Fire Management at the Jack and Laura Dangermond Preserve

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Executive Summary: A Vision for Fire Management at the Jack and Laura Dangermond Preserve

We envision the Preserve to be a platform for learning how fire can be used to support biodiversity and resilience.

Fire presents both challenges and opportunities at the Jack and Laura Dangermond Preserve (hereafter "the Preserve"). Catastrophic wildfires in the Western United States, driven by drought, climate change, and land management practices pose serious biodiversity and safety concerns. Paradoxically, prescribed fire or "beneficial fire" is a valuable tool in our conservation toolbox to support biodiversity and to reduce the risk of catastrophic wildfires.

Historically, the Chumash peoples used fire to steward and augment important plant and animal species. More recently, ranchers have used fire to improve forage conditions for cattle grazing. Today, we see the opportunity to bring beneficial fire back to benefit the mosaic of grasslands, shrublands, riparian, and oak woodland habitats across the Preserve. If done thoughtfully, with science-based, ecological objectives, prescribed fire can maintain and enhance Preserve habitats like grasslands and oak woodlands and manage undesirable, invasive species. By leveraging the Preserve as a living laboratory, we can develop an understanding of the long-term role of prescribed fire as a management tool against the backdrop of a changing climate in systems that are not well understood. By developing ecological objectives and prescribed burning prescriptions we can experiment with different fire behaviors, conditions, and seasons to learn the effects of beneficial fire in the region. The unique enabling conditions of strong research partnerships, agency support, and burn units that can be scaled across a variety of habitat types can provide unparalleled opportunities to better understand the long-term effects of wildfires and prescribed fire.

Beneficial fire on the land uses a collaborative approach, working with multiple partners with diverse objectives informed by western science, Traditional Ecological Knowledge (TEK), and the expertise of fire practitioners and agencies. We hope the Preserve can bring these diverse perspectives together to learn and manage our fire-adapted landscapes and serve as a model for the greater Western United States where fire management is a priority and useful land management tool. Our vision is to build a regional community of interested stakeholders who want to learn how to use prescribed fire to benefit both nature and people. With TNC's expertise in conservation we will work alongside fire practitioners to build nature into prescribed fire management goals.

This plan is comprised of three parts: a wildfire management plan, a prescribed fire management plan, and a description of the management actions that will be taken in each management zone of the Preserve and opportunities to use prescribed fire to support

biodiversity. The plan will guide on the ground fire management at the Preserve and our vision for engaging as a leader in fire management across the region over the next five years. We plan to update the plan biennially as we adaptively steward the land.

Dangermond Preserve Fire Management Goals

1. Reduce the risk of catastrophic wildfire to the Preserve and our neighbors, ensuring the safety of Preserve staff, residents, and visitors, and the protection of natural and cultural resources.
2. Conduct experimental burning activities to learn about the use of fire as a conservation management tool, and the impacts of fire, both prescribed and wildfire, on habitats and species at the Preserve.
3. Implement prescribed fire activities to enhance the Preserve's conservation and biodiversity goals, including maintaining grassland habitat and improving oak woodland health.
4. Build a diverse, collaborative community around fire management that promotes a culture of inclusion and learning that advances ecologically based fire management in Santa Barbara County.

Fire Management Plan

Background

Catastrophic wildfire is an environmental hazard that threatens both people and habitats across California and the Western US. With its Mediterranean climate characterized by hot, dry summers and cool, wet winters, California has many fire-adapted landscapes. However, years of suppression of wildfire, encroachment of humans into the wildland-urban interface, introduction of nonnative vegetation, and an increase in the number of human-mediated ignitions has increased the risk of fires igniting. Additionally, as the climate warms, wildfires are expected to increase in severity and frequency, impacting both human and ecological communities A. The Jack and Laura Dangermond Preserve (hereafter "the Preserve"), like much of Coastal California, lies primarily in high or very high fire hazard severity zones (Figure 1) statewide map of fire hazard severity zones). As a result, careful planning and preparation for potential wildfire ignitions informs management at the Preserve.

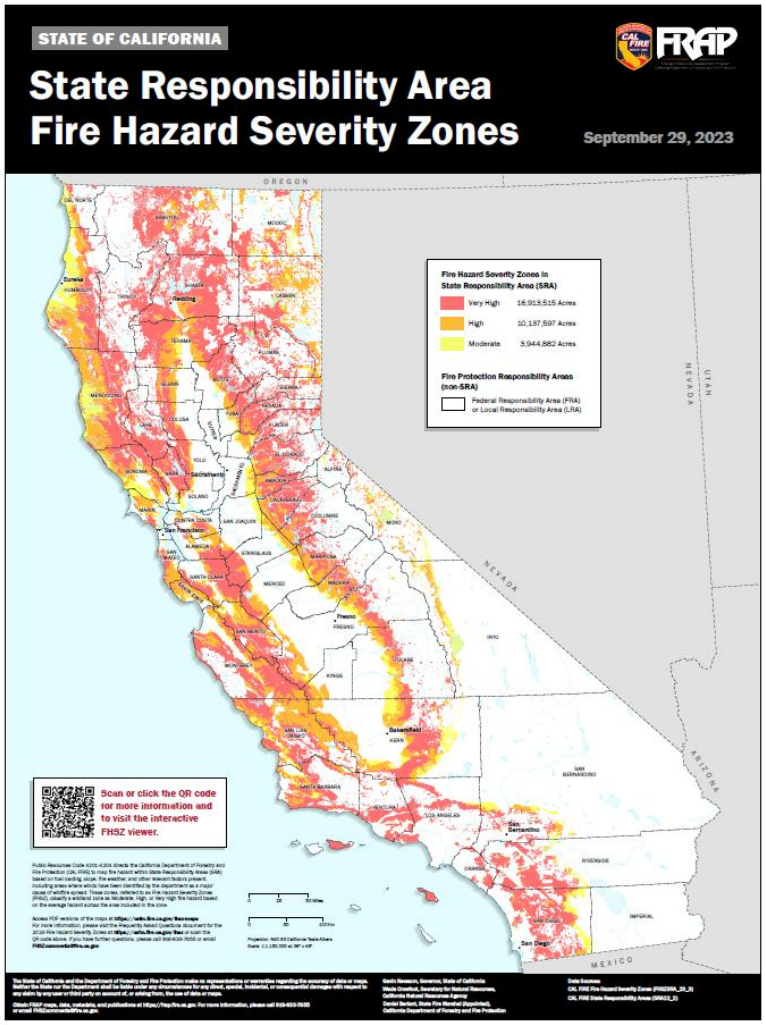


Figure 1: State Responsibility Areas in High and Very High Fire Hazard Severity Zones. The Dangermond Preserve has 10,825 acres in the Very High Fire Hazard Severity Zone and 12,791 Acres in the High Fire Hazard Severity Zone.

At the Preserve, we use a combination of stewardship methods to reduce the risk of wildfire. These include cattle grazing of fine fuels, mowing and maintaining our extensive road system including evacuation routes, ensuring we have adequate water supply, and creating defensible space around the Preserve's historic headquarters at the Jalama and Cojo Ranch Headquarters. The Preserve staff are developing a regional prescribed fire program that aims to understand if prescribed fire can be a land management tool that simultaneously reduces the risk of catastrophic wildfire while supporting biodiversity goals. The Theory of Change (ToC) distilling our approach to fire management on the Preserve can be found in Appendix 1.

History of Wildfires at the Jack and Laura Dangermond Preserve

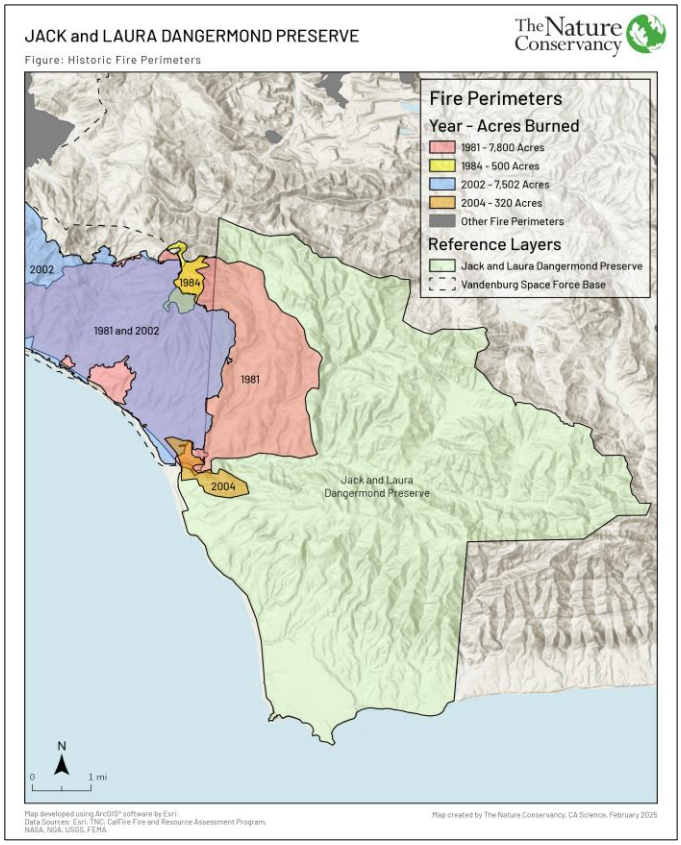


Figure 2: Known historic wildfire perimeters at the Jack and Laura Dangermond Preserve. Known wildfires occurred in 1981, 1984, 2002, and 2004. All fires originated from the west and burned on to the west side of the Preserve in the Army Camp, Lower Jalama, and Tinta Management Zones.

A known comprehensive, long-term fire history at the Preserve does not exist; however, there are some data on wildfires from the last 40 years (Figure 2). It is assumed that wildfires have occurred occasionally across the Preserve, though this fire history has not been extensively researched. A future research effort could reconstruct the burn history in the region through interviews with long time residents paired with an ecological study looking at the ecological indicators of fire in the vegetation communities. Three known wildfires occurred between 1981 and 2004. The 1981 fire burned 7,800 acres in total, including acreage at Vandenburg Space Force Base (VSFB). The fire impacted a majority of the West Tinta, East Tinta, and Jalama Horse pastures coming close to Jalama Ranch Headquarters. In 2002, a 7,502-acre wildfire occurred at VSFB and impacted a small portion of the West Tinta pasture. In 2004, a 320-acre wildfire occurred in the Little Cojo pasture, just west of Jalama Beach County Park and south of Jalama Road.

Ignitions

Fires can be ignited by both human and natural causes. Lightning is the primary source of environmental ignition however, it is relatively rare in this region (Keeley & Syphard, 2018). In Southern California most ignitions are human-caused, from things like powerlines sparking, a chain dragging on a road and sparking, or an untended campfire. As a result, ignition risk is often closely associated with roads, campsites, and communities in the wildland-urban interface. At the Preserve, potential ignition sources likely arise from traffic on Jalama County Road – the public road that bisects the Preserve, the highly trafficked and visited Jalama County Park Campground, and proximity to Vandenberg Space Force Base where previously wildfire events have started and spread onto the Preserve.

Prescribed Fires

In addition to wildfire history, we have anecdotal knowledge that the Cojo-Jalama Ranch performed numerous prescribed fires on the ranch during the Bixby Era between the first half of the 1900's and about 2001, though most of these burns were unrecorded (see Prescribed Fire Management Plan). The Preserve staff are working to advance regional knowledge about how prescribed fire can be used as a management tool to support the needs of both natural and human communities.

Components of the Fire Management Plan

The Fire Management Plan is a comprehensive plan that covers both wildfire and prescribed fire. It contains the following components:

- Wildfire Response Plan
- Defensible Space Plan
- Emergency Action Plan
- Prescribed Fire Management Plan
- Fire Management by Zone

Each plan can be used as a standalone plan, for example detailed information about the Preserve's approach to defensible space on the Preserve. Or to comprehensively understand the approach to both prescribed fire and wildfire management together. Separate spatial tools have been developed to aid agency response to wildfires specifically and can be made available on an as-needed basis because they contain sensitive information. For an overview to the approach for fire that is spatially explicit, the Fire Management by Zone section covers both prescribed fire and wildfire.

Wildfire Response Plan

TO REPORT A FIRE CALL 911
And
RADIO TNC STAFF
"Preserve staff, do you copy, I am reporting a fire"
Secondary Contacts
Dangermond Preserve Office: 805-980-0711
Moses Katkowski, Stewardship Manager: 856-305-0720
Tracy West, Stewardship Technician: 805-705-3735

Preserve Location

Jack and Laura Dangermond Preserve (a.k.a. Cojo-Jalama Ranch)
8101 Jalama Road
Lompoc, CA 93436
805-980-0711

Fire Control Agency responsible for suppression:
Santa Barbara County Fire Department
Station 31 (Battalion 3)
168 W Hwy 246
Buellton, CA 93427
805-686-5062

The Dangermond Preserve, previously known as the Cojo-Jalama Ranch, is located southeast of Lompoc, CA. The Preserve encompasses 8.5 miles of coastline around Point Conception between Jalama Beach County Park in the north to the Preserve's eastern boundary at the Surfing Cowboys property and Hollister Ranch at Cojo Creek.

The Preserve is accessed from Jalama Road off Highway 1. The Jalama Headquarters is accessed through a locked gate at 8101 Jalama Road, about 10 miles from Highway 1, and the Cojo Ranch is accessed through a locked gate at 10,000 Jalama Road, about 10 miles from Highway 1 and 1 mile before Jalama Beach County Park. Both headquarters locked gates have Knox Boxes for Fire Department access. Regular access is through a 4-digit code that changes monthly.

Multiple locked gates along Jalama Road provide dirt road access to the Preserve. Most locked gates include a keyed lock that is only used by Preserve staff, and a combination lock

that is used by visitors and changes monthly. To access through the key/combo locks off Jalama Road, please call the Preserve Office at 805-980-0711 to be informed of procedures for entering the property.

Protection and Command Responsibilities: Santa Barbara County Fire Department (SBCFD) has suppression responsibilities. All fires within the Dangermond Preserve will be extinguished or contained to a controllable area. It is a Nature Conservancy requirement that all wildfires be reported and responsibility for fire control efforts is turned over to the appropriate fire control agency. Fire suppression actions will be based upon firefighter and the public's safety as the priority. The Nature Conservancy will provide as much information as possible to aid in firefighting activities, including providing up to date information on road status, geospatial information, archaeological information, and provide input on the types of fire suppression activities being carried out, where there is flexibility. TNC staff have categorized the Preserve into different zones based on the sensitivities of those zones that highlight firefighting resources and sensitive areas. The data can be made available through mapping apps and static maps to help provide real time situational awareness to help teams coordinate more effectively.

Site Description

Fuels

Major fuel types include oak woodlands of various sizes, age classes and understory types, native coastal sage scrub shrublands, and native and non-native grasslands, including noxious weeds like black mustard (*Brassica nigra)*, radish (*Raphanus raphanistrum*), and various thistle species.

Topography

The Preserve lies from sea level to about 1,680 feet at the ridgeline that separates the Cojo and Jalama Ranches. Both the Cojo and Jalama Ranch are composed of small watersheds that drain directly into the ocean or into Jalama Creek. The watersheds typically have steep canyons with limited access from the creeks to the top of the ridgelines.

Roads

The paved Cojo Road follows the coast, beginning at the Cojo Gate at 10,000 Jalama Road, and continues for approximately 8 miles where it enters the Surfing Cowboy and Hollister Ranch properties. The private road continues another approximately 11 miles to Gaviota State Park through locked gates. Non-paved roads provide access to the interior areas of the Preserve. Main access routes are routinely maintained for firefighting access and as control lines. However, road conditions may vary depending on the season and access across streams could be limited.

Fire Sensitive Areas

Numerous threatened, endangered, rare, and sensitive species occur year-round at the Preserve, and additional species migrate through the Preserve during the year. There are also numerous known sites of cultural significance across the Preserve. If possible, without undue hazards to firefighters or the public, protection of these species, cultural sites, the coastal areas of the Preserve, and riparian habitats would constitute a higher priority than other areas of the Preserve, except those areas with values at risk. Spatial data showing these areas can be made available as needed.

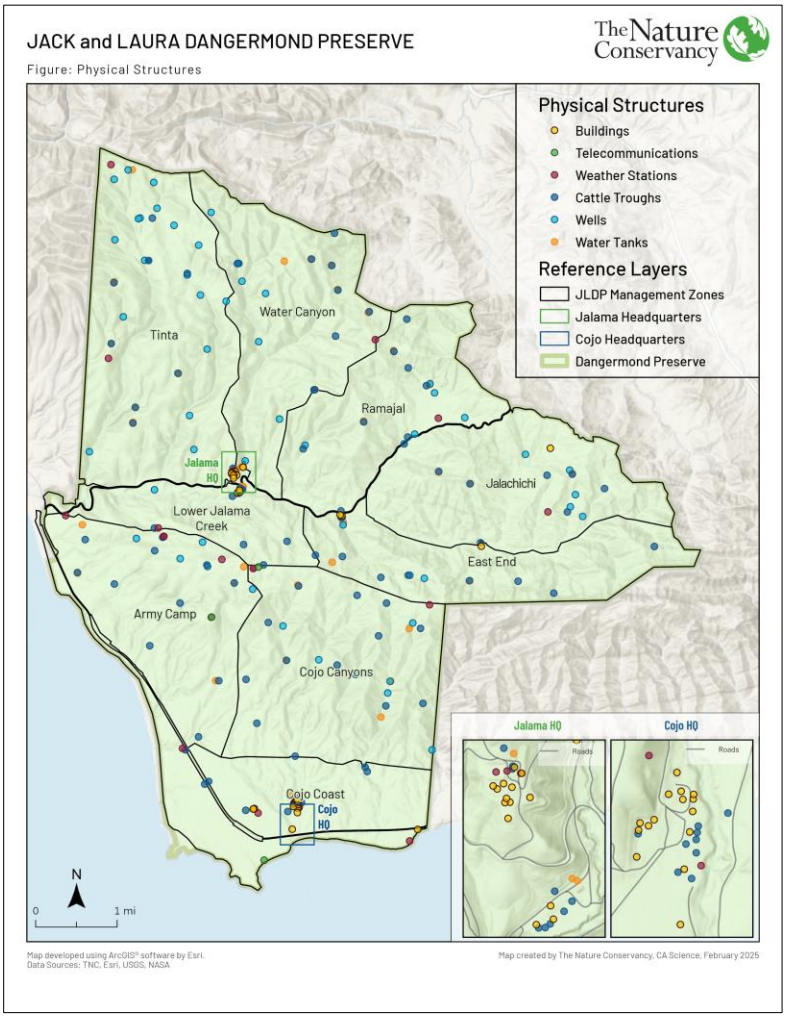


Figure 3: Physical infrastructure and points of interest at the Jack and Laura Dangermond Preserve. Various infrastructure is across the entire Preserve.

Open Water Areas

The ocean, groundwater, springs, and livestock troughs and stock ponds are the primary water sources on the Preserve. Surface water varies throughout the year, with the lowest water levels typically occurring during fire season in the late summer and early fall. The Preserve is currently working to provide additional surface water locations through new water tanks and troughs.

Values at Risk

Figure 3 displays the various infrastructure across the Preserve, which includes many values at risk. Different infrastructure may need different levels of protection in a wildfire. Or may be used as staging areas or water sources during wildfire events. In the event of an emergency, this data can be imported into field mapping apps to allow for real-time data updates and information sharing.

A. Jalama Headquarters (8101 Jalama Rd. Lompoc, CA 93436)
    a. 5 residential structures, **3 that are permanently occupied by staff, including children and pets, and 2 guests houses that are occupied intermittently.**
    b. 4 agricultural structures that store vehicles, agricultural equipment, and hazardous materials (fuel, pesticides, paint).
    c. **All buildings have historical significance and are therefore, priorities for wildfire protection. The Jalama Barn and the Gordon Davis House are the oldest at Jalama headquarters**.

B. Jalama Corrals (across Jalama Road from headquarters)
    a. **Primary staging area for large vehicles, helicopter access, firefighters**
    b. Livestock (horses and cattle)
    c. Tack room
    d. Storage of hazardous materials (paint, fuel)

C. Cojo Headquarters
    a. Located through a locked gate at 10,000 Jalama Rd., 5.6 miles to headquarters along a single lane, windy, paved road. Travel time is about 20 minutes from Jalama Road at Cojo gate to the Cojo headquarters.
    b. Primary site for Preserve overnight guests.
    c. 9 residential structures, many used for intermittent stays. Including the Schoolhouse and Teacher's House along Cojo Road and is about 1/3 mile from the Cojo Headquarters driveway.
    d. 1 office building
    e. 5 agricultural buildings for storage of hazardous materials and equipment
    f. Livestock are sometimes around Cojo headquarters

D. Ranch Infrastructure
    a. There is significant water infrastructure across the Preserve: 50 water wells, 49 water tanks, 97 water troughs. There is over 200km of fence across the Preserve, some which has metal t-posts and some with wooden posts that may burn in a wildfire. Pole barns exist at the Jalama Corrals, near the Cojo Headquarters and in the Lower Diamond between the Jalachichi and Blackbrush pastures.

E. Research and IT Infrastructure
    a. Over 15 weather stations occur throughout the Preserve, monitoring sensors are installed in many of the Preserve's creeks and groundwater wells, and telecommunication sites including trailers and equipment occur at multiple locations (see Figure 3).
    b. IT Infrastructure

i. Radio Repeater
    1. Located on the Cojo ridge, in the Cojo Cow pasture, a 60 ft. tall tower holds communication equipment including the radio repeater, internet connectivity, and a Wildfire Alert camera.
    2. Bunker Hill
        a. Located near the ridge on the coast side, in the Cojo Cow pasture, a telecommunications trailer and tower support point to point Wi-Fi relay signal down to the water tanks above Cojo headquarters, Teachers House, and the M2 marine monitor station at Government Point

F. Restoration Sites
    a. There are 150 acres of oaks restoration sites in the Ramajal and Jalachichi Management Zones, including the Ramajal field, Narrow field, and Venadito pasture. These are places where oak woodland has been restored to meet California Coastal Commission Orders.
    b. In the Jalachichi Management Zone, the 32-acre Jalachichi Ponds restoration was completed in 2024 and is now being monitored.
    c. On the coast, there are over 300 acres of restoration projects, including the 300-acre ice plant removal and restoration, Cojo Marine Terminal Restoration, and the Percos Beach Road Restoration. These areas are important for ensuring that suppression operations (e.g. bulldozer cuts) do not fragment the sites, especially the road restoration, if possible.

