Jack and Laura Dangermond Preserve

INTEGRATED RESOURCES MANAGEMENT PLAN

The Nature Conservancy

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Opposite: Grasshopper Sparrow © Chris Helzer/TNC

Executive Summary

The next 10-20 years are critical for the future of life on Earth. Human activities are reshaping all the Earth's systems so profoundly that a new geologic age, the Anthropocene, is upon us. The actions we take together right now are important for protecting the natural world we rely on today and for setting us on the path to a more hopeful, sustainable future. Many of the tremendous challenges facing society today—from resource scarcity to climate upheaval—can only be addressed by resetting and rebalancing how we interact with the natural world.

Protecting, restoring, and managing natural systems to be more resilient to change, and thereby securing all the associated co-benefits that natural systems provide for people, will ensure more resilient human communities. Land protection has been a key strategy for The Nature Conservancy since its beginning as a grassroots organization in 1951 and is even more important today. Globally, only 5% of the natural lands at high risk of development are protected. Demands on land and water continue to increase. Protected areas today must not only provide protection for species and natural communities but also adapt to change, serve as learning platforms for addressing current and future conservation challenges, and help create and engage the next generation of environmental leaders.

In December 2017, The Nature Conservancy, through a generous donation from Jack and Laura Dangermond, acquired 24,460 acres of a former private ranch at Point Conception, California. This unique natural area, now called the Jack and Laura Dangermond Preserve, offers enormous opportunity for conservation, scientific research, education, and understanding of historical human ecology.

Located near Santa Barbara, Point Conception and its surrounding lands comprise one of the last and best "wild coast" areas in Southern California, and have some of the highest biodiversity and cultural values in the world. In acquiring the Jack and Laura Dangermond Preserve, The Nature Conservancy's first responsibility is to build a nature preserve capable of protecting this irreplaceable collection of natural and cultural resources for the benefit of future generations. In this Integrated Resources Management Plan, The Nature Conservancy defines its long-term vision for Preserve management as well as its shorter-term goals and objectives. This Plan documents and evaluates the natural and cultural resources currently present at the Preserve and uses this framework to establish management recommendations for stewardship and program development across both longer (>5 years) and shorter (1-5 years) time frames. The Nature Conservancy has been able to leverage an extensive amount of natural resource-based assessment and planning work that was conducted by the previous landowners and their consultants. However, there are several near-term priority planning and assessment priorities at the Jack and Laura Dangermond Preserve, including the development of a number of implementation plans—that will be developed as resources become available—and will nest under the Integrated Resources Management Plan and guide on-the-ground management efforts. These include:

- 5-year Grazing and Fire Management Plan
- Natural Resources Monitoring Plan
- Road Management Plan
- Managed Access Plan
- Pig Management Plan
- Invasive Species Action Plan
- Dune Management Plan
- Reintroductions and Translocations Plan

Terrestrial-based resource assessments have recently been conducted at the Jack and Laura Dangermond Preserve and are documented in this Plan. The Nature Conservancy has prioritized the development of similar assessments for the Preserve's freshwater and coastal ecosystems. These will be developed as resources become available.

In building this nature preserve, the protection and restoration of sensitive species and natural ecological communities is paramount. Situated at Point Conception, a biogeographical boundary zone between Northern and Southern California marine, coastal, and terrestrial ecoregions, the Jack and Laura Dangermond Preserve is a natural laboratory for investigating impacts from large environmental challenges, including global warming, increased drought severity, increased fire frequency and intensity, and sea level rise. There are only a handful of places globally where terrestrial and marine ecoregional boundaries co-occur. These places are not only hotspots for biodiversity but are ground-zero for managing species redistributions in response to environmental change. The Jack and Laura Dangermond Preserve has the potential to serve as a resilient stronghold for biodiversity that has been lost throughout Southern California and as a linchpin between Southern and Northern California ecoregions responding to changing climate. The development of a nature preserve with intact and restored natural ecosystems creates an additional opportunity—utilization of this special place to pioneer next-generation conservation solutions and programs that will drive local, regional, and global efforts to protect the natural world and ensure resilient human and natural systems.

