolution to approve an Addendum to the Final EIR for the IPM Program (R-19-11). Staff have incorporated the associated mitigation measures and BMPs from both environmental review documents into the project.

NEXT STEPS

Staff will continue the implementation of the 2020 Annual IPM Plan (Year 5 of the Program), consistent with the FEIR and subsequent 2019 Addendum of the IPM Program. In October 2020, staff will begin preparing the 2021 Annual IPM Plan to guide IPM work for the calendar year 2021. District staff will evaluate and reprioritize natural and rangeland treatment areas to account for available staff time. Staff will continue to monitor and report to the Board both the science and associated policies on the use of pesticides. Natural Resource staff work with all departments (e.g. Engineering & Construction, Planning, and Land & Facilities) to ensure projects minimize environmental impacts and adhere to Best Management Practices and Mitigation Measures from the IPM Program EIR, Addendum and Guidance Manual.

Attachments:
1. 2019 Annual IPM Report
2. IPM Maps
3. 2019 Sudden Oak Death Progress Report

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2019 Annual IPM Report

Integrated Pest Management Program Goal:

"Control pests by consistent implementation of IPM principles to protect and restore the natural environment and provide for human safety and enjoyment while visiting and working on District lands."

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1 Introduction

This report presents the results of the fifth year of pest management activities prescribed under the Midpeninsula Regional Open Space District (District) Integrated Pest Management (IPM) Program. The Program was established in 2014 upon adoption by the Board of Directors of the IPM Guidance Manual. Five policies set the foundation of the Program:

- Develop specific pest management strategies and priorities that address each of the five work categories;
- Take appropriate actions to prevent the introduction of new pest species to District preserves, especially new invasive plants in natural areas, rangeland, and agriculture properties;
- Manage pests using the procedures outlined in the implementation measures;
- Monitor pest occurrences and results of control actions, and use adaptive management to improve results;
- Develop and implement an IPM Guidance Manual to standardize pest management, and IPM procedures across all District Lands.

Figure 1: Contractors mow Distaff thistle (*Carthamus creticus*) near Kneudler Lake in Russian Ridge OSP

2 Implementation of IPM Program

The full implementation of the IPM Program was originally scheduled to be completed by 2019. Due to shifts in staff capacity to fulfill Measure AA commitments as well as multiple key vacancies of positions that support the IPM Program during the last three years, some aspects of the IPM Program are still underway. Complete implementation of all elements of the Program is anticipated by the end of 2021. Staff is currently developing a landscape-level monitoring protocol and an Early Detection/Rapid Response Protocol as new elements under the IPM Program. Both are described below and would be brought to the Board at a later date for approval and inclusion into the IPM Program. As described in the Final Environmental Impact Report of the Program, the entire IPM Program will be revisited in 2025 to set the framework for the next cycle of IPM work.

2.1 Landscape-Level Monitoring Protocol

To better assess both natural (e.g. succession, disturbances such as wildlife fire) and human caused effects (e.g. management activities, climate change) in natural areas, a landscape-level monitoring protocol is needed. This protocol will allow staff to see changes in vegetation and habitat over time. The District is currently part of a regional effort to develop a fine-scale vegetation map for all of San Mateo County. This map will be extremely helpful for tracking landscape-level vegetation changes over time. The District has already received new high-resolution imagery and shaded relief map components and expects to receive the final vegetation map in 2021. A similar regional mapping effort is now in the early planning stages for Santa Clara and Santa Cruz counties, which will complete the imagery coverage for the entire Santa Cruz Mountains landscape.

On January 8, 2020 (R-20-01) the Board selected three research questions for study by a Science Advisory Panel (SAP). One question is focused on monitoring: "How can the District effectively and efficiently monitor changes in priority plant and animal populations at the landscape scale?". The SAP will address this question in two phases, the first phase will be conducted between July and December 2020, and the second conducted (upon Board approval of funding for the second research phase) between January and June 2021. The first phase of research will seek to refine the District's monitoring objectives, identify priority species and communities, and develop a conceptual model for monitoring. In the second phase of research, the SAP would use that information to create a monitoring framework with the following elements:

- A clear problem statement that includes the temporal and spatial extent of the question;
- Ecological objectives that define desired conditions;
- Ecological and statistical justifications for monitoring elements and sampling design;
- A prioritized list of taxa that can be effectively and cost-efficiently monitored; and
- Recommendations for monitoring protocols, sampling designs, and monitoring intervals.

2.2 Early Detection / Rapid Response Protocol

Early Detection / Rapid Response (EDRR) places emphasis on preventing the establishment of new pest populations on District lands through increased surveys for pests. If new pest populations get established, EDRR would implement rapid response measures to control pests before they spread. EDRR programs

increase the likelihood that pest invasions are addressed successfully before the population sizes and/or extents are beyond that which can be practically and economically contained and eradicated. The District treats several species considered to be early detection targets (i.e. spotted knapweed, hanging sedge); however, a dedicated early detection surveillance program will help ensure timely discovery and treatment of emerging threats.

Increased pest surveys may allow District personnel and/or contractors to more rapidly identify and prevent pest infestations prior to establishment, thereby decreasing the amount of pest management treatments necessary on District lands over time. The IPM Guidance Manual includes EDRR strategies to respond to pests, however, current staffing levels and commitments limit the District's ability to fully implement a comprehensive EDRR program. The District is currently evaluating the long-term resource (i.e., staffing, volunteers, contractors, etc.) and funding needs to implement the EDRR strategies, which include:

- Identifying potential threats early to allow control or mitigation measures to be taken;
- Detecting new invasive species in time for allowing efficient and safe eradication or control decisions to be made;
- Taking additional preventive actions such as providing facilities to clean vehicles and tools to stop the spread of seeds of invasive plants;
- Responding to invasions effectively to prevent the spread and permanent establishment of invasive species;
- Providing adequate and timely information to decision-makers, the public, and to partner agencies concerned about the status of invasive species within an area; and
- Adaptively implementing detection and early response strategies over time.

The District has budgeted funds for Fiscal Year 2020-2021 to implement a small-scale effort of EDRR strategies and will bring those results and recommendations to the full Board during the 2021 Annual IPM Report. Increased pest surveys may allow District personnel and/or contractors to more rapidly identify and prevent pest infestations prior to establishment, thereby decreasing the amount of pest management treatments necessary on District lands over time.

3 Summary of Pest Management

This section is a summary of the pest problems that the District has encountered during the year.

3.1 Pre-Treatment Surveys

The District's Best Management Practices from the FEIR Integrated Pest Management Program outlines the use of pretreatment surveys. Specifically, it states:

> "A District biologist shall survey all selected treatment sites prior to work to determine site conditions and develop any necessary site-specific measures. On a repeating basis, grassland treatment sites shall be surveyed once every five years and brushy and wooded sites shall be surveyed once every three years. Brush removal on rangelands will require biological surveys before work is conducted in any year. Site

inspections shall evaluate existing conditions at a given treatment site including the presence, population size, growth stage, and percent cover of target weeds and pests relative to native plant cover and the presence of special-status species and their habitat, or sensitive natural communities."

Surveys are entered into CalFlora, an online database. In 2019, District biologists completed the following surveys:

Table 1: Number of Pre-Treatment Surveys

Category	El Corte de Madera Creek	Foothills	Long Ridge	Los Trancos	Pulgas Ridge	Purisima Creek Redwoods	Rancho San Antonio	Total
Fuel Management	3	-	6	3	1	1	1	12
Natural Lands	33	-	12	14	-	-	-	59
Rangeland	-	-	-	-	-	2	-	2
Recreational Facilities	24	2	19	7	-	1	-	1
Total	60	2	37	24	1	4	1	127

Surveys identified both biotic and abiotic environmental factors including:

- Special status plants and animals in the area (e.g. California red-legged frog)
- Cultural resources (e.g. known archeological sites)
- Aquatic systems (e.g. ephemeral streams)
- Jurisdictional areas
- Erosive conditions (e.g. steep hillside with treatment to remove large areas of vegetation)
- Presence of disease (e.g. Sudden Oak Death)

The information recorded during pre-treatment surveys is provided to staff and contractors on the Annual Project Spreadsheet.

3.2 Ongoing and General Maintenance

3.2.1 Vegetative Pest Species

Sixty-eight (68) plant pest species found on District lands are treated on an on-going basis (Appendix A) to control for asset-based protection and long-term management, an increase of seven (7) species from 2019. These species have the potential to invade natural areas, displace native plant and wildlife species, and reduce biodiversity. Of the listed species, twenty (20) are considered noxious weeds by the State of California (Table 2). Some species that are considered a low priority for treatment in wildlands are treated in restoration sites to ensure that recently installed native plants have a higher chance of survival. An increase in the number of species treated is partially due to increased quality of the field data collection.

Table 2: Treated Species by Rating for Ongoing and New Projects

Year	Species Treated	Cal-IPC[a] Rating			CDFA[b]	Alert
		Limited	**Moderate**	**High**	Rated	
2019	68	11	23	11	20	2
2018	61	14	22	13	20	2
2017	44	5	17	9	16	4
2016	33	3	14	10	17	3
2015	31	4	12	8	12	4

[a]Cal-IPC – California Invasive Plant Council
[b]CDFA – California Department of Food and Agriculture

3.2.2 Fauna Pest Species

Eight (8) species of invasive fauna were monitored and/or treated in 2019.

Table 3: Invasive fauna species present in District Preserves

Scientific Name	Common Name	Preserve	Location	Activity
Felis catus	Cat, feral	Rancho San Antonio		Monitoring
Mus musculus	House mouse	Multiple – see below	Deer Hollow Farm; Residential	Monitoring, Trapping
Otospermophilus beecheyi	California Ground squirrel	Rancho San Antonio	Deer Hollow Farm	Exclusion
Pseudemys nelsoni	Florida red-bellied cooter	Skyline Ridge	Alpine Pond	Attempted trapping
Rattus norvegicus	Norway rat	Multiple – see below	Deer Hollow Farm; Residential	Monitoring, Trapping
Rattus	Black rat	Multiple – see below	Deer Hollow Farm; Residential	Monitoring, Trapping
Sus scrofa	Pig, feral	Russian Ridge, Sierra Azul	Mindego Ranch	Monitoring
Trachemys scripta elegans	Red-eared slider	Bear Creek Redwoods	Mud Lake	Monitoring, Trapping

3.2.3 Pest Control in Buildings

Between January and December of 2019, the District hired *Complete Pest Control* to perform rodent control at thirteen Open Space Preserve locations, with seventeen residences.[1] The District performed all rodent control in 2019 using traps, and did not resort to the use of any rodenticides. Locations of IPM in buildings are listed below:

- El Corte de Madera OSP (1) – 4 residences
- Fremont Older (1)

[1] The number in parenthesis is the number of building that pest control activities occurred.

- La Honda OSP (2)
- Monte Bello OSP (1)
- Rancho San Antonio (1) – duplex with 2 residences
- Russian Ridge OSP (2)
- Skyline OSP (2)
- Thornewood (1)
- Tunitas Creek OSP (1) – two structures, one location
- Windy Hill OSP (1)

3.2.4 Fuel Management

The District works with local communities and fire districts to minimize the potential for fires to spread to and from Preserve lands. The District provides necessary fire and fuel management practices to protect forest resources, public health, and safety by taking the following actions:

- Maintain essential roads for emergency fire access, and forest management activities to reduce fire hazard.
- Maintain adequate fire clearance around District structures and facilities.
- Encourage neighboring property owners to maintain adequate fire clearance around existing development; consult with regulatory agencies to encourage that construction of new development maintains fire agency recommended setbacks for fire clearance between new development and District forests and woodlands.

Figure 2: Crews build a shaded fuel break at Sierra Azul OSP

- Evaluate the potential to reduce forest fuel loading through the removal of smaller trees to reduce forest floor fuel buildup and ladder fuels.
- Coordinate with fire agencies and local communities to define locations where fire protection infrastructure is desirable and practical.
- Reintroduce fire as a resource management tool to reduce forest floor fuels and reestablish fire for ecosystem health where stand conditions, access, and public safety permit; coordinate with other agencies for planning and implementation.
- Seek grant opportunities and partnerships for fuel management projects and monitoring.

The District is developing an Environmental Impact Report (EIR) to increase fuel management work. The fuel management portion of the EIR is expected in Fall 2020, and at that time, fuel management work will become a component of the fire program.

3.2.4.1 *Fuel Reduction Permits*

Preserve neighbors wishing to modify vegetation on District preserves to create defensible space around their homes and occupied structures may apply for a Fuel Reduction Permit. District staff perform pre-surveys prior to issuing a permit to ensure adequate protection and mitigation measures are implemented during the work.

In 2019, there were no new requests for fuel management permits, and two permits remain active from previous years.

3.2.4.2 *Fuel Reduction Projects Implemented by the District*

The District currently maintains various types of fuel breaks at many preserves. This work is accomplished primarily through mechanical means using handheld power tools or heavy equipment. In addition to the acreage listed below, the District maintains approximately 30 miles of disc lines (a gap in vegetation or other combustible material that acts as a barrier to slow or stop the progress of wildfire, created by plowing the ground with a tractor pulling a disc harrow apparatus), mostly along Preserve boundaries.

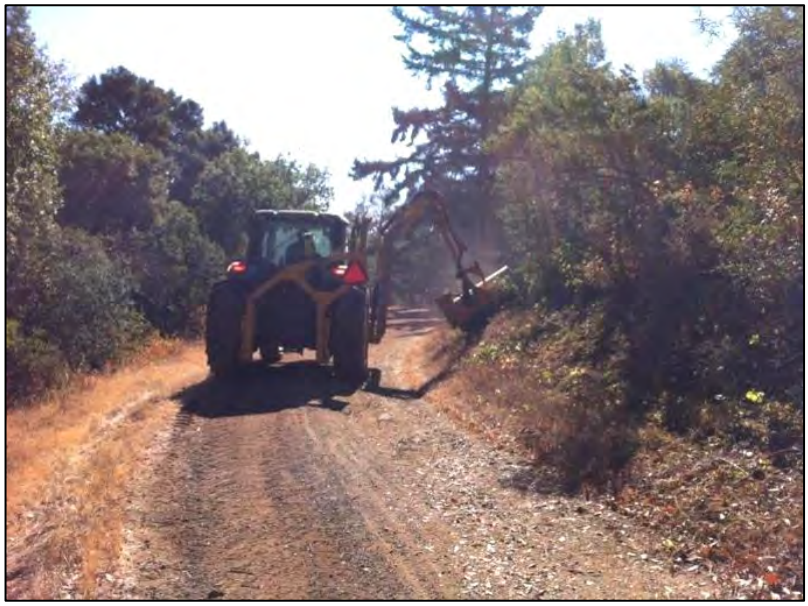


Figure 3: Preserve roads are maintained to allow safe passage of emergency vehicles

The IPM program covers maintenance for existing fuel breaks and does not allow for the construction of major new fuel breaks. The District is seeking additional CEQA compliance that will greatly expand the fuel reduction program on District lands and allow for the creation of new fuel breaks.

Table 4: Summary of Fuel Reduction projects District-wide

Purpose	Acres		Total Area
	Foothills	Skyline	
Defensible Space	21.9	33.23	55.13
Landing Zones	6.5	5.25	11.76
Shaded Fuel Break	36.8	22.7	59.5
Other Fuel Break	-	14.4	12.2

Purpose	Acres		Total Area
	Foothills	Skyline	
TOTAL	**65.2**	**75.58**	**140.78**

3.3 Conservation Grazing

The District's conservation grazing program manages more than 11,000 acres of coastal property as rangelands. On these lands, grazing is used as a broad management tool to achieve outcomes for both conservation of biodiversity and fuel management to reduce wildfire risk while supporting local sustainable agriculture and the viability of grazing in our region. Grazing can reduce the height and thatch build-up of non-native annual grasses, which benefits native bunch grasses and forb species. Since grasslands generally support more plant diversity than nearby wooded or brushy areas, control of non-native annual grasses is one of the most significant actions that can be taken to promote plant diversity. In addition, several special status wildlife species benefit from the vegetation structure created by grazing activity. As the conservation grazing program continues to grow, the District will continue to work with grazing tenants to develop new grazing strategies that target priority invasive plant species.

Grazing can also be an effective tool to reduce biomass and fuel loads, which helps reduce the intensity of wildfires. Using mechanical methods for fuel management can be prohibitively expensive, and grazing allows fuel reduction at scales that would be unfeasible with other methods. Additionally, brush removal for rangeland improvement also contributes to a significant amount of fuel management District-wide.

Table 5: District Properties in the Conservation Grazing Program[1]

Property	Preserve	Total Acres[2]
Apple Orchard	La Honda	222
Driscoll Ranch	La Honda	3,700
McDonald Ranch	La Honda	2,060
Bluebrush Canyon	Purisima Creek Redwoods	302
Elkus-Lobitos	Purisima Creek Redwoods	839
October Farms	Purisima Creek Redwoods	270
Mindego Hill	Russian Ridge	1,047
Big Dipper	Skyline Ridge	955
Toto Ranch	Tunitas Creek	952
Tunitas Creek Ranch	Tunitas Creek	707
TOTAL		11,054

3.4 New Pest Control Projects

Potential pest control projects were submitted to the IPM Coordinator using the District's New Pest Control Project form. Potential projects were evaluated using the Project Ranking System developed by the IPM Coordination Team. The Project Ranking System evaluates projects using five categories:

[1] Several new properties have been purchased that will be included in the grazing program in coming years, including Gordon Ridge (Tunitas Creek OSP), and Purisima Uplands (Purisima Creek Redwoods OSP)
[2] This acreage accounts for grazing leases, and includes some ungrazed land (e.g. drainages, brush patches, etc.) A full inventory of actively grazed lands will result from the upcoming San Mateo Vegetation Map

- Safety
  - Human health
  - Environmental health
- Prevents and controls the most destructive pests
- Protects biodiversity
- Provides for public engagement
- Feasibility and effectiveness

Twenty (20) new pest control projects were determined to have a high priority for treatment on District lands (Table 6).

Table 6: New Pests Control Projects

Scientific Name	Species	Cal-IPC[a] rating	CDFA[b] rating	Alert	Gross Acres	Person Hours
Genista monspessulana	French Broom	High	Noxious	-	5.2	122
Dipsacus sativus	Teasel	Moderate	-	-	1	6
Carduus pycnocephalus	Italian thistle	Moderate	Noxious	-	2	8
Cytisus scoparius	Scotch Broom	High	Noxious		0.4	18
Centaurea solstitialis	Yellow starthistle	High	Noxious	-	0.1	4
Carthamus lanatus	Distaff thistle	Moderate	Noxious	-	1.0	0.21
Eucalyptus globulus	Eucalyptus	-	-	-	0.1	6
Dittrichia graveolens	Stinkwort	Moderate	Noxious	X	0.5	8
Foeniculum vulgare	Fennel	High	-	-	0.25	8
Hedera helix	English Ivy	High	-	-	0.1	4
Cortaderia jubata	Jubatagrass	High	-	-	1.8	70
Pinus radiata	Monterey Pine		-	-	0.5	12
Total					**12.95**	**266.21**

[a]Cal-IPC – California Invasive Plant Council
[b]CDFA – California Department of Food and Agriculture

Table 7: New Fuel Management Projects

Preserve	Location	Purpose	Treatment Type	Treatment Method	Gross Acres	Person-Hours
La Honda OSP	Driscoll-Djerassi	Fuel Break	Manual & Mechanical	Mowing & Cutting	1.0	8
Purisima Creek Redwoods OSP	Irish Ridge	Shaded Fuel Break	Manual & Mechanical	Mowing & Cutting	4	200
Saratoga Gap OSP	Stevens Canyon Ranch	Shaded Fuel Break	Manual & Mechanical	Mowing & Cutting	2	40

Figure 4: Preserve Partners volunteers remove Purple starthistle (*Centaurea calcitrapa*) at La Honda Creek OSP

4 Summary of Pest Control Treatments

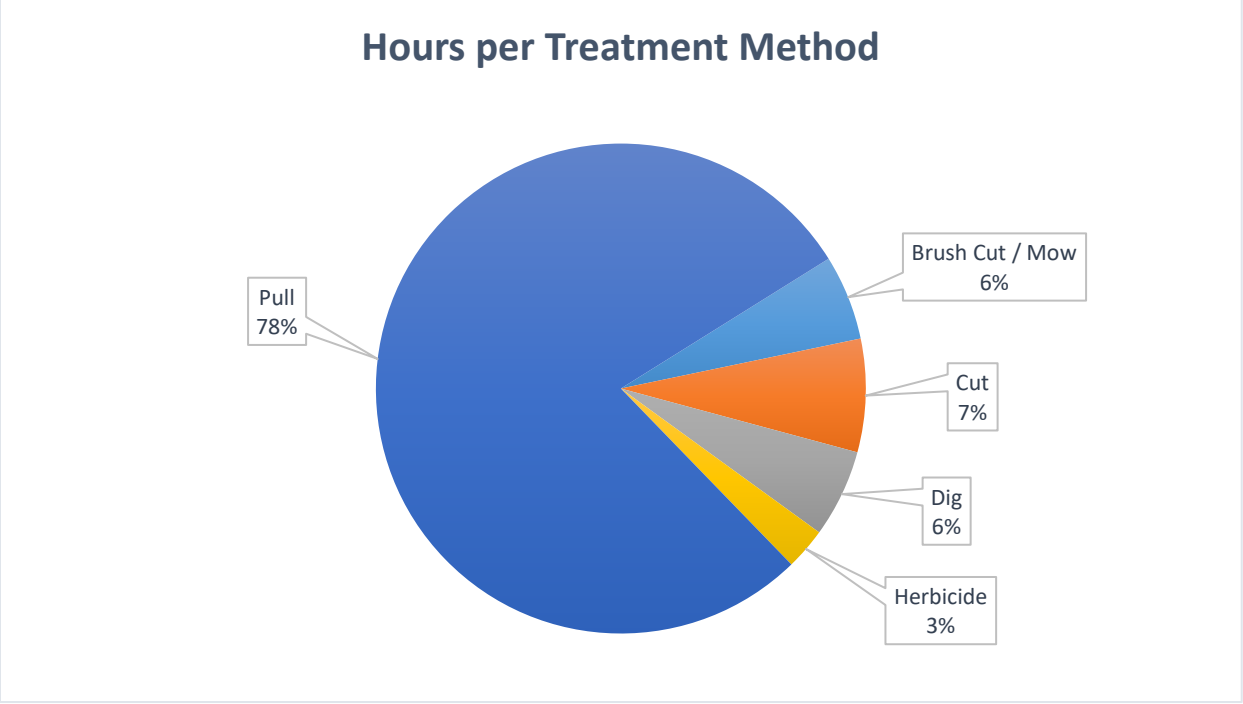
4.1 Invasive Plant Control

The following data reflects natural areas and does not include brushing/mowing of roads, trails, defensible space, or emergency landing zones. Data for brushing/mowing of roads, trails, defensible space, or emergency landing zones are not presented because these activities do not change from year to year.

Table 8: Treatment Methods and Hours in Natural Areas and Rangelands in 2019

Treatment Method	Hours			Total	% of Total
	Staff	Contractor	Volunteer		
Brush Cut / Mow	108	576	-	**684**	**6 %**
Cut	197	183	530	**910**	**7 %**
Dig	183	265	258	**706**	**6 %**
Herbicide	34	302	-	**336**	**3 %**
Pull	980	5,095	3,473	**9,548**	**78 %**
TOTAL	**1,502**	**6,421**	**4,261**	**12,184**	
% of Total	**12 %**	**53 %**	**35 %**		

Figure 5: Treatment Method Breakout



Manual weed pulling remains the most common treatment method at 78% of all hours; herbicide use accounted for only 3% of all hours. Herbicide hours were low in 2019 because of the implementation of the Santa Clara Valley Water District (Valley Water) Memorandum of Understanding (MOU), which focused on manual treatment methods. In addition, some past herbicide projects have effectively reduced the cover of the target invasive species enough that follow up manual control is feasible. In a typical year, herbicide use

accounts for approximately 10% of labor hours and may have periods of increased use as new projects are initiated.

During the creation of the IPM Annual Plan, treatment methods are evaluated using the best available science in weed management. The IPM Annual Plan, which is finalized in January of each year, lays out the work plan for the new calendar year. Treatment methods have shifted across the five years of the Program, with the largest change in the reduction of hours spent applying herbicide (reduced from 60.8% to 3 %, with a relative reduction of 57.8%) and the largest increase in the percentage of hours spent hand pulling (increased from 35.5% to 78%, with a relative increase of 42.5%).