G. Culturally Significant Sites
    a. There are a significant number of cultural sites on the property. During wildfire suppression operations, the Operations Chief should consult with Preserve staff, to protect cultural sites from ground disturbance wherever possible. The locations of cultural sites are strictly confidential.

H. Public and Private Utilities
    a. Southern California Edison power lines and poles (1-800-611-1911)
    b. Oil and Gas pipelines (Ira Razon at 805-567-1654)
    c. Union Pacific Railroad tracks and easement (Javier Sanchez 805-249-0959)
    d. Verizon Fiberoptic – runs along the railroad

I. Neighboring Properties
    a. Jalama Beach County Park (southwest)
        i. Jalama Beach County Park Emergency Number: 805-736-6890
    b. Hollister Ranch and Surfing Cowboy Ranch (east)
        i. Hollister Ranch Gatehouse: 805-567-5016

c. Vandenburg Space Force Base (west)
    i. Vandenburg Space Force Base, Base Operator: 805-606-1110
d. Private cattle ranches (north)

Fire Season

Although a wildfire can occur anytime throughout the year, the summer and fall months represent a higher fire danger than during the winter and spring. In the summer and fall, grasses are dead and dry, with lower humidities, and less available surface water for fire suppression. Typically, all plants have a lower live fuel moisture (LFM) during summer and fall, and are therefore, more prone to burn. LFM patterns for different species on the Preserve are currently being developed to identify seasons of the highest risk. LFM data can be viewed in the National Fuel Moisture Database. LFM monitoring occurs every two weeks at the Preserve through a partnership with UCSB.

Staging Areas

Staging areas for firefighting activities depend on the location of the fire, but the main locations would be at the Cojo Ranch headquarters and Jalama Ranch Corrals (aka Pipeyard), across Jalama Road from Jalama Ranch Headquarters. The other location for staging is located at the parking area inside the Cojo gate at 10,000 Jalama Road (see Figure 3).

Water Resources

Livestock ponds are scattered across the property and can provide low to moderate levels of water during some periods of the year, primarily in the winter and spring rainy season. 2-inch hydrant hook-ups are at both the Jalama Ranch Headquarters and Cojo Ranch Headquarters (Figure 3).

Suppression Activities

Wildfire suppression activities can have significant impact on natural and cultural resources. As such, as landowners we would like to be included in decision making about where to put bulldozer lines or conduct aerial firefighting activities. Where possible, and depending on fire weather conditions, we may be open to allowing fire to burn across larger areas with a managed wildfire approach. We also prioritize using the Preserve's existing road network as fire breaks and control lines, as opposed to creating new control lines that impact natural and cultural resources. Spatial data can be made available to agency partners to help identify fire suppression resources and areas in greatest need for protection.

Firefighter Safety

Firefighter safety is of utmost importance and takes precedence over resource protection.

Evacuation Routes

A. The primary evacuation routes are Jalama County Road and Cojo Road. Jalama Road is a public road that bisects the Preserve and ends at Highway 1 near Lompoc. Cojo Road follows the coastline and enters Surfing Cowboy Ranch and Hollister Ranch to the east. Cojo Road may also be an evacuation route for Surfing Cowboy and Hollister Ranch if needed to evacuate to the west (Figure 4).

B. If it is necessary to evacuate west, towards VSFB, the evacuation route is through the Espada Gate, off Jalama Road, and follows a dirt road west into VSFB (Figure 4).

C. Within the Preserve, the dirt roads can be used for evacuation. Primary dirt roads are maintained to provide safe access and allow for firefighter access during wildfire.

D. TNC staff and Preserve visitors should familiarize themselves with the Preserve's roads and evacuation routes. It is recommended that all visitors download the Avenza application to their device for help in navigating the Preserve's road system.

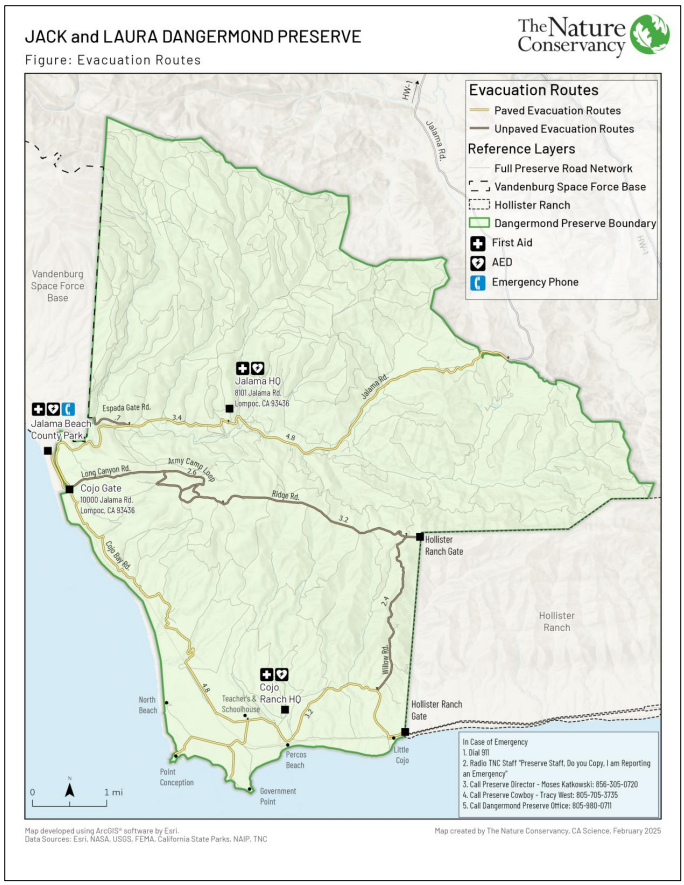


Figure 4: Evacuation routes in case of emergency on the Jack and Laura Dangermond Preserve.

TNC Personnel

There are specific procedures for TNC staff to follow during a wildfire, and the TNC Fire Management Manual have specific directions about how to report and manage an incident. The TNC Fire Incident Response Protocol provides helpful decision-making materials for how to respond to an incident. All resources are internal documents to TNC and can be found on the TNC Connect website. Multiple TNC staff have obtained qualifications as a Firefighter Type 2 (FFT2) and are permitted to assist in firefighting activities. Additional TNC personnel can act as resource advisors during a wildfire. The Preserve Director will be the primary point of contact for the fire agency managing suppression operations and

provide organizational leadership for TNC and Preserve employees supporting operations. Note that TNC has specific requirements for TNC employees to participate in suppression activities or to use TNC-owned equipment in suppression activities and the TNC Fire Management Manual should be consulted.

TNC Staff Roles During a Wildfire

1. TNC-CA Fire Manager – Angie Carl (TNC CA Fire Manager as of March 2025)
2. Dangermond Preserve Lead – Moses Katkowski (Dangermond Preserve Director)
    a. Communicate with North America Fire leadership, TNC-CA leadership, and serve as a resource liaison for lead fire agency.
3. Dangermond Preserve additional fire qualified staff for support and resource advisors
    a. Tracy West (FFT2, Dangermond Stewardship Technician)
    b. Elizabeth Hiroyasu (FFT2)
    c. Kelly Easterday (FFT2)
    d. Keith Miller (FFT2)
4. Dangermond Visitation Team – communication with off-site TNC staff and coordination of Preserve visitors.

Priority Areas for Pre-suppression Activities

A. Jalama Road
B. Cojo Bay Road
C. Ridge Road
D. Cojo Gate
E. Jalama Headquarters Driveway

Jack and Laura Dangermond Preserve Defensible Space Plan

Defensible space is the area maintained around homes, roads, and driveways to reduce the intensity of an approaching wildfire while protecting structures and people from flames, heat, and embers. Maintaining defensible space around structures is required by state law.

Defensible Space will be maintained at the Cojo and Jalama Ranch Headquarters, and other built infrastructure named below, and is the responsibility of the Stewardship Team. The Santa Barbara County Fire Department (SBCFD) deadline to complete all defensible space work is June 1st of each year. SBCFD annually inspects properties for defensible space around the June 1st deadline and may arrive without prior notification.

Defensible Space maintenance will primarily occur in April and May and includes weed abatement around structures, mowing roads and roadsides, and trimming trees to the required height and distance from the road and structures. Additionally, we will remove vegetation around IT infrastructure around the Preserve including weather stations, mobile IT trailers, etc.

Santa Barbara County Fire Department (SBCFD) outlines proper Defensible Space implementation, described below. Annual inspections are based on these requirements from SBCFD.

After the initial work to implement defensible space, the Stewardship Team will inspect all structures weekly to ensure proper work is complete. If additional work is needed, the team will prioritize defensible space maintenance through wildfire season.

Defensible Space Implementation Zones

The implementation zones below guide defensible space work around the built infrastructure at the Preserve.

Zone Zero: 0-5 ft.

The area starts at the roof and extends 5 feet from walls. Remove all combustible materials and protect vents and openings where wind-blown embers can enter.

A. Use only inorganic, non-combustible mulches such as stone or gravel.
B. Remove combustible outdoor furniture. Replace with metal or non-combustible varieties.
C. Replace jute or natural fiber doormats with heavy rubber or metal grates.
D. Remove or relocate all combustible materials including garbage and recycling containers, lumber, trash, and patio accessories.
E. Clean all fallen leaves and needles.

Zone 1: 5-30 ft.

Keep this area "Lean, Clean, and Green" and be sure to maintain regularly through fire season.

A. Remove all dead grasses, weeds, plants, and foliage.
B. Remove fire-prone plant varieties.
C. Remove all fallen leaves, needles, twigs, bark, cones, and branches.
D. Remove shredded bark mulch to maintain soil moisture or for erosion control.
E. Choose only fire-resistant plants and keep them healthy and well irrigated.
F. Provide spacing between shrubs and add space on steeper slopes.
G. Remove limbs 6-10 ft. from the ground.
H. Remove branches that overhand your roof or within 10 ft. of chimneys.
I. Move firewood and lumber out of Zone 1
J. Remove combustibles around and under decks and awnings.
K. Clear vegetation around fences, sheds, outdoor furniture and play structures.
L. Outbuildings and LPG tanks should have at least 10 ft. of clearance.

Zone 2: 30-100 ft.

Reduce fuel for fire and separate trees and shrubs in the area. Remove dead vegetation regularly.

A. Cut annual grasses and weeds to a maximum of 4 inches.
B. Create horizontal spacing between shrubs and trees.
C. Create vertical spacing between grass, shrubs, and lower tree limbs.
D. Allow no more than 3 inches of loose surface litter, if needed, to protect from erosion
E. Remove all piles of dead vegetation.

Access Zone: 0-10 ft.

Access roads are critical evacuation and first responder access. Maintenance is required year-round.

A. Clear vegetation 13.5 ft. overhead and 10 ft. from sides of roads and driveways in the same manner as Zone 1.
B. Maintain 12 ft. of unobstructed pavement for passage of vehicles.
C. Within this zone, choose only fire-resistant plant varieties and ensure that they do not extend into the driveway.
D. 13.5 ft. of clearance is required above the roadway for emergency vehicle access.
E. Address numbers must be clearly visible from the road, with at least 4-inch numbers on a contrasting background. Reflective or lighted numbers are best.
F. Create vertical spacing between shrubs and lower tree limbs.

Jalama Ranch Headquarters and Corrals

Residential Structures

A. Guest House (occupied intermittently)
B. Jalama Manager's House (Moses)
C. Jalama Cook House (Nancy)
D. Gordon Davis House (Preserve office)
E. Cowboy Residence (Tracy)

Operational Facilities

A. Jalama Barn
B. Jalama Shop
C. Horse Stables
D. Quonset Hut
E. Jalama Corrals
    a. Tack Room, Barn and Stables
    b. Pipeyard

Entrances, Driveways, and Roads

A. Main Jalama Headquarters Entrance and Driveway
B. Lower Jalama Headquarters Entrance and Driveway (across from Jalama Corral gate)
C. Jalama Corrals Gate and Driveway

Cojo Ranch Headquarters

Residential Structures

Dangermond Conservation Foundation Complex (occasional guests)

A. Main Adobe
B. Cabin
C. Bunkhouses A and B (occasional guests)

PCI Field Station (occasional guests)

A. Old Adobe Office
B. Zarcades Family House
C. Zegar Cojo Cook House
D. Cojo Manager's House
E. Schoolhouse and Teacher's House Complex (1/3 mile before Cojo headquarters driveway on Cojo Road)

Operational Facilities

A. Cojo Garage

B. Cojo Shop
C. Cojo Stables
D. Dairy Barn
E. Pole Barn
F. Walnut Shed

Entrances, Driveways, and Roads

G. Cojo Road
H. Cojo Gate
I. Cojo Headquarters Driveway

Jack and Laura Dangermond Preserve Emergency Action Plan

Location

- Address: Jalama Headquarters – 8101 Jalama Rd, Lompoc, CA 93436
- Address Cojo Gate/Headquarters – 10,000 Jalama Rd, Lompoc, CA 93436 (Headquarters is 5.6 miles from Cojo Gate)

*Special Instructions: locked gate, need code or someone to meet for access. Both Jalama and Cojo Gates have Knox Boxes for Fire Department access.

Nearest Telephone

- There is no reliable cell phone service on the Preserve.
- Cell phones can be used if Wi-Fi calling is enabled and phones are connected to the internet at the Cojo and Jalama headquarters. There is no Wi-Fi outside of the two headquarters.
- Dangermond Preserve Office: 805-980-0711

Other Communication

All staff and visitors on the Preserve carry radios and can communicate using channel 1 across the Preserve.

AED and First Aid Kit

Dangermond Preserve has an AED (Automated External Defibrillator) and First Aid equipment stored at the Jalama Office at the Volgenau (Gordon Davis) House and the PCI laundry room at the Cojo Headquarters. If CPR, First Aid, or an AED are necessary, have a nearby person follow 911 procedures (below). Begin administration of First Aid, CPR, or AED until support arrives, or for as long as is necessary.

Follow 911 procedures below

A. If you are near a working phone, dial 911. Alternatively, Radio staff to call 911. Tell the operator the nature of the emergency: medical, fire, police or other.
B. Describe the emergency. Describe the person(s) involved and their specific injuries or conditions.
C. Provide the location of the emergency.
D. Give your name, location, and the number of the phone you are calling from.
E. Stay on the phone line, as the operator may require more information. Follow all directions you are given. Hang up when instructed to do so by the 911 operator.
F. If possible, send someone to the property entrance to direct emergency responders to the correct location.

TNC Telephone Numbers

After calling 911, call the following TNC Staff Contacts in order until you reach someone.

ONSITE CONTACTS			
Name	**Title**	**Mobile Phone**	**Alternate Phone**
DANGERMOND PRESERVE OFFICE/Nancy Anderson		**805-980-0711**	
Moses Katkowski	Preserve Director	856-305-0720	805-538-2438
Tracy West	Stewardship Technician	805-705-3735	805-736-8017
Nancy Anderson	Operations Coordinator	805-757-0485	805-736-1106
Ron Kinney	Security	805-717-5848	
Chelsea Nielsen	Visitation Manager	530-277-2044	

Non Life-Threatening Emergency

Radio or Call TNC Staff Contacts in order until you reach someone.

If an injury does not warrant immediate medical attention, the person(s) injured may be transported to the nearest hospital location (Figure 5):

Lompoc Valley Medical Center
Hospital Phone: 805-737-3300
Hospital Address: 1515 E Ocean Ave, Lompoc, CA 93436

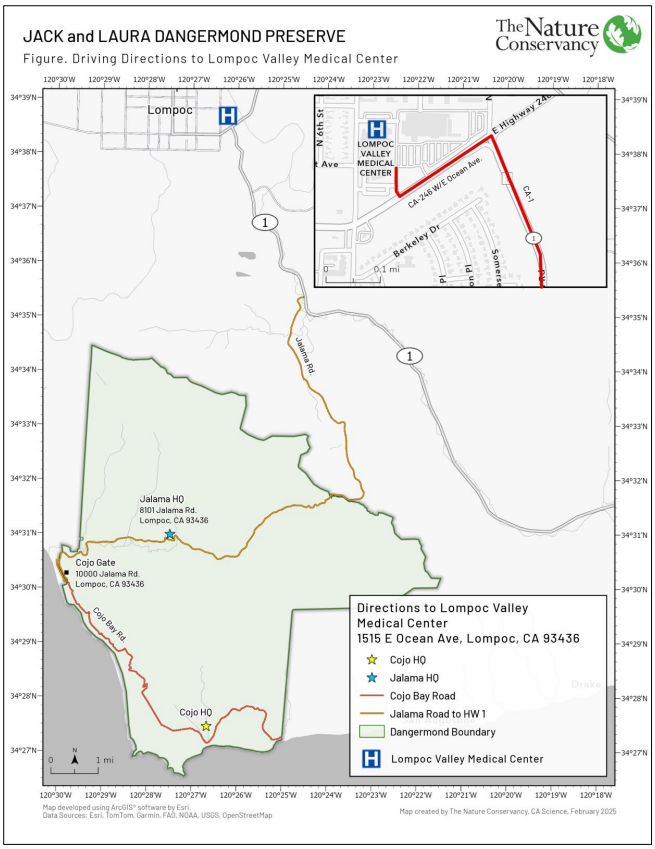


Figure 5: Map and Driving directions from Dangermond Preserve to Lompoc Valley Medical Center.

Jack and Laura Dangermond Preserve Prescribed Fire Management Plan

Background

Prescribed fire, good fire, beneficial fire, or controlled burns, are when fire is intentionally introduced to the landscape to meet land management objectives, including to support cultural practices, for ecological benefit, and/or to reduce risk to human communities and habitats. “Good fire” is typically used when cultural objectives are the primary objective driving the use of fire on the landscape. The California Department of Forestry and Fire Protection (hereafter “CalFire”), the leading fire agency in California defines prescribed fires as “The planned and controlled application of fire to the land under specified conditions, to reduce vegetation and risk from wildfire” (California Department of Forestry and Fire Protection, 2025). Prescribed fires can be used to reduce the amount and density of fuels on the landscape, which can be an important driving factor of wildfires becoming catastrophic. It can also be used to manage invasive species or pests, or to promote native species that are fire adapted. Prescribed fire can maintain historic habitats such as open grasslands or aid in habitat restoration (California Wildfire and Forest Resilience Task Force, 2022; R. Reiner, 2007). Prescribed fire is being increasingly adopted across the West for forest and fuels management, with the California Wildfire and Forest Resilience Task Force recently releasing a strategic plan to increase the use of beneficial fire in the state to 400,000 acres annually by 2025 (California Wildfire and Forest Resilience Task Force, 2022). For the purposes of this plan, prescribed fire will be the term used to describe when fire is intentionally set to achieve the goals outlined in this plan including cultural objectives, wildfire risk reduction, and ecological management and restoration.

Across the globe, The Nature Conservancy (TNC) has engaged in the use of prescribed fire to manage TNC owned landscapes and in partnership with other land managers for the last 60 years. While TNC often focuses on biodiversity goals, TNC has also been involved in prescribed fires and prescribed fire planning to develop more equitable fire policy and funding, elevate Indigenous fire practitioner leadership, grow the fire management workforce, and help communities live more safely with wildfire. More information about TNC’s fire program can be found on the fire networks website (https://firenetworks.org/).

Prescribed Fire in the Santa Barbara Region

In the Santa Barbara region, fire has been used as a land management tool since the Chumash stewarded the land. Historically, fire was used by the Chumash to create open spaces in coastal sage scrub habitat. Fire was also used to promote the growth of important foodplants and reduce pests (Timbrook et al., 1982, Teresa Romero, personal communication 2022). Following colonization, cultural fire was criminalized and therefore excluded from the landscape through a law enacted in 1850 and enforced until the 1930s (Chap. 133 § 1 *et seq.*, 1850). During the ranching period, prescribed fire was used to type

convert chaparral and coastal sage scrub habitat to grasslands to increase forage for cattle. The Range Improvement Association in Santa Barbara County has been actively burning since 1956 with the goal of promoting livestock forage and promoting native habitat. Currently, prescribed fire is being used as a tool by a variety of land managers in the region including ranchers, Santa Barbara County Fire Department, and the US Forest Service, to meet different objectives, including fuels reduction, vegetation management, and promotion of grazing habitat.

Prescribed Fire Training Exchanges (TREX)

Prescribed Fire Training Exchanges (TREX) and cooperative burns provide experiential training that builds robust local capacity for prescribed fire and offers fire practitioners a more holistic perspective to fire management. The key focus of TREX is promoting the spread of effective cooperative burning helping diverse partners leverage skills, resources and staff in ways that maximize opportunities for outreach, treatment, and training. The TREX program was developed by TNC and the US Forest Service with participation from other partners like UC Cooperative Extension and state fire agencies. On a practical level, TREX events help to enable more prescribed fire because they surmount burdens around liabilities and provide capacity to conduct burns on private and public lands. Learn more about the TREX program here.

TREX burns often burn smaller areas and move more slowly than prescribed burns that are carried out by agencies. This can enable more research to be built into the burn planning process and provide opportunities for fire scientists to implement different treatment types to be associated with the burns. The Preserve is intentionally using Santa Barbara (SB) TREX burns to build research projects and answer important fire management questions for the Preserve, as well as the greater region, while also helping to build local fire capacity and knowledge.