The transformation of natural and human systems and the role that nature will play in solutions has emerged as the issue of our time. Society urgently needs to figure out how to do that reset and focused research is needed to enable this transformation—open science that is available to public and able to be shared among researchers and that harnesses the power of emerging technologies and institutionalizes what works in policy and the marketplace. Proven solutions can then be exported to people and places facing similar challenges around the world. Protecting, restoring, and managing natural systems to be more resilient to change, and thereby securing all the associated co-benefits that natural systems provide for people, will ensure more resilient human communities.

A century of intense development and population growth has pushed biodiversity to the brink in California and especially in Southern California. Most existing protected areas are located far from areas of human influence and protection of coastal areas has lagged. In fact, most public protection of the coast in Southern California is specifically for human use and recreation, giving wildlife and biodiversity few options. Protected by over a century of private ownership as a working cattle ranch, the Jack and Laura Dangermond Preserve has retained a "wild" condition. The Preserve is adjacent to the 20-square-mile Point Conception State Marine Reserve, which is protected by the State of California under the most-strict category of marine life protection. Together, the Jack and Laura Dangermond Preserve and Point Conception State Marine Reserve constitute the largest mainland (non-island) complex of adjacent land-sea protected areas in Southern California.

In addition to its ecological significance, the Jack and Laura Dangermond Preserve has a rich cultural history extending back more than 9,500 years. The Preserve is home to thousands of archaeological sites, including two important Chumash villages, that represent the complete diversity of site types found in California. These sites provide an excellent means for addressing questions of value to science and society. The continuous archaeological record of human history in the region is an unprecedented opportunity for learning and better understanding how humans have adapted to environmental change over millennia—potentially valuable lessons as we adapt to rapid environmental change now. These cultural attributes are addressed at a high level in this Integrated Resources Management Plan, however The Nature Conservancy plans to develop a separate, more comprehensive Cultural Resources Management Plan as resources become available.

To meet The Nature Conservancy's goals and maximize the opportunities at the Jack and Laura Dangermond Preserve, The Nature Conservancy is developing planning processes and management approaches that will ensure careful management and stewardship of the natural and cultural resources. The management approaches are based on foundational principles of using the best available science, practicing adaptive management, and investing in efficient monitoring that leverages technology. The Nature Conservancy's top priority at the Jack and Laura Dangermond Preserve is to protect, restore, and manage the natural and cultural resources. Key to this will be implementing a structured decision-making process that evaluates the impacts of proposed activities to natural and cultural resources as well as their contribution to programmatic goals.

1.0 Introduction

1.1 VISION, GOALS, AND MANAGEMENT PHILOSOPHY

1.1.1 Vision

Serving as a global platform for applied conservation research and education to inspire the next generation of conservation leadership, the Jack and Laura Dangermond Preserve is an enduring nature preserve protecting intact and resilient natural and cultural resources—last-of-their-kind coastal ecosystems, natural communities and species, and significant cultural resources—at a dynamic, ecological crossroads between land and sea and northern and southern coastal California at Point Conception.