The total number of hours for IPM-related work (Table 9) has increased by 20% from 2015 levels. Field staff hours have fluctuated since 2015 depending on other annual competing priorities, including the number of scheduled Measure AA capital improvement projects under construction. Volunteer and contractor hours have substantially increased since 2015. The hiring of a second Volunteer Program Lead in 2018 increased the capacity of volunteers for IPM projects, and in 2019 they have begun to host simultaneous projects. The five-year MOU grant agreement with Valley Water (R-17-79) provided substantial funding for manual IPM related work at Bear Creek Redwoods Open Space Preserve.

Figure 6: Resource Management by Crew Type

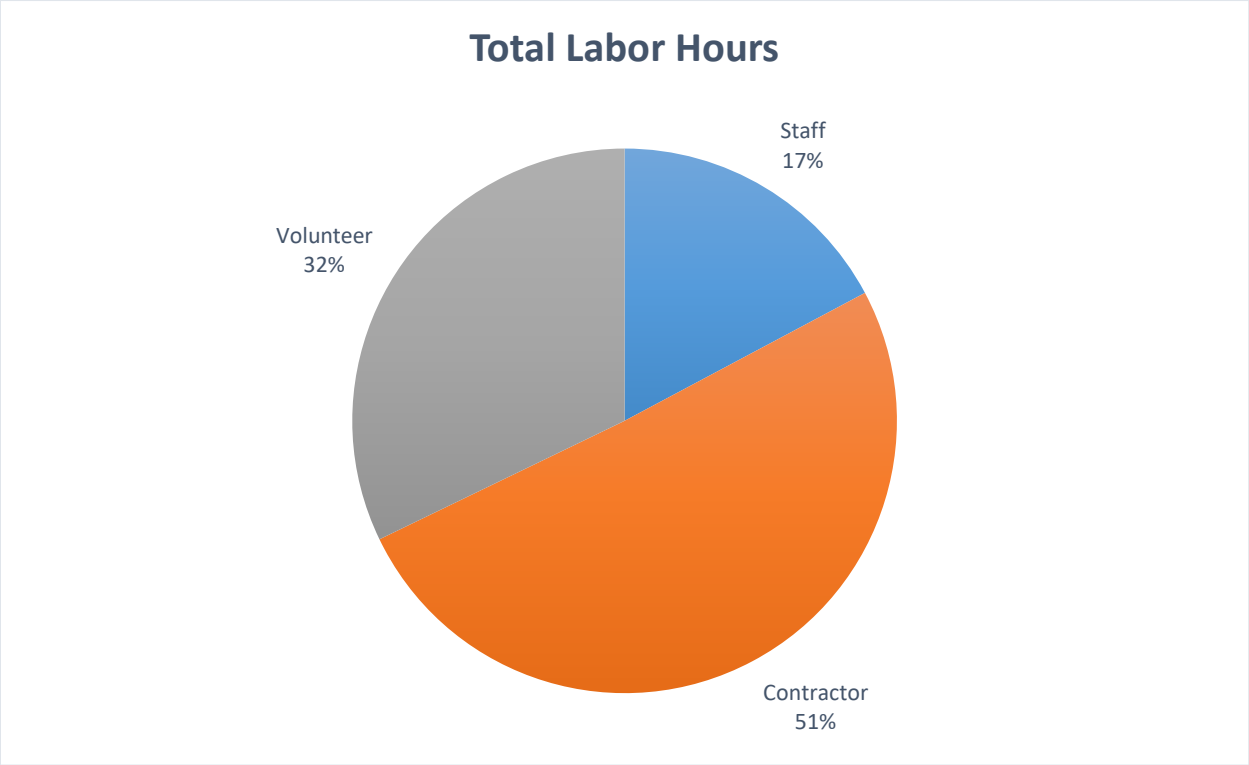
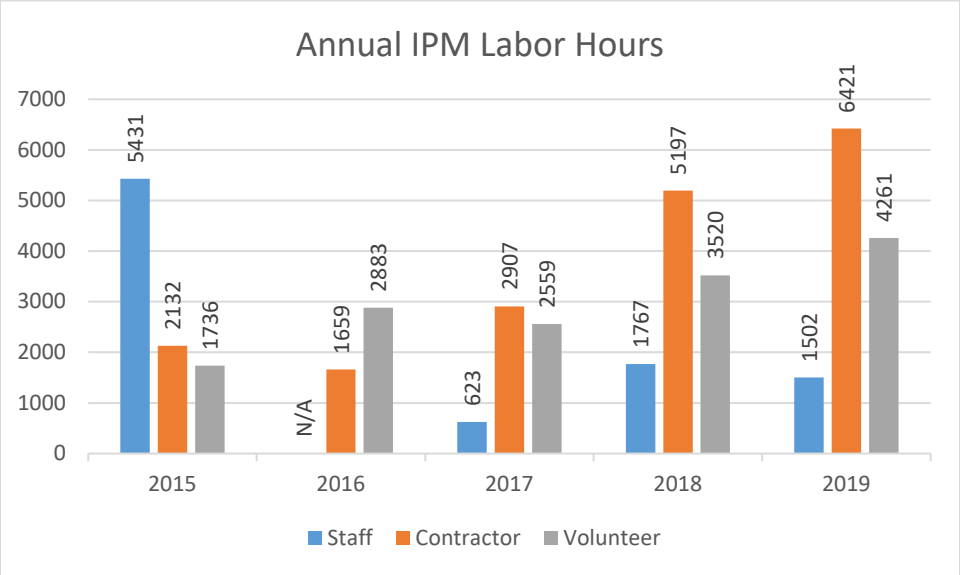


Table 9: Comparison of Hours by Crew Type and Year

Year	Staff	Contractor	Volunteer	Total
2015	5,431	2,132	1,736	**9,299**
2016	Unknown[3]	1,659	2,883	**4,542**
2017	623	2,907	2,559	**6,089**
2018	1,767	5,197	3,520	**10,484**
2019	1,502	6,421	4,261	**12,184**

Figure 7: Annual IPM Labor Hours for Natural Lands and Rangeland[4]



Increased contractor hours are primarily due to large scale, Measure AA project-related mitigation work. In 2019, 323 contractor hours were spent removing non-native plant species at mitigation sites. Mitigation is required when District projects may potentially cause impacts to natural areas. This work often requires excessive labor input from restoration planning, site preparation, planting, site maintenance, and up to 10 years of follow-up monitoring.

Figure 8 (below) shows the comparative cost for different treatment methods for 2019. Mowing and brush cutting are shown as cost per gross acre. All other treatment methods are shown as cost per infested acre. The District uses the following hourly costs estimates for comparative cost analysis purposes only:

- Contractor - $50.00 per hour
- Staff – $43.45 per hour
- Volunteers - $31.51 per hour[5]

[3] Staff hours were not recorded into the Weed Database or CalFlora as this was a transitional year from one database to another.
[4] In 2016, staff hours were not recorded into the Weed Database or CalFlora as this was a transitional year from one database to another.
[5] Signifies the estimated value of volunteer work and not true cost, as this is pro bono, volunteer work. This value is used for analysis purposes only. Refer to: https://independentsector.org/news-post/new-value-volunteer-time-2019/

Figure 8: Treatment Cost per Acre

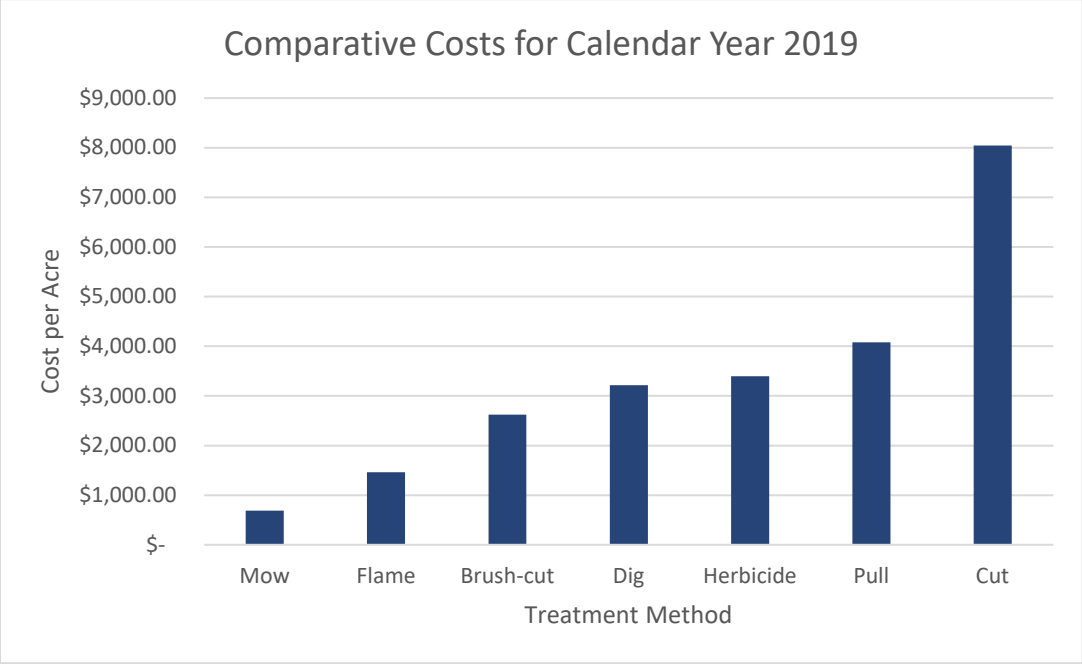


Figure 9: Yellow starthistle (*Centaurea solstitialis*) at Long Ridge OSP

5 Effectiveness of Pest Control Program

The IPM Program identifies the following criteria for assessing the effectiveness of the Program every year:

- Work health/exposure in buildings;
- Reduction of pesticide use in buildings;
- Per-acre herbicide use;
- Preservation of biodiversity and natural resource values;
- Public participation in pest control; and
- Staff training, public outreach, and educational activities.

5.1 Worker Health/Exposure in Buildings

The District is committed to lowering worker health/exposure risk classifications in buildings when pesticides are used. Specific pesticides were approved for use on buildings (Table 9) and are described in the 2014 IPM Program Environmental Impact Report. All are "Caution" labeled and pose a reduced risk to workers or occupants of treated buildings. A specific type of rodenticide bait (Cholecalciferol) is approved for use under very strict conditions; however, it was not utilized. Only prevention and traps were approved for rodent control in 2019.

Table 10: Pesticides Approved for Use in Buildings and Recreational Structures

Pesticide Category	Active Ingredient	Product Formulation	Purpose	Signal Word
Rodenticide	Cholecalciferol	Cholecalciferol baits	Rodent control	Caution
Insecticide[6]	Indoxacarb	Advion Gel baits	Structural pest control	Caution
	Hydroprene	Gentrol Point Source	Structural pest control I	Caution
	Fipronil	Maxforce Bait Station	Structural pest control I	Caution
	Sodium tetraborate	Terro Ant Killer II	Structural pest control	Caution
	Diatomaceous earth	Diatomaceous earth	Structural pest control	Caution

5.2 Reduction of Pesticide Use in Buildings

The District seeks to comprehensively oversee all pesticide use in and around District buildings, including use by tenants, which is expected to result in an overall reduction of pesticide use in buildings, and in particular, eliminate the use of pesticides around human occupants or visitors, or when chemicals can inadvertently escape into the surrounding wildland environment.

[6] Employees, contractors and tenants may install approved ant and roach bait stations inside buildings in tamperproof containers without review by a Qualified Applicator License/Certificate holder.

5.3 Wasp Control for Public Safety

Many social wasps such as yellow jackets are native species and are generally only considered pests when their nests are located in areas where they are incompatible with human use. For example, when social wasps nest under the eaves of buildings or alongside trails, they can sometimes exhibit aggressive protective behaviors that can threaten humans with painful stings that can cause allergic reactions in some people. In locations where multiple stinging incidents occur, District staff control wasp nests using physical or chemical control methods. In 2019, there were five (5) yellow jacket nests treated with the pesticide Wasp Freeze II (active ingredient Prallethrin), all along District trails.

5.4 Per-acre Herbicide Use

The District seeks a reduction in per-acre usage of herbicides over time at individual sites and acknowledges that in some instances, chemical use will initially increase, followed by a reduction in herbicide use once the pest is eliminated or reduced. Most projects utilize an integrated treatment approach which incorporates several different treatment methods throughout the life of the project. Initial treatment can consist of intensive chemical or mechanical methods, and will typically shift towards low-intensity manual methods as the infestation becomes under control and the seedbank is eliminated.

Pulses of increased herbicide use should be expected in future years as new projects are initiated due to the District:

- Acquiring new lands with priority infestations,
- Identifying high priority fuel management areas, and
- Prioritizing new pest management sites on exiting lands.

District staff selected twelve (12) distinct herbicide projects to perform trend analysis:

- Bear Creek Redwoods, Phase I (two herbicides);
- Big Dipper Ranch (two herbicides);
- Driscoll Ranch (two herbicides);
- Los Trancos (two herbicides);
- Mindego Hill;
- Slender False Brome; and
- Stinkwort (two herbicides).

All but one of the selected treatment sites have shown a decline in herbicide use over time, with several sites not requiring any herbicide use at all. The treatment area at Big Dipper Ranch was expanded in 2019 due to progress made on target invasive species at Mindego Hill. This expansion in area resulted in an increase in herbicide use. As the density of the target invasive plant species declines, manual and mechanical treatment methods become more feasible and desirable. This is the expected trend for all herbicide treatment sites within the IPM program. Figure 10 below shows select sites where Roundup has been used for invasive species control. An in-depth technical report will be presented in two years (2021 Annual IPM Report) to allow for more data to be collected.

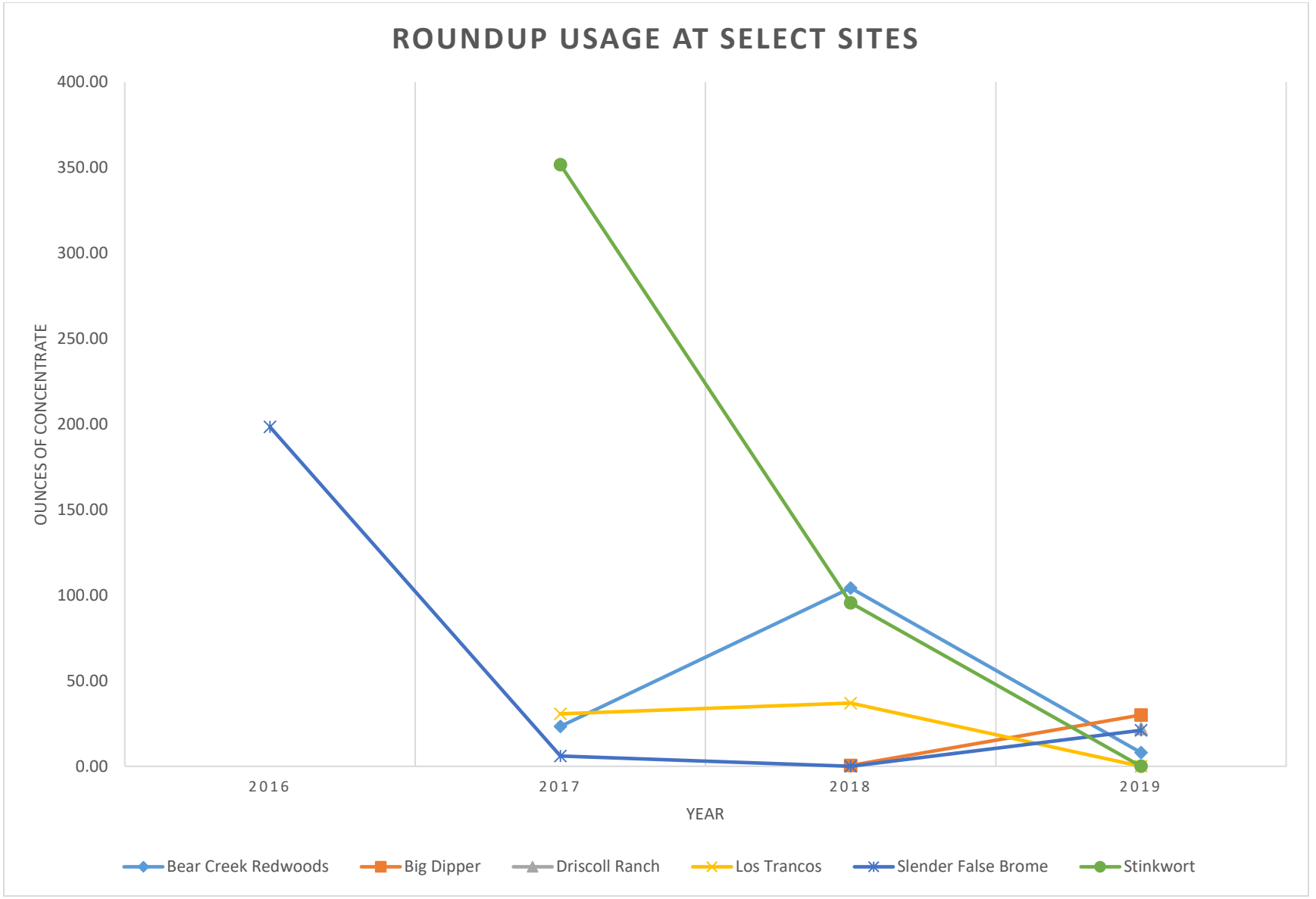


Figure 10: Roundup Usage at Select Sites

5.5 Preservation of Biodiversity and Natural Resource Values

As part of this section, District staff provides an annual qualitative assessment of natural resources conditions of IPM projects in natural areas, rangelands, and agricultural properties in the Annual IPM Report.

5.5.1 Natural Areas

In natural areas, herbicide and non-herbicide methods were used to control high priority invasive plants to protect and restore native vegetation at preserves.

5.5.2 Rangeland

The District uses conservation grazing to manage fuel (flammable vegetation) for fire protection; enhance the diversity of native plants and animals; help sustain the local agricultural economy; and foster the region's rural heritage. The District uses conservation grazing on more than 11,000 acres as a tool to manage grassland habitat on portions of these five preserves:

- Russian Ridge Open Space Preserve
- Skyline Ridge Open Space Preserve
- Purisima Creek Redwoods Open Space Preserve
- Tunitas Creek Open Space Preserve
- La Honda Creek Open Space Preserve

In the absence of natural disturbance (i.e. fire), the District periodically does brush removal on grasslands to slow the encroachment.

5.6 Volunteer Contributions to IPM

The public is an integral part of the success of the IPM program. Volunteers who assist with invasive plant control and detection are a valuable asset to the IPM program. In 2019, the District's Preserve Partner volunteers contributed 2,918 hours to resource management through seventy-two (73) outdoor service projects in eighteen (19) different Open Space Preserves. The District hosted eighteen (18) Special Group projects, a subset of Preserve Partners, which include school groups, technology companies, scout troops, running clubs, and other community groups.

Figure 11: ARMS volunteer pulling French Broom at Bear Creek Redwoods OSP

Preserve Partner projects focused primarily on addressing seventeen (18) invasive plant species: French broom, Spanish broom, purple starthistle, yellow starthistle, Italian thistle, milk thistle, bull thistle, acacia, fennel, summer mustard, rose clover, teasel, stinkwort, vinca, barbed goatgrass, medusahead, and tocalote. French broom removal dominated Preserve Partner projects with twenty-eight (28) French broom projects taking place in thirteen (13) open space preserves.

"Pop-Up" projects began in 2018 as a new model for volunteer participation at Rancho San Antonio Open Space Preserve. A Pop-Up project is strategically located in a place with high trail use by visitors and an adequate population of easily identifiable invasive plants in order to engage and utilize the visitors already hiking in the preserve. Pop Up projects are not advertised in advance and registration is not required. A total of ninety-five (65) visitors helped to remove Italian thistle during the two Pop Up projects held on the Rogue Valley Trail in 2019.

There were nineteen active Advanced Resource Management Stewards (ARMS) in 2019. The ARMS volunteers work independently on resource management projects in designated preserve areas and on their own time. In total, the ARMS volunteers contributed 1,061 hours to resource management with project sites located in eighteen (18) open space preserves.

Figure 12: Preserve Partners volunteers pull Hanging sedge (Carex pendula) at Purisima Creek OSP

Stewardship partnerships formalized in previous years continued in 2019. Grassroots Ecology contributed over 900 hours of resource management at two sites. French broom removal and yellow starthistle mowing coordination continued at the Hawthorns Property in Windy Hill Open Space Preserve.

In 2019, the Volunteer Program Partnership continued with the Student Conservation Association (SCA). This program exposes local, underserved youth to careers in the open space management field while providing Geographic Information System (GIS) and resource management services to the District. The SCA contributed approximately 2,000 hours mapping coyote brush (*Baccharris pilularis*) over 25 project days in Rangelands at various open space preserves.

5.7 Staff Training, Public Outreach, and Educational Activities

5.7.1 Staff Training

The mandatory annual Pesticide Safety Training was held for all field staff at the Skyline Field Office in June of 2019. California Department of Pesticide Regulation required training information was presented by the District's IPM Coordinator, Tom Reyes. Rangers who only handle Wasp Freeze received an abbreviated training focused on wasp control in 2019.

In November 2019, the IPM Coordinator participated in the annual California Invasive Species Council symposium in Monterey, California. Tom Reyes helped Cal-IPC lead a training about planning IPM projects and gave a presentation about the San Mateo County Weed Management Area, of which Midpen is a part of.

Figure 13: District biologists give biological sensitivity training to staff and volunteers working in endangered species habitat

5.7.2 Regional Cooperation

Invasive species are not limited by jurisdictional boundaries, so it is of utmost importance to work with neighboring land management agencies to target invasive species at a regional scale. The District is a part of numerous regional cooperatives, including the San Mateo and Santa Clara Weed Management Areas (WMA). These cooperatives are coordinated from the County Agricultural Commissioner's offices and help foster communication and cooperation on high-priority species among agencies in the given region. Through WMAs, the District can apply for grants to receive funding for treating invasive species across multiple jurisdictions.

The District is also a part of the Santa Cruz Mountains Stewardship Network (SCMSN), which aims to coordinate actions across all three counties (San Mateo, Santa Clara, and Santa Cruz) in the Santa Cruz Mountains. The District is helping to develop an "Atlas" in partnership with Cal-IPC and CalFlora to help facilitate sharing GIS data related to invasive species and other natural resources. As the upcoming EDRR protocol is developed, tools such as this, which will facilitate regional inter-agency data sharing, will be critical to address emerging threats quickly.

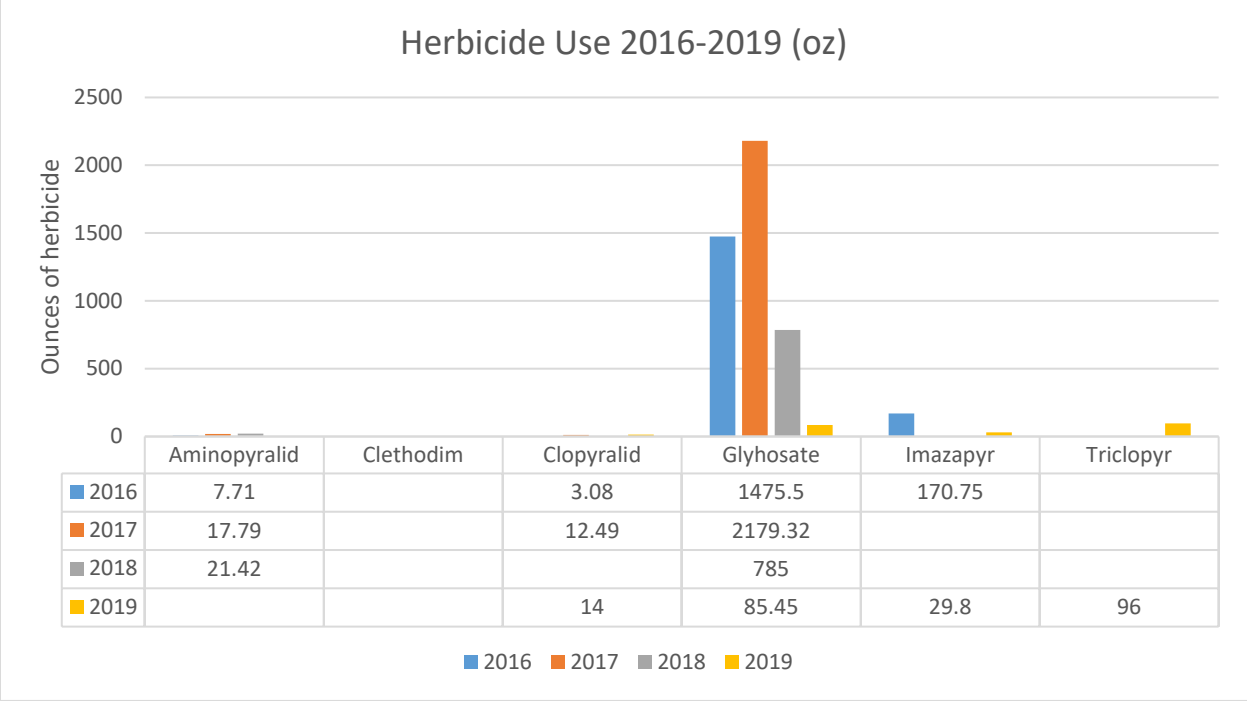
6 Summary of Pesticide Use

The following tables summarize the use of pesticides on District lands by staff and contractors. This data excludes PG&E, which is not covered under the District's Integrated Pest Management Program. PG&E is required to report pesticide use to each County Agricultural Department separately.