In 2022 and 2024, the SB TREX program was the primary mechanism to accomplish prescribed fire objectives at the Preserve and will likely continue to be in the near term. However, this may change as more capacity is built within the TNC California Chapter and the Preserve team. Preserve staff will remain active participants in the leadership team of the SB TREX program, even if burns do not occur at the Preserve (for example the 2023 SB TREX, occurred at the UCSB Sedgwick Reserve). The community being built through the SB TREX is critical to accomplishing the fire management goals of the Preserve by supporting important partner-led research, maintaining relationships with regional fire management agencies, building cultural burning objectives into prescribed fire plans, and by building ecologically-based fire management expertise in California and beyond.

Prescribed Fire at the Jack and Laura Dangermond Preserve

At the Jack and Laura Dangermond Preserve, there is limited documentation of prescribed fire, see Figure 6. We know that the Chumash people stewarded the land with fire prior to the Mission Period beginning in the early 1800's, though this practice was halted following colonization. We also know anecdotally that range improvement burns took place within the Preserve borders during the ranching era of California, with the goal of increasing forage for cattle and reducing shrub encroachment. The previous prescribed fires that have been documented within the Preserve boundaries were conducted to promote grazing habitat and reduce shrub encroachment. Recent research at the Preserve demonstrated that, consistent with patterns seen across the California coast, grassland habitat has decreased with the reduction of fire and grazing at the Preserve (Genua et al., 2024).

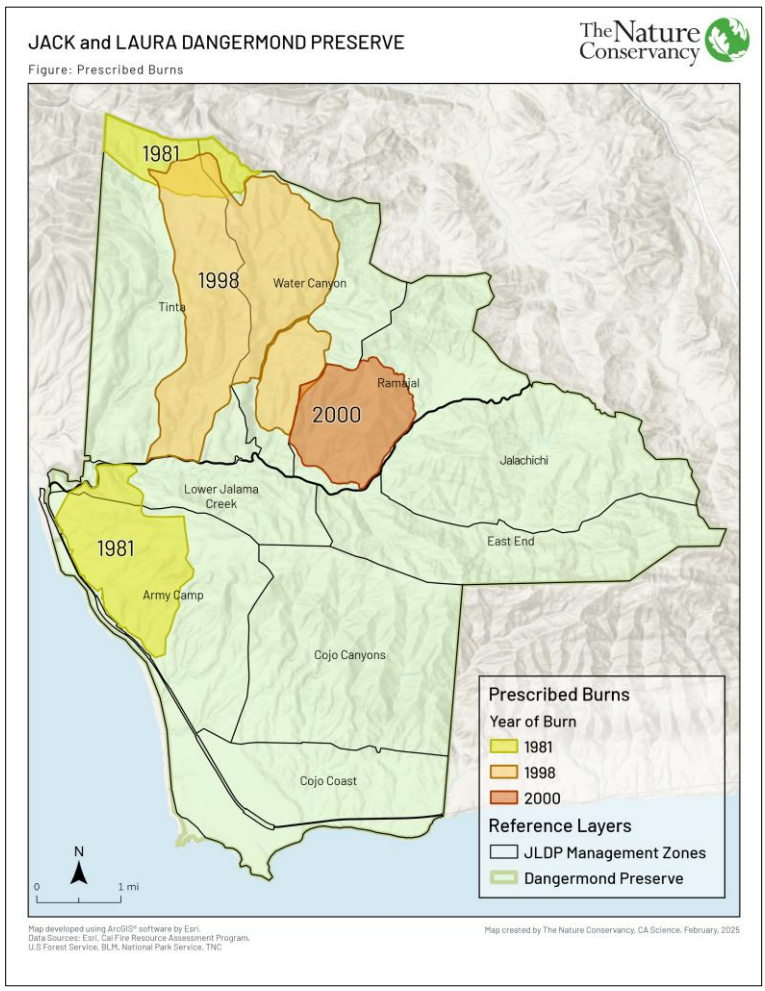


Figure 6: Known prescribed fires occurring within the Jack and Laura Dangermond Preserve boundaries.

Presently, TNC's overarching 10-year management goal includes testing the use of prescribed fire to promote biodiversity in the major habitat types: oak woodlands, grasslands, and shrublands; and reduce the risk of catastrophic wildfires impacting habitats, people, and Preserve infrastructure. This work aims to provide insights to the ways that prescribed fire can be a tool that can support both biodiversity and reduce risk from catastrophic wildfire. We recognize that to meet our prescribed fire goals at the Preserve, additional management actions are needed to complement prescribed fire activities. Some of the management actions include livestock grazing, invasive plant species treatments, road maintenance, and native species restoration.

Through research, monitoring and adaptive management, we will refine our approaches to prescribed fire and other management actions to better meet our long-term goals of

maintaining and enhancing biodiversity across the Preserve. Preserve staff are committed to working as leaders and collaborators in advancing the conservation goals of the Gaviota region. Serving as a "living laboratory," we are interested in promoting research and using data-driven approaches to understand the role of fire behavior and severity in determining biodiversity and risk outcomes. We are partnering with researchers interested in the ecological response to low intensity fire and plan to collect data prior to, during, and after burns. Through collaborative partnerships built through the TREX, we are demonstrating that critical research can be implemented within prescribed burns to provide more fine-scale data on fire behavior, which can then help inform biodiversity and ecosystem outcomes. See subsequent sections below describing the research enterprise that the Preserve is helping to develop on prescribed fire in the region.

The objectives, locations, and scope of prescribed fires at the Preserve are driven by the primary goal of supporting biodiversity and ecosystem function across the habitats where fire is introduced. Preserve staff engage in a careful planning process to locate burn units and identify prescribed burn objectives for each unit. To minimize the need to create additional control lines and the impacts of heavy machinery, burn units leverage existing roads, water infrastructure, and landscape features. This can reduce the soil disturbance that may occur with heavy machinery and traffic from prescribed fire participants and equipment. Because the habitat across the Preserve occurs in a mosaic, careful planning for each individual burn unit is required with specific objectives for each habitat type. Sensitive habitat can be excluded or protected when burn units are prepared, or the prescription can reflect the need for different conditions to adjust the intensity or extent of the fire. Preserve staff have identified three burn units at the Preserve that they will target for prescribed fire activities in the next 5-10 years (Figure 7). Burn plans have been developed for all of these units (see Appendix 2), research and burn objectives are discussed in detail in the Management by Zone section following the Prescribed Fire Management Plan.

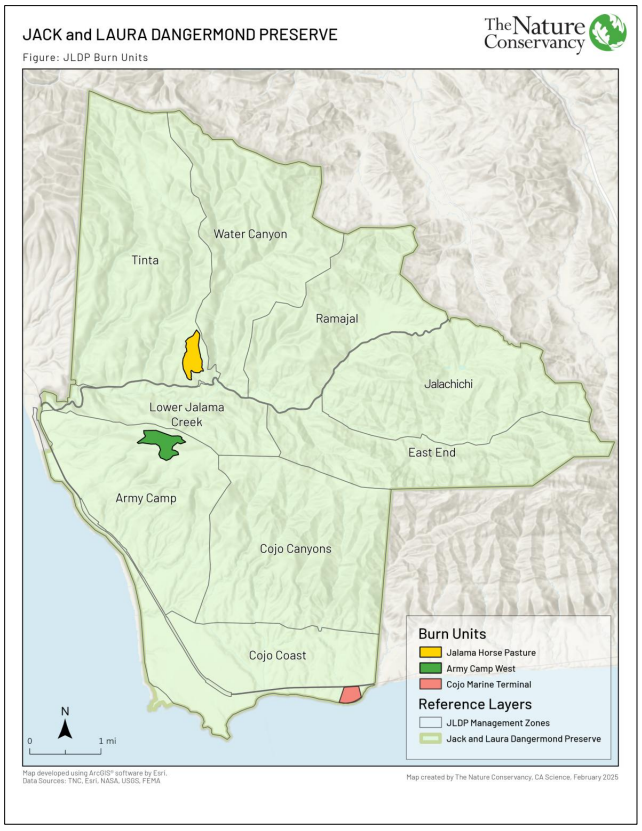


Figure 7: Potential prescribed fire burn units at the Preserve.

Certain areas of the Preserve are excluded from consideration for prescribed fire. Areas where recent restoration has occurred, like the coast live oak (*Quercus agrifolia*) restoration sites and ice plant restoration site, are excluded from consideration because they are not consistent with the restoration goals in these areas over the next 5 years. Additionally, areas with endangered species, where a take permit would likely be needed or where the impact of fire is unknown (e.g., pastures with endangered Gaviota tarplant *Deinandra increscens ssp villosa*), will need significant analysis before prescribed fire can be considered. There are many areas of the Preserve where prescribed fire may require a significant amount of preparation; or areas where prescribed fire may be appropriate, but preparation of the area would threaten the ecological function. Here, other management tools will be used, and the application of fire could be considered farther into the future. There are other areas, like the East End Management Zone, where the heavy build-up of fuels and proximity to neighboring properties makes prescribed fire too risky to implement at this time. Areas of "hard" chaparral, like the La Purissima manzanita (*Arctostaphylos purissima*) groves, are being excluded from burn planning over the next five years until a better understanding of the fire history and appropriate burn intervals can be gained. This is an area of research that the Preserve and PCI science teams are actively working to grow. We are also not targeting burn units that are comprised primarily of coastal sage scrub, or "soft" or "maritime" chaparral, given the sensitivity of this habitat. Small, pilot studies where it occurs in existing burn units may first help us gain an understanding of fire effects and appropriate management. Over the next five years, Preserve staff are focused on the existing proposed burn units in the Tinta and Army Camp Management Zones (see Appendix 2 Dangermond Preserve Burn Plan). In the next 10 years, we plan to explore the effectiveness of prescribed fire on the coastal grasslands, outside the ice plant eradication area. This may change over time as restoration projects are completed and more information is known about the role of fire in different ecosystem types.

Regulatory, Planning, and Permitting Processes for Conducting Prescribed Fires

The Preserve is governed by organizational, national, and local rules for conducting prescribed fires. The Nature Conservancy operates under the organization's Fire Management Manual, a guiding document for all aspects of wildland fire management. The Fire Management Manual is a comprehensive document that should be reviewed and understood by all staff involved in leading prescribed fire operations on TNC land, government owned land, or other private lands.

Fire Management at The Nature Conservancy occurs across the United States and around the world. In the U.S., The Nature Conservancy operates under the rules of the National Wildfire Coordinating Group (NWCG). The NWCG provides training and establishes rules for fire management operations like required Personal Protective Equipment (PPE) and provides qualifications for official firefighting positions.

In California, the California Prescribed Fire Liability Claims Fund can reduce the liability exposure that TNC faces in the event of an escape of a prescribed fire on TNC land. Administered by CalFire, burn bosses overseeing prescribed fires on private lands can enroll in the claims fund prior to conducting a burn with up to $2million in coverage. Burn bosses overseeing prescribed fires at the Preserve should enroll in the claims fund for all prescribed fire activities.

Locally, the Preserve must coordinate all prescribed fire activities with Santa Barbara County Fire Department (SBCFD) and the Santa Barbara Air Pollution Control District (SBAPCD). SBCFD is the agency responsible for wildfire suppression and grants permits for prescribed burning, including broadcast burns and pile burns. First, the Preserve's burn plan is submitted to SBCFD to be reviewed. Once approved, a burn permit must be obtained and signed before conducting any burning activities (broadcast and pile burns). SBAPCD must also approve of the burn based on expected smoke impacts to local communities. All burn plans must include a smoke management plan that is reviewed and approved by SBAPCD. Because the Preserve is relatively far from major population centers in Santa Barbara, there are fewer concerns of smoke impact to populations. However neighboring properties, including Hollister Ranch, VSFB, and Jalama Beach County Park may have concerns about smoke occurring locally. The Preserve has conducted outreach and built relationships with these neighboring communities, and all neighbors are notified of prescribed fire activities prior to their implementation. The prescription for controlled burns on the Dangermond Preserve typically call for an offshore wind direction so smoke blows offshore, instead of toward neighboring communities.

Within TNC-CA, the state fire manager must also sign off on any burn activities and acquire approvals from TNC's Fire Management chain of command. Additionally, all prescribed burns conducted by TNC-CA must go through a science review process to ensure burn projects are scientifically sound with science-based objectives. TNC-CA Science staff are designated to provide science review by preserve or region in California.

Prescribed Fire Equipment and Supplies

The Dangermond Preserve maintains a cache of fire equipment and supplies used for both wildfire response and prescribed fire activities. Fire equipment includes three truck bed water pumpers and a 4,000-gallon water truck. The Preserve has a supply of hand tools and PPE used by TNC staff and TREX participants. In 2024, TNC purchased a fire equipment trailer which is used to store and transport the Preserve's fire supplies. The trailer is kept in the Jalama Corrals Pipeyard and can be moved across the Preserve as needed.

Maintaining our equipment and supplies is critical to their safe and effective use. The Stewardship Team will regularly maintain equipment and supplies. In the winter months,

outside of fire season, the team will perform annual maintenance and repair, get rid of old or broken equipment, and purchase new equipment and supplies as needed.

Fire extinguishers are placed across the Preserve in strategic locations including in each building and in each vehicle. Fire extinguishers are required in Preserve visitor vehicles, and they can also be checked-out during a visit if needed. Fire extinguishers will be inspected annually by an external party in the winter or spring. They will be charged or replaced as needed. Managing the Preserve's fire extinguishers is the responsibility of the Stewardship Team.

Prescribed Fire Research

Across California, TNC and many other land managers are aiming to understand how to balance the intersection of biodiversity, public safety, and respect for cultural resources and practices. In the American West, prescribed fire has most often been applied to conifer forest systems where fire has been excluded for centuries. A large body of research and literature has described the importance of prescribed fire to the ecosystem function of these forest systems. However, the role of prescribed fire and the frequency with which it should be applied is not well understood in central coast California ecosystems. Much of the research in the region is conducted following wildfires. The central question driving fire research at the Jack and Laura Dangermond Preserve is *can prescribed fire be used as a tool to increase or support biodiversity?* We envision that this research can inform prescribed fire activities in the region by filling an important gap in understanding when, where, and how fire should be applied in central coast habitats. In Santa Barbara County, there are already a range of prescribed fires being proposed as part of Vegetation Management Plans (VMPs) to reduce fuels. With the assumption that fuels reduction prescribed fires will continue to occur in California and in Santa Barbara County by fire agencies and Prescribed Burn Associations (PBAs), we aim to incorporate science-informed, ecologically based goals and practices into future fuel reduction prescribed burns through the research conducted at the Preserve and with our research partners.

At the Preserve, the extensive freshwater sensor and weather station networks can be used to understand the relationship between fire, biomass loss, and groundwater, providing important insights for the role of fire in determining the availability of freshwater resources. Contemporary models of wildfire vulnerability and risk are often assessed via field measurements and remotely sensed metrics of above ground processes (e.g., vegetation, topography, fuels, wind). However, this only accounts for a fraction of the processes driving wildfire vulnerability. To accurately characterize wildfire vulnerability and understand ecosystem resilience, a better articulation of the interactions and linkages between freshwater resources; particularly groundwater and vegetation is needed. Freshwater data, and in particular data on groundwater, is rarely rapidly integrated into decision making, nor is it proactively used for forecasting or planning processes related to

fire. Research and decision-making activities have focused on post-fire effects on water quality and quantity (Williams et al., 2022), but there has been little work directed at integrating freshwater (but see (Bart et al., 2020)), and particularly groundwater, into models of fire risk, fire related decision-support tools, and as derived inputs to community wildfire protection plans, prescribed burn plans, and statewide assessments of fire risk. Through a NASA Applied Science Grant, researchers with TNC have been using machine learning to understand the effect of short-term and long-term hydrologic variables in mapping wildfire probability. This work is the first of its kind to effectively state the importance of long-term hydrologic effects in predicting wildfire probability and highlights existing gaps in our understanding of the important linkages- including the need to better monitor ground water resources to elucidate this connection. Groundwater availability three years prior to the fire is as important as the meteorological conditions the day of or before including wind and precipitation (Khodaee et al. 2024). The Dangermond Preserve, is therefore uniquely situated to contribute to a growing body of work on the interactions between ecohydrology, plant- water relations, and fire. Across all habitat types, there is additional interest in understanding the impacts of prescribed fire on wildlife and existing knowledge about how and where to network wildlife cameras and acoustic monitors can be leveraged to develop monitoring protocols for wildlife in different habitat types.

When conducting an experimental prescribed fire, it is important to capture as much information as possible, to implement any positive aspects in other areas. Pertinent data includes past land use or land management, preceding weather and climate, soil type, species coverage, species density, litter and thatch coverage and density, fire timing, fire weather, fire behavior, post-fire weather and climate, and any active restoration. Since TNC's ownership of the Preserve, we are tracking land use and management, have weather stations throughout the Preserve, digitized soil information, and are measuring residual dry matter in grasslands. Spatial data are collected for all burn activities, as well as detailed fire effects monitoring during the burn.

Beyond the research specific to the ecological response to prescribed fire, there is an opportunity to support research related to traditional resource management and stewardship if co-developed or led by Indigenous partners. Preserve staff are in early conversations with tribal partners to better identify opportunities and ways to build capacity around questions that are priorities for partners. There is also further research that can be done related to the social dynamics and public opinion about prescribed fire. In general, communities in Santa Barbara County are engaged with fire management and additional social science research can help to understand what social factors determine the success of fire and fuels management. Relatedly, additional research about the public health implications of prescribed fire work, including the impacts of smoke, has important implications about when and where prescribed fires are carried out.

Research Collaborations

The Preserve, in its role as a living laboratory and convener will enable broad, region-wide collaborations to understand different dimensions of prescribed fire. Through close collaboration with the Sedgwick UC Natural Reserve, there is an enormous amount of high-resolution data to compare the two sites and track changes over time. Through building a research enterprise around fire alongside programs to build fire practitioner capacity, the Preserve can bring in researchers at the ground floor to develop burn objectives, treatments, and monitoring plans. Through collaborative research we aim to demonstrate if and how management can satisfy the public desire to manage landscapes near human communities, support biodiversity, and respect the cultural history of the land.

The enabling conditions in Santa Barbara County and at the Dangermond Preserve make the region a place with unparalleled opportunity to understand the impacts and opportunities of both wildfires and prescribed fire. The region has consistently experienced the impacts of catastrophic wildfires. There is current research aiming to understand the recovery of different ecosystems post-fire, as well as the atmospheric conditions that cause catastrophic fires, such as the Sundowner Wind Experiment (SWEX; Carvalho et al. 2024). The Santa Barbara County Fire Department (SBCFD) has a long history of collaborating with a variety of partners to conduct prescribed fires and fuels management. SBCFD's Vegetation Management Program (VMP) works closely with private landowners and organizations to reduce wildfire risk to human communities. While the primary objectives of SBCFD may not be the same as TNC, SBCFD has been integral to the planning of TREX activities by providing important contingency resources and access to burn sites for researchers. Through these relationships and with the associated research, TNC can influence where, when, and how prescribed fire is used on the landscape, accounting for the conservation of important ecosystems and their functions.

The Sedgwick Reserve and La Kretz Research Center at Sedgwick Reserve have developed a robust research program associated with their prescribed fire work, examples of the associated research projects are described in Appendix 3. This research is associated with the Vegetation Management Program (VMP) agreement that Sedgwick Reserve has with SBFCD (Appendix 4). The La Kretz Center and Dangermond Preserve Point Conception Institute (PCI) are also working closely together to develop high resolution vegetation maps for the region and have been close partner field sites for the past SHIFT campaign. Comparison between the Sedgwick Reserve and the Dangermond Preserve can provide insights to the role of coastal influence and abiotic factors like relative humidity, fog, and temperature for oak woodlands, grasslands, and shrublands - habitat types that are present at both sites.

A meeting of interested fire researchers was held on September 14, 2023 with researchers from UCSB, the US Forest Service, and Padre Associates consulting company. Broadly, researchers recognized the opportunity to understand the relationship between prescribed

fire, biodiversity, and grazing. There are large amounts of preliminary data that can be leveraged to support this research. In general, baseline monitoring, including live fuel moisture monitoring (discussed below) is an important place to start for developing a research enterprise. A detailed summary of the meeting is available in Appendix 5.

A TNC hosted workshop under NASA Applied Science Wildland Fire Program (Grant 80NSSC22K1816) was held at the National Center for Ecological Synthesis and Analysis on Sept 23-25th 2024. The Prescribed Fire as a Conservation Tool workshop was intended to build off the momentum of the collaborative TREX program, by continuing to find ways that researchers can interact with agency professionals to develop prescribed fire planning tools, research questions, and monitoring protocols. After many discussions, several themes became clear that centered on defining success in three realms: community protection, ecological impacts, and socio-cultural outcomes. With these elements in mind, every prescribed fire can act as an opportunity to begin answering unresolved questions. What does an ideal long-term prescribed fire plan look like for SBC? Strategic fuel reduction burns that promote community safety have been successful, but are there more opportunities? Could native grasslands, which are more wildfire resilient than non-native grassland systems, be promoted through the use of fire? There are many unanswered questions, but one thing remains certain–the flammable environments that we live in will continue to be subjected to frequent and severe fire as climate change continues to increase temperatures, aridity, and fire season length. Integrated Western science and traditional ecological knowledge and long-term planning aimed at conservation outcomes are more important than ever before. Despite the unanswered questions, Santa Barbara County has an opportunity to be a learning landscape of intentional fire that optimizes the achievement of community protection objectives, ecological objectives, and cultural objectives making our landscape and communities resilient. It was clear from the workshop that there is work to do, but also that there is the energy, enthusiasm, and buy-in to do it collaboratively. The variety of tools available to fire practitioners was discussed, as well as the need for researchers to involve practitioners in any further tool development (Appendix 6). A detailed summary of the workshop is available in Appendix 7.

Research objectives are presented in the individual management zone plans where burn units currently exist and burn objectives have been identified. See Appendix 8 for a summary of current research and research partners associated with prescribed fire on the Dangermond Preserve.