1.1.2 Goals

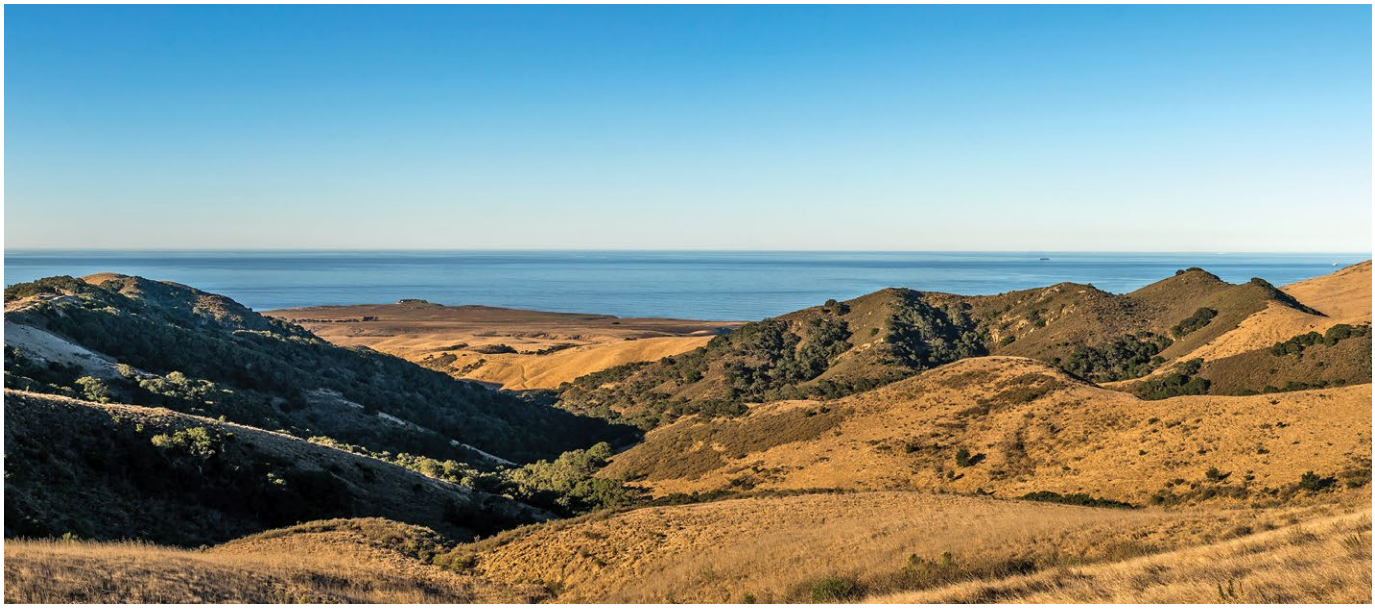
The Nature Conservancy (TNC) will achieve this Vision for the Jack and Laura Dangermond Preserve (the Preserve) through four major goals:

Goal 1: Protection, restoration and management of natural resources. TNC's management of the Preserve will promote and restore natural communities, ecosystems, and biodiversity so that they are resilient to environmental change and catastrophic events by using the best available science, state-of-the-art technology, best management practices, and a learning and adaptive management philosophy that demonstrates how to deal with uncertainty, risk, conflicting objectives, and diverse values.

Goal 2. Conservation and protection of cultural resources. TNC's management will protect and conserve cultural resources, which provide a rich history of human land use and lifeways, through the stewardship of archaeological, ethnographic, and historical resources; partnerships with local communities; and the use of the best available science, technology, and management practices.

Goal 3: Research and technology. TNC will promote and support scientific research to understand and advance protection, restoration and management of native species and ecosystems through research partnerships and by leveraging state-of-the-art technology and data-intensive science.

Goal 4: Public engagement. TNC will engage the public in the vision of the Preserve by supporting K-12 and community education programs, through which current and future generations of Californians will explore the landscape and deepen their knowledge of the ecological and cultural significance of this extraordinary area.



Dangermond Preserve Landscape Panorama © Peter Montgomery

1.1.3 Management Philosophy

There are few places remaining on the coast of Southern California where highly biodiverse terrestrial, coastal, and marine ecosystems remain largely intact. Most coastal protected areas in California were established, in part, to provide public access to the coast. Only a small fraction of the entire coast of California protects fully functioning ecosystems, limits or restricts access, and provides refuge for wildlife and sensitive natural and cultural resources relatively free of human disturbance. California needs such places, exemplified by the Preserve, where intact nature can thrive, be studied, and be experienced. The Preserve has the potential to serve as a resilient stronghold for biodiversity that has been lost throughout Southern California and as a large protected land-seascape at Point Conception that is a sentinel site for understanding climate change impacts on marine and terrestrial ecosystems. The Preserve also encompasses sensitive cultural sites and resources reflecting more than 9,500 years of human presence that provide learning opportunities and inspiration for future generations.