Pesticide	*Trade Name*	*Active Ingredient*	*Amount Used (ounces)*	*Gross Acres Treated*	*Ounces/Acre*
Fungicide	Reliant	Potassium salts of phosphorus acid	4,608	-	-
Herbicide	Milestone	Aminopyralid	-	-	-
	Envoy Plus	Clethodim	-	-	-
	Transline	Clopyralid	14	10.8	1.3
	Roundup Custom	Glyphosate	28	73.5	0.4
	Roundup ProMax	Glyphosate	59.5	44.7	1.3
	Polaris	Imazapyr	29.8	0.98	30.4
	Capstone	Triclopyr + aminopyralid	94	1.05	89.5

Pesticide	*Trade Name*	*Active Ingredient*	*Amount Used (ounces)*	*Gross Acres Treated*	*Ounces/Acre*
	Garlon 4 Ultra	Triclopyr	2	trace	-
Insecticide		Prallethrin[7]	113.5	-	-
Rodenticide		Cholecalciferol	-	-	-

Figure 14. Herbicide use from 2016-2019



	Aminopyralid	Clethodim	Clopyralid	Glyhosate	Imazapyr	Triclopyr
2016	7.71		3.08	1475.5	170.75	
2017	17.79		12.49	2179.32		
2018	21.42			785		
2019			14	85.45	29.8	96

Table 11: Total herbicide used by species

Scientific Name	Product Trade Name	Total Ounces Used
Acacia dealbata	Capstone	24
Acacia dealbata	Roundup Pro Max	20
Acacia melanoxylon	Garlon 4 Ultra	2
Ailanthus altissima	Roundup Pro Max	4
Baccharis pilularis	Capstone	70
Brachypodium sylvaticum	Roundup Pro Max	5.45
Brassica rapa* var. *rapa	Roundup Custom	3
Centaurea solstitialis	Transline	14
Dittrichia graveolens	Roundup Pro Max	24

[7] Prallethrin is used only to treat stinging insects when they pose a direct threat to public safety (i.e. nests adjacent to trails, restrooms, and parking lots).

Scientific Name	Product Trade Name	Total Ounces Used
Ehrharta erecta	Roundup Pro Max	2
Eucalyptus globulus	Roundup Pro Max	4
Vinca major	Polaris	29.8
Various (Restoration Site)	Roundup Custom	25

Table 12: Total herbicide used by Preserve

Preserve	Product Trade Name	Total Ounces Used
Bear Creek Redwoods	Capstone	70
Bear Creek Redwoods	Polaris	29.8
El Corte de Madera Creek	Roundup Pro Max	4
El Sereno	Roundup Pro Max	16
La Honda Creek	Roundup Pro Max	4
Pulgas Ridge	Roundup Pro Max	20
Purisima Creek Redwoods	Garlon 4 Ultra	2
Purisima Creek Redwoods	Roundup Pro Max	2
Russian Ridge	Roundup Custom	28
Russian Ridge	Transline	14
Sierra Azul	Capstone	24
Sierra Azul	Roundup Pro Max	8
Thornewood	Roundup Pro Max	5.45

7 Public Interactions

7.1 Notifications

7.1.1 Pesticide Applications

Prior, during, and after the application of a pesticide (including herbicides, insecticides, or other types of pesticides) on District preserves, employees or contractors post signs at the treatment area notifying the public, employees, and contractors of the District's use of pesticide. Posting periods designated below are the District's minimum requirements; signs may be posted earlier and left in place for longer periods of time if it serves a public purpose or if it provides staff flexibility in accessing remote locations.

- For pesticide application in outdoor areas of all District-owned preserves and in buildings that are not occupied or are rarely visited (e.g. pump houses), signs are posted at the treatment areas 24 hours before the start of treatment until 72 hours after the end of treatment. Signs stating "Pesticide Use Notification" are placed at each end of the outdoor treatment area and any intersecting trails.

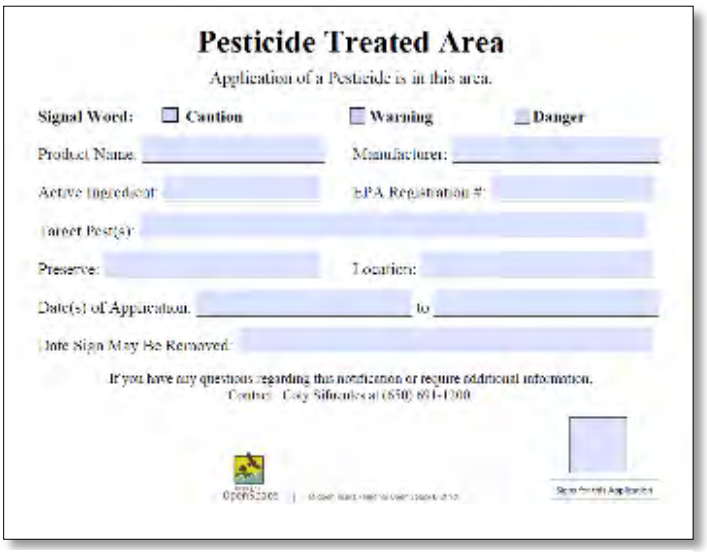

Pesticide Treated Area
Application of a Pesticide is in this area.
Signal Word: Caution Warning Danger
Product Name: Manufacturer:
Active Ingredient: EPA Registration #:
Target Pest(s):
Preserve: Location:
Date(s) of Application: to
Date Sign May Be Removed:
If you have any questions regarding this notification or require additional information,
Contact: Cory Sifuentes at (650) 691-1200

Figure 15: Pesticide Notification Sign

- For urgent application of pesticides to control stinging insects, signs are posted at the treatment area 72 hours after the end of treatment, but no pre-treatment posting is required.
- For pesticide applications in occupied buildings such as visitor centers, offices, and residences, notification is provided to building occupants (employees, visitors, residents) 24 hours before the start of treatment by email, letters, or telephone calls. Additionally, for buildings that might be visited by more than just a single-family, signs stating "Pesticide Use Notification" will be placed at the entrances to the building 24 hours before the start of treatment until 72 hours after the end of treatment. The use of approved insecticidal baits in tamper-proof containers requires notification 24 hours before the start of treatment by email, letters, or telephone calls.
- The information contained in the pesticide application signs includes: product name, EPA registration number, target pest, preserve name and/or building, date and time of application, and contact person with a telephone number. The contact person is the IPM Coordinator.
- On lands that the District manages but does not own (e.g., Rancho San Antonio County Park), the District will provide notification of pesticide use in the same manner and applies the same actions as it does with its properties unless the contracting agencies have adopted more restrictive management standards. In those cases, the more restrictive management standards would be implemented by the District.
- In the event of an immediate public safety concern, notification occurs at the time of treatment, but pre-posting may not be possible.

All contractors notify the District before application on any property and comply with requirements for notification and posting of signs described above.

At the discretion of District staff and depending on the site conditions, neighboring landowners are notified if the District is conducting pest management near a property line.

7.2 Inquiries

The District received several inquiries in 2019 concerning the IPM Program. This list does not include public comments received at IPM-related Board meetings.

Table 13: Public Inquiries into the IPM Program

Date	Inquirer	Contact Method	Request/Comment	Response
3/6/2019	Raptors are the Solution (RATS)	Board Contact Form	Inquired about whether or not we use anticoagulant rodenticides at Midpen.	Midpen does not use anti-coagulant rodenticides. Midpen has one rodenticide on the Approved Pesticide List, and it has not been used in several years.
5/13/2019	Preserve Visitor	General Info	Request to stop using glyphosate herbicides	Explained safety protocols in place to protect people and the environment.
7/23/2019	Preserve Neighbor near Long Ridge	Phone	Responding to stinkwort notification flyers. Notified of stinkwort on his property.	Informed him of the stinkwort control efforts in the nearby areas.
7/23/2019	BCR Visitor	Email	Saw pesticide notification sign at BCR and was concerned about bee health.	Explained safety protocols in place to protect people and the environment.
9/11/2019	Pulgas Visitor	Email	Does not think that Midpen should use glyphosate	Explained safety protocols in place to protect people and the environment.
10/3/2019	Sierra Azul Visitor	Phone	Concerned about stinkwort growing along Hicks Road.	Informed him of the stinkwort control efforts in the nearby areas of Sierra Azul.
Multiple (20)	Russian Ridge Visitor	Various (phone, email, in-person)	Provided a proposal to provide vegetation management at Russian Ridge; submitted a variety of information requests and concerns about District practices.	Staff have provided several point by point responses and engaged in discussion with the inquirer.

8 Consultants and Contractors

The District contracts with consultants and contractors to assist in the implementation and maintenance of the IPM Program. Table 14 outlines the scope of services and work by these firms.

Table 14: Consultants and Contractors who performed IPM related work[8]

Firm	Scope of Services/Work	Amount
AECOM	Biomonitoring for invasive species management at Russian Ridge OSP	$24,560
CalFlora	Annual subscription and improvements to the CalFlora Weed Manager Database	$8,275
Community Tree Service	Bear Creek Redwoods Tree Farm Mitigation Project	$88,500
Ecological Concerns	Treatment of invasive species District-wide	$380,154
On Point Land Management	Preparation of Pest Control Recommendations	$3,750
Phytosphere Research	Treatment of Sudden Oak Death in three (3) District Preserves	$11,677
San Jose Conservation Corps	Treatment of invasive plant species at Purisima Creek Redwoods OSP	$30,000
San Mateo County RCD	Treatment of slender false brome on private properties that have the potential to infest District lands	$65,221
Sara Grove, PhD Ecological Consulting	Preparation of the pesticide Literature Review	$10,000

9 Compliance with Guidance Manual

9.1 Updates to the IPM Program

On February 22, 2019 (R-19-11), the full Board approved the IPM EIR Addendum, which included six (6) new recommendations aimed at further reducing glyphosate use and increasing worker and visitor safety. These recommendations have been incorporated into the IPM program beginning in the 2019 field season, and are summarized below:

1. Increase Field Crew Training
    a. Ensure all District field crew who perform herbicide treatments have specialized experience and training in pesticide safety, IPM principles, and special status species.
    b. Evaluate the suitability of securing Qualified Applicator Certificate (QAC) certifications for additional field staff, and implement as appropriate.
2. Re-examine ongoing IPM projects
    a. Identify suitable sites to shift treatment methods away from glyphosate.
    b. Ensure that all projects are performed at the time of year and phenological window for maximum effectiveness, thereby increasing the efficiency of current pesticide treatments.
3. Add Garlon 4 Ultra and Capstone to the list of approved pesticides
    a. Garlon is more effective at controlling woody vegetation than glyphosate
    b. Capstone is more effective at controlling some broadleaf weed species than glyphosate
4. Assess the availability of an alternative pesticide to replace glyphosate. This herbicide would be the safest available, broad-spectrum, post-emergent herbicide with minimal residual soil activity

[8] This list is not to be considered exhaustive as some contracts contain IPM related work that is secondary to the main scope (e.g. plant maintenance contracts for mitigation sites).

5. Expand the BMPs that reduce staff and visitor exposure to pesticides.
    a. Establish no-spray trail buffers where no herbicides can be sprayed within 5-feet of trails, trailheads, or parking lots UNLESS a 24-hour trail closure is put into place.
    b. Define "Spare-the-Air" days as a no-spray day due to the likely possibility of an inversion layer being present.
6. Implement an annual pesticide literature review of all newly published toxicological research and court proceedings related to pesticides on the "Approved Pesticides List" to inform updates to the IPM Program.

9.2 Experimental Pest Control Projects

9.2.1 Slender False Brome (*Brachypodium sylvaticum*)

The District, RCD, and Santa Clara University partnered to assess the efficacy of several non-herbicidal treatment methods, including mechanical mowing and several types of mulch. Field experiments and data collection for non-herbicide control of Slender false brome were concluded in 2019, and a final report is expected in December 2020.

9.2.2 Tall Oatgrass treatments

Tall oatgrass occurs in dense monocultures in several grasslands throughout the District, possibly introduced as forage from earlier grazing operations. To restore biodiversity in these grasslands, the District plans to implement a treatment study in Long Ridge OSP in Fiscal Year 2020-21 (FY21) to test the efficacy of a treatment method described in the academic journal Applied Vegetation Science. If trial treatments prove successful, this method will be expanded to infestations within Skyline Ridge OSP, Los Trancos OSP, and Monte Bello OSP.

9.2.3 Sudden Oak Death (SOD)

The District partnered with Phytosphere to test several potential treatment methods for Sudden Oak Death, including targeted Bay tree removal and fungicide applications. While unlikely to result in viable landscape-level treatment options, this is an important contribution to SOD science and may provide tools to protect significant heritage oaks and areas with high natural resource value. A final report is expected in December 2020.

9.2.4 Pesticide Literature Review

To assist with an understanding of the least harmful and most effective pesticides to use in the IPM Program, Midpen has entered a 4-year partnership with a UC Santa Cruz researcher to perform an annual literature review of the latest science surrounding the products on our List of Approved Pesticides. The scientific literature review focuses on land management with pesticides in natural areas or rangeland as it relates to human and environmental health. The District has received the 2015-2018 Pesticide Literature Review and Annotated Bibliography, which is now available to the public on the District website. The District received the draft 2019 Review in June 2020, and the final version will be provided to the Board and posted on the District's website. Glyphosate continues to undergo a significant amount of scientific studies related to human and environmental health. Most notably, a new study correlates increased rates of non-Hodgkin's

lymphoma (NHL) in workers who were at the highest frequency and intensity of exposure in agricultural settings. Due to the very low use of glyphosate at the District and extensive Best Management Practices followed during applications, these new findings should not impact the IPM Program.

9.3 Changes to Guidance Manual

9.3.1 Updating the List of Approved Pesticides

The List of Approved Pesticides is intended to change over time as the science of pest control advances and more effective, safer, and less harmful pesticides are developed; as manufacturers update, discontinue, or substitute products; and as the District's target pests change over time.

In instances where new products with new active ingredients are found to be safer, more effective, and/or less costly than products on the List of Approved Pesticides, the District may elect to add new pesticides. This type of change typically requires additional toxicological review, and depending on the results, may also require additional environmental review.

9.3.1.1 *Use of the disinfectant Virex II*

Per the IPM program, in the event of an emergency (such as a human health disease outbreak), pesticides that are not included on the List of Approved Pesticides may be used for short periods. In these unusual situations the District will comply with required regulatory procedures, then will evaluate the emergency response pesticide use and determine if its IPM program needs to be modified to accommodate similar future emergencies. To protect staff during the COVID-19 pandemic, the District is using the viral disinfectant Virex II (active ingredient didecyl dimethyl ammonium chloride) to clean offices, vehicles, and other high-touch surfaces. Virex II in its undiluted form is registered as a pesticide, and only trained staff who hold valid Qualified Applicator Certificates (QAC) with the CA Department of Pesticide Regulation (DPR) are authorized to mix the undiluted product. The District is only cleaning with the product in its diluted form, which is not regulated and is a widely used cleaning disinfectant. However, it is only available in concentrate so trained staff must first dilute it for use as a disinfectant. District staff will continue to use Virex II to clean surfaces at regular intervals throughout the duration of the pandemic. The District will evaluate whether this pesticide or other suitable pesticides authorized to use against the virus by the Department of Pesticide Regulations, should be permanently added to the District's Approved Pesticide List. The Annual IPM Report, as approved by the General Manager and accepted/approved by the Board of Directors will be the basis for making changes to the Program, including modification of any IPM procedures or changes to the List of Approved Pesticides.

11 List of Preparers and Contributors

MROSD
Carmen Lau, Public Affairs Specialist I
Jean Chung, Property Management Specialist I
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Aleksandra Evert, Volunteer Program Lead
Tom Reyes, IPM Coordinator
Coty Sifuentes-Winter, Senior Resource Management Specialist

Appendix A – Invasive Plant Treatment List

Ongoing and general maintenance plant pest species that were treated in 2019 sorted by total treatment hours:

Scientific Name	Common Name	Cal-IPC Rating	State Noxious Weed	Labor Hours
Genista monspessulana	French broom	High	X	5294.78
Hedera helix	English ivy	High		1531.35
Centaurea solstitialis	Yellow starthistle	High	X	753.8
Vinca major	Vinca	Moderate		752.4
Carthamus creticus	Smooth distaff thistle		X	389
Centaurea calcitrapa	Purple star thistle	Moderate	X	359.95
Carduus pycnocephalus	Italian thistle	Moderate	X	357
Cortaderia jubata	Andean pampas grass	High	X	351.8
Dittrichia graveolens	Stinkwort	Moderate	X	320.45
Aegilops triuncialis	Goatgrass	High	X	298
Dipsacus fullonum	Wild teasel	Moderate		245.2
Spartium junceum	Spanish broom	High	X	184.2
Pseudotsuga menziesii (cultivar)[9]	Douglas fir			152
Conium maculatum	Poison hemlock	Moderate		140.75
Ehrharta erecta	Upright veldt grass	Moderate		135.85
Acacia dealbata	Silver wattle	Moderate		126
Hirschfeldia incana	Mustard	Moderate		121.75
Carex pendula	Hanging sedge	Watch		115.5
Phalaris aquatica	Harding grass	Moderate		85.15
Eucalyptus globulus	Blue gum	Limited		74.5
Baccharis pilularis[10]	Coyote brush			68
Acacia melanoxylon	Blackwood acacia	Limited		60.5
Foeniculum vulgare	Fennel	Moderate		57.25
Silybum marianum	Milk thistle	Limited		54.5
Dipsacus sativus	Indian teasel	Moderate		51.1
Typha domingensis[11]	Cattail			45
Brachypodium sylvaticum	Slender false brome	Moderate	X	35.25
Aegilops cylindrica	Jointed goatgrass	Watch	X	29.47
Rubus armeniacus	Himalayan blackberry	High		22.5
Vinca minor	Common periwinkle			21
Cytisus scoparius	Scotch broom	High	X	20.25

[9] Douglas Fir cultivars at a former tree farm in Bear Creek Redwoods were removed for mitigation.
[10] Although *Baccharis pilularis* (coyote brush) is a native species, the District selectively removes this to slow down the encroachment into and type conversion of California grasslands.
[11] *Typha domingensis* (cattail) is selectively removed for aquatic habitat improvements for Special Status Species.

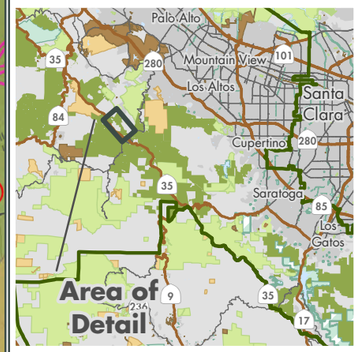
Scientific Name	Common Name	Cal-IPC Rating	State Noxious Weed	Labor Hours
***Pinus radiata* (cultivar)**[12]	Monterey pine	Limited		16
Cirsium vulgare	Bullthistle	Moderate	X	15.6
Plantago lanceolata	Ribwort	Limited		12.25
Delairea odorata	Cape ivy	High	X	12
Elymus caput-medusae	Medusa head	High	X	11
Myosotis latifolia	Wide leaved forget me not	Limited		10
Sonchus oleraceus	Sow thistle			10
Rumex crispus	Curly dock	Limited		10
Avena fatua	Wildoats	Moderate		9
Medicago polymorpha	California burclover	Limited		8
Brassica nigra	Black mustard	Moderate		8
Centaurea melitensis	Tocalote	Moderate	X	7.5
Ranunculus californicus	Common buttercup			7
Solanum furcatum	Forked nightshade			6
Polygonum aviculare	Prostrate knotweed			6
Brassica rapa	Common mustard	Limited		6
Baccharis pilularis ssp. Consanguinea	Coyote brush			5
Helminthotheca echioides	Bristly ox-tongue	Limited		4
Stellaria media	Chickweed			4
Taraxacum officinale ssp. officinale	Common dandelion			4
Trifolium hirtum	Rose clover	Limited		4
Carduus pycnocephalus ssp. pycnocephalus	Italian thistle	Moderate		3.5
Cynodon dactylon	Bermuda grass	Moderate		3.5
Helminthotheca echioids	Bristly ox-tongue	Limited		3.5
Erodium botrys	Big heron bill			3
Bromus diandrus	Ripgut brome	Moderate		2.5
Ailanthus altissima	Tree of heaven	Moderate	X	1.4
Solanum nigrum	Black nightshade			1
Senecio vulgaris	Common groundsel			1
Hypericum perforatum ssp. perforatum	Klamathweed	Limited		1
Avena sativa	Wild oat			1
Lysimachia arvensis	Scarlet pimpernel			0.5
Brassica rapa var. rapa	Turnip			0.5
Lactuca serriola	Prickly lettuce			0.5
Lactuca saligna	Willow lettuce			0.5

[12] *Pinus radiata* (Monterey pine) is the most widely planted commercial timber tree in the world. However, in its native range, consisting of five populations in California and Baja California, Mexico, the species is threatened by several human-caused impacts: development, human-dispersed plant pathogens, non-native herbivores, etc. Cal-IPC's assessment is specifically based only on populations, stands, or individuals of the species that have become established due to human introductions, or reasonably considered to have been dispersed from such human introductions of the species.