Monitoring

In addition to a lack of information about the role of prescribed fire in different habitat types at the Preserve, the application of prescribed fire is often not paired with long-term data collection to track baseline conditions and outcomes over time. By identifying specific research objectives for each burn unit, units can be prepared differently or burned with

different fire behaviors or in different seasons to understand how the application of prescribed fire may change ecological outcomes. Added capacity from TNC-CA and TNC-North America to support prescribed fire work in different seasons can allow for additional prescribed fire experimentation beyond the TREX model, which is the only avenue date. For example, burn piles could be used to eradicate exotic seed banks in some areas of the Preserve, or spring burns could be used to reduce the extent of nonnative annual grasses.

Long-term research and monitoring are in the early stages across a variety of habitat types and will require many years and various treatments to discern how, when, and where prescribed fire should be applied. Since March 2023, the Preserve staff have been working with collaborators at UCSB to collect live fuel moisture (LFM) data twice per month, both inside and outside of the proposed Preserve burn units, with protocols outlined in Appendix 9. The data collected has been added to the US Fire Environment Mapping System (FEMS) (Santa Barbara County FD Group), which is used to predict fire danger conditions across the US. Additional LFM and vegetation monitoring inside and outside of the burn units will be added in the future to better understand fire risk and expected fuel behaviors across the Preserve. This may include collecting LFM data in areas that have a higher ignition risk, collecting pre-dawn live fuel moisture measurements to understand the water balance of plants over time, or characterizations of plant diversity across habitat types and their associated burn probabilities.

Habitat Specific Considerations

At the Preserve, there is an enormous opportunity to better understand the role and outcomes of introducing low intensity, prescribed fire in a variety of ecosystem types. The Preserve habitats are largely mosaic, resulting in almost any potential burn unit covering a variety of habitat types, including shrublands, grasslands, and oak woodlands. Research will be stratified by habitat type with special considerations made for any rare, threatened, or endangered species in each habitat type, as well as California Coastal Commission designated Environmentally Sensitive Habitat Areas (ESHAs). Additional protections can also be added for special status individuals such as legacy trees or known archaeological site locations.

Coast Live Oak (*Q. agrifolia*) Woodlands

The Preserve contains about 6,000 acres of coast live oak (*Q. agrifolia*) woodlands. While there is some research on prescribed fire in coast live oak (*Q. agrifolia*) woodlands, the response of the understory and the response of individual trees at various demographic stages themselves are not well understood. Historically, fire has been used in the oak woodlands in the central coast by the Chumash to control pests like acorn weevils (*Curculio* spp.) and reduce brush in the understory (Keeley, 2002; Teresa Romero personal communication 2022). Across multiple oak species, the literature suggests that there is high overall survival of oaks after fire and even those that are top killed often resprout from

the base (Holmes et al., 2008). Fire may promote oak germination and growth, but there are likely a suite of mechanisms driving this pattern, including reduced competition, release of soil nutrients, reduced pathogen load, or increased mineral availability (Holmes et al., 2008). Further investigation is needed to better leverage this pattern for land management purposes. In one study, Schwan et al. (1997) found there was accelerated coast live oak (*Q. agrifolia*) growth following wildfire on the urban fringe. Low-intensity, prescribed fires in the fall, have been demonstrated to promote sapling establishment in well-structured oak woodlands, though careful preparation is required to protect saplings from high fuel loads that may be present and increase residency time of fire (Tietje et al., 2001). Increases in native species cover in the understory of coast live oak (*Q. agrifolia*) woodlands following fire has been documented, but this diminishes over time as nonnative plants are able to encroach (Dagit, 2002). However, fire may impact aboveground biomass of shrub species in the oak understory, reducing the facilitative effect that shrubs can have for seedlings, so protecting seedlings in recently burned areas may be important for seedlings to escape pressure from browsers.

TNC staff are interested in the role of fire to support recruitment of oaks and reduce the extent of noxious weeds in the understory. Two burn units contain areas of coast live oak (*Q. agrifolia*) woodland. Different experiments may be conducted in each burn unit to understand how fire can be leveraged to support the community. We seek to understand if there is increased recruitment and survival of oak seedlings and saplings following prescribed fire, and if there is a change in patterns of understory diversity. Preserve staff are also interested in understanding the role of different levels of preparation of fuel loads – that is, understanding the effects of removing thousand and ten-thousand-hour fuels from the understory and its relationship with fire severity and oak survival. Experiments that also leverage if pastures are grazed or ungrazed can also provide insights to the role of grazing and prescribed fire to reduce fire risk.

Data Collection

Before the 2024 Army Camp oak woodland prescribed burn, Preserve staff collaborated with researchers from Cal Poly San Luis Obispo to develop monitoring protocols (see Appendix 10), which are based on the Forest Service Common Stand Exam Protocol (CSE). The protocols collect measurements on tree characteristics, tree regeneration, understory composition, ground surface cover, and down woody material/fuels. Preserve staff also seek to understand the effects of livestock grazing on fire behavior and post-fire vegetation recovery. Accordingly, 10 monitoring plots were set up within the 2024 Army Camp burn unit, with 5 fenced plots to exclude cattle (*Bos taurus*) grazing. There were also five unburned monitoring plots set up as controls. An interactive map of the experiment location and description of treatment can be found on this map.

Coast live oak (*Q. agrifolia*) are the only tree species we are currently collecting live fuel moisture samples from because of their broad extent across the Preserve. Preliminary data

have been collected identifying percent non-native cover, seedling counts, and sapling counts. Additional data measuring fire behavior, impacts to adult trees, and assessments of tree health have been added to experimental protocols. Staff plan to develop a protocol to identify important legacy trees that should be better protected from prescribed fire operations though preparation work.

Grasslands

Globally, grasslands cover 40% of the terrestrial area, but only ~4% are protected, resulting in widespread degradation (Bardgett et al., 2021; Petermann & Buzhdygan, 2021). In the Western US, grasslands are threatened by a variety of factors, including land use change, desertification, conversion to shrublands, and overgrazing (Conner et al., 2001). In California, a biodiversity hotspot, grasslands support ~40% of CA's native species, but CA grasslands have declined significantly (Stromberg et al., 2007). As a result of the decline in habitat, grassland dependent species are suffering as well, with 74% of grassland birds experiencing population declines since 1970 (Rosenberg et al., 2019). Moreover, climate change driven drying has contributed to decreases in CA grassland plant species richness at both the community and landscape scale (Harrison et al., 2015; Zhu et al., 2024). The biodiversity decline is partly due to a smaller number of exotic grass flora outperforming natives. Without active management, CA grassland biodiversity is expected to continue declining under climate change, due to the traits of exotic species' favoring warmer temperatures, including their larger leaves and seeds, greater specific leaf area and leaf N percentage, annuality, and taller structure (Sandel & Dangremond, 2012).

Broadly, fire has been demonstrated as a potential method to maintain biodiversity in grassland systems (Veldman et al., 2015). In California, frequent (~5-year return interval) prescribed fire has been used as a successful tool to restore native grassland species and reduce non-native annual grasses (Keeley et al., 2023; R. Reiner, 2007). On San Clemente Island, Keeley et al. (2023) monitored grassland composition following two repeated prescribed burn treatments in 2012 and 2017. Sixty plots (10m x 10m) were identified across three sites using a randomized block design, with half of the plots burned and half unburned controls. Within each plot, species density and coverage were recorded within four 1m x 1m quadrats. The first burn had little to no effect on native purple needlegrass coverage (*Nassella pulchra*), which is the dominant native bunchgrass at Dangermond Preserve, while the second burn showed a very small positive change. The native geophyte *Brodiaea kinkiense* had minimal coverage and did not show any change. For non-natives, *Bromus* spp. coverage decreased, *Avena* spp. decreased modestly, and *Festuca* spp. coverage increased during the 9-year monitoring period. Non-native *Erodium* spp. were the dominant forb in both unburned control and burn plots, but they favored the burned areas, with relative cover increasing three-fold throughout the study. Overall, the decrease in large *Bromus* spp. seemed to decrease the competition-driven, non-native inhibition of purple needlegrass growth (Keeley et al., 2023). Implementing a similar experiment can help to understand how fire can be used to manage grasslands in mainland grasslands.

Historically, Indigenous Peoples frequently burned grasslands to promote food/medicine resources and open the landscape, among other benefits (Timbrook et al., 1982). Later, the ranching community used prescribed fire to maintain grasslands for grazing by reducing shrub encroachment, but fire also helped reduce the density of thatch that can inhibit the growth of native species. In experiments that assess the role of fire and grazing on native grass species composition, variable effects have been observed, depending on the target species. A 2002 meta-analysis on 46 different fire and grazing CA grassland restoration studies could not quantitatively determine that fire caused an increase in native species or a decrease in non-natives (D'Antonio et al. 2002). Rather, the outcome depended upon grazing and burn frequency. For example, a single burn typically helps to promote both native and non-native forbs in ungrazed areas, but post-fire grazing decreases non-native abundance while helping to sustain the positive effects on natives. The meta-analysis results also suggested that native *N. pulchra* is more tolerant of fire than *Danthonia californica*. Importantly, the review found that many studies did not provide enough details on methodology and pre-/post-burn restoration management practices to discern clear outcomes (D'Antonio et al., 2002).

In one of the few CA coastal grassland studies (Hatch et al., 2002), a 150-ha area of Pomponio Beach State Park was burned in November 1990. Three 0.25 ha study areas were established, all of which included grazing exclosures. Each study area had two randomly placed 10-m transects for each experimental combination: grazed-burned, grazed-unburned, ungrazed-burned, ungrazed-unburned. Percent foliar cover was recorded along 50 transect points; perennial grass frequency was observed in four 50cm x 50cm transect quadrats; and peak standing crop was measured from two 0.06m^2 quadrats randomly placed in each study area. The results showed no response to fire for the natives *N. pulchra, D. californica*, and a positive response to grazing for *D. californica*, although the study areas were only observed for one-year post-burn (Hatch et al., 2002). In another grazing-fire dynamics study in serpentine grasslands near San Jose (Hernández et al., 2021), eight 50m transects were established with ten 0.5m x 0.5m quadrats along each transect. In the two years following a May 2004 wildfire, native forb richness and cover increased in both ungrazed and grazed burned areas, while non-native grass coverage decreased. In post-fire years 3 and 4, native forb cover maintained increased richness and coverage in the grazed areas, while the benefits subsided in ungrazed areas as non-native grasses increased in coverage (Hernández et al., 2021).

In Tehama County, TNC conducted 13 grassland burns in the spring between 1996 – 2003, studying four prescribed fire assumptions: native forbs increase, native grasses increase, native species richness increases, and annual weeds decrease (R. J. Reiner et al., 2007). Native forbs had a mean increase of 7%, while non-natives forbs increased 10%. These changes follow the understanding that spring burns reduce annual grass seeds, remove grassland thatch, and boost nutrient supply, thus allowing forbs to thrive. The forbs that

thrive the most have protection of their growing parts, such as the native geophyte *Brodiaea* spp. and non-native *Erodium* spp. For native grasses, the Tehama County burns found an average increase of 1%, but results were difficult to discern due to the low initial coverage (<1%). The authors did note a propensity of increased native mortality when the heat of a burn is greater, such as during a backing fire. Regarding native biodiversity increases, the study noted both increases and decreases that fluctuated year to year post-fire, which aligns with other research. Lastly, the study found an average 8% decrease in exotic annual grasses, with 9 out of 13 burns showing more significant decreases than the increases found at 4 burn sites (R. J. Reiner et al., 2007). The authors noted phenology-driven, species-specific outcomes, with other studies finding that *Taeniatherum caput-medusae* could be controlled with a single spring burn (Pollak & Kan, 1998), but *Centaurea solstitialis* needs two or more burns in successive years to control (DiTomaso et al., 1999). At Santa Rosa Plateau Ecological Reserve, spring burns were combined with native forb (*Erodium macrophyllum*) seeding. Fire did not directly enhance *E. macrophyllum* fecundity and germination, but it did help reduce the competition from non-native grasses (Gillespie & Allen, 2004). For an in depth, species-specific review of prescribed burn effects, as well as ideas on how to use fire in an integrated vegetation management strategy, see the review by DiTomaso et al. (2006).

Grassland bird populations are experiencing concerning declines across North America, mostly due to loss of habitat, including rangeland degradation in the Western US. Historically, fire and grazing created a disturbance regime that supported a mosaic of successionally distinct vegetation communities and thus, varied habitat for bird populations (Brennan & Kuvlesky Jr., 2005). While it is well understood that grassland birds can thrive in fire-adapted ecosystems, the timing of spring burns to reduce non-native grasses coincides with the nesting season of grassland birds. Therefore, it is important to monitor nesting activity before and after prescribed fire. In southeastern Arizona, birds were surveyed in fourteen 25-ha plots (7 burned, 7 unburned) using 1km long transects. The abundance of both wintering and breeding birds did not change post-fire, but breeding bird species richness declined the first year post-burn (Kirkpatrick et al., 2002). At Point Reyes National Seashore, songbird populations were monitored following the 1995 Vision Fire. The fast spread of the fire left some riparian unburned patches, which served as refugia for many songbirds. Researchers thought that increased predation from loss of vegetative cover would lead to declines in songbird populations, but the opposite occurred. During the following year, nests within the burned area showed greater productivity than nests in unburned areas (Geupel, 1997). In south-central Washington, avian point counts were conducted, mainly between late April and early May, in various grass and shrub ecosystems for 4 years prior to and 7 years following a severe wildfire. For grassland birds, Grasshopper Sparrow (*Ammodramus savannarum*) and Western Meadowlark (*Sturnella neglecta*) populations were decreasing significantly pre-fire, then stabilized at a mean population level post-fire that was lower than pre-fire. Vesper Sparrow (*Pooecetes gramineus*) populations declined for two years post-fire, then increased for

three years, then declined again for the last two years. Lastly, Horned Lark (*Eremophila alpestris*) increased significantly post-fire (Earnst et al., 2009). Many of these same species are present on the Preserve. In a separate study of avian response following the 2003 Cedar and Otay Fires in southern California, no effects were recorded in low elevation grasslands (Mendelsohn et al., 2008). In general, grass nesting birds favor native mosaic habitats, which can be successfully promoted by fire (Shaffer et al., 2021), and also grazing (Gennet et al., 2017), but considerations should be taken into account, including nearby unburned refugia, mobility, and nestling/fledgling stage (Hovick et al., 2011).

In the grassy understory of oak woodlands, we are interested in the role that both pile burning and broadcast burning can play in supporting increased native biodiversity. We are currently working with researchers to develop experimental protocols that would leverage pile burning as a restoration technique. The concentration of fuels in pile burns causes concentrated soil heating, which has the potential to eradicate the seed bank, including non-natives and natives, thus requiring post-fire seeding. Importantly, pile burning also influences the surface soil through multiple pathways. High heat can cause detrimental effects, such as volatilization of organic carbon and nitrogen, decreased microbial activity, increased pH, and reduced soil water holding capacity (Covington et al., 1991; Jiménez Esquilín et al., 2007; Loupe et al., 2007; Massman & Frank, 2004; Miller et al., 2005). Conversely, the "ash-bed effect" can boost plant-available nutrients, especially nitrogen, calcium, magnesium, potassium, and phosphorus (Neary et al., 2005; York et al., 2009). These effects depend on the pile composition, underlying soil, and burn timing. In the Lake Tahoe region, a pile burning study found that the composition of fuels within the pile affected the soil heating the most, with piles mostly containing large bolewood creating significant heating (400 C) over 10 cm deep, while piles with a mix of all fuel sizes caused >250 C temperatures at 5 cm below the surface. The diameter of the piles did not affect heating, although the pile centers did experience the highest temperatures. Dry and cured fuels can also reduce smoldering, which in turn reduces soil heating (Busse et al., 2013, 2014).

In a pile burn restoration study near Kamloops, British Columbia, the researchers conducted a full factorial stratified, randomized experiment with native seeding, agronomic seeding, and no seeding; addition of commercial inoculum and no inoculum; and addition of straw cover and no straw. Native seeding caused establishment, but non-natives also took hold in those plots at a rate that was not significantly different from the no seeding plots. Agronomic seeding created establishment, while also suppressing non-natives. Straw cover promoted plant establishment and growth, while the arbuscular mycorrhizal fungal inoculant had no effect. The pile burns were conducted in January 2008, treatments occurred in May 2008, and the response variables were measured in July 2009, notably only one year after treatment (DeSandoli et al., 2016).

Grasslands at the Dangermond Preserve

Similar to other areas across California, the 7,000 acres of native and non-native grasslands at the Dangermond Preserve are believed to have had a varied fire regime, due to historical burning of Indigenous Peoples, followed by burning and seeding of non-native grasses by the ranching community. Currently at the Preserve, our primary goal is to maintain the current extent of grasslands and coastal prairie, while supporting and enhancing existing stands of native bunchgrasses. A recent study at the Preserve demonstrated that grassland cover decreased significantly over the last 80 years, attributed to decreases in grazing and fire (Genua et al., 2024). We do not have a goal of eradicating all non-native annual grasses, though we are managing for the extent of pervasive invaders like veldt grass *(Ehrharta calycina).* Broadly, we are interested in understanding if prescribed fire can be used to support the expansion of native bunchgrasses over the long term and for how long fire effects remain present. Additionally, we are interested in understanding how fire and grazing can be used together to support grassland biodiversity and reduce competition between invasive annual grasses and native bunchgrasses and forbs. We plan to implement experiments to better understand and document the role of seasonality in timing the application of prescribed fire to reduce the density and biomass of non-native annual grasses. In addition to impacts to the vegetation community, we are particularly interested in if/how the use of fire can increase the quality of habitat for grassland birds and other grassland wildlife.

Data Collection

The Preserve will begin spring grassland bird monitoring to understand the diversity of bird species present in the grasslands in 2025. Previous monitoring has observed horned larks (*E. alpestris*), lark sparrows (*Chondestes grammacus*), grasshopper sparrows (*A. savannarum*), Western meadowlarks (*Sturnella neglecta*), American kestrels (*Falco sparverius*), California towhees (*Melozone crissalis*), and red-winged blackbirds (*Agelaius phoeniceus*). A fine scale vegetation map being produced with the California Native Plant Society can provide insights to the extent and locations of purple needlegrass (*N. pulchra*) extent across the Preserve grasslands. Residual dry matter (RDM) is measured annually at the Preserve and grazing is managed, with decisions reflected in the annual update of the Preserve's Rangeland Management Plan.

Shrublands

Globally, shrubland systems dominate the five Mediterranean-type climate regions and include the greatest flora biodiversity outside of the tropics. These ecosystems are unique with evergreen sclerophyll shrub diversity, along with many annuals and herbaceous perennials. Mediterranean climate regions only cover 2.2% of land area, but they contain nearly 17% of the world's vascular plant species (Rundel, 2018). These regions are also experiencing heavy impact from human activities, especially in California, causing biodiversity loss due to conversion and degradation of habitat, invasion of non-native

species, land use change, and nitrogen deposition (Underwood et al., 2009). In western North America, the Mediterranean shrublands are known as chaparral and mostly occur in California. The diversity of chaparral species composition has led to many subgroups, including 44 community types (Holland, 1986) or 60 classified alliances (Sawyer et al., 2009), which indicates how management of different chaparral ecosystems can vary. The type of chaparral in a given location is influenced by the typical soil moisture conditions. In more xeric locations, species are typically drought tolerators, with shallower roots and drought tolerant physiology, which helps with seedling recruitment post-fire. More mesic chaparral are often drought avoiders, with deeper roots and a propensity to resprout post-fire, due to their dependency on their deep roots for drought survival (Keeley, 2018). Additionally, chaparral can be broken into two types, "hard", or dominated by more woody species (e.g., chamise (*Adenostoma fasciculatum*), ceanothus (*Ceanothus* spp.), mountain mahogany (*Cercocarpus* spp.), manzanita (*Arctostaphylos* spp.), scrub oak (*Quercus berberidifolia*), toyon (*Heteromeles arbutifolia*)) and "soft" or "maritime", which is dominated by less woody species (e.g., CA sagebrush (*Artemesia californica*), purple sage (*Salvia leucophylla*), laurel sumac (*Malosma laurina*)), and often referred to as coastal sage scrub (Jennings, 2018).

Chaparral systems have evolved with fire, with some patterns in biodiversity even being driven by fire (Keeley, 2018). Fires are often large, stand-replacing crown fires that kick off a series of successional species. Initially, fire-following annuals and herbaceous perennials sprout from seed banks that are triggered by ash deposits. A majority of shrubs can re-establish through resprouting from root crowns, but some are obligate seeders, while others combine seedling recruitment and resprouting (Pratt et al., 2008). Within 10 years post-fire, shrub canopies close, shading out ephemeral flora until the next fire. For another decade or so, canopies continue to expand, keeping the live/dead fuel ratio high, and thus flammability lower. As chaparral ages, dead fuels accumulate and raise the susceptibility to fire (Rundel, 2018). The historic fire return interval varies greatly, with an estimate of about 30 years in areas prone to lightning ignition and potentially greater than 100 years in coastal areas with rare lightning (Van De Water & Safford, 2011). Within the first 5 years post-fire, chaparral is the most vulnerable, due to the possibility of dry flashy fuels (e.g. non-native grasses) carrying fire through an area experiencing shrub regrowth. An area is even more susceptible to re-burn if the previous fire was only moderate severity and left available dead fuels (Keeley et al., 2012). Too frequent of fire can kill shrub regrowth and lead to type conversion, where non-native grasses or subshrubs permanently take over. Due to their reliance on seedling recruitment, obligate seeders are more vulnerable to frequent fire than resprouters (Syphard et al., 2006).