Preservation of the wildness, biodiversity, and ecosystem function at the Preserve through threat abatement, restoration, and adaptive management is foundational to achieving the broader vision and goals for the Preserve. The Preserve goals extend beyond biodiversity and cultural preservation to include advancing conservation science for broad-scale impact and inspiring the next generation of conservation leaders. By protecting, restoring, and managing the natural resources of the Preserve, we will be able to study and learn how wild and functioning ecosystems can fulfill their full potential for biodiversity conservation and benefits for people. A Preserve with intact and restored natural ecosystems creates an opportunity to use this special place to pioneer next-generation conservation solutions and leaders that will drive local, regional, and global efforts to protect the natural world and ensure resilient human and natural systems. The Preserve, at the boundary of Southern and Northern California terrestrial and marine ecoregions, is also a unique platform for scientific research and learning that can advance conservation science, resource management, and environmental education in a time of significant environmental challenges for both people and nature.

From top: Coast Live Oak Woodland © Bill Marr/TNC; Annual grassland © Karin Lin/TNC

The Nature Conservancy has extensive experience developing natural resource-based management plans. Therefore, we are furthest along in developing goals, long-term (>5 years) and near-term (1-5 years) objectives, and priority actions related to Preserve Goal 1. Table 1 summarizes the management goals and objectives in furtherance of Preserve Goal 1, which are further elaborated on in this document. Priority Actions will be completed as resources become available. Preserve Goals 2, 3, and 4 are addressed in the document, but more extensive planning will be addressed for each under separate cover.

Table 1. Natural resource-based management goals, long-term (>5 years) and near-term (1-5 years) priority objectives, and priority actions to support the Preserve Vision and Goals. Priority Actions will be completed as resources become available. Resource types include: Grasslands, Oak Woodlands, Shrublands, Freshwater Ecosystems, Coastal and Marine Ecosystems, Dunes, Special-Status Plants, Special-Status Animals, and Regional Connectivity and Climate Change Adaptation.

Resource	Management Goal	Long-term Objectives (>5 years)	Near-term Objectives (1–5 years)	Priority Actions
Grasslands	- Adaptively manage grasslands to be resilient to catastrophic fire and climate change and to support high levels of native plant and animal diversity, ecosystem function, and habitat structure	- Increase the current acreage of native perennial bunchgrass populations through compatible management and restoration - Create a mosaic of grassland structure, which includes both open, short-grass conditions and dense, tall-grass conditions, to support native plant and animal diversity - Increase the absolute cover and species richness of native grassland herbs by reducing the cover of herbaceous exotic plants - Reduce the cover of invasive noxious weed species, including large stands of black mustard, milk thistle, bull thistle, iceplant, veldt grass, and fennel	- Use cattle grazing to reduce fine fuel loads and decrease fire threat - Use cattle grazing to support 300-acre iceplant eradication project (California Coastal Commission [CCC] priority), including potential management of veldt grass and other invasive grass and forb species - Use cattle grazing to encourage re-establishment and expansion of Gaviota tarplant within 300-acre CCC iceplant eradication project	- Develop 5-year Grazing and Fire Management Plan - Develop Invasive Species Action Plan - Develop Reintroductions and Translocations Plan that includes an evaluation of whether natural grazers (e.g., elk) can be safely and effectively introduced to play complementary and/or supplementary grazing roles - Evaluate region-wide grassbank/ conservation cooperative, as part of an evaluation of the best potential uses of the grasslands at the Preserve - Develop and implement efficient rangeland monitoring program that leverages remote sensing and conservation technology
Oak Woodlands	- Adaptively manage oak woodlands to be resilient to catastrophic fire and climate change and to support high levels of regeneration and recruitment and native plant and animal diversity, ecosystem function, and habitat structure	- Increase the current acreage of coast live oak woodlands through active restoration and compatible management - Develop an early detection and rapid response protocol for oak pests and pathogens	- Complete the 200-acre oak restoration project (CCC priority) - Use cattle grazing, when possible, to prepare sites for oak plantings - Use cattle grazing to reduce fine fuel loads and decrease fire threat - Manage the cattle grazing operation to maintain high levels of native plant and animal diversity	- Develop 5-year Grazing and Fire Management Plan - Develop Invasive Species Action Plan - Develop Pig Management Plan, focused first in oak restoration plots (and then at "Army Camp" site, possibly as part of an experimental fencing project—potential CCC priority) - Develop Reintroductions and Translocations Plan that includes an evaluation of whether natural grazers (e.g., elk) can be safely and effectively introduced to play complementary and/or supplementary grazing roles - Develop and implement efficient rangeland and oak woodland monitoring program that leverages remote sensing and conservation technology