Scientific Name	Common Name	Cal-IPC Rating	State Noxious Weed	Labor Hours
Erigeron bonariensis	Flax-leaved horseweed			0.25
Carthamus lanatus	Woolly distaff thistle	High	X	0.2
Leucanthemum vulgare	Oxe eye daisy	Moderate		0.1
Holcus lanatus	Common velvetgrass	Moderate		0.1
Poa bulbosa	Bulbous blue grass			0.01

IPM Work Plan
Coal Creek
Coal Creek

Miles
0 0.125 0.25



Invasive Plants

CalFlora_191125

Weeds

- Brooms
- Early Detection
- Low Priority Weeds; Teasel
- Perennial Grasses
- Purple star-thistle
- Yellow star-thistle

ATTACHMENT 2

MIDPENINSULA REGIONAL OPEN SPACE

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IPM Work Plan
El Corte de Madera Creek
El Corte De Madera

Miles
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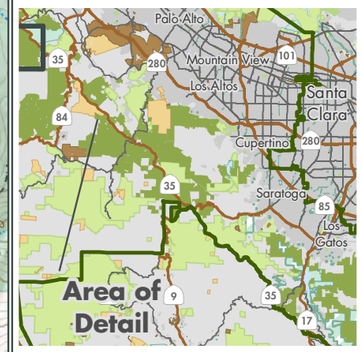


Invasive Plants

- Acacia
- Brooms
- Early Detection
- Jubata Grass
- Low Priority Weeds; Teasel
- Other Thistles
- Perennial Grasses
- Slender False Brome
- Stinkwort
- Vinca
- Woody Invasives
- Yellow star-thistle

ATTACHMENT 2

MIDPENINSULA REGIONAL OPEN SPACE

PURISIMA CREEK REDWOODS
TEAGUE HILL
EL CORTE DE MADERA CREEK
TUNITAS CREEK
LA HONDA CREEK

Kings Mountain Elementary School
Kings Mountain Learning Center (Day Care)
Teague Hill
Sandstone Formation
Sierra Morena
Skeggs Point
Resolution Aircraft Crash Site
Vista Point
Methusela Tree
Old Growth Redwood Grove
Old Growth Redwood
Virginia Mill
Big Tree (Redwood)
Allen Road Pond (LH025)

Upper Tunitas Canyon Road
Swett Road
Central Ridge Road
Upper Mitchell Canyon Road
Lower Tunitas Canyon Road
Old Ridge Road
Star Hill Road
Tunitas Creek Rd
South Boundary Road
Native Sons Rd.
Durham Road
Bear Gulch Rd
Bear Glen
Allen Road
Skyline Trail
Bear Gulch Rd

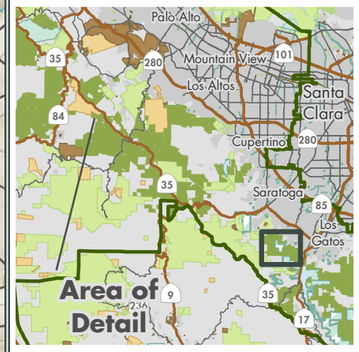
Tunitas Creek
Mitchel Creek
Bear Creek
El Corte de Madera Creek
East Fork Tunitas Creek
Honda Creek

Ridge Trail
El Corte de Madera Creek Trail
Tafoni Trail
Fir Trail
Sierra Morena Trail
Methuselah Trail
Resolution Trail
North Leaf Trail
South Leaf Trail
Manzanita Trail
Molder Trail
Olion Trail
Crosscut Trail
Steam Donkey Trail
Giant Salamander Trail
Timberview Trail
Gordon Mill Trail
Spring Board Trail
Blue Blossom Trail
Lawrence Creek Trail
Virginia Mill Trail
Honda Creek Trail
Stillwater Trails

CM00 CM01A CM01B CM01L CM02 CM03 CM04 CM04 - 1/2 CM05 CM06 CM07 CM08 CM08 - 1/2 CM09 CM10 CM11
PC08 TC02 LH01 LH02

IPM Work Plan
El Sereno
El Sereno

Miles
0 0.2 0.4



Invasive Plants

CalFlora_191125

Weeds

- Blackberry
- Brooms
- Early Detection
- Eucalyptus
- Ivy
- Low Priority Weeds; Teasel
- Perennial Grasses
- Stinkwort
- Vinca
- Woody Invasives
- Yellow star-thistle

ATTACHMENT 2

MIDPENINSULA REGIONAL OPEN SPACE

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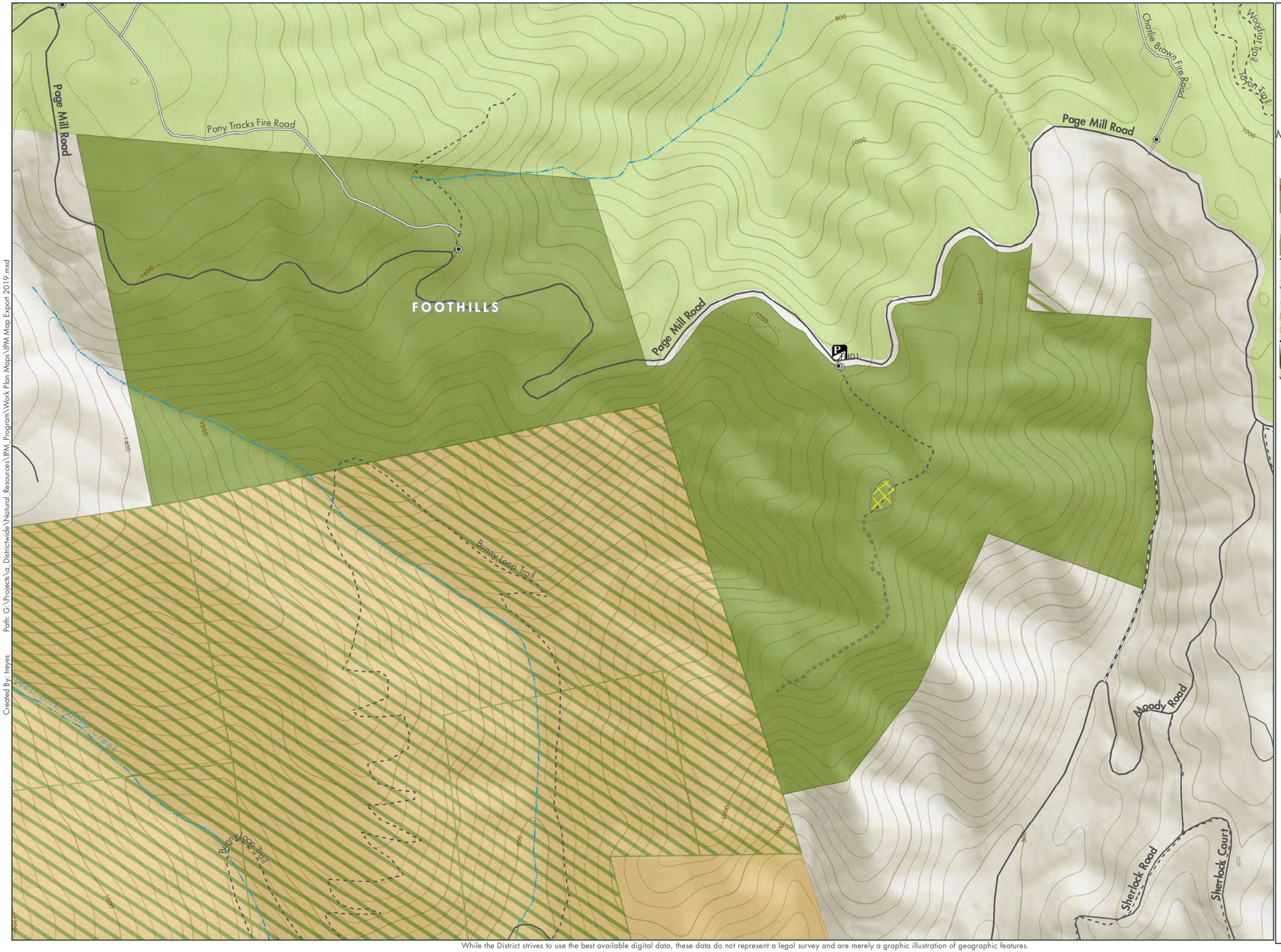

IPM Work Plan
Foothills
Foothills

Miles
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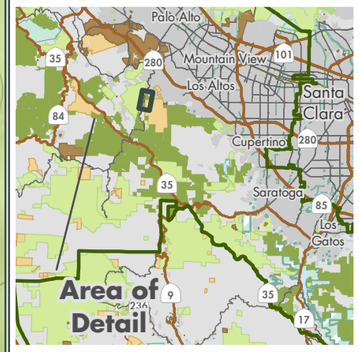

Invasive Plants
CalFlora_191125
Weeds

Yellow star-thistle

ATTACHMENT 2

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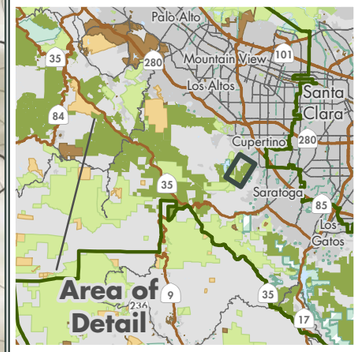
IPM Work Plan
Fremont Older
Fremont Older

Miles
0 0.1 0.2



Invasive Plants

CalFlora_191125

Weeds

- Blackberry
- Early Detection
- Eucalyptus
- Low Priority Weeds; Teasel
- Other Thistles
- Perennial Grasses
- Stinkwort
- Vinca
- Woody Invasives
- Yellow star-thistle

ATTACHMENT 2

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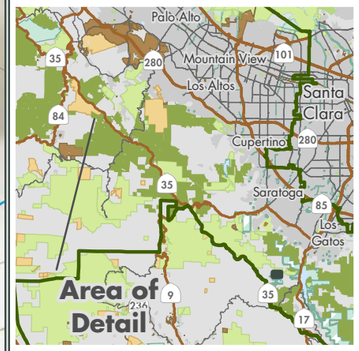
IPM Work Plan
Felton Station
Felton Station

Miles
0 0.035 0.07



Invasive Plants

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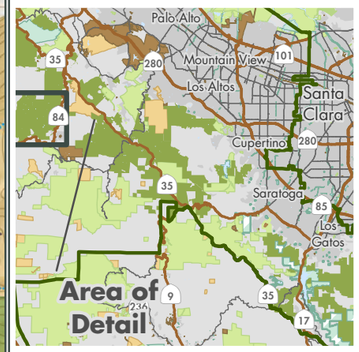
MIDPENINSULA REGIONAL OPEN SPACE

IPM Work Plan
La Honda Creek
LH- Driscoll Ranch

Miles
0 0.3 0.6



Invasive Plants

CalFlora_191125

Weeds

- Acacia
- Blackberry
- Brooms
- Eucalyptus
- Ivy
- Jubata Grass
- Low Priority Weeds; Teasel
- Mustards
- Other Thistles
- Perennial Grasses
- Purple star-thistle
- Slender False Brome
- Stinkwort
- Vinca
- Woody Invasives
- Yellow star-thistle

ATTACHMENT 2

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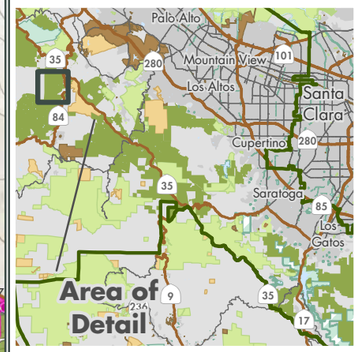
IPM Work Plan
La Honda Creek
LH- Upper

Miles
0 0.175 0.35



Invasive Plants

CalFlora_191125

Weeds

- Brooms
- Eucalyptus
- Low Priority Weeds; Teasel
- Other Thistles
- Purple star-thistle
- Slender False Brome
- Stinkwort

ATTACHMENT 2

IPM Work Plan
Long Ridge
Long Ridge

Miles
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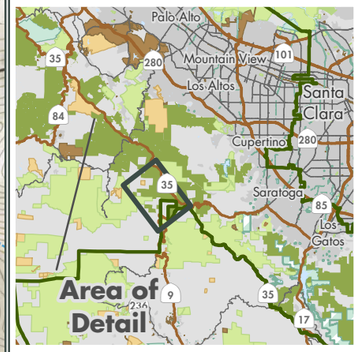

Invasive Plants

CalFlora_191125

Weeds

- Brooms
- Early Detection
- Goat grass
- Ivy
- Low Priority Weeds; Teasel
- Mustards
- Perennial Grasses
- Stinkwort
- Yellow star-thistle

ATTACHMENT 2

MIDPENINSULA REGIONAL OPEN SPACE

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IPM Work Plan
Los Trancos
Los Trancos

Miles
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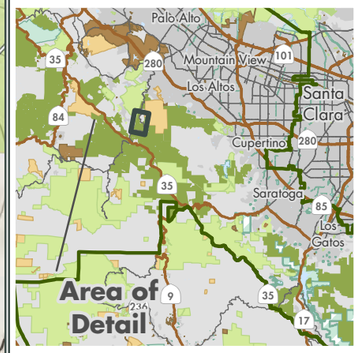

Invasive Plants
CalFlora_191125

Weeds

- Brooms
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- Yellow star-thistle

ATTACHMENT 2

LOS TRANCOS
MONTE BELLO
FOOTHILLS
Los Trancos Creek
West Fork Adobe Creek
Lost Creek Loop Trail
Los Trancos Trail
Pony Tracks Fire Road
White Oak Trail
Nonette Hanko San Andreas Fault Trail
Franciscan Loop Trail
Page Mill Trail
Canyon Trail
Adobe Creek Trail
Montebello Road
Page Mill Road
MB-MAINLOT
ADOBE
LT03
MB00
LT01
MB03
MB02
MB01
Private Residence
Private Residence
Bag Pond
Leak Pond
2000
2200
1800
1600
1400
1200

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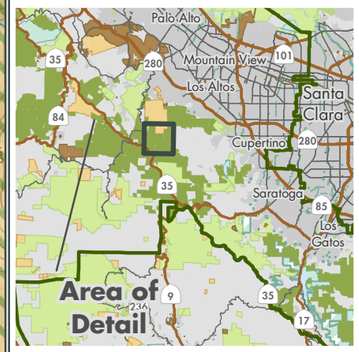
IPM Work Plan
Monte Bello
Black Mountain

Miles
0 0.175 0.35



Invasive Plants

CalFlora_191125

Weeds

- Brooms
- Early Detection
- Ivy
- Low Priority Weeds; Teasel
- Other Thistles
- Perennial Grasses
- Purple star-thistle
- Stinkwort
- Yellow star-thistle

ATTACHMENT 2

MIDPENINSULA REGIONAL OPEN SPACE

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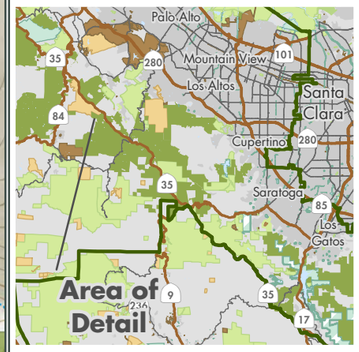
IPM Work Plan
Miramontes Ridge
MR- Lower

Miles
0 0.125 0.25



Invasive Plants

CalFlora_191125

Weeds

- Eucalyptus
- Ivy
- Jubata Grass
- Low Priority Weeds; Teasel
- Perennial Grasses

ATTACHMENT 2

MIDPENINSULA REGIONAL OPEN SPACE

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Created By: treyes

IPM Work Plan
Miramontes Ridge
MR- Upper

Miles
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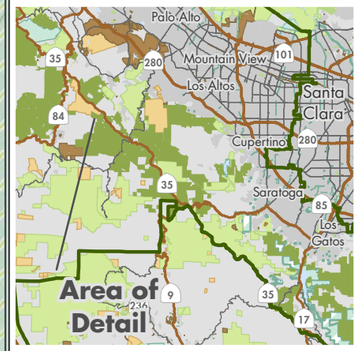


Invasive Plants

CalFlora_191125

Weeds

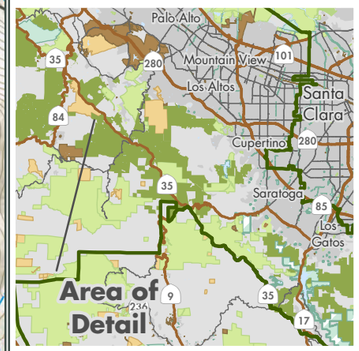
- Acacia
- Brooms
- Eucalyptus
- Ivy
- Other Thistles
- Perennial Grasses
- Stinkwort

ATTACHMENT 2

MIDPENINSULA REGIONAL OPEN SPACE

IPM Work Plan
Purisima Creek Redwoods
PCR- Ranches

Miles
0 0.225 0.45



Invasive Plants

CalFlora_191125

Weeds

- Acacia
- Brooms
- Eucalyptus
- Ivy
- Jubata Grass
- Low Priority Weeds; Teasel
- Perennial Grasses
- Vinca

ATTACHMENT 2

MIDPENINSULA REGIONAL OPEN SPACE

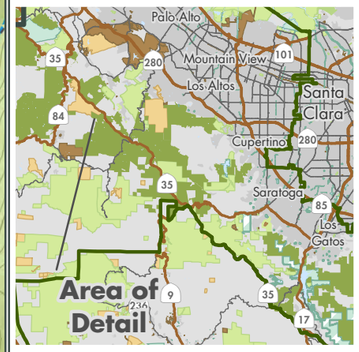
PURISIMA CREEK REDWOODS

Purisima Creek Rd
Higgins Canyon Rd
Verde Rd
Farm Road A
Farm Road B
Purisima Creek
Lobitos Ridge Ranch House
Lobitos Ridge Historical House
PC09
PC10
PC11
PC12
PC07
PC08
PC20
PC21
PC23
October Ranch House
October Pond
Bathtub Pond
Chalus Pond
Purisima Pond
Pond
Walker Gulch
Lobitos Creek
Lobitos Creek Rd
Tunitas Creek Rd
Lower Tunitas Canyon Road
Irish Ridge Road
Irish Ridge Trail
Lobitos Creek Trail
Bald Knob Trail

Path: G:\Projects\a_Districtwide\Natural_Resources\IPM_Program\Work Plan Maps\IPM Map Export 2019.mxd
Created By: lreyes

IPM Work Plan
Purisima Creek Redwoods
PCR

Miles
0 0.225 0.45



Invasive Plants

CalFlora_191125

Weeds

- Acacia
- Brooms
- Early Detection
- Ivy
- Jubata Grass
- Low Priority Weeds; Teasel
- Other Thistles
- Perennial Grasses
- Slender False Brome
- Vinca

ATTACHMENT 2

MIDPENINSULA REGIONAL OPEN SPACE

PURISIMA CREEK REDWOODS

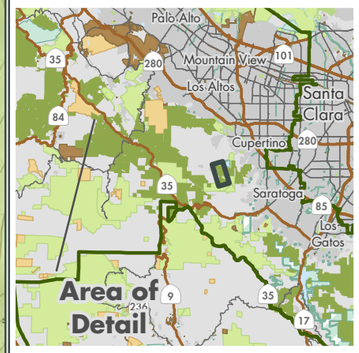
EL CORTE DE MADERA CREEK

PC01NN Resident
PC01LOT PC01 Exit PC01 Entry
PC01
PC02
PC03
PC03A
PC04
PC05
PC08
NRIDGE

Arroyo Leon
North Ridge Trail
Whittemore Gulch Trail
Harkins Ridge Trail
Harkins Fire Trail
Purisima Creek Trail
Borden Hatch Mill Trail
Craig Britton Trail
Grabtown Gulch Trail
Walker Gulch
Tobias Creek
Bald Knob Trail
Ridge Trail
Forest View Road
Harkins Rd
Purissima St
Comstock Rd
Ware Rd
Big Pine Rd
Old Ranch Road
Megan Ln
Forest Ln
Henrik Redwood Terr
Lonely Trail
West Union Creek
Raymundo Trail
Mount Redondo Trail
Ridge Road
Richards Road
Upper Skyline Ridge
Redwood Trail
Skyline Trail
Sierra Morena
Bear Creek
Squealer Gulch
Big Spring Road
Big Stump Road
Tunitas Creek Rd
Lower Tunitas Canyon Road
Upper Tunitas Canyon Road
Lower Grabtown Road
Star Hill Road
Swett Road
Central Ridge Road
Tunitas Creek
35
9
17
84
85
101
280

IPM Work Plan
Picchetti Ranch
Picchetti Ranch

Miles
0 0.1 0.2



Invasive Plants

CalFlora_191125

Weeds

- Blackberry
- Eucalyptus
- Ivy
- Jubata Grass
- Low Priority Weeds; Teasel
- Other Thistles
- Perennial Grasses
- Purple star-thistle
- Stinkwort
- Vinca
- Woody Invasives
- Yellow star-thistle

ATTACHMENT 2

MIDPENINSULA REGIONAL OPEN SPACE

FREMONT OLDER

Stevens Creek Reservoir

Stevens Creek -Tony Look Trail

Lookout Trail

Mt. Eden Rd

22

Creek Trail

Stevens Creek

Stevens Canyon Rd.

Orchard Loop Trail

Bear Meadow Trail

Vista Trail

PICCHETTI RANCH

Zinfandel Trail

ZINFANDEL

ORCHARD

Picchetti Pond

Swiss Creek

PI03

PI01

Main House

Picchetti Winery

PR-MAINLOT

PI04

PI02

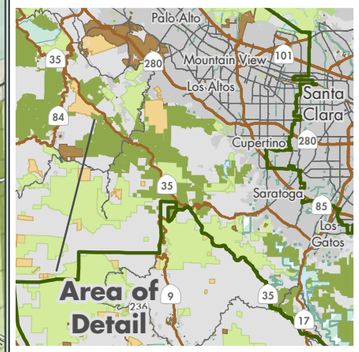
Montebello Road

Path: G:\Projects\a_Districtwide\Natural_Resources\IPM_Program\Work Plan Maps\IPM Map Export 2019.mxd

Created By: treyes

IPM Work Plan
Pulgas Ridge
Pulgas Ridge

Miles
0 0.075 0.15



Invasive Plants

CalFlora_191125

Weeds

- Acacia
- Blackberry
- Brooms
- Eucalyptus
- Ivy
- Jubata Grass
- Low Priority Weeds; Teasel
- Other Thistles
- Perennial Grasses
- Stinkwort
- Vinca
- Woody Invasives
- Yellow star-thistle

ATTACHMENT 2

MIDPENINSULA REGIONAL OPEN SPACE

Created By: treyes
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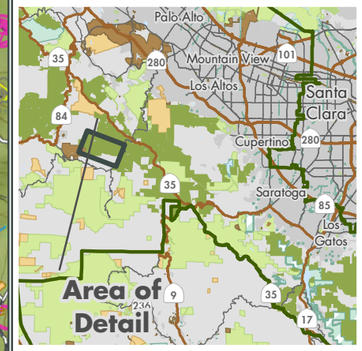
While the District strives to use the best available digital data, these data do not represent a legal survey and are merely a graphic illustration of geographic features.

IPM Work Plan
Russian Ridge
RR- Mindego Hill

Miles
0 0.175 0.35



Invasive Plants

CalFlora_191125

Weeds

- Blackberry
- Brooms
- Early Detection
- Low Priority Weeds; Teasel
- Other Thistles
- Perennial Grasses
- Purple star-thistle
- Stinkwort
- Yellow star-thistle

ATTACHMENT 2

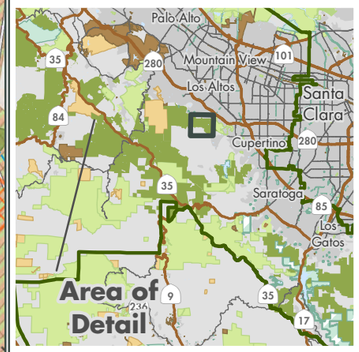
MIDPENINSULA REGIONAL OPEN SPACE

Created By: treyes Path: G:\Projects\a_Districtwide\Natural_Resources\IPM_Program\Work Plan Maps\IPM Map Export 2019.mxd

While the District strives to use the best available digital data, these data do not represent a legal survey and are merely a graphic illustration of geographic features.

IPM Work Plan
Rancho San Antonio
Lower Rancho

Miles
0 0.125 0.25



Invasive Plants

CalFlora_191125

Weeds

- Early Detection
- Eucalyptus
- Ivy
- Low Priority Weeds; Teasel
- Mustards
- Other Thistles
- Perennial Grasses
- Purple star-thistle
- Stinkwort
- Woody Invasives
- Yellow star-thistle

ATTACHMENT 2

MIDPENINSULA REGIONAL OPEN SPACE

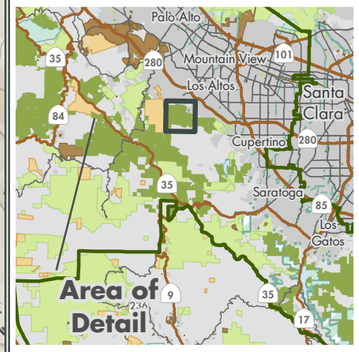
Path: G:\Projects\a_Districtwide\Natural Resources\IPM_Program\Work Plan Maps\IPM Map Export 2019.mxd

Created By: lreyes

While the District strives to use the best available digital data, these data do not represent a legal survey and are merely a graphic illustration of geographic features.

IPM Work Plan
Rancho San Antonio
Upper Rancho

Miles
0 0.175 0.35



Invasive Plants

CalFlora_191125

Weeds

- Brooms
- Early Detection
- Low Priority Weeds; Teasel
- Stinkwort
- Woody Invasives
- Yellow star-thistle

RANCHO SAN ANTONIO

UPPER-MEADOW

WP02 WP04 RS07 RS08

Private

Rhus Ridge Residence

Black Mountain Trail
Quarry Trail
Upper Meadow Trail
Stephen E. Abbors Trail
Upper Wildcat Canyon Trail
Upper Rogue Valley Trail
Rogue Valley Trail
Rogue Valley Creek
Chamise Trail
Ewing Trail
Horse Trail
Nary Trail
Nary Davey Loop Trail
Rhus Ridge Trail
Rhus Ridge Drive
Moody Road
Bassett Lane
Summitview Road
La Loma Drive
Olive Tree Lane
Laura Court
Kate Drive
Prospect Avenue
Stonebrook Drive
Oak Knoll Circle
Oak Park Court
Magdalena Ave
Blandor Way
Mary Sipiz Path
Adobe Creek

ATTACHMENT 2

MIDPENINSULA REGIONAL OPEN SPACE

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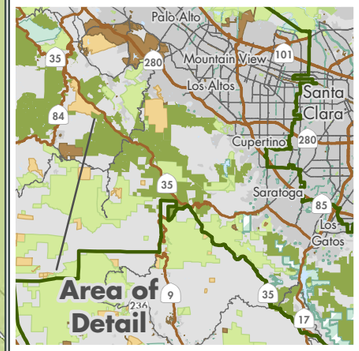
Created By: treyes

While the District strives to use the best available digital data, these data do not represent a legal survey and are merely a graphic illustration of geographic features.