Through ethnographic and biogeographic evidence, researchers believe that Native Americans utilized fire for many purposes, including enhanced growth of plants used for food, medicine, basketry, and cordage, maintenance of habitat for game animals, control of plant insects and pathogens, increased water availability, and improved travel and safety in

communities. This burning of chaparral likely began not long after humans arrived in the area over 12,000 years ago. The use of fire was constantly refined to produce a mosaic of open grasslands interspersed with differing age classes of shrublands and woodlands. Researchers believe this early type conversion likely contributed to the current mosaic of grasslands, shrublands, and woodlands throughout California (Anderson & Keeley, 2018). During the ranching period, controlled burn induced type conversion was intentionally used to increase the spread of rangeland, with non-native grasses often seeded post-fire.

The varied history of land management in chaparral, as well as the introduction of alien species, make it hard to determine if and when prescribed fire would be beneficial to the ecosystem to meet biodiversity objectives. In a study on post-fire recovery in Orange County, CA, 58 coastal sage scrub (22 burned, 36 unburned) and 39 grassland transects (13 burned, 26 unburned) were monitored between 2007-2021 with the Canyon 2 Fire occurring in 2017. Vegetation cover was determined by identifying species that intersected a vertical 1.7m dowel every 1m along the 50m transect. Species richness and diversity were recorded at ten 1x1m quadrats along the transects. In the coastal sage scrub sites four years post-fire, native shrub cover remained 50% lower than pre-fire levels, but there was an increase between year 3 and 4. Species richness was higher along burned transects compared to unburned, but the unburned transects showed native shrub cover increases in all of the years post-fire. Native forb, non-native forb, and non-native grass cover increased along the coastal sage scrub transects through year 3 post-fire, but then all began declining in year 4, although these declines matched trends recorded along unburned transects (Li et al., 2024). The slow recovery of CA sagebrush (*A. californica*), black sage (*Salvia mellifera*), and CA buckwheat (*Eriogonum fasciculatum*), which all employ both resprouting and seedling recruitment post-fire, can allow non-native grasses and forbs to prosper (Keeley, Baer-Keeley, et al., 2005; Keeley et al., 2006; Pausas & Keeley, 2014). Part of the recorded low native shrub cover recovery is due to the authors of this study classifying *Acmispon glaber* as a native forb, rather than native shrub, which other previous studies have done (Li et al., 2024). In another study using the same transects, native shrub cover was reported as having recovered four years after the 2007 Santiago fire. In reality, shrub cover had shifted from *A. californica* to *A. glaber* (Kimball et al., 2018). As mentioned above, chaparral ecosystems can take up to 10 years to fully recover their canopy, so it is possible that deerweed (*A. glaber*) is an intermediate successional species before the final successional species (e.g. *A. californica*, *S. mellifera, E. fasciculatum*) fully recover.

In another southern California study, 90 sites (14 coastal chaparral; 22 coastal sage scrub; 26 interior chaparral; 28 interior sage scrub) were monitored in the spring for five years after wildfires in late October and early November 1993. Study sites (20 x 50m) were subdivided into ten, 10 x 10m plots, with two 1x1m quadrats in opposite corners used to measure density and cover. The first growing season post-fire saw 68% ground cover recovery at coastal and interior chaparral sites, with coastal sage scrub having 52% cover and interior sage scrub having 83%. All but coastal sage scrub saw little change in woody

plant density, with pre-fire shrubs either resprouting or recruiting seedlings, causing steady increases in size and cover through the five years. The coastal sage scrub sites were dominated by *Encelia californica* (bush sunflower) and *Hazardia squarrosa* (sawtooth goldenbush), which do not establish seed banks. These subshrubs did resprout year 1 and vigorously flower, producing strong seedling recruitment in the second year. For both sage scrub types, pre-fire stand age was correlated with fire severity, which was then negatively correlated with shrub recovery, indicating subshrub sensitivity to fire severity. The larger-stature chaparral shrubs did not have pre-fire stand age and fire severity relationships (Keeley et al., 2005).

When observing chaparral recovery during prescribed fires in the 1980s, researchers noted that chamise (*A. fasciculatum*), a dominant hard chaparral resprouter, experienced the highest mortality with high fire intensity or when burns were conducted during the growing or flowering season. Obligate seeder recruitment, such as manzanita (*Arctostaphylos spp.*) and buck brush (*Ceanothus cuneatus*), was found to mostly depend on the season of the burn. Seedling survival is highly dependent on the ability of the seedling to establish roots before the following dry season. Therefore, cool season burns allowed obligate seeders to establish with lower competition of non-natives and enough time to develop roots that can withstand the dry season, as long as there was sufficient precipitation during the wet season (Florence & Florence, 1988).

Locally in Santa Barbara County, four prescribed fires in 2022, 2023, and 2024 containing sage scrub have been conducted as part of a vegetation management plan near Sedgwick Reserve. These areas are being monitored to determine vegetation response and recovery, with current resprouting data varying between burns (Frank Davis, personal communication). More research is needed to better understand if, how, and when prescribed fire can be an appropriate management tool to potentially reduce the fire danger of nearby communities, while also supporting the biodiversity of these unique ecosystems. Embedding research within relatively small prescribed fires in these habitat types can inform models that predict fire behavior and outcomes. To date, most of these fuel models are based on conifer ecosystems and do not reflect the various types of shrubs that burn increasingly frequently in Southern California catastrophic wildfires.

Shrublands at the Dangermond Preserve

There are approximately 10,000 acres of chaparral and scrub habitat across the Dangermond Preserve. Any scrub and chaparral burning on the Preserve is limited to small areas within larger burn units. We do not currently have plans to burn the relatively small areas of mature, "hard" chaparral on the Preserve, some of which is dominated by rare, endemic La Purisima (or Lompoc) Manzanita (*Arctostaphylos purissima*). We are actively working to develop research to better understand the La Purisima Manzanita (*A. purissima*), with no plans to apply fire to this rare shrub habitat. The "soft" maritime chaparral is Venturan coastal sage scrub and may be more resilient to post-fire invasion

given that along the coast, sites are relatively mesic. There have been no documented fires in the Preserve shrublands over the last 40 years, which would also help recovery, as the vegetation is mature and within the estimated, and likely natural, 30 to 90-year return interval. Small experiments where pockets of coastal sage shrub are embedded within burn units can help us better understand the diversity, maturity, resilience, and expected recovery of shrub systems.

Data Collection
Prior to the 2022 TREX, the Dangermond Team enlisted the services of Padre Associates to conduct pre-fire vegetation surveys. This small study of the shrublands at the Preserve measured shrub cover and species diversity. We plan to expand this work with shrub monitoring plots in both the Army Camp and Horse Pasture burn units to measure the biodiversity impacts before and after the implementation of prescribed fire. Measurements of fire severity and intensity within the shrub systems will also give insights to the relationship between post-fire recovery and fire behavior.

Live fuel moisture sampling of three shrub species, purple sage (*S. leucophylla*), California sagebrush (*A. californica*), and coyote brush (*Baccharis pilularis*), began in March 2024 at both burn units to assess fire danger and moisture dynamics. Additional pre-dawn live fuel moisture sampling could also help inform the diurnal water use dynamics, water status, and soil water availability in the shrublands at the Preserve. By co-locating these sampling sites close to wells and at various distances from the coast, we also hope to study the relationship between groundwater availability, coastal influence, and live fuel moisture. By collecting live fuel moisture across the entire year, we can start to develop LFM curves to estimate when fire risk is the highest.

Through review of other shrubland-fire research, it is clear that there are many confounding factors that can affect post-fire recovery. Pre-fire monitoring and control plots are crucial to determining if post-fire conditions deviate from natural variability. Stand age is also important, which is difficult to decipher at the Preserve due to undocumented controlled burns on the ranches before TNC ownership. Live to dead fuel ratio is pertinent and could help estimate stand age. Fire severity is also important to quantify, despite the difficulties in doing so. If an area of obligate seeders was burned, it would be helpful to know the composition of the seed bank pre-burn. Lastly, environmental conditions pre- and post-burn play a large role in vegetation recovery and non-native species colonization. Research plot monitoring should be done annually for at least 5 years, but ideally longer to fully understand shrubland recovery. Given the limitations in what we know about the relationship between prescribed fire and biodiversity, the Preserve and Santa Barbara region can serve as a leader in refining models of fire behavior, post-fire recovery, and habitat restoration in this rare ecosystem.

Community Engagement

The Santa Barbara County community has made significant progress in building collaborations in fire management amongst fire agencies, private landowners, and public lands. Through Community Wildfire Protection Plans, communities are collaborating on actions to reduce their risk to wildfire. TREX events have built partnerships in training and implementing beneficial, prescribed fire to lands within the County. SBCFD has been working with private landowners for years to support Vegetation Management Program (VMP) burns to accomplish various goals of private landowners.

The Dangermond Preserve's leadership in supporting annual Santa Barbara TREX events is aimed at building a community of fire practitioners in the County through fire training and prescribed fire projects that prioritize research and learning. Currently, our collaborators in TREX include TNC CA's Fire Team within the forest strategy in the Climate Program, UCSB Sedgwick Reserve, Santa Barbara County Fire Safe Council, Cal Poly University, UCSB, Santa Ynez Band of the Chumash Indians, and the Santa Barbara County Fire Department. Moving forward, we are aiming to include additional collaborators, with a focus on working with established indigenous burning communities across California and the West. The Preserve Scientist is also taking part in the Indigenous People's Burning Network Beginner's Working Group on cultural burning to build partnerships beyond our local tribal engagements and learn from other partners across TNC North America as they support cultural burning.

Continuing collaborations and relationship building with the Santa Barbara County Fire Department is a priority to ensure the Fire Department is informed and engaged in the Preserve's fire management and has the best available information if a wildfire response is needed. This includes firefighting road access, helicopter landing locations, water sources, and sensitive areas to protect. As one of the largest private landowners along the Santa Barbara coast, the Preserve will also continue to participate in community planning efforts to reduce wildfire risk including the Gaviota Coast Community Wildfire Protection Plan.

Fire Management by Zone

The Preserve is broken into nine management zones (Figure 8) that contain a series of pastures that are grazed on a rotation. Management occurs across and within zones on the Preserve. The following sections outline fire management activities within each management zone and a summary of information relevant to fire management.

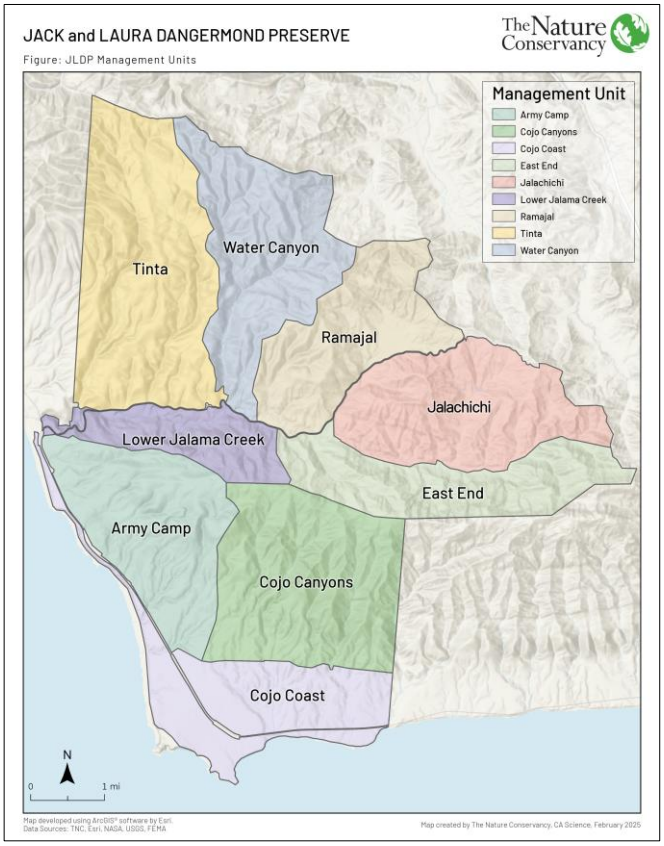


Figure 8: Management zones at the Jack and Laura Dangermond Preserve. The Management Zones contain multiple pastures.

Army Camp

Management Zone at a Glance:

Total Acres	2,731.10
Water Infrastructure	6 wells, 5 tanks, 10 troughs
Restoration Sites	0 sites
Top Three Dominant Vegetation Types **(see Appendix 11 for full description of vegetation types in Management Zone)**	California sagebrush (*A. californica*) scrub (1087.52 acres) Non-native annual grassland (438.45 acres) Coast live oak (*Q. agrifolia*) woodland (325.41 acres)
Number of Burn Units Within Management Zone	1 – Army Camp West Burn Unit
Acres in High Fire Hazard Severity Zone	1,972 ac. in Very High (72%); 760 ac. in High (28%)
Built Infrastructure	Cojo Road, Army Camp bunkers site, telecommunications tower at Bunker Hill, 5 weather stations, and 4 well sensors.

Wildfire History and Prescribed Fire History

In 2004, a 320-acre wildfire burned through the Lower Jalama Creek Management Zone and into the Army Camp Management Zone. A majority of the area burned (~300 acres) was coastal sage scrub habitat (Figure 2). Over the last 100 years, there were range improvement burns in the Army Camp Management Zone to improve forage for cattle and reduce shrub encroachment. However, the extent and frequency of the burns for these purposes is unknown.

Management Actions to Reduce Wildfire Risk

- The Army Camp West Burn Unit is within the Army Camp Management Zone. Prescribed burning in this burn unit is aimed at understanding how prescribed fire can be used to enhance oak woodland and grassland understory habitat, while reducing fire risk.
- Cattle grazing is being used to reduce fine fuels in the grasslands and oak woodland understory, targeted during the growing season.

- Cutting and removing downed limbs and trees across and within about 20 feet of roads to limit fuel loads near roads and allow safe access on the dirt roads.
- Mowing roads in the spring and early summer to reduce fire ignition risk by vehicles. Stewardship staff prioritize mowing more frequently used roads, including Long Canyon Rd., Army Camp Rd., Bunker Loop Rd., Bunker Rd., and Black Canyon Rd.
- In the spring and summer, mowing and weeding around the built infrastructure in the Management Zone including telecommunications towers, weather stations, water infrastructure, and monitoring sensors.

Army Camp West Burn Unit

Army Camp West Burn Unit		
Unique Veg Classes	**Acres**	**Percentage of Coverage**
Coast Live Oak (*Q. agrifolia*) Woodland	68.3	85.38%
California Sagebrush (*A. californica*) Scrub	4.96	6.22%
Purple Sage (*S. leucophylla*) Scrub	3.48	4.35%
Developed/Disturbed Areas	1.66	2.08%
Non-native Grassland	1.58	1.97%

The burn unit in Army Camp is 80 acres and the only burn unit in the Army Camp Management Zone (Figure 9). The burn unit is predominantly coast live oak (*Q. agrifolia*) woodland with a non-native annual grass understory. During the 2022 Santa Barbara TREX, participants conducted pile burning in the understory, with approximately 80 piles burned, as well as a one-acre broadcast burn in the coastal sage scrub. Anecdotally, coastal sage scrub recovery seems to be good with high native cover and resprouting of shrubs two years following the burn, although more robust monitoring will be needed in the future to quantify burn outcomes. In 2024, the Santa Barbara TREX burned the southeast third of the burn unit (~23 acres) in a broadcast burn. Research infrastructure was installed prior to the burn (see the next section on Research Objectives), and a squad of fire effects monitors took detailed weather and fire behavior measurements during firing operations (see the FEMo Report in Appendix 12).

Research Objectives

Coastal Sage Scrub

In the areas of coastal sage scrub, we are currently monitoring Live Fuel Moisture (LFM). LFM sampling occurs twice per month inside the burn unit and in an adjacent shrub area outside the burn unit. LFM monitoring can help to better understand how fire risk and phenology within the shrublands may change throughout the year. No research is currently planned in the coastal sage scrub areas for this burn unit given the small acreage present and resulting difficulty to create replicate plots within the burn unit.

Oak Woodlands

The oak woodlands in the Army Camp West Burn Unit are the central area for research associated with the prescribed fire program at the Preserve. Research objectives include the following:

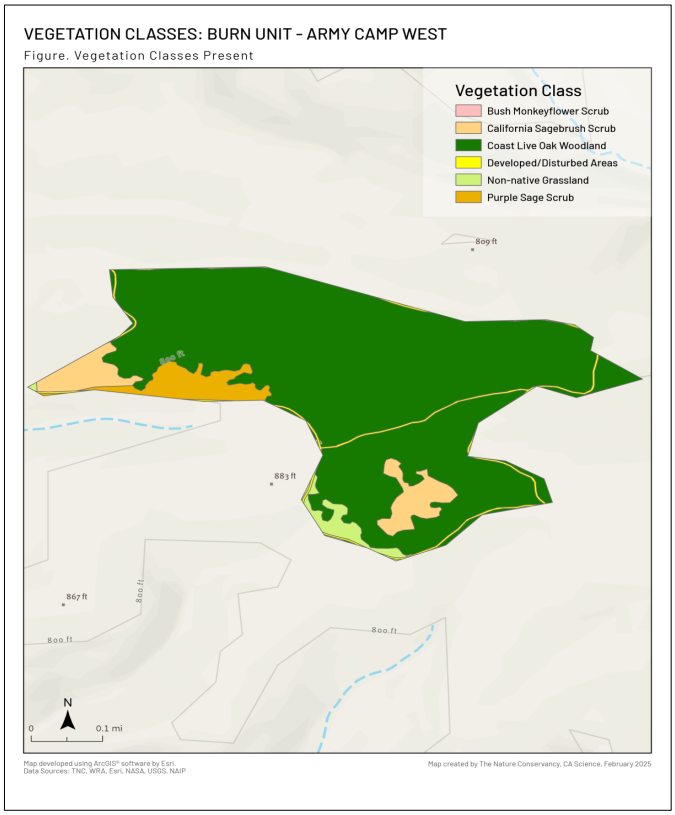


Figure 9: Army Camp Burn Unit Vegetation Map. The unit is primarily made up of coast live oak (Q. agrifolia) woodland. See the above table for acreages.

- Understanding how prescribed fire impacts coast live oak (*Q. agrifolia*) trees, including recruitment of seedlings, survival of saplings and adults, and impacts on adult tree health.
- Understanding how prescribed fire impacts understory plant diversity.
- Characterizing the relationship between grazing, prescribed fire, and biodiversity.

In August 2024, 15 research plots were established inside and adjacent to the Army Camp West Burn Unit (Figure 10) to understand the relationship between grazing, prescribed fire, and plant biodiversity. There are five plots that exclude grazing that were burned in the 2024 Santa Barbara TREX, five plots that allow grazing that were burned in the 2024 Santa Barbara TREX, and five plots that allow grazing that were not burned. All plots are being monitored through a research partnership with Dr. Ashley Grupenhoff at Cal Poly San Luis Obispo (see Appendix 8 describing current research projects). Plots are being monitored using a modified Common Stand Exam protocol (see Appendix 10 for the full

monitoring protocol). Data were collected prior to burning, two weeks post burn, and is currently expected in the Spring and Fall 2025. Monitoring will continue annually thereafter. Factors being monitored include tree regeneration, adult health, and plant diversity. Monitoring is aimed to continue into perpetuity to understand how diversity may change over time and the unit may be reburned in the future. During firing operations, an additional 45 pyrometers were deployed in a 50m x 50m grid to understand how maximum surface temperature varied across the burn unit. At each witness tree for each plot within the burn unit, pyrometers were placed at the soil surface, dbh, and 2m high on the uphill side of the tree to understand how temperature varied by height. Finally, 6 soil ibuttons were deployed in each plot (3 in the northwest corner and 3 in the southeast corner) at different depths to understand soil heating. More information on protocols and deployments can be found in this online viewer.

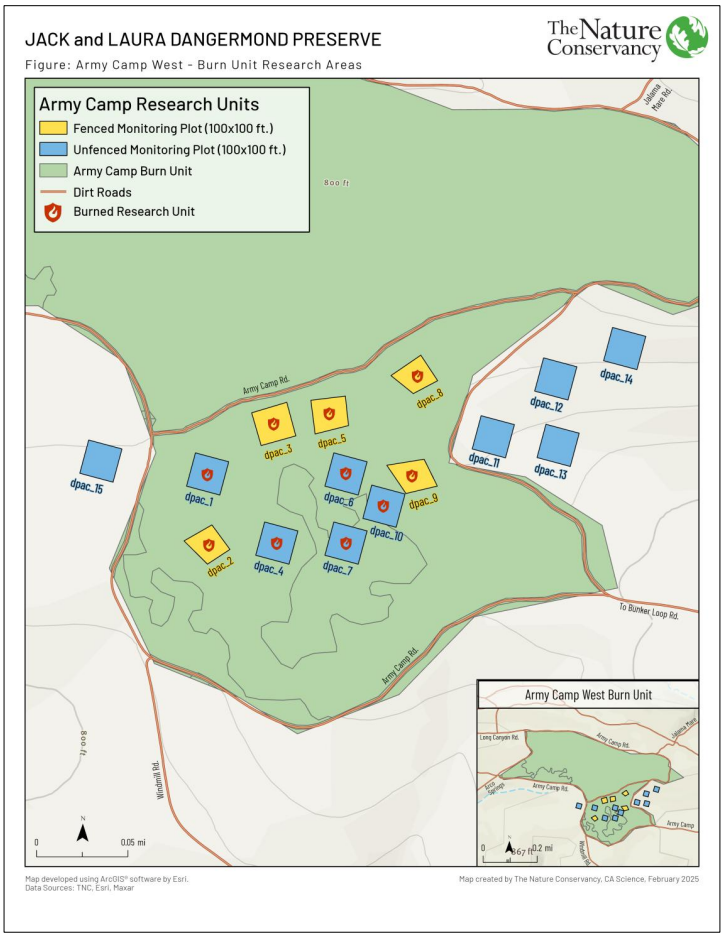


Figure 10: Army Camp prescribed fire and grazing experimental plots. There are 5 plots outside the burn unit that are unburned and grazed. There are 5 plots inside the burn unit that are burned and grazed. And there are 5 plots inside the burn unit that are burned and ungrazed.