Resource	Management Goal	Long-term Objectives (>5 years)	Near-term Objectives (1–5 years)	Priority Actions
Shrublands	- Adaptively manage shrublands to be resilient to catastrophic fire and climate change and to support high levels of native plant and animal diversity, ecosystem function, and habitat structure	- Maintain the current acreage of sensitive shrubland communities with compatible management and consideration of active restoration - Conduct biannual surveys to increase our understanding of the distribution of special-status plant and animal species within shrubland communities - Model future habitat suitability of sensitive shrubland communities under different climate scenarios to inform our management efforts - Evaluate planting of sensitive shrubland communities in to areas projected to be suitable under future climate scenarios - Determine what the natural fire return cycle is for shrubland communities, as part of the 5-year Grazing and Fire Management Plan, and then seek to restore that fire cycle using prescribed burning to encourage high levels of native plant and animal diversity and reduce the overall threats from catastrophic fire	- Use cattle grazing to reduce fine fuel loads and decrease fire threat	- Develop 5-year Grazing and Fire Management Plan - Develop and implement efficient shrubland monitoring program leveraging remote sensing and conservation technology
Freshwater Ecosystems	- Adaptively manage freshwater ecosystems to preserve biodiversity, ecosystem function, and processes	- Maintain or restore 10+ mi of healthy and diverse instream and riparian habitats in Jalama Creek and Cañada del Cojo Creek - Maintain or restore healthy and diverse instream and riparian habitats in Espada Creek, Gasper Creek, Escondido Creek, Wood Canyon Creek and unnamed creeks including special-status species - Maintain or restore healthy freshwater habitat in seeps, swales, springs, ponds and natural and artificial wetlands - Restore degraded freshwater ecosystems including removal of invasive species and restoration of natural hydrographic features - Maintain or restore terrestrial, riparian, instream and other freshwater-dependent wildlife use of coastal habitats that is reflective of "wild" coastal freshwater ecosystems with little human disturbance	- Manage human and livestock access and prevent trampling, illegal take of freshwater resources, and human disturbance of wildlife - Manage for healthy ecological processes and ecological functions that support wildlife of freshwater ecosystems - Eradicate populations of giant reed and Pampas grass - Restore natural freshwater ecosystem processes by excluding livestock access, adapting, and minimizing human infrastructure and, where needed, restoring natural habitat and species	- Develop 5-year Grazing and Fire Management Plan - Develop Invasive Species Action Plan - Develop Freshwater Ecosystem Baseline Assessment - Develop Reintroductions and Translocations Plan that evaluates whether steelhead can be re-introduced, along with barrier removal, within Jalama Creek and the Jalama Creek Watershed - Develop and implement wetlands monitoring program that leverages remote sensing and conservation technology