IPM Work Plan
Ravenswood
Ravenswood

Miles
0 0.075 0.15



Invasive Plants

CalFlora_191125

Weeds

- Early Detection
- Low Priority Weeds; Teasel
- Mustards
- Other Thistles
- Stinkwort
- Yellow star-thistle

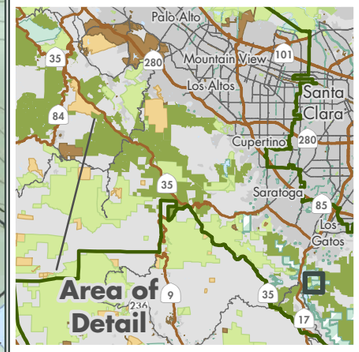
ATTACHMENT 2

Demeter St
Pulgas Ave
Tara St
Rogge Rd
Bay Rd
Stevens Ave
Temple Ct
Illinois St
Drew Ct
Fordham St
Service Road
Slough
Bay Trail
RAVENSWOOD
RW01
San Francisco Bay Mud
San Francisco Bay
Cooley Landing Education Center

Created By: treyes
Path: G:\Projects\a_Districtwide\Natural_Resources\IPM_Program\Work Plan Maps\IPM Map Export 2019.mxd

IPM Work Plan
Sierra Azul
SA- Beatty

Miles
0 0.1 0.2



Invasive Plants

CalFlora_191125

Weeds

- Brooms
- Stinkwort
- Yellow star-thistle

ATTACHMENT 2

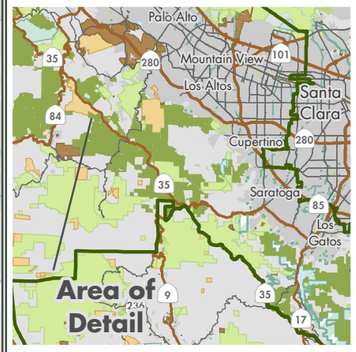
MIDPENINSULA REGIONAL OPEN SPACE

Path: G:\Projects\a_Districtwide\Natural_Resources\IPM_Program\Work Plan Maps\IPM Map Export 2019.mxd

Created By: treyes

IPM Work Plan
Sierra Azul
SA- Cherry Springs

Miles
0 0.1 0.2



Invasive Plants

CalFlora_191125

Weeds

- Blackberry
- Brooms
- Early Detection
- Low Priority Weeds; Teasel
- Perennial Grasses
- Stinkwort
- Yellow star-thistle

ATTACHMENT 2

MIDPENINSULA REGIONAL OPEN SPACE

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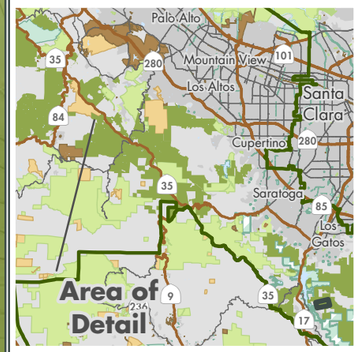
While the District strives to use the best available digital data, these data do not represent a legal survey and are merely a graphic illustration of geographic features.

IPM Work Plan
Sierra Azul
SA- Hendrys Creek

Miles
0 0.05 0.1



Invasive Plants

CalFlora_191125

Weeds

- Blackberry
- Brooms
- Low Priority Weeds; Teasel
- Perennial Grasses
- Stinkwort
- Vinca
- Woody Invasives
- Yellow star-thistle

SIERRA AZUL

Hendrys Creek

SA43

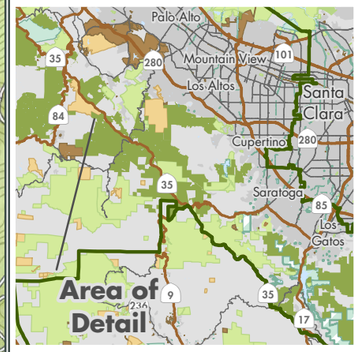
Weaver Road

ATTACHMENT 2

Created By: treyes Path: G:\Projects\a_Districtwide\Natural Resources\IPM_Program\Work Plan Maps\IPM Map Export 2019.mxd

IPM Work Plan
Sierra Azul
SA- Loma Prieta Ridge

Miles
0 0.275 0.55



Invasive Plants

CalFlora_191125

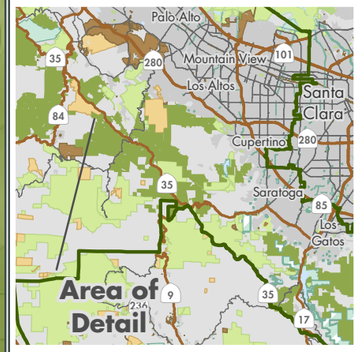
Weeds

- Brooms
- Early Detection
- Other Thistles
- Stinkwort

ATTACHMENT 2

IPM Work Plan
Sierra Azul
SA- Twin Creeks

Miles
0 0.05 0.1



Invasive Plants

CalFlora_191125

Weeds

- Acacia
- Blackberry
- Brooms
- Ivy
- Low Priority Weeds; Teasel
- Mustards
- Other Thistles
- Perennial Grasses
- Vinca
- Woody Invasives

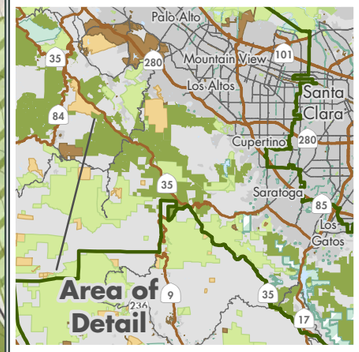
ATTACHMENT 2

Created By: treyes Path: G:\Projects\a_Districtwide\Natural_Resources\IPM_Program\Work Plan Maps\IPM Map Export 2019.mxd

While the District strives to use the best available digital data, these data do not represent a legal survey and are merely a graphic illustration of geographic features.

IPM Work Plan
Sierra Azul
SA- Woods-Barlow

Miles
0 0.125 0.25



Invasive Plants

CalFlora_191125

Weeds

- Brooms
- Early Detection
- Eucalyptus
- Low Priority Weeds; Teasel
- Other Thistles
- Stinkwort
- Yellow star-thistle

ATTACHMENT 2

MIDPENINSULA REGIONAL OPEN SPACE

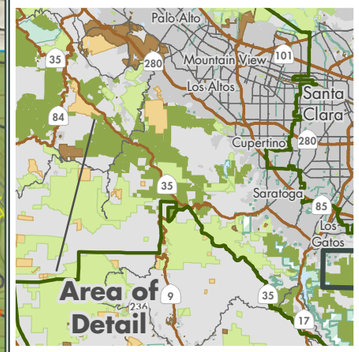
Path: G:\Projects\a_Districtwide\Natural_Resources\IPM_Program\Work Plan Maps\IPM Map Export 2019.mxd

Created By: treyes

While the District strives to use the best available digital data, these data do not represent a legal survey and are merely a graphic illustration of geographic features.

IPM Work Plan
Sierra Azul
Kennedy - Limekiln

Miles
0 0.225 0.45



Invasive Plants

CalFlora_191125

Weeds

- Brooms
- Jubata Grass
- Perennial Grasses
- Stinkwort
- Yellow star-thistle

ATTACHMENT 2

MIDPENINSULA REGIONAL OPEN SPACE

Path: G:\Projects\a_Districtwide\Natural_Resources\IPM_Program\Work Plan Maps\IPM Map Export 2019.mxd

Created By: treyes

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Path: G:\Projects\a_Districtwide\Natural_Resources\IPM_Program\Work Plan Maps\IPM Map Export 2019.mxd

Created By: treyes

MTUM

SIERRA AZUL

SA14

Mt. Umunhum Road

Mt. Umunhum Trail

Mt. Umunhum Trail

Guadalupe Creek

3200

3400

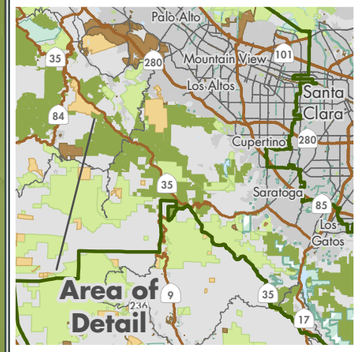
3200

3400

3200

IPM Work Plan
Sierra Azul
SA-Mt. Um

Miles
0 0.02 0.04



Invasive Plants

CalFlora_191125

Weeds

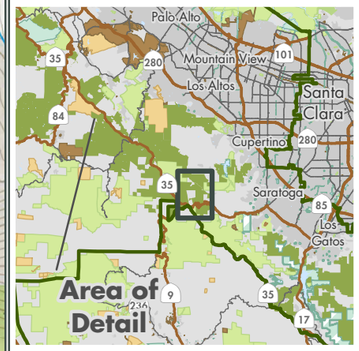
- Early Detection
- Low Priority Weeds; Teasel
- Mustards
- Other Thistles
- Purple star-thistle
- Yellow star-thistle

ATTACHMENT 2

MIDPENINSULA REGIONAL OPEN SPACE

IPM Work Plan
Saratoga Gap
Saratoga Gap

Miles
0 0.2 0.4



Invasive Plants

CalFlora_191125

Weeds

- Brooms
- Jubata Grass
- Low Priority Weeds; Teasel
- Slender False Brome
- Stinkwort
- Yellow star-thistle

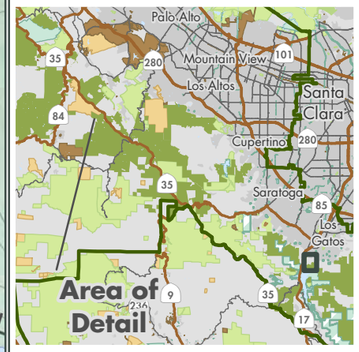
SARATOGA GAP
MONTE BELLO
LONG RIDGE
Redwood Gulch Rd
Stevens Canyon Rd
Stevens Canyon Ranch House
Heather Heights Rd.
Skyline Trail
Saratoga Gap Trail
Indian Rock Way
Fox Run
Snow Creek Trail
Skyline to the Sea Trail
Achistaca trail
Saratoga Toll Road Trail
Charcoal Road
Canyon Trail
Table Mountain Trail
Stevens Creek
Booker Creek
Saratoga Creek
Los Lorenzo River
Ort Creek
CALTRANS
Private
House
Lyson Lower House
Lyons Lower House
Powell House
Saratoga Gap Cabin 3
SG03
SG04
SG05
SG06
SG07
MB10
MB11
MB12
9
35

ATTACHMENT 2

Path: G:\Projects\a_Districtwide\Natural_Resources\IPM_Program\Work Plan Maps\IPM Map Export 2019.mxd
Created By: treyes

IPM Work Plan
St. Josephs Hill
St. Josephs Hill

Miles
0 0.075 0.15



Invasive Plants

CalFlora_191125

Weeds

- Brooms
- Low Priority Weeds; Teasel
- Other Thistles
- Perennial Grasses
- Stinkwort
- Yellow star-thistle

ATTACHMENT 2

MIDPENINSULA REGIONAL OPEN SPACE

Created By: treyes
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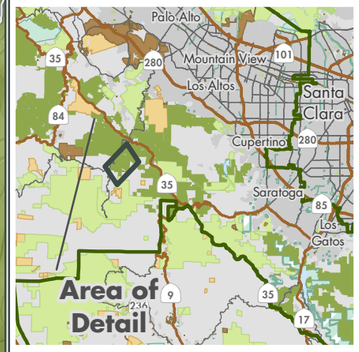
While the District strives to use the best available digital data, these data do not represent a legal survey and are merely a graphic illustration of geographic features.

IPM Work Plan
Skyline Ridge
Big Dipper Ranch

Miles
0 0.15 0.3



Invasive Plants

CalFlora_191125

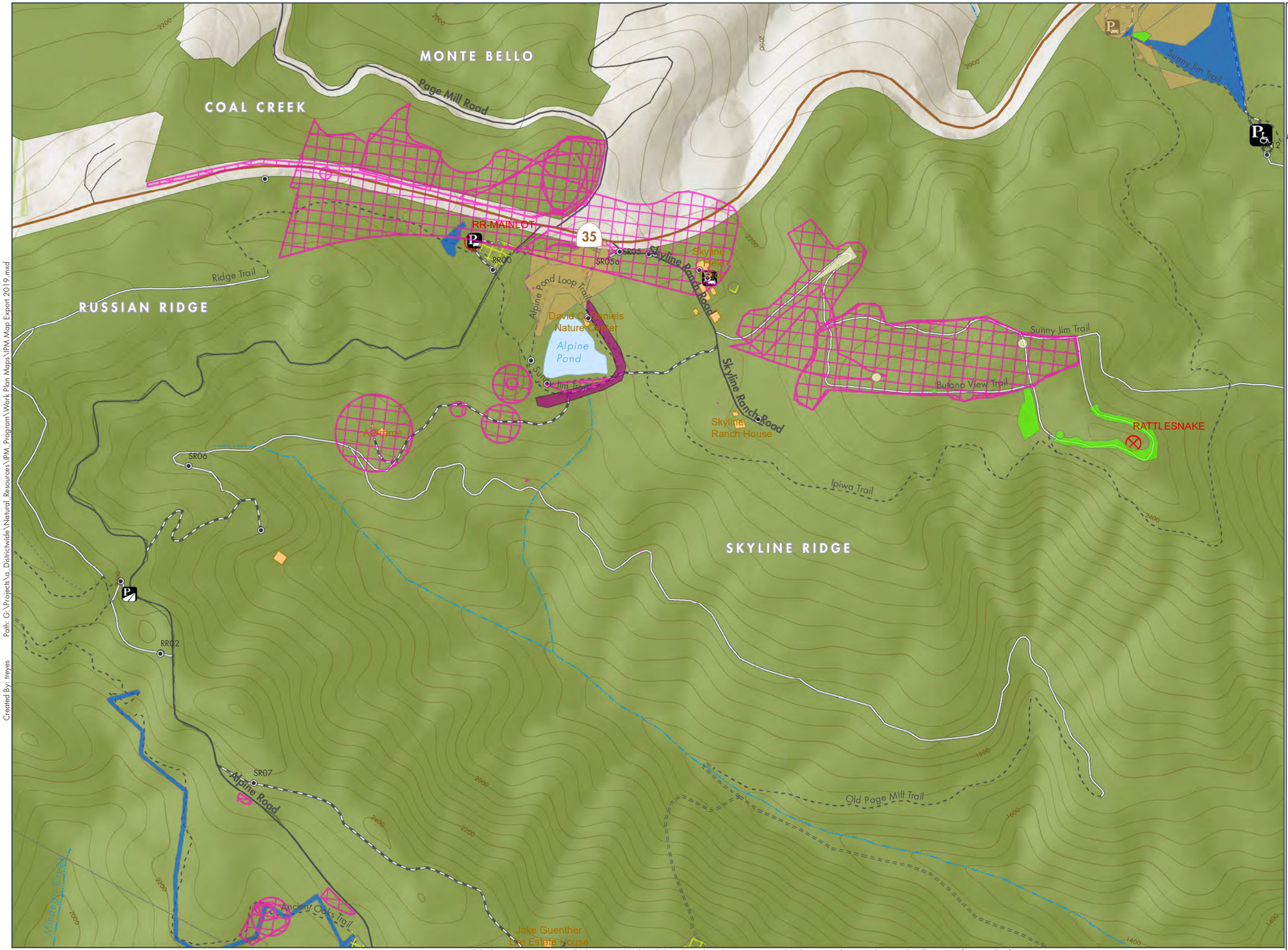
Weeds

- Brooms
- Goat grass
- Ivy
- Low Priority Weeds; Teasel
- Other Thistles
- Perennial Grasses
- Purple star-thistle
- Stinkwort
- Yellow star-thistle

ATTACHMENT 2

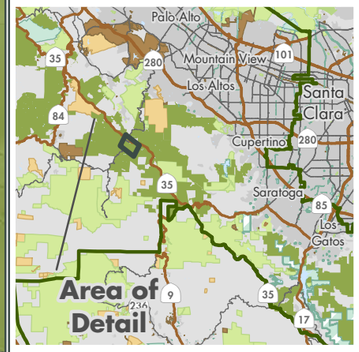
MIDPENINSULA REGIONAL OPEN SPACE

Created By: treyes
Path: G:\Projects\a_Districtwide\Natural_Resources\IPM_Program\Work Plan Maps\IPM Map Export 2019.mxd



IPM Work Plan
Skyline Ridge
SFO - Alpine Pond

Miles
0 0.075 0.15



Invasive Plants

CalFlora_191125

Weeds

- Blackberry
- Brooms
- Early Detection
- Low Priority Weeds; Teasel
- Other Thistles
- Perennial Grasses
- Stinkwort
- Yellow star-thistle

ATTACHMENT 2

MIDPENINSULA REGIONAL OPEN SPACE

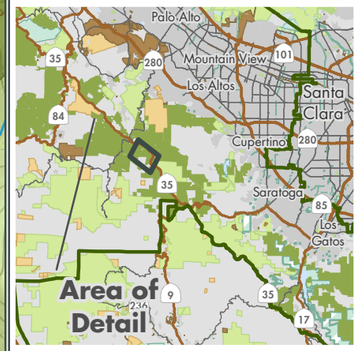
Path: G:\Projects\a_Districtwide\Natural_Resources\IPM_Program\Work Plan Maps\IPM Map Export 2019.mxd

Created By: lreyes

While the District strives to use the best available digital data, these data do not represent a legal survey and are merely a graphic illustration of geographic features.

IPM Work Plan
Skyline Ridge
Tree Farm

Miles
0 0.125 0.25



Invasive Plants

CalFlora_191125

Weeds

- Brooms
- Early Detection
- Ivy
- Low Priority Weeds; Teasel
- Other Thistles
- Perennial Grasses
- Stinkwort
- Yellow star-thistle

ATTACHMENT 2

MIDPENINSULA REGIONAL OPEN SPACE

MONTE BELLO
SKYLINE RIDGE
LONG RIDGE
Skid Road Trail
Bruin's Pond
Sherrill House
MB07
SR03
Kiosk
MB06
SR04
SR11
SR-MAINLOT
Sunny Jim Trail
Horseshoe Loop Trail
Tree Farm Trail
Fir Knoll Trail
Horseshoe Lake
35
Skyline Christmas Tree Farm Kiosk
SR02
INE
Ranch Rogers House
Butano View Trail
RATTLESNAKE
Ibiwa Trail
Lambert Creek Trail
Incerpi Main House
SR01
House
PORTOLA-HTS
IR03
Portola Heights Road
Chestnut Trail
Castanea Ridge Rd
Old Page Mill Trail
Portola Creek

While the District strives to use the best available digital data, these data do not represent a legal survey and are merely a graphic illustration of geographic features.

Created By: lreyes
Path: G:\Projects\a_Districtwide\Natural_Resources\IPM_Program\Work Plan Maps\IPM Map Export 2019.mxd

Stierlin Court

Crittenden Lane

Stevens Creek Trail

0

Slough

Levee Trail

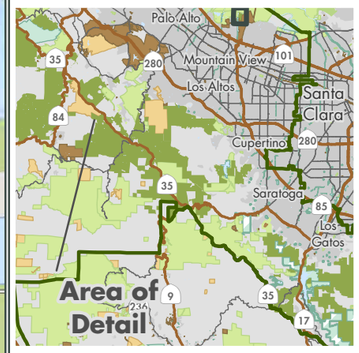
STEVENS CREEK
SHORELINE NATURE
STUDY AREA

Bay Trail

Created By: treyes Path: G:\Projects\a_Districtwide\Natural_Resources\IPM_Program\Work Plan Maps\IPM Map Export 2019.mxd

IPM Work Plan
Stevens Creek
Stevens Creek Study Area

Miles
0 0.075 0.15



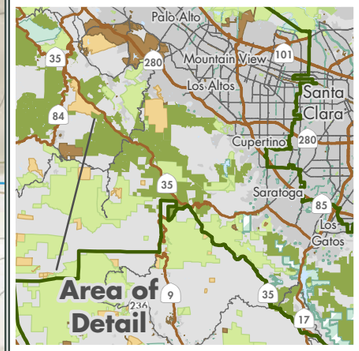
Invasive Plants

ATTACHMENT 2

MIDPENINSULA REGIONAL OPEN SPACE

IPM Work Plan
Tunitas Creek
TC- Toto Ranch

Miles
0 0.1 0.2



Invasive Plants

CalFlora_191125

Weeds

- Brooms
- Other Thistles

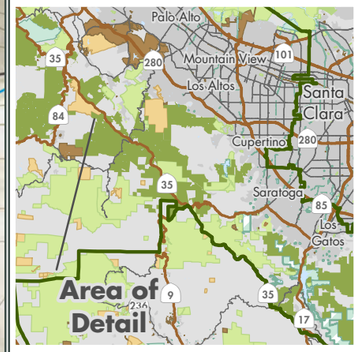
Tunitas Creek
Quarry Pond (TC01)
TC04
TUNITAS CREEK
TC Wetland
Toto Beach House
Star Hill Road
TC03
TC08
TC09
TC07
TC10
TC05
TC06
1
200
400
600
800

ATTACHMENT 2

Path: G:\Projects\a_Districtwide\Natural_Resources\IPM_Program\Work Plan Maps\IPM Map Export 2019.mxd
Created By: treyes

IPM Work Plan
Tunitas Creek
TC- Tunitas Creek Ranch

Miles
0 0.125 0.25



Invasive Plants

CalFlora_191125

Weeds

- Acacia
- Low Priority Weeds; Teasel

TUNITAS CREEK

Tunitas Ranch House (demo2)

TC01

TC01A

TC02

Tunitas Creek Rd

Lobitos Creek Cut-off

Lobitos Creek Rd

Durham Road

East Fork Tunitas Creek

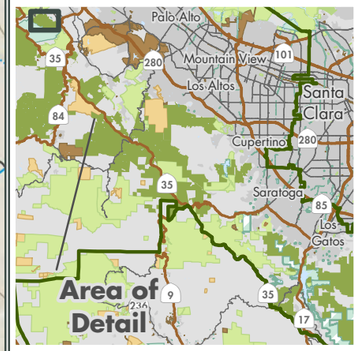
ATTACHMENT 2

MIDPENINSULA REGIONAL OPEN SPACE

Created By: treyes
Path: G:\Projects\a_Districtwide\Natural_Resources\IPM_Program\Work Plan Maps\IPM Map Export 2019.mxd

IPM Work Plan
Teague Hill
Teague Hill

Miles
0 0.125 0.25



Invasive Plants

CalFlora_191125

Weeds

- Acacia
- Brooms
- Ivy
- Low Priority Weeds; Teasel
- Perennial Grasses
- Stinkwort
- Vinca
- Woody Invasives

TEAGUE HILL

TH01

Kings Mountain Rd.
Patrol Rd
Pinto Wy
Roan Pl
Patrol Ct
Greer Rd
Joselyn Ln
Entrance Way
West Union Creek
Tripp Ct
Tripp Rd
Summit Springs Rd
Partition Road
Ndel Rd
Archery Fire Road
Skyline Trail
Bear Creek
Petrified Forest Trail

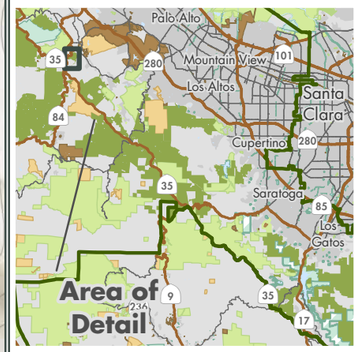
ATTACHMENT 2

MIDPENINSULA REGIONAL OPEN SPACE

Created By: treyes
Path: G:\Projects\a_Districtwide\Natural_Resources\IPM_Program\Work Plan Maps\IPM Map Export 2019.mxd

IPM Work Plan
Thornewood
Thornewood

Miles
0 0.075 0.15



Invasive Plants

CalFlora_191125

Weeds

- Acacia
- Brooms
- Early Detection
- Ivy
- Low Priority Weeds; Teasel
- Other Thistles
- Perennial Grasses
- Slender False Brome
- Stinkwort
- Vinca

ATTACHMENT 2

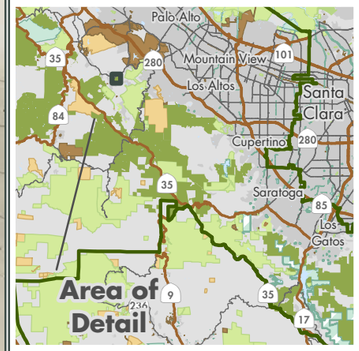
Path: G:\Projects\a_Districtwide\Natural_Resources\IPM_Program\Work Plan Maps\IPM Map Export 2019.mxd

Created By: treyes

While the District strives to use the best available digital data, these data do not represent a legal survey and are merely a graphic illustration of geographic features.