Cojo Canyons Management Zone

Management Zone at a Glance:

Acres	3,481.53
Water Infrastructure	6 wells, 5 tanks, 10 water troughs
Restoration Sites	0 sites
Top Three Dominant Vegetation Types (see Appendix 11 for full description of vegetation types in Management Zone)	California sagebrush (*A. californica*) scrub (540 acres) Non-native annual grassland (764 acres) Coast live oak (*Q. agrifolia*) woodland (495 acres)
Number of Burn Units Within Management Zone	0
Area in High Fire Hazard Severity Zone	3,362 ac. in Very High (97%) 120 ac. In High (3%)
Built Infrastructure	Telecommunications tower, fire camera, water cistern, 2 weather stations, and 2 well sensors.

Wildfire History and Prescribed Fire History

There is no documented wildfire or prescribed fire history in the Cojo Canyons Management Zone. There may have been range improvements burns in the mid-1900's, but there is no documentation currently known in this area.

Management Actions to Reduce Wildfire Risk

- There are currently no prescribed burn units identified in the Cojo Canyons Management Zone. The proximity to Hollister Ranch to the east and the steep, heavily vegetated canyons make this Management Zone unlikely for prescribed fire in the near future.
- Cattle grazing is being used to reduce fine fuels in the grasslands and oak woodland understory, targeted during the growing season.
- Cutting and removing downed limbs and trees across and within about 20 feet of roads to limit fuel loads near roads and allow safe access on the dirt roads.
- Mowing roads in the spring and early summer to reduce fire ignition risk by vehicles. Stewardship staff prioritize mowing more frequently used roads, including Shortcut Rd., Ridge Rd., Willow Rd., and Damsite Rd.

- In the spring and summer, mowing and weeding around the built infrastructure in the Management Zone including Relay Ridge Telecommunications tower and water infrastructure.

Cojo Coast Management Zone

Management Zone at a Glance:

Acres	2,478.23
Water Infrastructure	16 water troughs, 1 water tank, 0 wells.
Restoration Sites	CCC Ice Plant Restoration, Cojo Marine Terminal Restoration
Top Three Dominant Vegetation Types **(see Appendix 11 for full description of vegetation types in Management Zone)**	Non-native annual grassland (675 acres) Menzie's Golden bush (*Isocoma menziesii*) Shrub (457 acres) California sagebrush (*A. californica*) scrub (431 acres)
Number of Burn Units Within Management Zone	1 – Cojo Marine Terminal
Area in High Fire Hazard Severity Zone	2,402 ac. in Very High (98%) 43 ac. In High (2%)
Built Infrastructure	Cojo Road, PCI Headquarters, Dangermond Conservation Foundation Parcel, School House, Teacher's House, Point Conception Lighthouse and associated buildings (on VSFB property), 1 weather station.

Wildfire History and Prescribed Fire History

There is no documented wildfire or prescribed fire history in the Cojo Coast. Early records of Spanish colonizers describe the smoke in the region seen from off the coast of Pt. Conception from Chumash land stewardship using fire, however we do not know exact locations. There may have also been range improvements burns in the mid-1900's, but there is no documentation currently known in this area.

Management Actions to Reduce Wildfire Risk

- The methods for wildfire protection at the Cojo Headquarters is completing annual defensible space work around structures and driveways (see Defensible Space Plan).
- We will manage fine fuel ignition sources adjacent to the Cojo Headquarters by grazing and mechanical methods.

- In the spring and summer, mowing and weeding around the built infrastructure in the Management Zone including weather stations, water infrastructure, and monitoring sensors.

Additional Considerations

- The risk of wildfire is low in the Cojo Coast Management Zone; however, historic structures at the Cojo headquarters should be protected from potential wildfire.
- There are two large groves of eucalyptus (*Eucalyptus* spp.) trees that are important overwintering sites for monarch butterflies (*Danaus plexippus*). Planning is underway to manage these groves to reduce wildfire risk and support important habitat.

Cojo Marine Terminal Burn Unit

The Cojo Marine Terminal (CMT) Burn Unit has been identified to prepare the site for native plant restoration as part of the Cojo Marine Terminal CCC-mandated restoration project.

Cojo Marine Terminal Burn Unit		
Unique Veg Classes	**Acres**	**Percentage of Coverage**
Non-native Grassland	23.98	68.20%
Semi-natural Herbaceous Stands	9.65	27.43%
California Sagebrush (*A. californica*) Scrub	1.26	3.59%
Developed/Disturbed Areas	0.20	0.56%
Coastal Bluffs	0.04	0.13%
Coastal Strand	0.03	0.08%

Research Objectives

In the CMT Burn Unit, we are most interested in how prescribed fire can be used to prepare largely invaded grassland sites for restoration to coastal scrub habitat. The CCC-mandated restoration site is 5.9 acres, and the burn unit encompasses this area for a total of 35 acres. By burning this larger area, we can leverage roads and topographic features for better holding and management of fire behavior. The restoration area of the unit will be hydroseeded with native coastal terrace species (see restoration plan, which can be made available on request) and the remaining area will recover without additional planting.

Vegetation monitoring will characterize how the plant diversity may recover differently in the ungrazed, burned plot. Additional surveys are planned to identify the impacts of prescribed fire and restoration on the presence of grassland bird diversity and abundance.

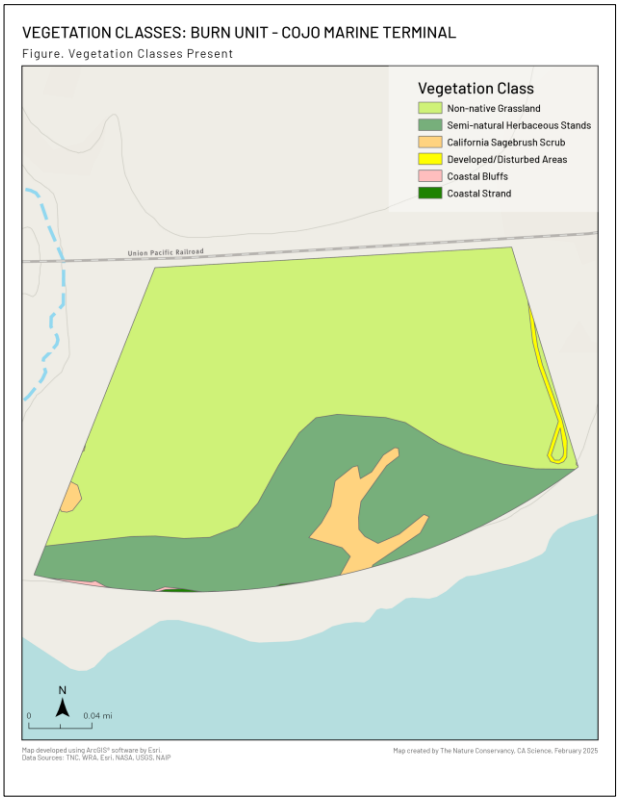


Figure 11: Cojo Marine Terminal burn unit vegetation map. The unit is primarily made up of non-native annual grassland. See the above table for acreages.

East End Management Zone

Management Zone at a Glance:

Acres	2,156.48
Water Infrastructure	10 water troughs, 3 water tanks, 3 wells.
Restoration Sites	0 sites
Top Three Dominant Vegetation Types (see Appendix 11 for full description of vegetation types in Management Zone)	Coast live oak (*Q. agrifolia*) woodland (1,258) Tanoak (*Notholithocarpus densiflorus*) Forest (292 acres) Coyote Brush (*B. pilularis*) Shrub (227 acres)
Number of Burn Units Within Management Zone	0
Area in High Fire Hazard Severity Zone	2,134 ac. in Very High (99%) 22 ac. In High (1%)
Built Infrastructure	Jalama Road, Diamond corrals, Diamond pole barn

Wildfire History and Prescribed Fire History

There is no documented wildfire or prescribed fire history in the East End Management Zone.

Management Actions to Reduce Wildfire Risk

The East End Management Zone contains a significant amount of heavy fuels in the coast live oak (*Q. agrifolia*) woodlands and tanoak (*N. densiflorus*) forest. The Management Zone is also adjacent and upwind of the Hollister Ranch, making it a risk to transferring fire from the Preserve to neighboring properties, and as a result this management is unlikely to be a candidate for prescribed fire in the future. While management actions to reduce fire risk are limited in the Management Zone, it is critical that the Preserve maintains safe roads for firefighting access and evacuation during a wildfire.

- Jalama Road, a primary fire ignition source, is adjacent to a portion of the East End Management Zone. While TNC does not control management of Jalama Road, we will work with the County to ensure the roadside's vegetation is mowed and sprayed during the growing season.

- Cattle grazing along Jalama County Road is being used to reduce fine fuels and reduce fire ignition potential.
- Cutting and removing downed limbs and trees across and within about 20 feet of roads to limit fuel loads near roads and allow safe access on the dirt roads.
- Mowing roads in the spring and early summer to reduce fire ignition risk by vehicles.
- In the spring and summer, mowing and weeding around the built infrastructure in the Management Zone including grazing infrastructure, water infrastructure, and monitoring sensors.

Jalachichi Management Zone

Management Zone at a Glance:

Acres	2822.96
Water Infrastructure	7 water troughs, 8 water tanks, 4 wells.
Restoration Sites	CCC Jalachichi Ponds Restoration. Oak Restoration at Narrow Field.
Top Three Dominant Vegetation Types (see Appendix 11 for full description of vegetation types in Management Zone)	Non-native Annual Grassland (914.14) Coast Live Oak (*Q. agrifolia*) Woodland (837.96) Coyote Brush (*B. pilularis*) Scrub (364.30)
Number of Burn Units Within Management Zone	0
Area in Very High Fire Hazard Severity Zone	255 ac. in Very High (9%) 2560 ac. In High (90%)
Built Infrastructure	Jalama Road

Wildfire History and Prescribed Fire History

There is no documented wildfire or prescribed fire history in the Jalachichi Management Zone.

Management Actions to Reduce Wildfire Risk

The Jalachichi Management Zone is adjacent to the East End Management Zone which contains a significant amount of heavy fuels in the coast live oak (*Q. agrifolia*) woodlands and tanoak (*N. densiflorus*) forest. The Management Zone is also adjacent to neighboring ranches, including Rancho San Julian, making the Management Zone a risk to transferring fire from the Preserve to neighboring properties. The Management Zone contains a stand of La Purisima Manzanita (*A. purissima*), a rare endemic of Santa Barbara County, which grows in a dense stand on the Preserve. This important species may be especially sensitive to fire, but also an obligate fire seeder (requires fire for the seeds to germinate). Research is currently being developed to assess the health of the manzanita stand and how to best manage it. While management actions to reduce fire risk are limited in the Management Zone, it is critical that the Preserve maintains safe roads for firefighting access and evacuation during a wildfire.

- There are currently no prescribed burn units identified in the Jalachichi Management Zone. The proximity to neighboring properties and the steep, heavily vegetated hillsides make this Management Zone unlikely for prescribed fire in the near future.
- Jalama Road, a primary fire ignition source, is adjacent to a portion of the Jalachichi Management Zone. While TNC does not control management of Jalama Road, we will work with the County to ensure the roadside's vegetation is mowed and sprayed during the growing season.
- Cattle grazing along Jalama County Road is being used to reduce fine fuels and reduce fire ignition potential.
- Cutting and removing downed limbs and trees across and within about 20 feet of roads to limit fuel loads near roads and allow safe access on the dirt roads.
- Mowing roads in the spring and early summer to reduce fire ignition risk by vehicles.
- In the spring and summer, mowing and weeding around the built infrastructure in the Management Zone including weather stations and water infrastructure.

Lower Jalama Creek Management Zone

Management Zone at a Glance:

Acres	1,229.53
Water Infrastructure	12 water troughs, 2 water tanks, 1 well.
Restoration Sites	Fish Passage Barrier Removal Projects (JA-1 and JA-2)
Top Three Dominant Vegetation Types **(see Appendix 11 for full description of vegetation types in Management Zone)**	Non-native grassland (371 acres) Coast live oak (*Q. agrifolia*) woodland (338 acres) Purple sage (*S. leucophylla*) scrub (112 acres)
Number of Burn Units Within Management Zone	0
Area in High Fire Hazard Severity Zone	198 ac. in Very High (16%) 1,027 ac. In High (84%)
Built Infrastructure	Jalama Ranch pipeyard, Jalama Road, 1 weather station, and 1 well sensor.

Wildfire and Prescribed Fire History

In July 2004, a 320-acre wildfire started in the Lower Jalama Creek Management Zone near Jalama County Road. The wildfire's perimeter was on both the Lower Jalama Creek and Army Camp Management Zones. There is no known prescribed fire history in the Lower Jalama Creek Management Zone, but there may have been range improvement burns in the 1900's.

Management Actions to Reduce Wildfire Risk

- There are currently no prescribed burn units identified in the Jalachichi Management Zone.
- Jalama Road, a primary fire ignition source, is adjacent to a large portion of the Lower Jalama Creek Management Zone perimeter. While TNC does not control management of Jalama Road, we will work with the County to ensure the roadside's vegetation is mowed and sprayed during the growing season.
- Cattle grazing along Jalama County Road in Jalama Bull and Jalama Mare pastures is being used to reduce fine fuels and fire ignition potential.
- Mowing roads in the spring and early summer to reduce fire ignition risk by vehicles.

- In the spring and summer, mowing and weeding around the built infrastructure in the Management Zone including grazing infrastructure, weather stations, water infrastructure, and monitoring sensors.

Ramajal Management Zone

Management Zone at a Glance:

Acres	2,312.13
Water Infrastructure	9 water troughs, 8 water tanks, 5 wells.
Restoration Sites	Oak Restoration at Ramajal Field and Venadito Field.
Top Three Dominant Vegetation Types **(see Appendix 11 for full description of vegetation types in Management Zone)**	Non-native grassland (466 acres) Coast live oak (*Q. agrifolia*) woodland (493 acres) Semi-natural herbaceous stands (318 acres)
Number of Burn Units Within Management Zone	0
Area in High Fire Hazard Severity Zone	429 ac. in Very High (19%) 1,646 ac. In High (71%)
Built Infrastructure	Jalama Road. Pig fencing perimeter on oak restoration sites.

Wildfire and Prescribed Fire History

There is no documented wildfire or prescribed fire history in the Ramajal Management Zone. However, range improvement burns may have occurred in the 1900's.

Management Actions to Reduce Wildfire Risk

- There are currently no prescribed burn units identified in the Ramajal Management Zone. However, some sites may be identified in the future.
- Jalama Road, a primary fire ignition source, is adjacent to a portion of the Ramajal Management Zone perimeter. While TNC does not control management of Jalama Road, we will work with the County to ensure the roadside's vegetation is mowed and sprayed during the growing season.
- Cattle grazing in pastures adjacent to Jalama County Road is being used to reduce fine fuels and reduce fire ignition potential.
- Mowing roads in the spring and early summer to reduce fire ignition risk by vehicles.

Tinta Management Zone

Management Zone at a Glance:

Acres	4,166.12
Water Infrastructure	12 water troughs, 8 water tanks, 18 wells.
Restoration Sites	0 sites
Top Three Dominant Vegetation Types **(see Appendix 11 for full description of vegetation types in Management Zone)**	Coast live oak (*Q. agrifolia*) woodland (1,125 acres) Purple sage (*S. leucophylla*) scrub (1,024 acres) Non-native grassland (591 acres)
Number of Burn Units Within Management Zone	3 Burn Units: 1. Cherry Ridge 2. Jalama Horse Pasture 3. Jalama Headquarters
Area in High Fire Hazard Severity Zone	1,762 ac. in Very High (43%) 2,025 ac. In High (49%)
Built Infrastructure	Jalama Ranch Headquarters, including the historic barn, staff residences, shop, and additional facilities. 4 weather stations, and 5 well sensors.

Wildfire and Prescribed Fire History

The Tinta Management Zone has the most extensive wildfire history of the management zones on the Preserve. In 1981, a 7,800-acre wildfire started on VSFB and burned into the Tinta Management Zone, covering most of the Management Zone area. In 2002, another wildfire from VSFB burned along the Preserve's border and into the West Tinta pasture. Anecdotally, range improvement prescribed fires also occurred in the Tinta Management Zone, but the exact perimeters, frequency, and timing are unknown.

Management Actions to Reduce Wildfire Risk

- The methods for wildfire protection at the Jalama headquarters is completing annual defensible space work around structures and driveways (see Defensible Space Plan).
- There are currently three prescribed burn units identified in the Tinta Management Zone, constraints and more information on each of these units is described below.

- VSFB, a possible ignition source is adjacent to the Tinta Management Zone, however VSFB maintains a wide fuel break along the property line.
- Cattle grazing in pastures adjacent to the border with VSFB is being used to reduce fine fuels and reduce fire ignition potential.
- Mowing roads in the spring and early summer to reduce fire ignition risk by vehicles.
- In the spring and summer, mowing and weeding around the infrastructure in the Management Zone including weather stations, water infrastructure, and monitoring sensors.

Tinta Management Zone Burn Units

The Tinta MZ contains three permitted burn units – Cherry Ridge, Jalama Horse pasture, and Jalama headquarters burn units (see Appendix 2 for the Dangermond Preserve burn plan). While four burn plans are written and approved by CalFire, we are not currently planning to burn any of the units within the next five years due to various complexities. As a result, we provide less detailed description of the units within this Management Zone (as compared to the treatment in the Army Camp West Burn Unit). Future fire management plans will include updated information on objectives for each of these burn units if constraints to the use of prescribed fire changes over time, including updated burn plans, detailed research objectives, and burn objectives.

Cherry Ridge Burn Unit

The Cherry Ridge burn unit contains the Preserve's largest population of Islay Cherry trees (aka Holly-leafed cherry; *Prunus ilicifolia*) which is a native plant of cultural significance. There is interest from tribal partners to burn this unit to understand the plant's response to fire and to help maintain the grove of cherry trees. However, because this is culturally significant, this will be done in collaboration with tribal partners. Any research objectives for this unit should be codeveloped with tribal or TEK scientists and stewards. Additionally, the endangered Gaviota tarplant (*D. increscens ssp villosa*) may occur near the burn unit. Additional work is needed to understand if the tarplants (*Deinandra* spp.) in the area is the endangered species or a hybrid. Before burning occurs, we need to engage the federal and state agencies responsible for the management of this threatened species.

Jalama Horse Pasture Burn Unit

The Jalama Horse Pasture burn unit a 77-acre unit that was originally planned to be burned in the 2024 Santa Barbara TREX event. Santa Barbara County Fire has expressed concerns about holding, especially on the steep canyon sides at the middle of the burn. Because of this, the Preserve fire team has determined that more preparation within the unit ahead of prescribed fire application is needed and that the TREX may not be the appropriate time to burn the unit due to its complexity. The team will continue to weigh

the risks of wildfire, prescribed fire, and potential to inform research against the challenges of applying prescribed fire to this burn unit.

Similar to the Army Camp burn unit, we are also building in research objectives for the dominant habitat types in the Jalama Horse Pasture Unit (Figure 12). Live Fuel Moisture samples are being collected in the shrublands and the oaks every two weeks to monitor how LFM is changing over time inside and outside the unit.

Jalama Horse Pasture Burn Unit		
Unique Veg Classes	**Acres**	**Percentage of Coverage**
Purple Sage (*S. leucophylla*) Scrub	22.09	28.69%
Semi-natural Herbaceous Stands	16.84	21.87%
Coast Live Oak (*Q. agrifolia*) Woodland	12.38	16.08%
California Sagebrush (*A. californica*) Scrub	10.64	13.82%
Non-native Grassland	4.40	5.71%
Sawtooth Golden Bush (*H. squarrosa*) Scrub	2.81	3.64%
Coyote Brush (*B. pilularis*) Scrub	2.30	2.99%
Developed/Disturbed Areas	2.07	2.68%
Redberry (*Rhamnus crocea*) Scrub	1.67	2.16%
Coffeeberry (*Frangula californica*) Scrub	1.16	1.51%
Black Sage (*S. mellifera*) Scrub	0.42	0.54%
Eucalyptus (*Eucalyptus* spp.) Groves	0.23	0.30%

Coastal Sage Scrub

In the areas of coastal sage scrub, we are interested in tracking how biodiversity changes over time following the application of low-intensity prescribed fire. Over 60% of the unit is made up of coastal sage scrub species. Given that we know that some fires have taken place in this area in 1981, we may be able to better understand how the shrub community responds following burning within the recommended >30-year interval of fire return. In contrast to the shrubland area of the Army Camp burn unit, this unit contains dramatic topographic variability, and we may be able to provide insights to the role of slope and aspect in determining the biodiversity outcomes when applying prescribed fire in the shrubland system.