Resource	Management Goal	Long-term Objectives (>5 years)	Near-term Objectives (1–5 years)	Priority Actions
Coastal and Marine Ecosystems	- Adaptively manage coastal and marine ecosystems to be resilient to climate change, sea level rise and changing ocean conditions, and to preserve the biodiversity, ecosystem processes and functions, and wildlife use of the coast and adjacent marine ecosystems	- Maintain or restore terrestrial and coastal wildlife habitat and important ecological processes to promote and maintain wildlife access and use of coastal habitats reflective of a "wild" coast with little human disturbance - Maintain or restore the health of coastal confluences and their associated species and ecosystem services, by maintaining and managing for appropriate natural processes and land-sea connectivity - Restore natural dynamic coastal processes by removing, adapting, and minimizing human infrastructure (including, where appropriate and compatible, associated railroad infrastructure such as train tracks/berms) and, where needed, restoring natural habitat and species in the coastal realm - Track coastal changes and ocean conditions to promote the resilience of coastal ecosystems by minimizing other stressors in the face of sea level rise, changing ocean conditions, and other direct anthropogenic impacts	- Conduct a comprehensive baseline assessment of the coastal ecosystems and their dynamics to inform best management and restoration of coastal resources - Assess current levels of human access and develop a Managed-Access Plan to guide activities and human access to the coast, with the goal of minimizing disturbance of wildlife and trampling of intertidal resources, and trespass - Develop partnerships and a long-term research agenda that leverages the unique geographic and "wild" coast context to advance understanding of coastal and marine biodiversity, ecological processes and functions, and land-sea connectivity in the face of climate change	- Develop Coastal Ecosystems Baseline Assessment - Develop Managed-Access Plan - Develop partnership agreements with all neighbors to promote responsible conservation-compatible use patterns and a general understanding and support of our "wild" coast desired outcomes - Develop and implement coastal ecosystems monitoring program leveraging remote sensing and conservation technology

Dangermond Preserve Coastal Landscape © WRA

Resource	Management Goal	Long-term Objectives (>5 years)	Near-term Objectives (1–5 years)	Priority Actions
Dunes	- Adaptively manage and restore dune communities and natural sand shed to support natural coastal geophysical processes and biodiversity	- Reduce total iceplant cover - Reduce total veldt grass cover - Conduct a geomorphological study of the sand shed with a focus on sand sources, supply, and transport in the littoral cell and across the headlands - Work with neighbors in adjacent watersheds along the littoral cell to restore natural sand supplies by identifying and removing obsolete dams and armoring, as well as minimizing use of hardened infrastructure or practices that impact sand transport and environmental flows - Conduct biannual surveys of coastal dune vegetation to increase our understanding of the distribution of special-status plant species - Model future habitat suitability under different climate scenarios for federal- and state-listed plant species, like surf thistle, to inform future management and restoration efforts	- Complete 300-acre CCC iceplant eradication project - Identify and protect current nesting grounds for the endangered snowy plover	- Develop Dune Management Plan - Develop Geomorphological Study of the sand-shed
Special-Status Plants	- Adaptively manage to support the recovery, resilience, and long-term persistence of 20+ special-status plant species known to occur on-site and to allow for the expansion of special-status species known to be present on adjoining properties that also have the potential to occur on-site	- Conduct biannual surveys to increase our understanding of the distribution of special-status plant species - Model future habitat suitability under different climate scenarios for federal- and state-listed plant species to inform our management and restoration efforts - Where compatible with climate change projections, maintain current collection of special-status plant species - Restore populations and promote recovery of federal- and state-listed plant species to areas projected to be suitable under future climate scenarios - Eliminate invasive noxious weed species in areas where direct competition could lead to loss of special-status species - Ensure that the 5-year Grazing and Fire Management Plan is compatible with recovery of special-status plant species - Conduct road and trail management that supports the recovery of special-status plant species	- Complete 300-acre CCC iceplant eradication project, to support expansion of Gaviota tarplant and surf thistle populations	- Incorporate new special-status plant discovery into Integrated Resources Management Plan - Develop 5-year Grazing and Fire Management Plan - Develop Invasive Species Action Plan - Develop Dune Management Plan - Develop Reintroductions and Translocations Plan - Develop Road Management Plan