IPM Work Plan
Windy Hill
Hawthorns

Miles
0 0.05 0.1



Invasive Plants

CalFlora_191125

Weeds

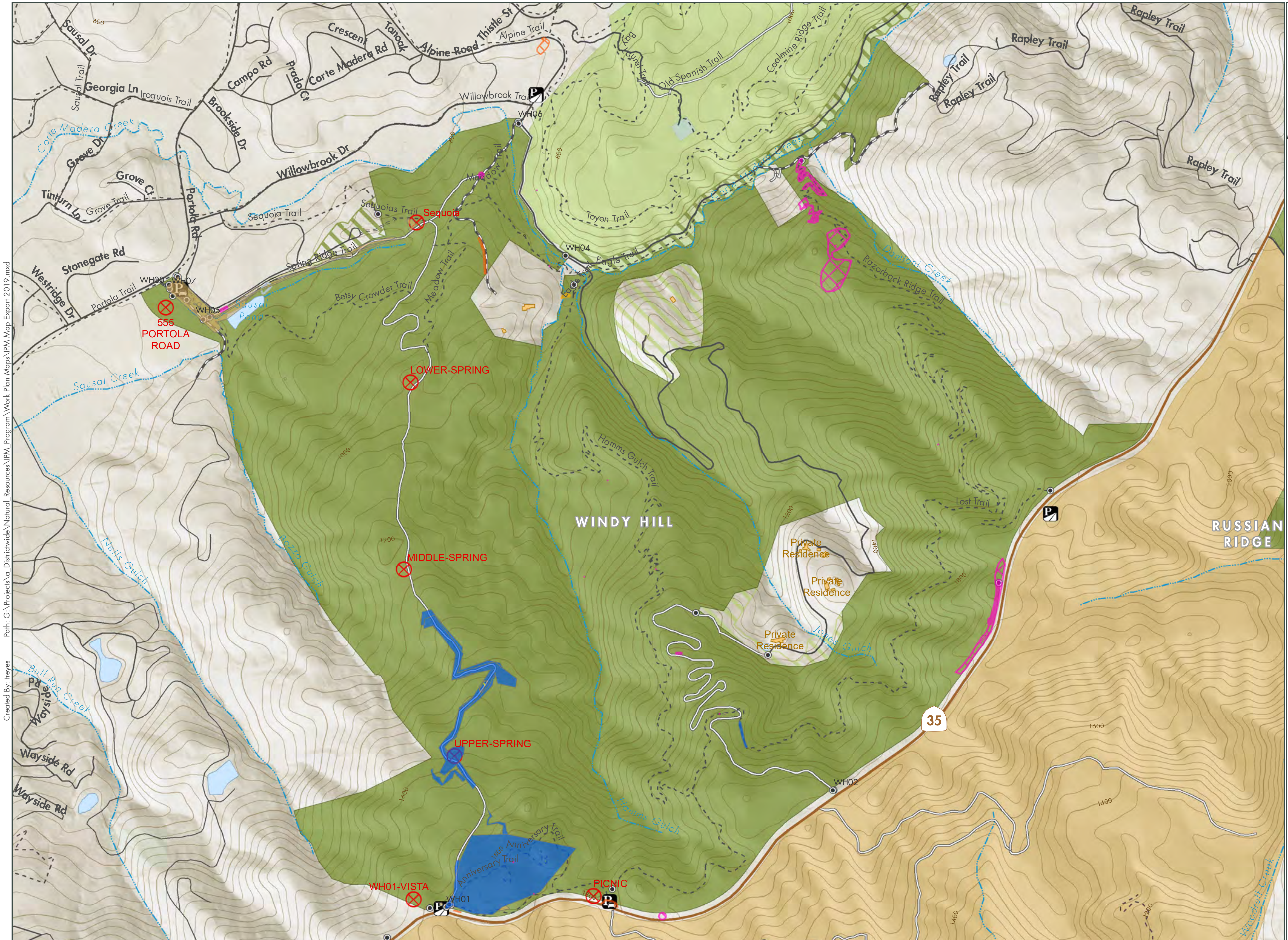
- Brooms
- Stinkwort
- Yellow star-thistle

ATTACHMENT 2

Path: G:\Projects\a_Districtwide\Natural_Resources\IPM_Program\Work Plan Maps\IPM Map Export 2019.mxd

Created By: treyes

While the District strives to use the best available digital data, these data do not represent a legal survey and are merely a graphic illustration of geographic features.



IPM Work Plan
Windy Hill
Windy Hill

Miles 0 0.175 0.35

Area of Detail

Invasive Plants

CalFlora_191125

Weeds

- Acacia
- Blackberry
- Brooms
- Eucalyptus
- Low Priority Weeds; Teasel
- Other Thistles
- Perennial Grasses
- Purple star-thistle
- Stinkwort
- Woody Invasives
- Yellow star-thistle

ATTACHMENT 2

MIDPENINSULA REGIONAL OPEN SPACE

Sudden Oak Death (SOD) Management and Monitoring in the Bay Area

Forest Service Agreement No. 15-DG-11052021-208

Performance report for June 1 – December 31, 2019

31 December 2019

Prepared by:
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Summary

This contract continues work which has been jointly funded by the Midpeninsula Regional Open Space District (MROSD) for management projects on District lands. During the performance period we monitored plots at Los Trancos, Monte Bello, and Russian Ridge Open Space Preserves where California bay removal is being used to reduce the risk of sudden oak death (SOD) in susceptible Shreve and canyon live oak. Bay removal treatments have been very effective. SOD incidence has continued to increase among nontreated controls whereas only a single stem in all of the treated areas has become symptomatic over the past several years. We also monitored tanoak plots in the Creighton Ridge area of Sonoma County and at El Corte de Madera Open Space in San Mateo County where trunk spray applications of potassium phosphite are being tested as a preventive treatment for SOD. SOD incidence has increased in a patchy fashion in these plots, so we cannot yet determine whether phosphite is an effective preventative treatment. We ordered phosphite needed to retreat the tanoak plots in 2020.

Project objectives

Objectives for the USFS 2018-2019 contract year (1 July 2018 through 1 June 2019) are listed below in Table 1.

Objectives

Objectives for the project are listed below.

1	Continue management projects designed to protect vulnerable stands of tanoak by treating with potassium phosphite via bark spray application in plots located at: A. MROSD El Corte de Madera Open Space Preserve. B. Creighton Ridge, Sonoma County. C. Healdsburg, Sonoma County.
2	Continue treatments and monitor effectiveness of the combined use of localized California bay removal and phosphite bark spray application for protecting large, high value oaks at: A. MROSD Rancho San Antonio Open Space Preserve (coast live oak). B. MROSD Los Trancos Open Space Preserve (canyon live oak). C. MROSD Russian Ridge Open Space Preserve (canyon live oak)
3	Monitor the effectiveness of area-wide California bay removal to protect vulnerable stands of oaks at: A. MROSD Rancho San Antonio Open Space Preserve (coast live oaks) B. MROSD Monte Bello Open Space Preserve (Shreve oaks)

Summary of project activities to date

A summary of management projects undertaken to date is shown in Tables 1 and 2.

Table 1. SOD management studies initiated on MROSD lands from 2008 through 2010.

Open Space Preserve	Host species present[1]	Treatment(s) and dates applied	Treated sample size	Control sample size	Last evaluation
El Corte de Madera (ECDM)—near gate CM06	tanoak, coast live oak, canyon live oak	Phosphite trunk spray application with removal of small understory tanoak: Jan 2009, May 2009,Nov 2009, Nov 2010, Nov 2011, Nov 2012, Nov 2013, Jan 2015, Jan 2016, Dec 2016, Feb 2018, Feb 2019.	158 trunks	164 trunks	Oct 2019
Monte Bello—Skid Road trail gate (MB06)	shreve oak, canyon live oak	Area-wide bay removal (includes hack and squirt herbicide bay treatments): Dec 2008 /Mar 2009 bay removal, stump treatment, hack and squirt July 2009, May 2010, Dec 2011 bay hack/squirt	95 trunks	84 trunks	June 2019
Rancho San Antonio (RSA)—permit lot area	coast live oak	Localized bay removal (Nov 2008 and Jan 2015) and phosphite injection: Arborjet injectors Nov 2008, ArborSystems injectors Jan 2011.	9 trunks[2]	61 trunks	Aug 2018
		Localized bay removal (Nov 2008 and Jan 2015) and phosphite trunk spray application: Jan 2009, May 2009, Nov 2009, Nov 2010, Nov 2011, Nov 2012, Nov 2013, Jan 2015, Jan 2016. Dec 2016, Feb 2018,	14 trunks		Aug 2018
		Areawide bay removal only: Nov 2008	42 trunks		Aug 2018
Los Trancos—Near Page Mill Road, Franciscan Loop Trail and Fault Trail	canyon live oak, coast live oak	Localized bay removal (Dec 2009, April 2010) and phosphite spray application: Nov 2009, April 2010, Nov 2010, Nov 2012, Nov 2013, Jan 2015, Jan 2016, Dec 2016, Feb 2018, Localized bay removal only: Dec 2009, April 2010, summer 2011	16 trunks 20 trunks	31 trunks	June 2019
Russian Ridge—Near Ancient Oaks Trail	canyon live oak	Localized bay removal: Dec 2009, Sep 2010, summer 2011	36 trunks	34 trunks	June 2019

[1]Bold font face= primary species

[2]One sprayed tree was removed in 11/09. One injected trunk of a multitrunked oak failed in 2009, and the three remaining trunks were switched to spray application in 2010. As a result, the number of injected trunks changed from 13 to 9 and sprayed trunks from 11 to 14.

Table 2. Overview of tanoak phosphite-treated and control plots established in Sonoma County and brought into this project beginning in 2013-2014 contract year.

Study site	Locality	Plots	Phosphite applications	Notes	Last evaluation
SF	Seaview Ranch, Creighton Ridge area	phosphite treated+thinned 63 trunks; thinned control 61 trunks nonthinned control 72 trunks	Dec 2005 May 2006 May 2007 May 2008 May 2009 May 2010 Oct 2011	Plots initially established under contract to Kashia Band of Pomo Indians. Plots no longer being treated due to the high amount of disease in the treated plot.	September 2012. No longer in study due to high disease in phosphite treated plots
BL	Gualala Ranch Creighton Ridge area	phosphite treated+thinned 57 trunks; thinned control 57 trunks; nonthinned control 56 trunks	Dec 2005 May 2006 May 2007 May 2008 May 2009 June 2010 Oct -Nov 2011 Jan, Nov 2013 Dec 2014 Jan 2016 Feb 2017 Feb 2018 Mar 2019	Plots initially established under contract to Kashia Band of Pomo Indians.	June 2019
PC	Gualala Ranch Creighton Ridge area	phosphite treated + thinned control + thinned, 75 trees per plot. Each plot reduced to 65 trunks during summer 2018 due to thinning designed to suppress fire risk.	Jan, May 2007 May 2008 May 2009 May 2010 Nov 2011 Jan, Nov 2013 Dec 2014 Jan 2016 Feb 2017 Feb 2018 Mar 2019	Plots established with funding from PSW-USFS as part of a collaborative project with M. Garbelotto and Y. Valachovic. Understory tanoak mostly pre-thinned by landowner. Some minor additional thinning was conducted in treated and nontreated plots.	June 2019

Study site	Locality	Plots	Phosphite applications	Notes	Last evaluation
FE	Mill Creek Road, Healdsburg	2 phosphite treated + thinned 36 and 34 trunks; 2 thinned control 30 and 41 trunks.	Feb, May 2007 May 2008 May 2009 April 2010 Nov 2011 Jan, Nov 2013 Jan 2015 Jan 2016 Jan 2017 Feb 2018 Mar 2019	Plots established with funding from PSW-USFS as part of a collaborative project with M. Garbelotto and Y. Valachovic. Understory tanoak mostly pre-thinned by landowner. Some minor additional thinning was conducted in treated and nontreated plots	June 2017

Project activities

Objective 1. Continue management projects designed to protect vulnerable stands of tanoak by treating plots with potassium phosphite via bark spray application

In fall 2019, we ordered phosphite and Pentra-Bark surfactant for retreatment of all phosphite plots in early 2020 (Jan-Mar).

A. El Corte de Madera Open Space Preserve

At this location, we are comparing SOD levels in a large contiguous block of trees treated by bark application of phosphite with untreated trees in adjacent areas. Mean trunk diameter of plot trees is 26 cm. Phosphite was last applied to tanoak trees in February 2019.

When these plots were established in 2008, they were thought to be at high risk of developing SOD within the next several years. However the drought conditions which prevailed for many years after plot establishment apparently retarded the spread of SOD into the plots. By the September 2016 plot evaluations, SOD infections were confirmed in tanoaks and California bay located to the northwest, about 120 m and 160 m from the edges of the nearest control plot and treated plot, respectively. Tree mortality in the plots through Sept. 2016 was observed primarily in somewhat suppressed understory trees and appeared to be mostly associated with *Diplodia corticola* trunk cankers, although Armillaria cankers were also observed on several tanoaks.

After the historically rainy winter of 2016-2017, SOD symptoms were seen in the plots for the first time during the disease evaluations which were conducted in October 2017 (Figures 1 and 2). SOD symptoms have increased in a discontinuous and patchy fashion across the landscape in the two succeeding years.

At the August 2019 evaluation, SOD symptoms were still relatively uncommon and spatially clustered in the study area. Two of the four control plots each had 5 SOD-affected trunks; one control plot had one SOD-affected trunk; no SOD symptoms have been seen in the remaining control plot (Figures 1, 2). The phosphite treated plot has had only one SOD-affected trunk to date. the overall difference in SOD incidence between the controls (7.53%, 11/145) and treated trunks (0.69%, 1/145) is significant (p=0.0054, Fisher's exact test). Percentages are based on the number of trees that were live in 2017, the first year that SOD symptoms were observed within the plots. If the small number of shreve and canyon live oak tree included in the plots are omitted, the difference is similar (SOD incidence: controls 7.97%, 11/138; phosphite treated 0.75%, 1/134, p=0.0054, Fisher's exact test. However, we are cautious about interpreting this significant difference as a treatment effect due to the low numbers of symptomatic trunks and the spatial clustering of SOD in the plots. In other phosphite treatment plots where no efficacy was seen, SOD incidence in the phosphite-treated plots was initially significantly greater in the treated plots than in the control plots and this differences persisted for multiple years. Hence, it is possible that differences in SOD incidence between the treated and control plots are simply due to chance related to the scatted spatial distribution of SOD.

Mortality. High rates of mortality have been seen among the SOD-affected tanoaks. Of the 11 control trees that had SOD cankers by October 2019, 9 were dead, and 6 of these died between 2018 and 2019. Of the 36 trunks that have died in control plots since the study began, 9 died due

to SOD. In the treated plot, 19 trunks have died, none due to SOD as of 2019. Causes of tanoak mortality in the plots other than SOD include tree failures, Armillaria root disease, and trunk cankers caused by *Diplodia corticola* and possibly other fungi. Change in mortality within the plots over time is shown in Figure 3.

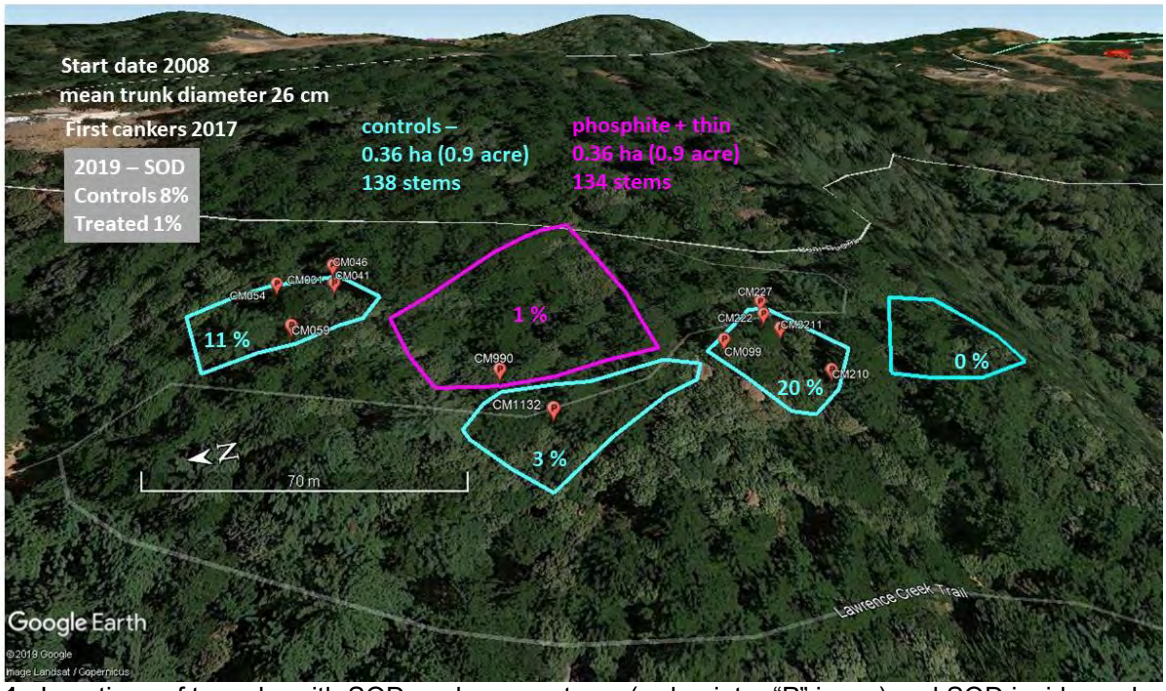

Figure 1. Locations of tanoaks with SOD canker symptoms (red pointer "P" icons) and SOD incidence by plot (percentages) as of October 2019 at El Corte de Madera Open Space Preserve. Controls are monitored in four plots. Cyan = control plots, fuchsia = treated plot. Percent SOD incidence in plots is based on the number of live tanoak trunks in 2017, when SOD cankers were first observed in the plots.

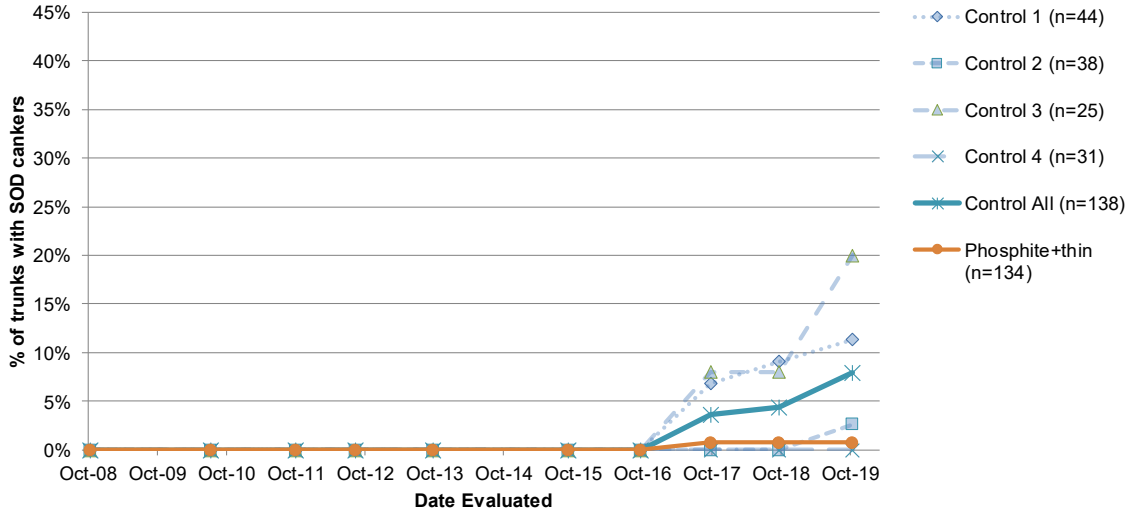

Figure 2. Percent of tanoak trunks with *Phytophthora ramorum* cankers in El Corte de Madera Open Space Preserve control and phosphite-treated plots. Number of live trunks per plot as of 2017 (first year of SOD in plots) was used to calculate percentages.

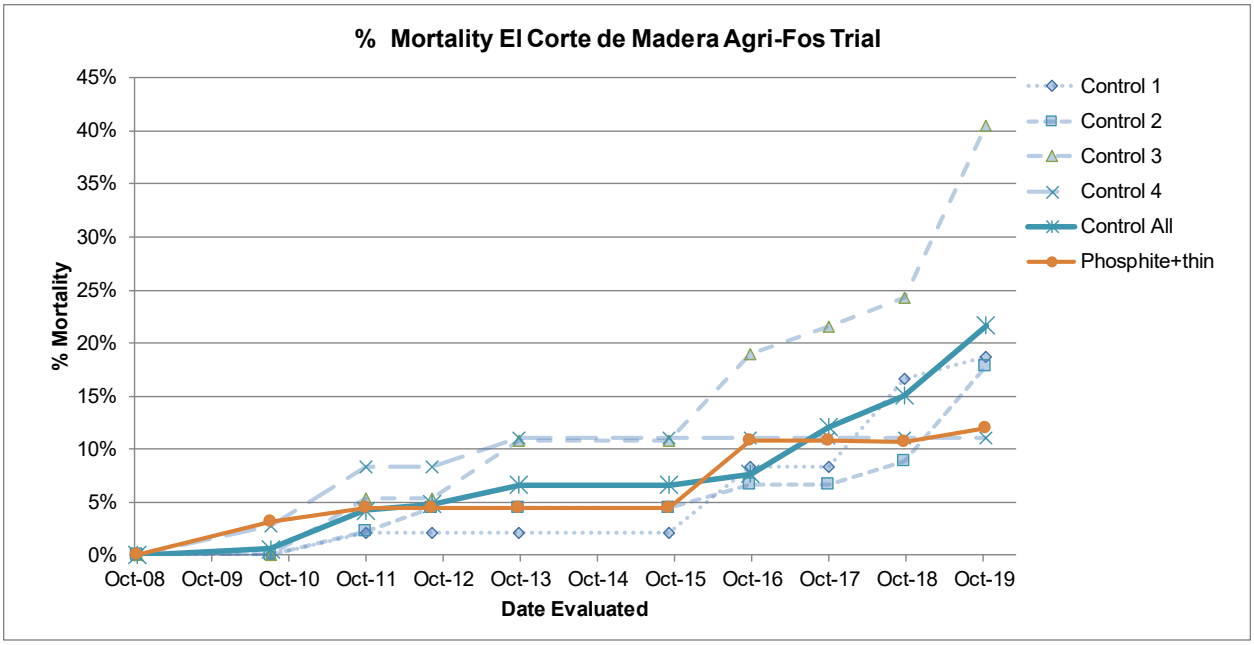

Figure 3. Mortality over time (% of trunks) at El Corte de Madera Open Space Preserve based on number live trunks at the start of the study in 2008 (157 trunks in phosphite treated plot, 166 trunks in control plots). Counts exclude two trunks removed from the treated plot within the first year due to damage from an adjacent root failure. Most mortality is due to Armillaria root disease or *Diplodia corticola* cankers. Death due to SOD was first seen in October 2018. As of Oct 2019, 16% of dead trunks were due to SOD.

B. Creighton Ridge, Sonoma County.

Locations of Sonoma County phosphite study plots are shown in Figure 4. SF plots were discontinued in 2012 due to high disease levels in the phosphite treated plots as explained below. At the Creighton Ridge sites, PC and BL locations, plots were relatively small and consist of mostly small-diameter tanoaks. The PC and BL plots are located about 0.56 km apart on separate ridges.