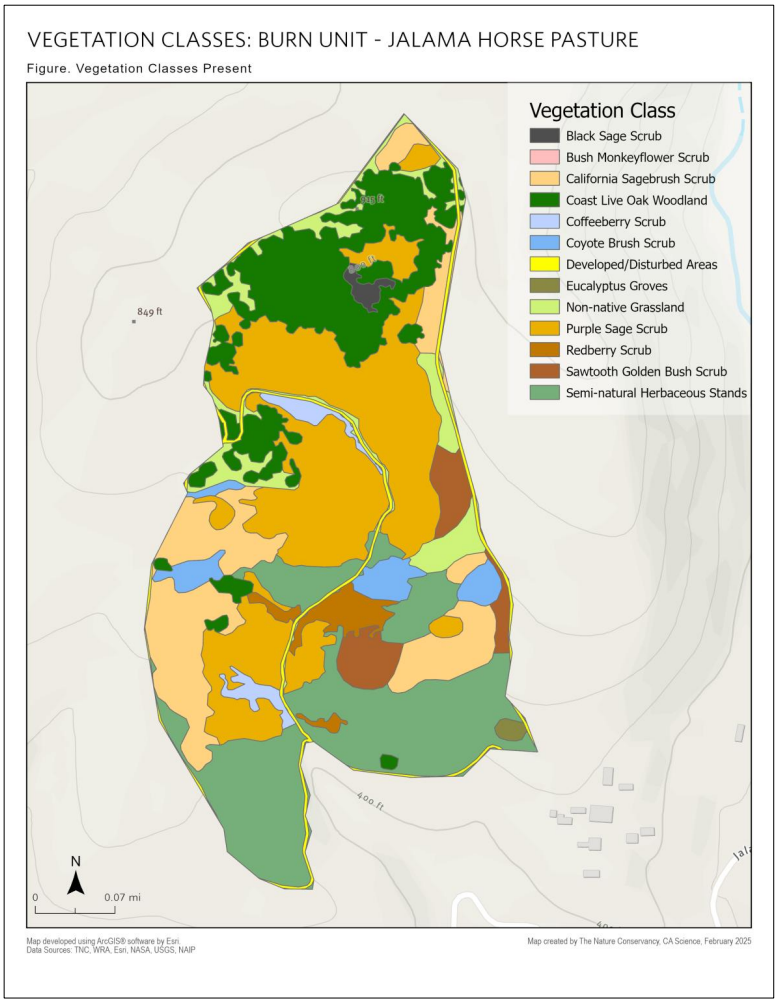


Figure 12: Vegetation classes in the Jalama Horse Pasture Burn Unit. This unit has the most mosaiced habitat of all the burn units but is predominantly made up of coastal sage scrub.

Oak Woodlands

The understory of the oak woodlands in the Horse Pasture Burn Unit are primarily made up of non-native annual grasses including noxious weeds like black mustard (*B. nigra*) and thistle species. Research objectives include understanding how fire impacts that recruitment of oak seedlings and saplings, including the rate of resprouting post fire. If fire is applied, we have targeted this unit to include an experiment to test how different levels of preparation of downed and dead fuels can impact fire behavior and severity and how this relates to biodiversity outcomes. By better understanding how to prepare the burn unit we may be able to better inform land managers how to manage the understory of oak woodlands to reduce the impacts of wildfire.

Jalama Headquarters Burn Unit

The Jalama headquarters burn unit is a small unit at the Jalama Ranch Headquarters that is aimed at reducing fuel loads that could threaten the headquarters's structures during a wildfire. Heavy vegetation like downed oak (*Q. agrifolia*) limbs, eucalyptus (*Eucalyptus* spp.), and dense, woody shrubs occur in this unit. We have discussed using this unit as a training burn with the SBCFD, but it is not high on the SBCFD priority list. We have also discussed the need to do some mechanical treatments and prescribed herbivory in this unit prior to burning. Application of prescribed fire in this unit will require careful preparation and partnership with SBFCD. Given its small size and the focus on structure protection for this unit, ecological research objectives are not likely to be developed with this burn unit.

Water Canyon Management Zone

Acres	2,923.66
Water Infrastructure	8 water troughs, 6 water tanks, 7 wells.
Restoration Sites	0 Sites
Top Three Dominant Vegetation Types (see Appendix 11 for full description of vegetation types in Management Zone)	Coast live oak (*Q. agrifolia*) woodland (1,089 acres) Non-native grassland (460 acres) Black sage (*S. mellifera*) scrub (277 acres)
Number of Burn Units Within Management Zone	0
Area in High Fire Hazard Severity Zone	424 ac. in Very High (15%) 2,477 ac. in High (84%)
Built Infrastructure	3 weather stations, and 3 well sensors.

Wildfire and Prescribed Fire History

There is no documented wildfire or prescribed fire history in the Water Canyon Management Zone. Range improvement prescribed fires may have occurred in the 1900's.

Management Actions to Reduce Wildfire Risk

- There are currently no prescribed burn units identified in the Water Canyon Management Zone. However, some sites may be identified in the future.
- Cattle grazing in the Cuesta pasture is being used to reduce fine fuels and fire ignition potential, because of its proximity to neighboring properties.
- Mowing roads in the spring and early summer to reduce fire ignition risk by vehicles.

Figures

Figure 1: State Responsibility Areas in High and Very High Fire Hazard Severity Zones. The Dangermond Preserve has 10,825 acres in the Very High Fire Hazard Severity Zone and 12,791 Acres in the High Fire Hazard Severity Zone.

Figure 2: Known historic wildfire perimeters at the Jack and Laura Dangermond Preserve. Known wildfires occurred in 1981, 1984, 2002, and 2004. All fires originated from the west and burned on to the west side of the Preserve in the Army Camp, Lower Jalama, and Tinta Management Zones.

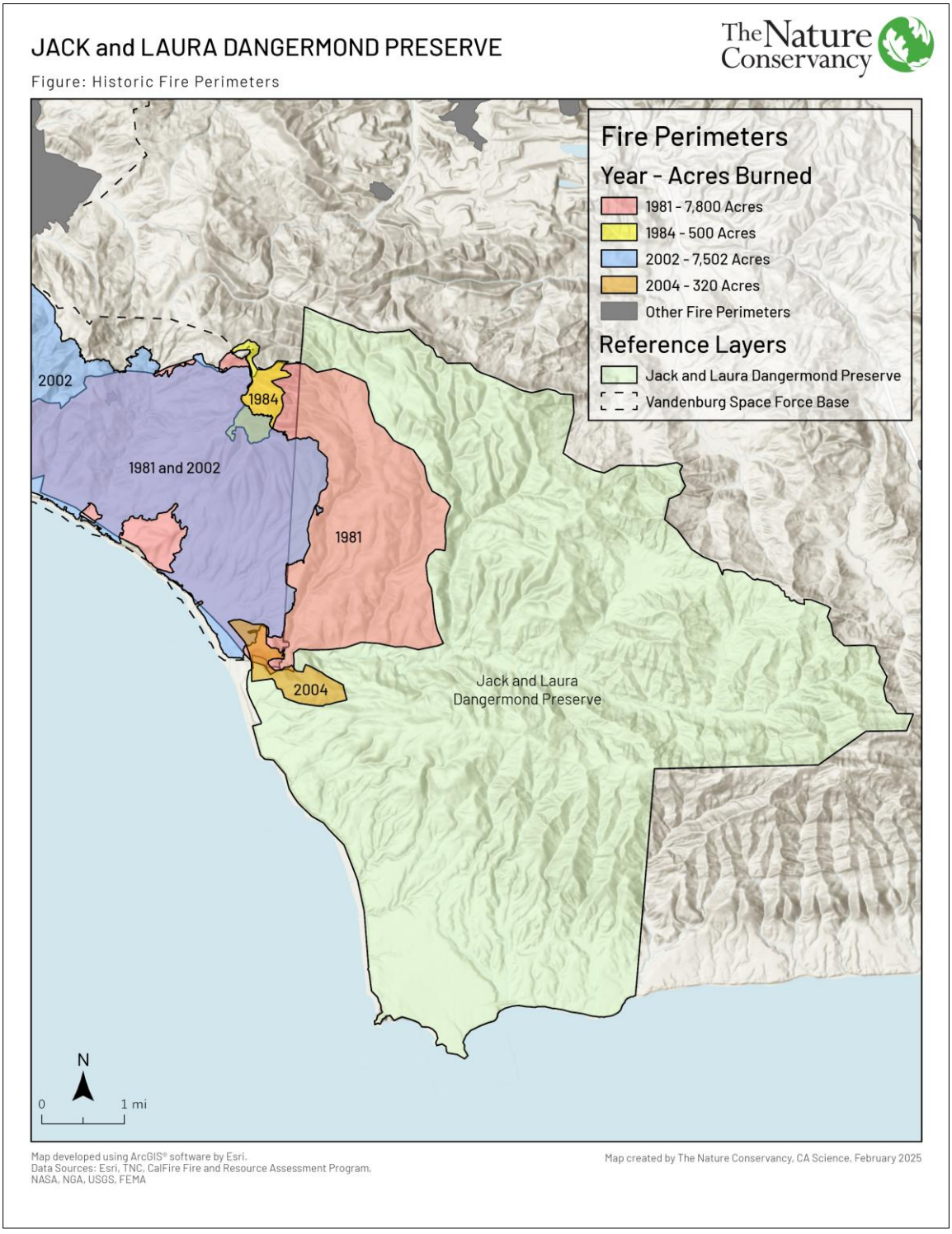


Figure 3: Physical infrastructure and points of interest at the Jack and Laura Dangermond Preserve. Various infrastructure is across the entire Preserve.

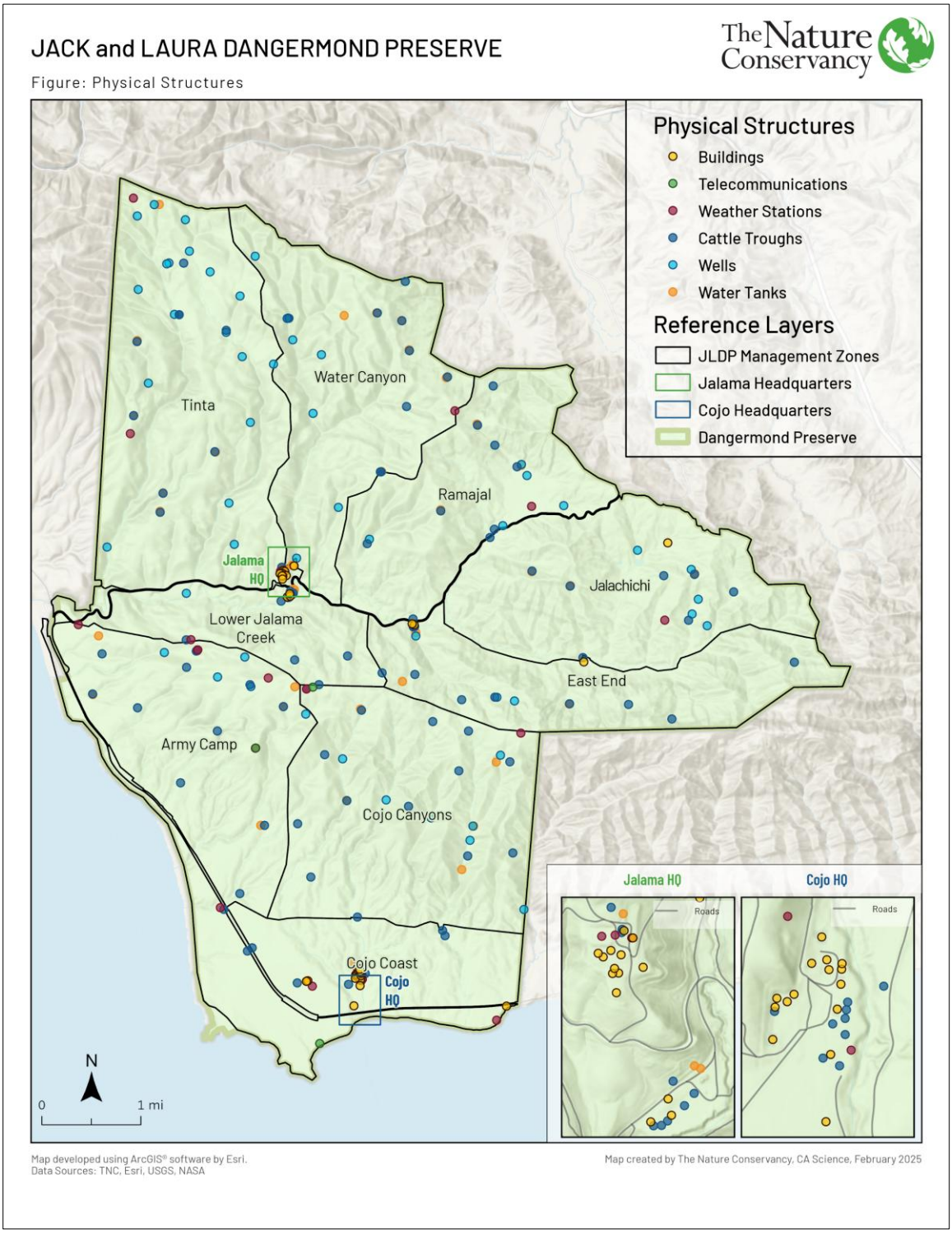


Figure 4: Evacuation routes in case of emergency on the Jack and Laura Dangermond Preserve.

Figure 5: Map and Driving directions from Dangermond Preserve to Lompoc Valley Medical Center.

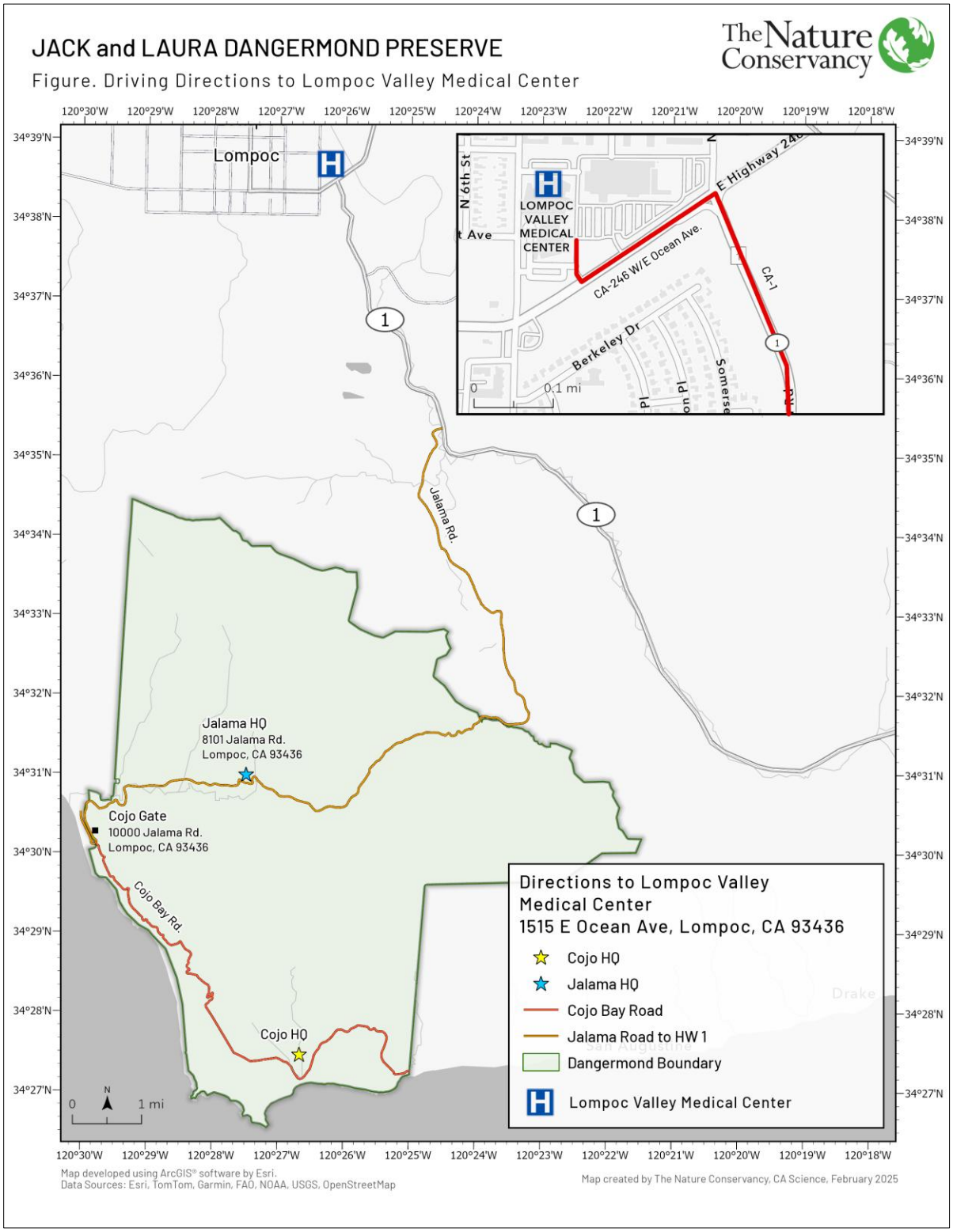


Figure 6: Known prescribed fires occurring within the Jack and Laura Dangermond Preserve boundaries.

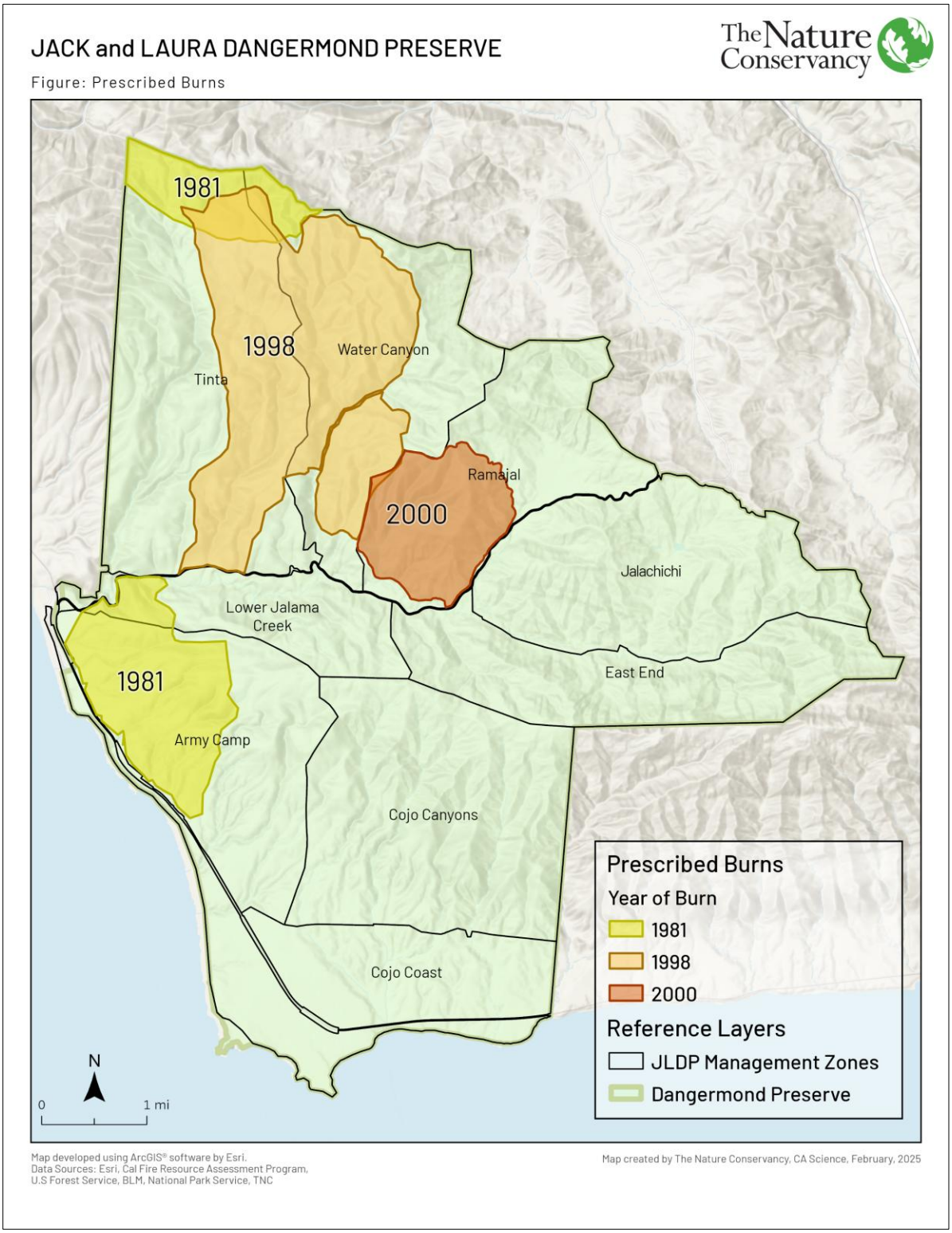


Figure 7: Potential prescribed fire burn units at the Preserve.

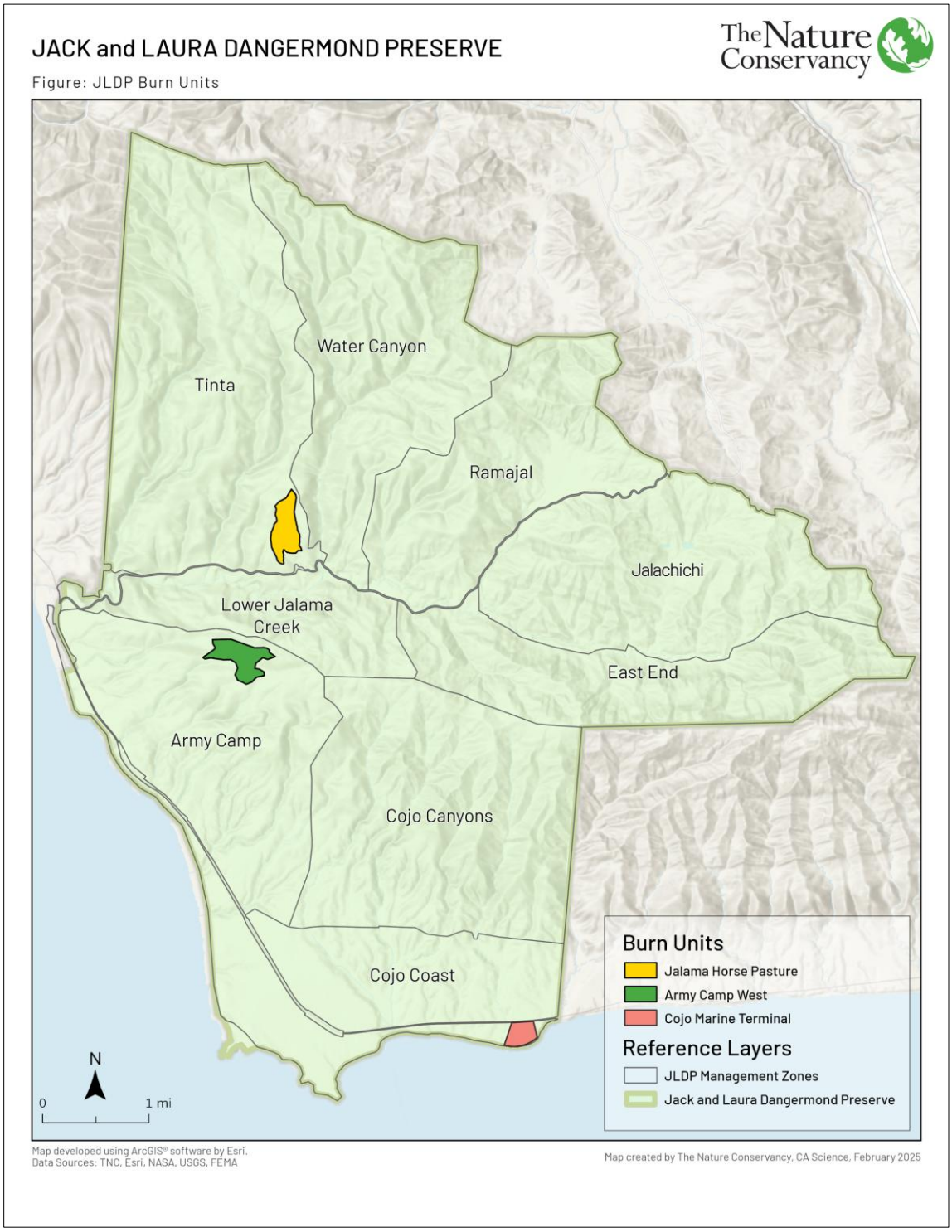


Figure 8: Management Zones at the Jack and Laura Dangermond Preserve.