Resource	Management Goal	Long-term Objectives (>5 years)	Near-term Objectives (1–5 years)	Priority Actions
Special-Status Animals	- Adaptively manage to support the recovery of 30+ special-status animal species known to occur on-site and allows for the expansion of special-status species known to be present on adjoining properties that also have the potential to occur on-site	- Conduct biannual surveys to increase our understanding of the distribution of special-status animal species - Model future habitat suitability under different climate scenarios for all special-status animal species to inform our management and restoration efforts - Where compatible with climate change projections, maintain populations of special-status animal species - Restore habitat and promote recovery of federally listed animal species to areas projected to be suitable under future climate scenarios - As part of a larger evaluation of reintroductions and translocations, develop a management plan for Jalama Creek designed to support the re-establishment of steelhead and expansion of special-status animal species, including least Bell's vireo - Develop a pond management plan designed to support expansion of special-status animal species, including California red-legged frog - Manage instream and adjacent riparian habitat for special-status herpetofauna by preventing the establishment of non-native aquatic animal species, maintaining basking sites, and maintaining breeding habitat - Eradicate invasive noxious weed species (e.g., iceplant) in areas where their presence and expansion could lead to decline or loss of special-status animal species - Ensure that the 5-year Grazing and Fire Management Plan is compatible with recovery of special-status animal species - Develop and implement with partners marine mammal and seabird stranding plan	- Complete 300-acre CCC iceplant eradication project - Ensure human access and visitation does not cause disturbance of nesting/resting special-status animals on beaches and rocky intertidal habitats	- Develop 5-year Grazing and Fire Management Plan - Develop Invasive Species Action Plan - Develop Reintroductions and Translocations Plan - Develop Dune Management Plan - Complete Artificial Intelligence-based analysis of historic wildlife camera data - Establish and re-establish wildlife monitoring camera survey - Develop and implement snowy plover monitoring plan - Develop and establish marine mammal haul-out monitoring plan

Resource	Management Goal	Long-term Objectives (>5 years)	Near-term Objectives (1–5 years)	Priority Actions
Regional Connectivity and Climate Change Adaptation	- Adaptively manage to promote regional connectivity, land-sea connections, and resilience of species, habitats, and ecosystems	- Leverage existing data to inform management in a changing climate - Establish climate change research and monitoring program to support adaptive management - Establish coastal climate change research and a monitoring program to inform "wild" coast responses to changing ocean conditions and adaptive management - Identify and restore habitat connectivity for focal wildlife dependent on different specific or unique habitat features at different life history stages that may take generations (aquatic to upland) - Identify rare plants for which leading-edge dispersal is needed (or translocations) or facilitate northern expansion of things leaving the Preserve (inbound and outbound) - Monitor, maintain, and enhance keystone species for their food and shelter and for their influences on community structure - Monitor and manage beach and rocky intertidal area and function as a wildlife corridor connecting to adjacent open space areas	- Manage infrastructure to facilitate redistribution of plant and animal species responding to a changing climate - Manage water infrastructure to mitigate the negative impact of drying conditions	- Identify priority conservation actions to maintain regional connectivity and climate change adaptation and resilience

Dangermond Preserve Incoming Tide Intertidal Zone © Bill Marr/TNC

1.2 PURPOSE OF THE INTEGRATED RESOURCES MANAGEMENT PLAN

The purpose of this Integrated Resources Management Plan (the Plan) is to capture TNC's vision, goals, objectives, and priority actions for the Preserve. The Plan also articulates TNC's approach to adaptive management and structured decision-making to ensure the long-term preservation of the natural and cultural resources of the Preserve. This Plan is intended to be a living document and will be periodically updated as we learn more about the Preserve and work with partners to incorporate new science and technology, public access and environmental education opportunities, and the need to address new and emerging threats to biodiversity at the Preserve.

Point Conception Lighthouse © Mark Reynolds/TNC

1.3 INTEGRATED RESOURCES MANAGEMENT PLAN FRAMEWORK

The Integrated Resources Management Plan is organized into 11 main sections:

1. Introduction
2. Regional Context and Management History
3. Existing Conditions and Threats
4. Resource Management
5. Stewardship and Program Management
6. Science and Research Agenda
7. Conservation Technology
8. Environmental Education
9. Decision-Making in an Adaptive Management Context
10. References
11. Figures

Within Sections 2, 3, and 4 we have focused on the following resource types:

- Grasslands
- Oak Woodlands
- Shrublands
- Freshwater Ecosystems
- Coastal Ecosystems (Dunes, Rocky Intertidal, Sandy Beaches, Natural Tar Seeps)
- Marine Ecosystems
- Special-Status Plants
- Special-Status Animals
- Regional Connectivity and Climate Change
- Cultural Resources

2.0 Regional Context and Property History

In this section, we introduce the regional context of the Preserve, including its geographic location and connectivity to other terrestrial and coastal-marine protected areas. We also summarize the climatological regime of the region, and the major vegetation and wildlife communities present at the Preserve. Lastly, we detail the property's history, including the Chumash, Spanish-Mexican, and ranching eras as well as maritime and military history.