Tree removal to increase defensible space near the residence at PC had been scheduled for the past 2 years and finally occurred sometime between our visits in June 2018 and March 2019. The plan for this work was to remove small diameter tanoaks (up to about 9 inches DBH) within a set radius of the residence. The tree removal area included portions of both the control and treated plots. The treated plots was initially set up near the residence so that if the phosphite treatment was effective, the landowners would achieve maximum benefit.

This work had much less impact on the study plots than originally feared. Extensive clearing near the residence effectively moved the front of the phosphite-treated plot closer to the stand edge than it was initially. The control plot was initially located close to the stand edge because the ground slope became quite steep where the control plot was located, and additional tree removal did not substantially affect its environment relative to the stand edge.

Ten of the original 75 trunks in each plot were felled. Similar sized trees were removed in each plot. Nine felled trees in the control plot were less than 9 inches DBH and one was 13 inches. In

the treated plot, nine felled trees were less than 6 inches DBH, and one tree was 14 inches. None of the felled trees were dead; 2 trees with SOD were felled in the control plot, 1 tree with SOD was felled in the treated plot.

Figure 4. Sonoma County plot locations. PC and BL plots are in an area known as Creighton Ridge.

Tanoaks with *P. ramorum* cankers were present within 100 m of both plot sets when they were first established. We last evaluated disease in the PC and BL plots in June 2019. Disease in the Creighton Ridge area has increased noticeably due to the record rainfall in 2016-17, but is still distributed in a patchy manner across the landscape. This is evident from aerial images of the plot locations (Figures 5 and 6). The problem with this patchy spatial distribution is that the percent SOD infection in any given untreated plot is highly dependent on its location. Shifting of plot locations by as little as 10 m in various directions could result in much higher or lower disease percentages. The design of the plot layout at El Corte de Madera with multiple control plots, (discussed above) partially accounts for this effect because it allowed us to document the variation in disease incidence between multiple untreated plots within a localized area. Although the Sonoma plots were set up in a paired fashion and matched to similarities in stand composition to the extent possible, it was not possible to control for the spatially stochastic nature of disease development in areas where *P. ramorum* had not yet become established at the start of the study.

Disease progress over time in the PC and BL plots is shown in Figures 5, 6 and 7. At BL, SOD incidence has increased most dramatically in the nonthinned control plot since 2017. From

Figure 5, it is evident that this plot is in a localized patch of high SOD incidence, based on the numbers of dead tanoak canopies visible. SOD incidence in the other two plots did not show a strong increase following the wet 2016-17 rainy season (Figure 7). At PC, both plots showed an increase in SOD incidence in response to the 2016-17 rains (Figure 7), with the thinned control plot showing a greater disease increase. Compared with the phosphite-treated plot, this plot had more trunks that were in relatively large clonal clumps resulting from coppice sprouting. Several of these clonal clumps had multiple trunks with SOD symptoms, which in part could account for the higher disease levels seen in that plot.

SOD has developed in some phosphite-treated trees, and SOD incidence does not differ significantly between phosphite-treated and control plots at BL or PC. As with the plots at El Corte de Madera, data analysis is complicated by the patchy distribution of SOD at these sites. Many of the tanoaks at both BL and PC have relatively small trunk diameters, and the thin bark on these small trunks may allow for better phosphite uptake than is possible in larger trees with thicker bark. Nonetheless, we cannot yet determine with confidence whether long-term annual phosphite application has reduced the risk of *P. ramorum* infection in these plots.

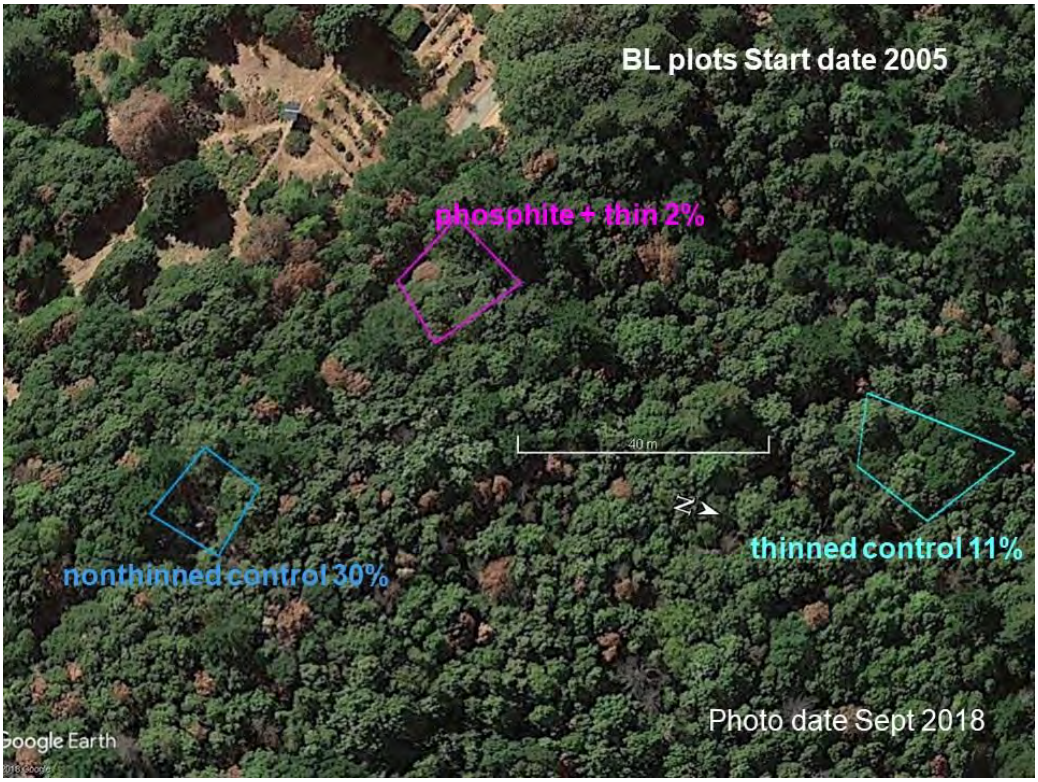

Figure 5. Percent SOD infection in phosphite treated and control BL plots at Creighton Ridge as of June 2019. Photo date 9/19/2018. Note patchy distribution of dead canopies. N=56-57 trunks per plot (see table 2).

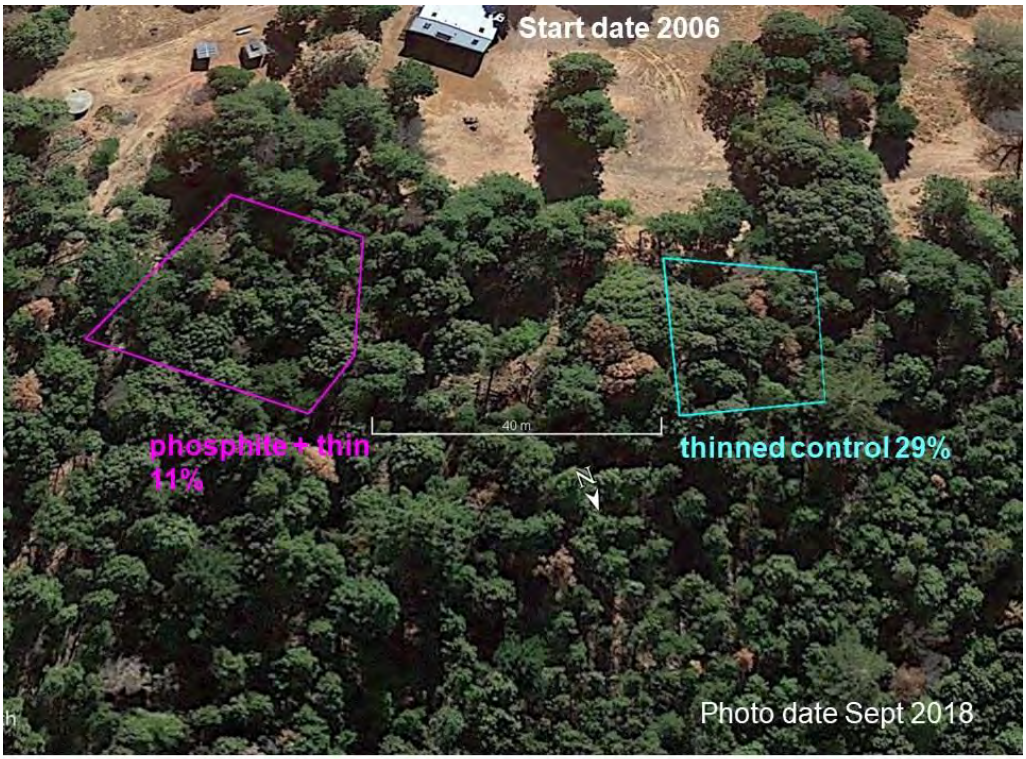

Figure 6. Percent SOD infection in phosphite treated and control PC plots at Creighton Ridge as of June 2019. Photo date 9/19/2018. Tree removal in the plots for fuels management had not yet occurred at the time of this photo. N=75 trunks per plot at study start.

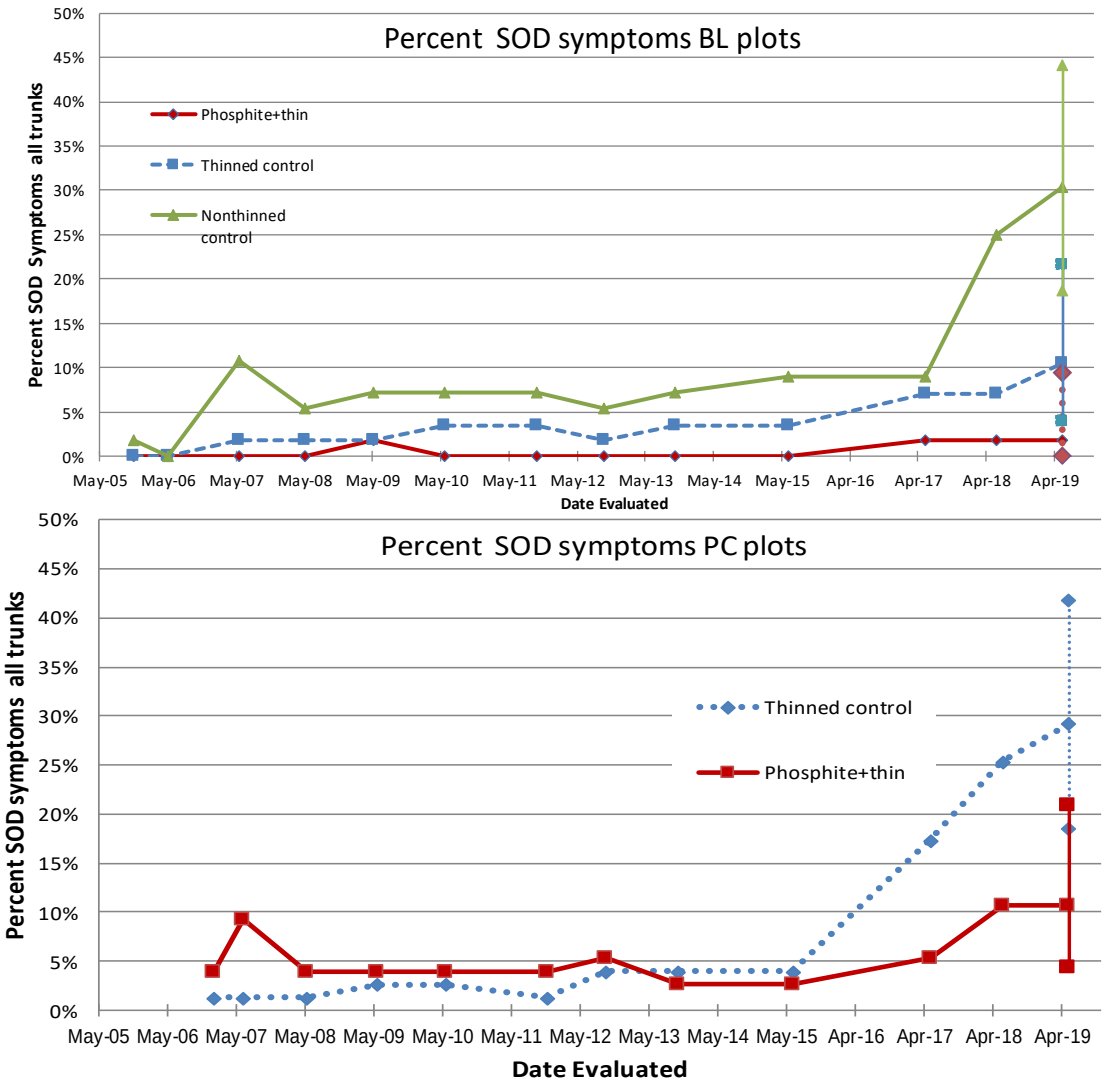

Figure 7. Percent of trunks diagnosed with SOD over time at BL and PC plots. N=56-57 trunks per plot at BL, N=75 for both treatments at PC. Vertical lines represent exact binomial confidence limits.

Mortality. Mortality has increased steadily in the BL control plots, due primarily to *Diplodia*-type cankers on small suppressed trees (Figure 8). SOD was not a factor in the deaths of four trees in the phosphite-treated plot. Three of 18 dead trees in the thinned control and 14 of 17 dead trees in the nonthinned control are due to SOD.

Due to a much lower incidence of *Diplodia*-type cankers, overall mortality at the PC plots is lower than at BL (Figure 8). SOD is the main factor associated with tanoak mortality at this location. Four of six dead trees in the phosphite-treated plot and 14 of 17 in the thinned control plot are due to SOD.

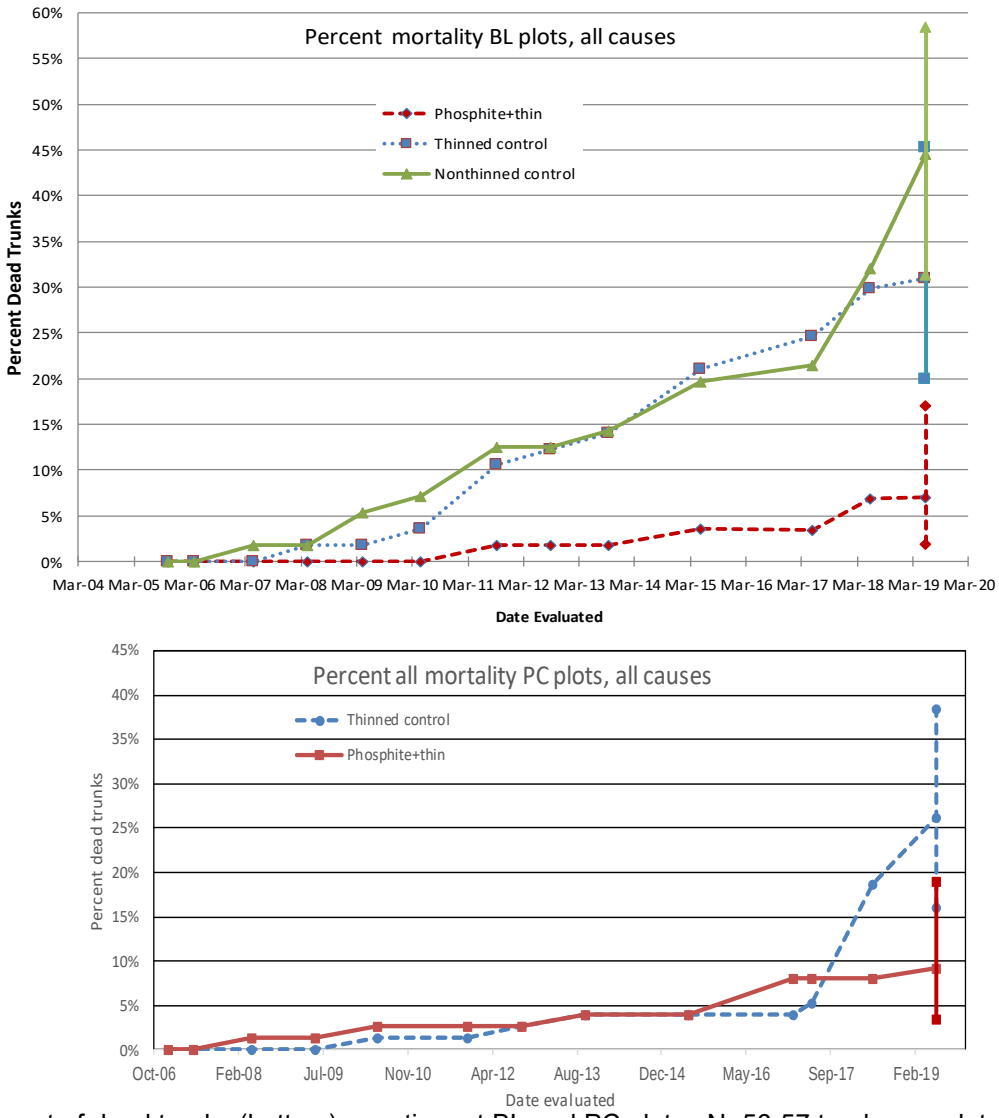

Figure 8. Percent of dead trunks (bottom) over time at BL and PC plots. N=56-57 trunks per plot at BL, N=75 for both treatments at PC. Vertical lines represent exact binomial confidence limits.

SF plots. The SF plots in the Creighton Ridge area were discontinued in 2012 due to high levels of SOD and SOD mortality in the phosphite-treated plots (Figure 9). SOD incidences shown in Figure 9 (top) are those at the time the plots were discontinued in 2012. Disease levels at the SF plots in 2012 were higher than those seen in 2019 at either PC or BL. A recent aerial photo (Sept 2018) of the SF plots is also shown in Figure 9. More brown canopies are visible now than at BL and PC locations, but local spatial variation in tanoak mortality is still apparent.

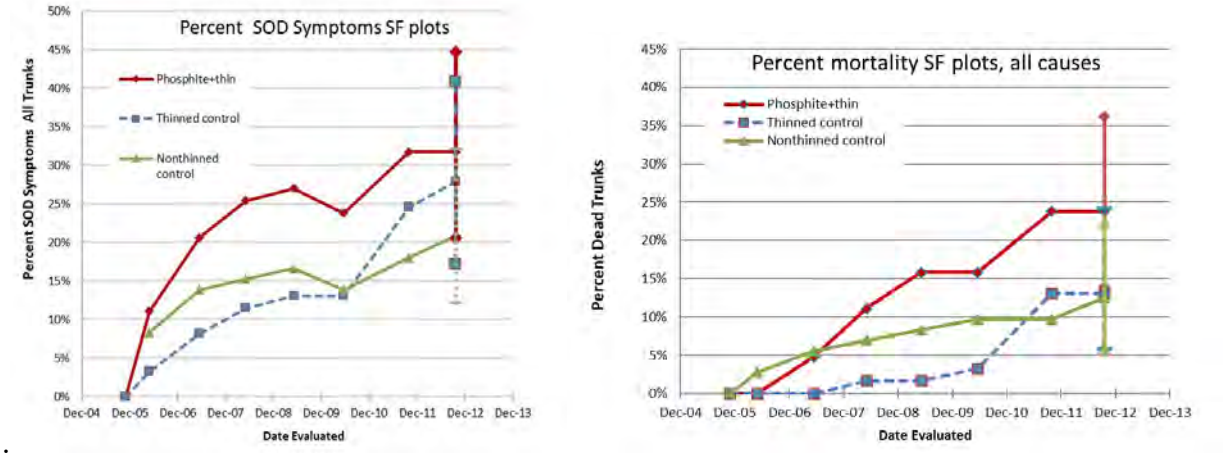

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Figure 9. Discontinued SF plots in Sonoma County. Top, SOD disease progress and all mortality at SF plots through 2012. Bottom: Current aerial photo image (9/19/2018) showing plot outlines and SOD disease levels in 2012. Douglas fir is the predominant co-occurring species.

C. Healdsburg, Sonoma County

The FE plots (mean trunk diameter 19 cm) are west of Healdsburg in a hotter, drier, more inland location compared to Creighton Ridge (Figure 4). The two pairs of treated and control plots at this location are about 0.2 km apart. SOD-infected tanoaks were observed 100 m of these plots when they were first established. Although the plots have not had a full assessment for disease since 2017, we did not see any obvious change in SOD incidence in or near the plots when visiting this location to spray the trees in February 2018 or March 2019. *Phytophthora ramorum* has been sporadically isolated from cankers in trees in these plots, but disease has remained at low levels, as can be seen by the predominantly green canopies in the September 2018 aerial photo (Figure 10) and the disease progress graph (Figure 11).

Mortality. Mortality from all causes in these plots is shown in Figure 11. Three trunks (1 phosphite-treated, 2 untreated) have died due to SOD. Mortality of 7 other trees (3 phosphite-treated, 4 untreated) was related to extensive *Diplodia* cankers.

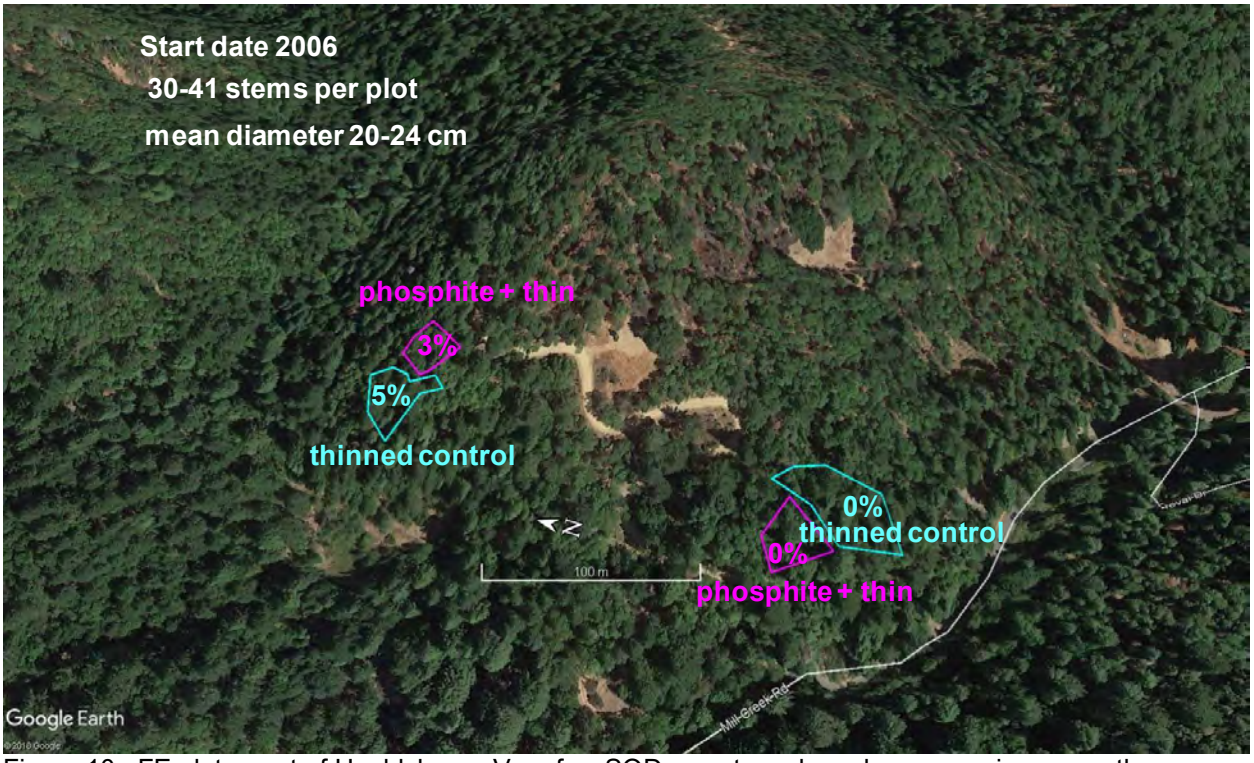

Figure 10. FE plots west of Healdsburg. Very few SOD symptoms have been seen in or near these plots. Redwood and Douglas fir co-occur with tanoak in these plots.