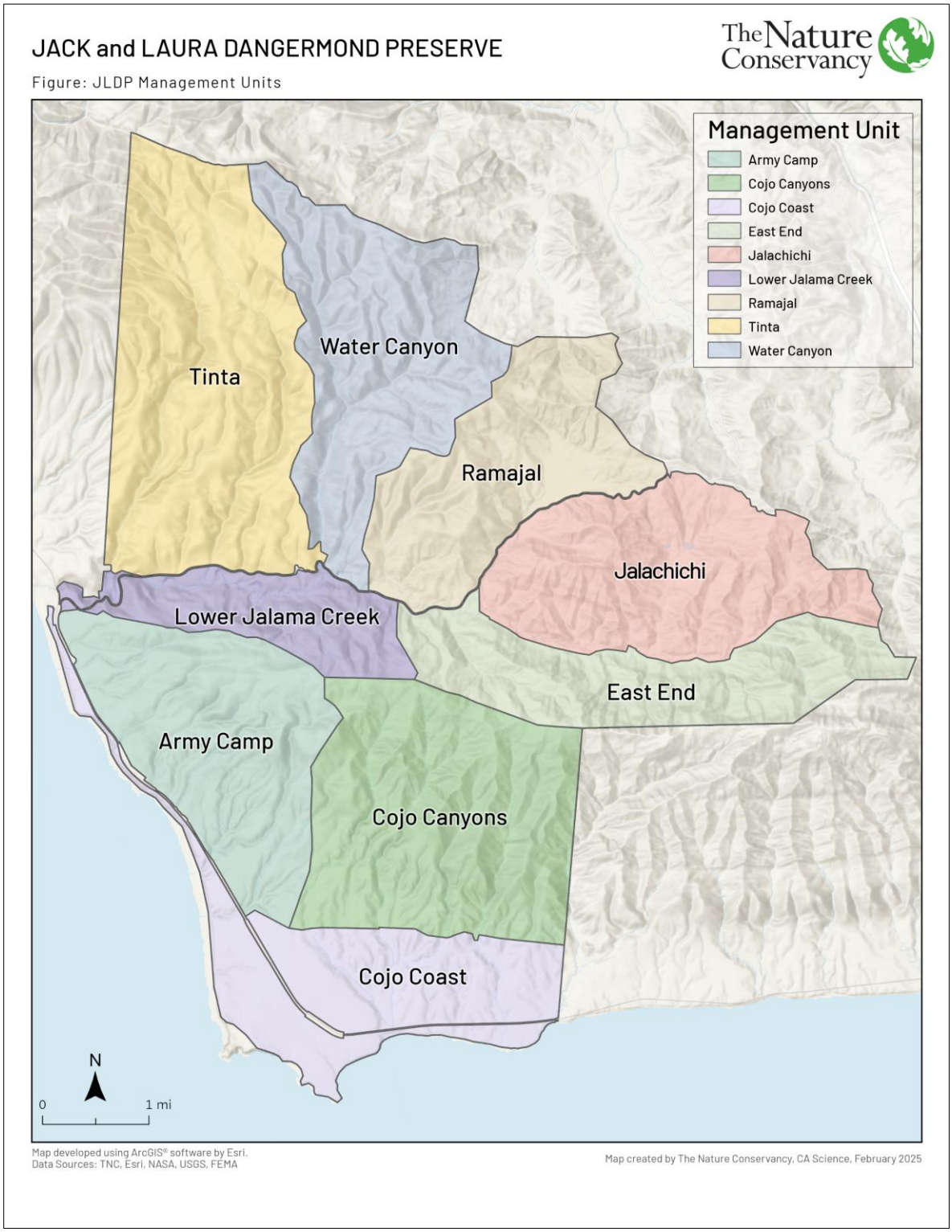


Figure 9: Army Camp Burn Unit Vegetation Map. The unit is primarily made up of coast live oak (*Q. agrifolia*) woodland. See the above table for acreages.

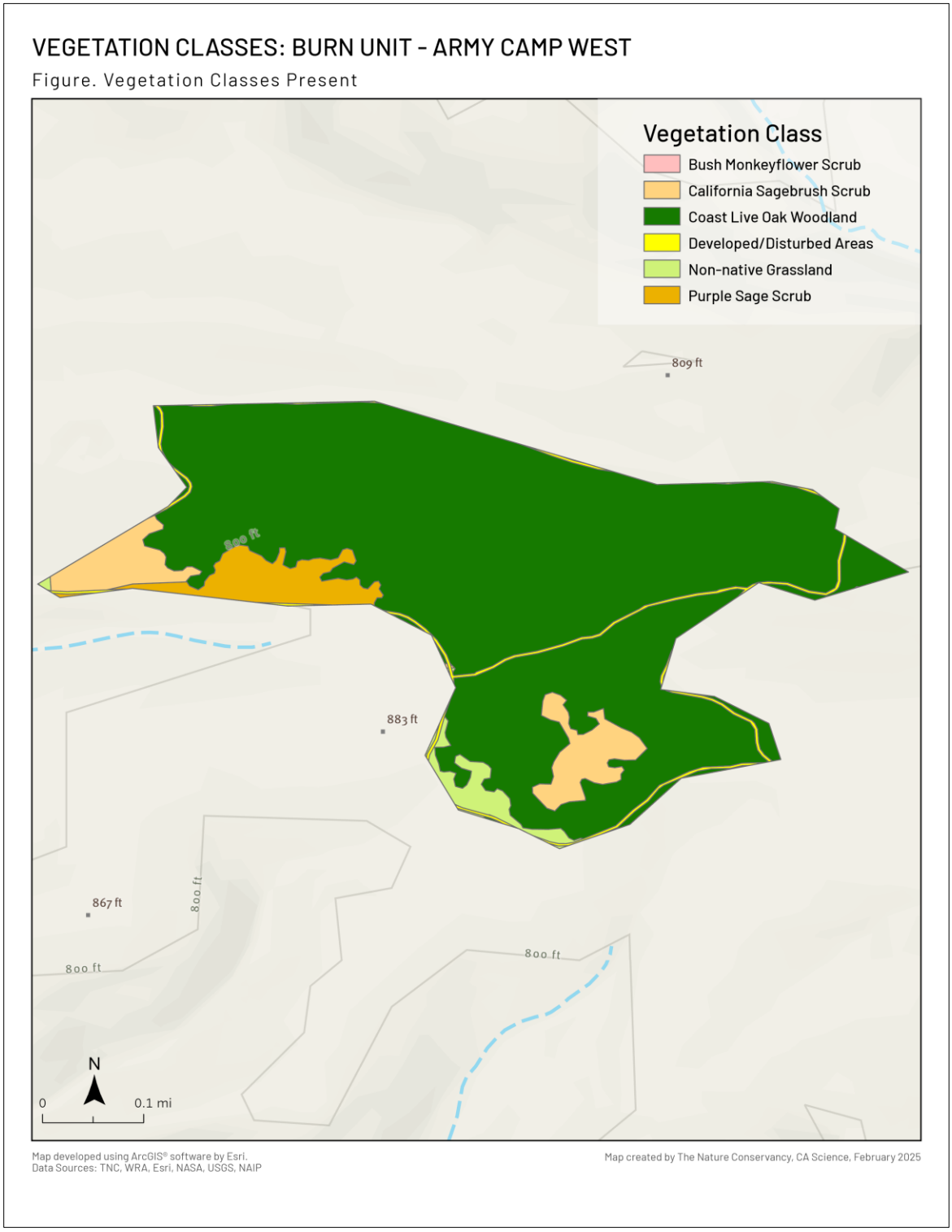


Figure 10: Army Camp prescribed fire and grazing experimental plots. There are 5 plots outside the burn unit that are unburned and grazed. There are 5 plots inside the burn unit that are burned and grazed. And there are 5 plots inside the burn unit that are burned and ungrazed.

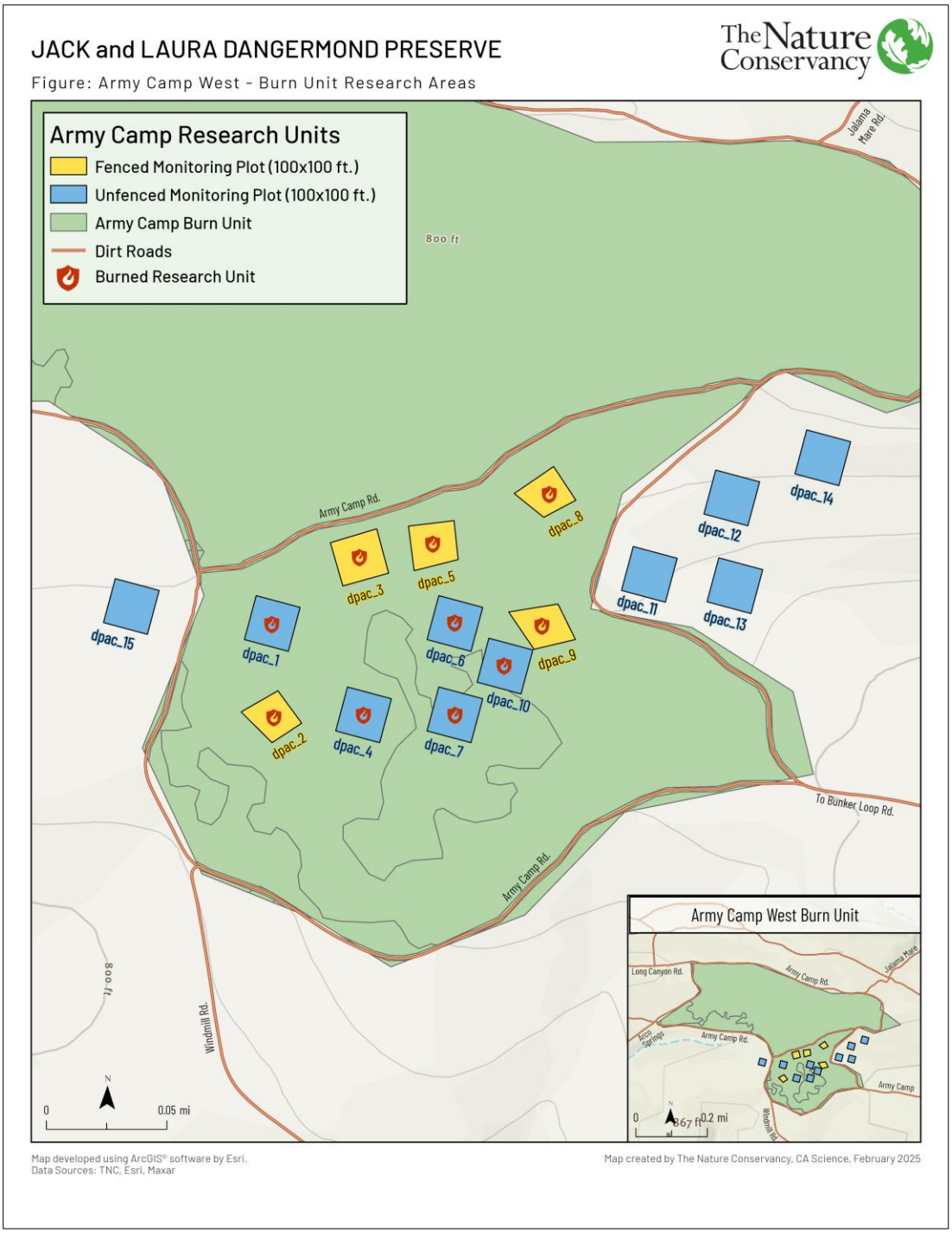


Figure 11: Cojo Marine Terminal burn unit vegetation map. The unit is primarily made up of non-native annual grassland. See the above table for acreages.

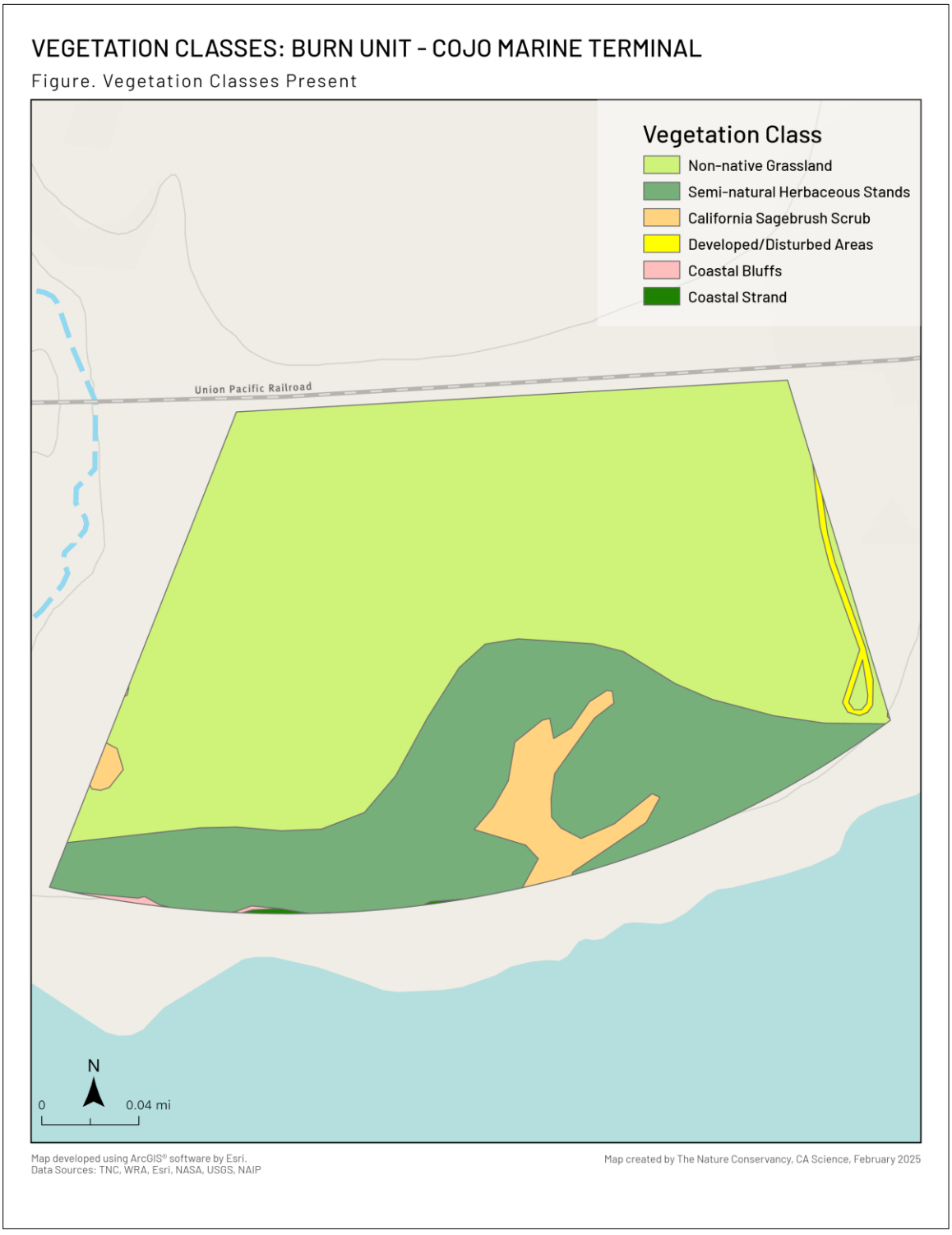
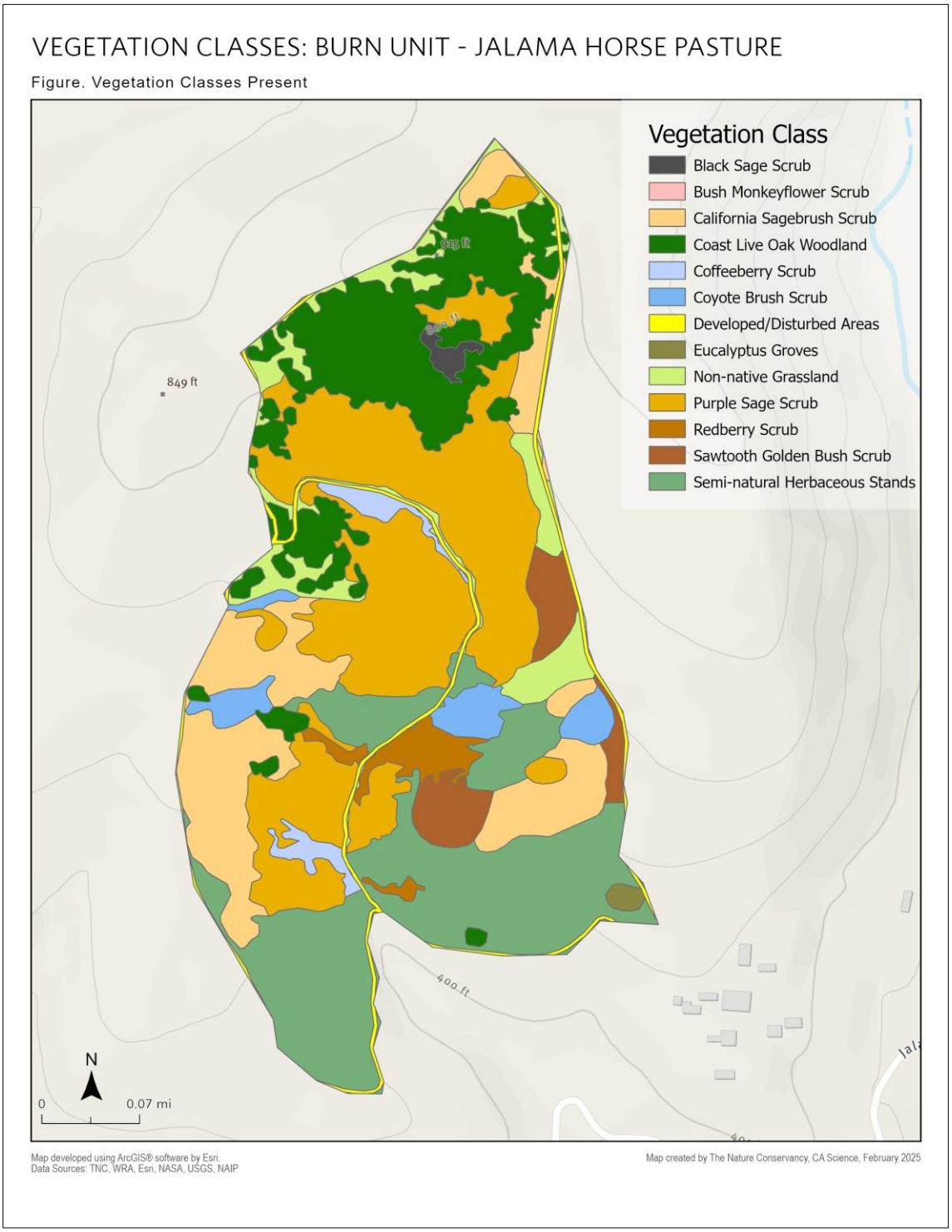


Figure 12: Vegetation classes in the Jalama Horse Pasture Burn Unit. This unit has the most mosaiced habitat of all the burn units, but is predominantly made up of coastal sage scrub.



Appendices

Note, for the sake of length and document management, links to the referenced documents are included below and in the shared Dangermond Preserve Fire Management Plan folder.

Appendix 1: Dangermond Preserve Fire Theory of Change (ToC)

Appendix 2: Dangermond Preserve Burn Plan

Appendix 3: Summary of Planned Research Activities Associated with 2023 TREX at Sedgwick Reserve

Appendix 4: Sedgwick Vegetation Management Plan

Appendix 5: Dangermond Preserve Prescribed Fire Research Working Group Summary

Appendix 6: Tools for Prescribed Fire Planning, Mapping, and Monitoring

Appendix 7: 2024 NASA Wells and Wildfires Workshop

Appendix 8: Prescribed Fire Research and Partnerships at the Dangermond Preserve

Appendix 9: Live Fuel Moisture Sampling Guide

Appendix 10: Army Camp Burn Unit Monitoring Protocols

Appendix 11: Vegetation Class by Management Zone

Appendix 12: 2024 Santa Barbara TREX Fire Effects MOnitoring (FEMo) Report (COMING SOON)

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