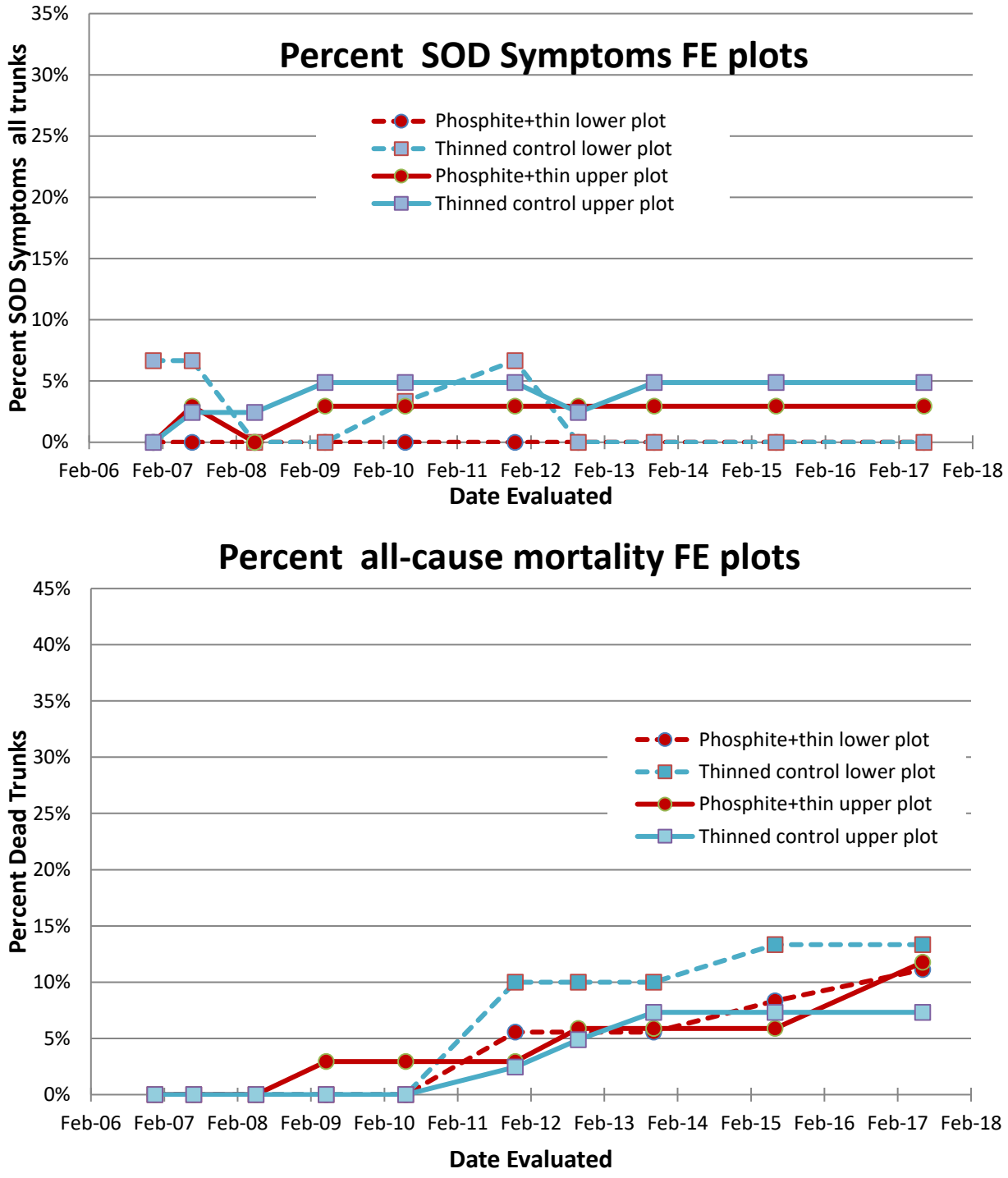

Figure 11. Change in percent of trunks with SOD symptoms (top) and mortality due to all causes (bottom) over time at FE plots. N=30-41 trunks per plot.

Objective 2. Monitor effectiveness of localized California bay removal for protecting large, high value oaks

A. MROSD Rancho San Antonio Open Space Preserve (coast live oak).

Some trees at this preserve were treated with localized California bay removal. These plots were last evaluated in August 2018. They were not evaluated during the last reporting interval.

B. Los Trancos Open Space Preserve - canyon live oak.

Of all the SOD-susceptible oaks, canyon live oak is the most difficult in which to observe and diagnose SOD symptoms. Cankers are often cryptic with no evident bleeding and it can be difficult to find the leading edge where a successful isolation can be made. In addition, although bleeding may occur shortly after infection, the amount of bleeding is generally small and may not persist to be observed in subsequent years. If the cankers continue to expand, they are eventually attacked by ambrosia beetles and commonly develop sporulation of *Annulohypoxylon thouarsianium*. However, when these late-stage symptoms are the first indication of infection, it is usually not possible to isolate *P. ramorum* from the cankers. As a result, there can be considerable uncertainty as to when *P. ramorum* infections occurred. This can affect the interpretation of treatment effects because some trees that appeared to be asymptomatic before bay removal treatments were imposed may actually have been cryptically infected. Hence, some of the symptoms that develop after treatment do not reflect the efficacy of the treatment.

The plot layout at Los Trancos Open Space Preserve is shown in Figure 12. At the start of the study, it was difficult to find canyon live oaks that were close to California bay that did not already have SOD symptoms at this location. Consequently, we included a number of trees with SOD symptoms at the start of the study that we evaluated for disease progress, along with asymptomatic trees. Thirty six tree were treated with localized bay removal; of these 16 large-diameter canyon live oaks located along major trails were also treated with phosphite. Eight of the treated trees and 10 of the 31 control trees had SOD symptoms at the start of the study.

The study trees were last re-evaluated for disease in June 2019. None of the 18 trees that were infected at the start of the study in 2010 had died by June 2019, although one of the initially-infected controls had >97% canopy dieback and was nearly dead. These data show that decline and mortality of SOD-affected canyon live oaks can be very slow, especially for large trees. Since the start of the study, no new SOD infections have been seen among any of the 28 initially asymptomatic trees treated with local California bay removal (Figure 13). In contrast, 5 of the 21 initially asymptomatic control canyon live oaks had developed symptoms by June 2019. None of these has yet died, although one was in severe decline with more than 80% canopy dieback. The difference in new disease incidence between the treated and control trees was not significant at P=0.05.

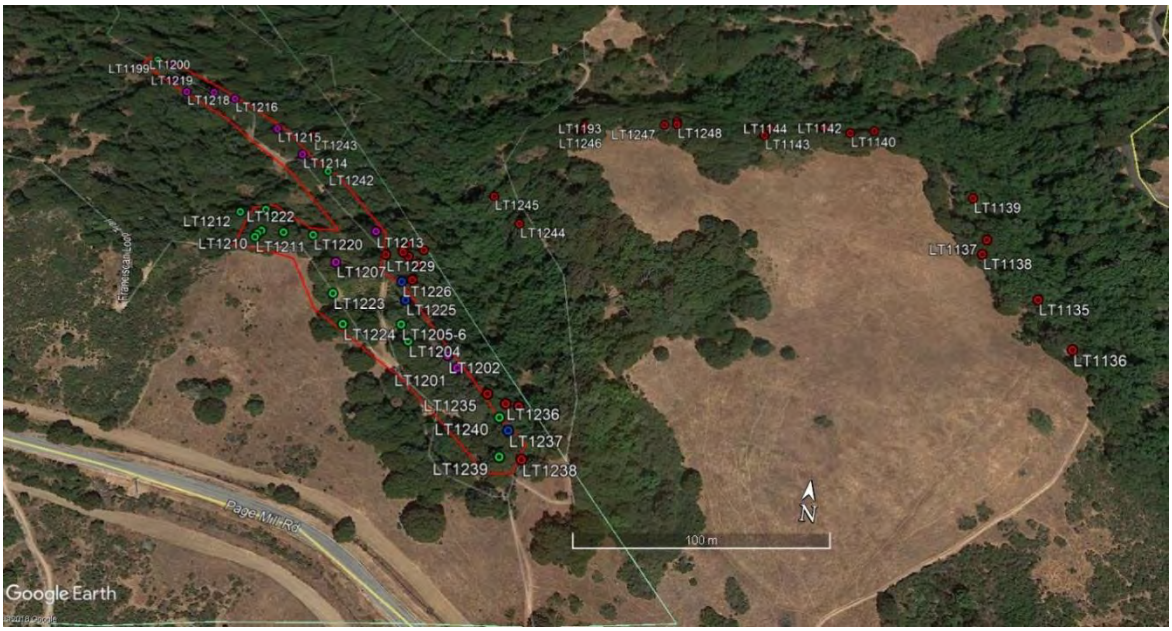

Figure 12. Los Trancos study plots. Bay removal has been conducted in the area bounded by the red line. Red icons represent control trees. Treated trees: green icons=localized bay removal at study start in 2009; blue=localized bay removal in 2011; purple icons=localized bay removal at study start + phosphite treated though 2018.

Because no new disease had been seen in any of the trees with local California bay removal, it seemed unlikely that the additional treatment with phosphite could demonstrably improve disease suppression. The last phosphite application at this location was made in February 2018.

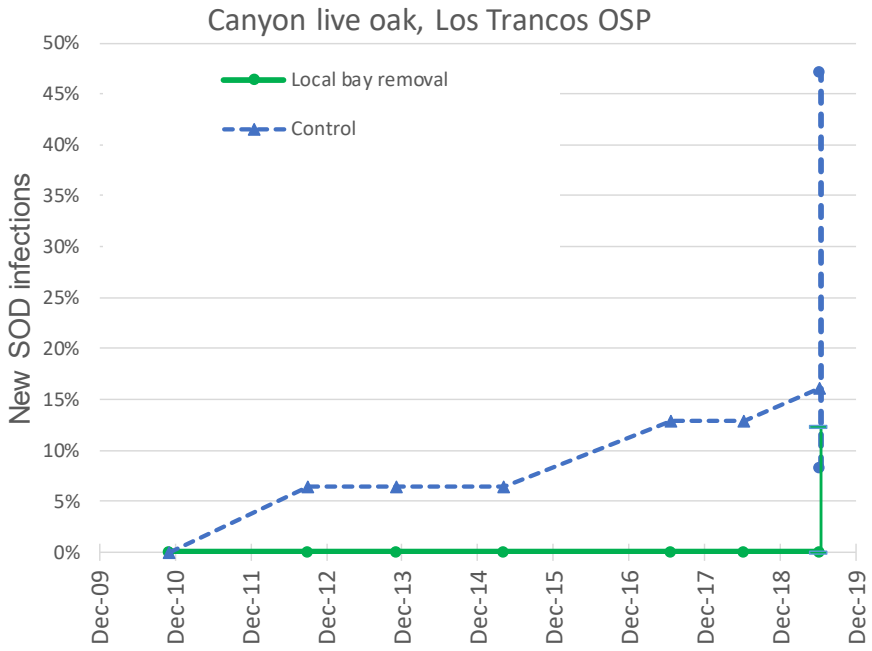

Figure 13. Increase in SOD incidence over time at Los Trancos OSP among trees that were asymptomatic in 2010. New infections have only been seen to date among controls (n=21). Local bay removal (n=28) includes all trees with local bay removal; 12 of these were also treated with phosphite from 2010 through 2018. Error bars are exact binomial 95% confidence limits.

C. Russian Ridge Open Space Preserve - canyon live oak

At Russian Ridge Open Space Preserve, targeted bay removal is being evaluated to protect a population of very large canyon live oaks along and near the Ancient Oaks trail (Figure 14). No phosphite applications have been used at this location. Bay removal occurred in December 2009, September 2010, and summer 2011, generally close to the trail and localized around individual trees or groups of trees. Control trees are located further from the trail, beyond the bay removal areas.

Localized bay removal has been very effective in preventing new SOD cankers among the large canyon live oaks (Figure 15). By May 2014, SOD symptoms appeared in two of 34 treated (bay removal) trunks of a large multitrunked canyon live oak that was initially asymptomatic. Given the cryptic nature of *P. ramorum* cankers in canyon live oak, it is likely that these infections occurred before the start of the study. Since that time, no new infections have been seen among initially asymptomatic oaks treated by local bay removal. In contrast, among initially asymptomatic control canyon live oaks (n=27), three trunks developed SOD symptoms by 2014 and the number of newly symptomatic trees has continued to increase to 12 (44%) in 2019. As at other locations, a steep increase in SOD incidence was seen after the wet 2016-2017 rainy season. Among initially asymptomatic trunks, the difference in SOD incidence between the bay removal treatment (5.9%) and controls (44%) is highly significant (P=0.0005, Fisher's exact test). This is a conservative estimate of the difference because at least some of the infections of the treated trees likely predate the treatment.

Initially symptomatic trees. As at other locations, a few trees that were symptomatic at the start of the study were included for monitoring. Among the 6 initially symptomatic controls, one has died. This tree had a large SOD canker and had failed at the base in 2017 but remained green, but was dead in June 2019. Most others have shown an increase in canker girdling rating since 2010, but several show callusing around old cankers. All four of the initially symptomatic canyon live oak trunks included in the bay removal areas are still alive, though canker girdling has increased on three of these. The tree showing the greatest canker expansion is a very large tree (270 cm DBH) located directly on a the trail that is commonly climbed upon by trail users. It appears that additional infections have been initiated through this activity from inoculum deposited from mud and debris on climbers' shoes and wounds created on the bark. The canopy of this tree has died back and thinned noticeably as the amount of girdling has increased.

Mortality. Two of the monitored trees in the control area died when they were knocked down by the failure of nearby adjacent dead trees in 2014 and 2015. These and the one SOD-killed and failed control noted above are the only study trees that have died to date at this study location.

Trees were last evaluated on 3 June 2019. Bay foliage showed symptoms of very heavy *P. ramorum* infection levels, so we anticipate that there was a strong disease pressure from the 2018-19 wet season, but possibly not as high seen from the 2016-17 wet season.

Figure 14. Russian Ridge Open Space Preserve canyon live oak bay removal study. White icons are control trees, green icons are treated trees.

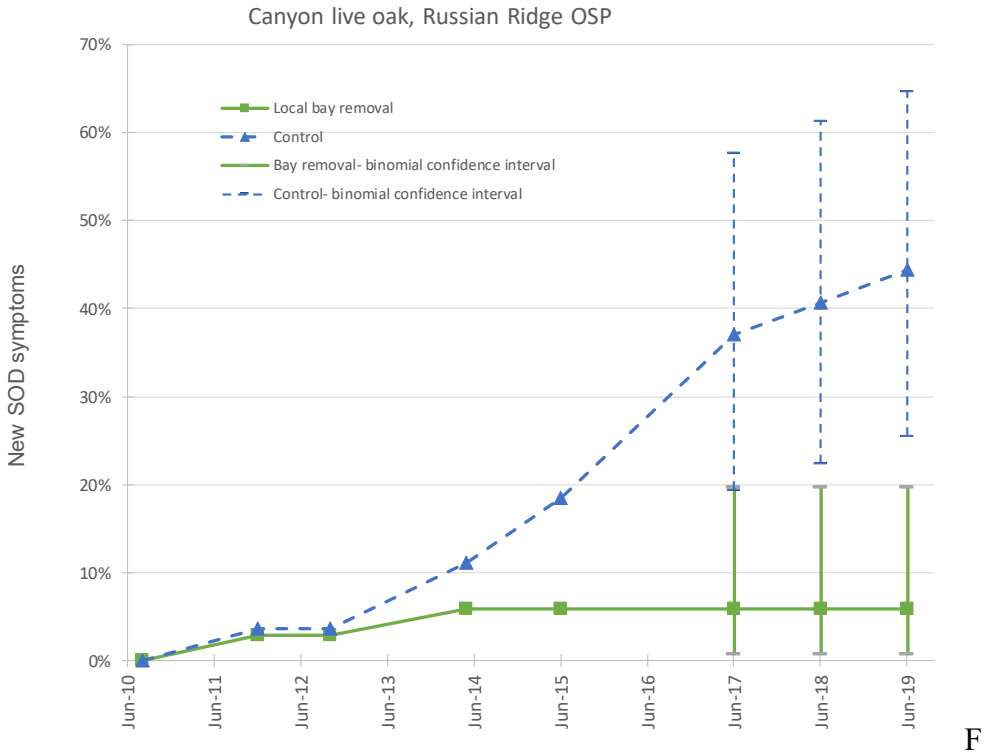

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Figure 15. SOD incidence (2010-2019) in initially asymptomatic canyon live oaks at Russian Ridge Open Space Preserve treated by local California bay removal (N=34, solid line, square icons) and in untreated control areas (N=27, broken line, triangle icons). Error bars are 95% exact binomial confidence intervals.

Objective 3. Monitor the effectiveness of area-wide California bay removal to protect vulnerable stands of oaks

A. MROSD Rancho San Antonio Open Space Preserve -coast live oaks

Some of the trees at this location were treated by area-wide California bay removal. As noted above, no new work occurred at this location during the reporting interval.

B. Monte Bello Open Space Preserve - Shreve oaks

At the Monte Bello Open Space Preserve, area-wide California bay removal is being evaluated to protect a unique stand of Shreve oaks. The plot layout is shown in Figure 16. Overstory and understory California bay was removed from a large central treated area and surrounding areas without bay removal were designated control areas. SOD symptoms in the plots were last evaluated in June 2019. SOD incidence in the controls has been significantly higher than in the area-wide bay removal plot since the 2013 evaluations. Starting with the 2018 evaluation and continuing into 2019, a large increase in SOD incidence was observed in untreated control trees, doubtless related to favorable conditions for disease spread and infection associated with the record rainfall in winter of 2016-17 (Figure 17). This has increased the difference in SOD incidence between the treated bay removal plot and the controls.

In 2019, we confirmed that one of the Shreve oaks in the bay removal treatment area had developed a basal *P. ramorum* canker. Although no California bay trees or saplings were observed within 20 m of this tree, it was located in a very dense patch of poison oak (Figure 18), a *P. ramorum* host that supports sporulation. We have previously seen rare situations where poison oak climbing in oak canopies was the only apparent source of *P. ramorum* inoculum, but had not previously seen a situation where P. ramorum infection appeared to be associated with shrubby (up to 1 m) stands of poison oak around susceptible oaks.

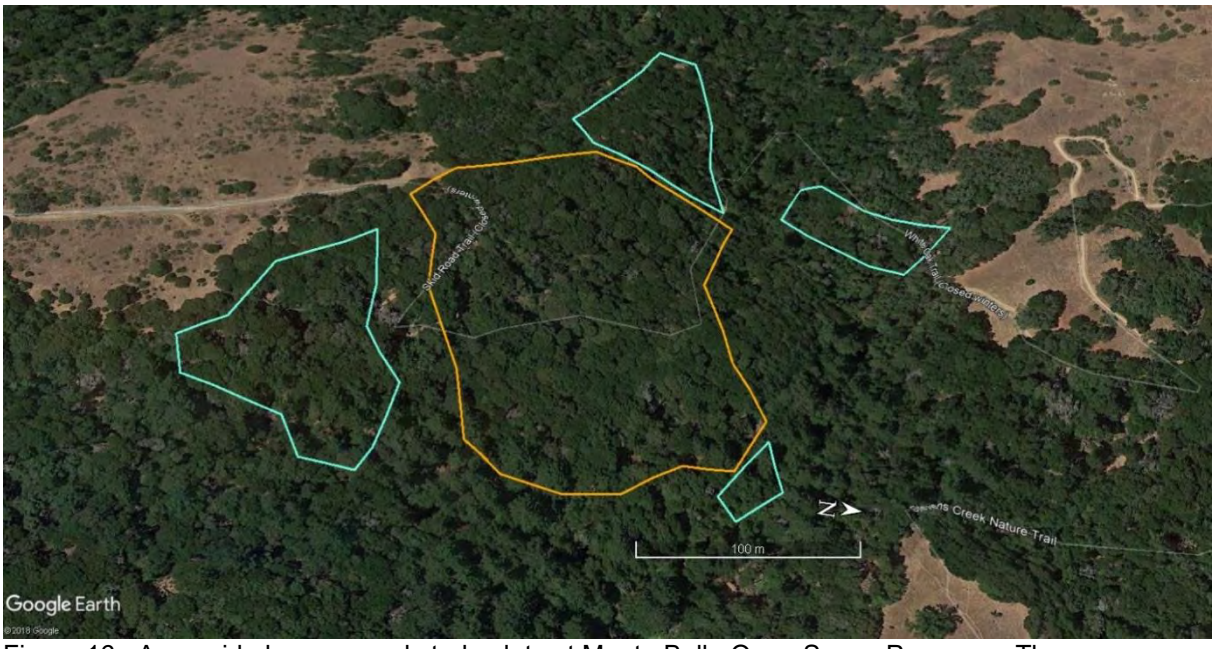

Figure 16. Area-wide bay removal study plots at Monte Bello Open Space Preserve. The orange polygon indicates where bay removal area occurred. Cyan polygons show where monitored control trees are located.

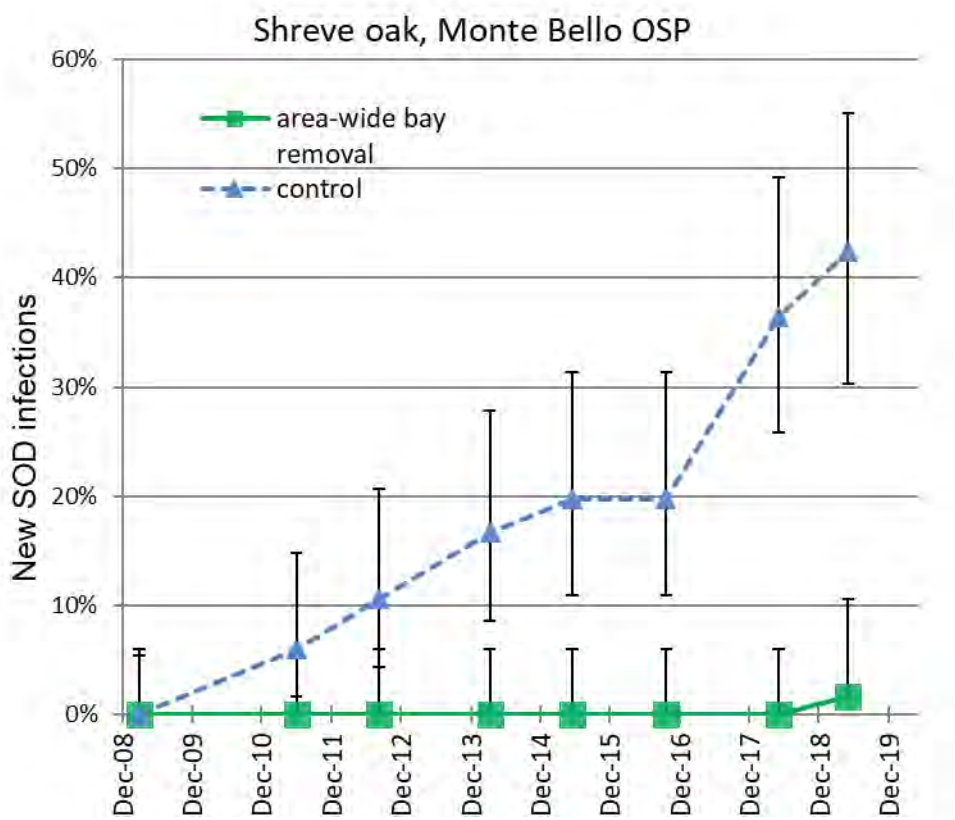

Figure 17. SOD incidence among initially-asymptomatic Shreve oaks in area-wide bay removal and untreated control areas at Monte Bello Open Space Preserve. N=66 control trunks and 60 treated trunks. Error bars are 95% exact binomial confidence intervals.

Mortality. Among Shreve oaks that were asymptomatic at the study start, four control trees have died due to *P. ramorum* cankers. Three additional control trees and four trees in the bay removal area have died from factors other than SOD.

Canyon live oaks. At this location, a few canyon live oaks occur that occur within control (10 trees) and bay removal (18 trees) areas have been monitored. Four of the canyon live oaks in the bay removal area (22%) and 3 control trees (30%) developed SOD symptoms by 2015, and one more control developed symptoms by 2016. Given the cryptic nature of SOD symptoms on canyon live oak and the long latent period between infection and symptom expression, most or all of these infections could have been initiated before the bay removal treatment was conducted. None of these monitored canyon live oaks have died over the course of the study, and in 6 of these 8 trees, SOD infections were rated as inactive in 2019. .

Figure 18. Staining on the trunk of tree 310 at Monte Bello was confirmed to be due to a *P. ramorum* canker. Although no California bay was nearby, the tree was in a dense and extensive stand of poison oak.