2.1 REGIONAL CONTEXT

The Preserve is a 24,460-acre property located in unincorporated Santa Barbara County, California (see Figure 1). The Preserve encompasses 8.5 miles of coast surrounding Point Conception, extending from the Jalama Beach County Park in the north to the western boundary of the Surfing Cowboy property and Hollister Ranch at Cañada del Cojo. Hollister Ranch is adjacent to the eastern boundary of Surfing Cowboy. Most of Jalama Creek (96.5%) and contributing tributaries fall within the Preserve, except for the mouth of the creek, which is off the Preserve. Vandenberg Air Force Base (VAFB) abuts the western boundary of the Preserve. Jalama Road, a county-maintained asphalt road, traverses the Preserve from east to west. Most of the Preserve is located on the Lompoc Hills and Point Conception U.S. Geologic Survey (USGS) 7.5-minute topographic quadrangle maps. The easternmost portion of the Preserve is located on the Santa Rosa Hills and Sacate quadrangle maps. Elevation varies from sea level to approximately 1,680 feet at the crest of the Santa Ynez Mountains. The Preserve consists of two historical cattle ranches: Cojo Ranch and Jalama Ranch.

The Preserve sits at the boundary of three USGS terrestrial ecoregions, the Central California Foothills and Coastal Mountains (CCF), the Southern California Mountains (SCM), and the Southern California/Northern Baja Coast (SCB) (see Figure 2), as well as two ecoregions that The Nature Conservancy uses for its planning purposes, the Central Coast (TNC 2006) and South Coast (TNC 1998). This unique positioning is mirrored in the ocean with Point Conception sitting at the breakpoint of the Northern and Southern California Current ecoregions (see Figure 2), which creates high marine biodiversity due to the meeting of the northern and southern ranges of many species. The southward flowing and colder California Current moves offshore at Point Conception, while the nearshore shelf is bathed by the warmer California countercurrent (CA-MLPA 2009, Claisse *et al.* 2018). This location is a biogeographic crossroads that serves as a "mixing" zone, or ecotone, between cooler, more maritime climate-adapted terrestrial and freshwater species of the Central Coast and species adapted to the warmer and drier South Coast and Northern Baja California region. The Transverse Ranges characteristic of the SCM ecoregion start less than 10 miles to the east, connecting the coastal ranges to the Sierra Nevada mountains, and Mojave and Colorado deserts with elevations of over 10,000 feet in the San Gabriel Mountains.

Vegetation types common in the general region surrounding the Preserve are a mosaic of oak woodlands, annual grasslands, chaparral and coastal shrublands, and scattered patches of conifer forests at more mesic sites and at higher elevations (see Figure 3). The primary USGS terrestrial ecoregion for the Preserve is the CCF, which spans all the way around the foothills of the Central Valley, on both the Sierra Nevada (eastern) side of the Valley and on the western side (Inner Coast Range) to the Pacific Coast south of the Santa Cruz Mountains (WRA 2017) (see Figure 2). This ecoregion reaches its southernmost point on the Preserve at Government Point. The CCF ecoregion is one of four Mediterranean ecoregions occurring within California. This portion of California is one of five Mediterranean climate regions globally, which encompass only 2% of the world's land area but 20% of the world's plant species (e.g., Rundel 2018). The Mediterranean biome is among the most imperiled globally (Hoekstra *et al.* 2005), and is recognized as a biodiversity hotspot, with high endemic species diversity and endangerment.

The varied climatic, geologic, soil, and topographic conditions at the Preserve and surrounding lands drive tremendous species diversity. Over 1,300 plant species, more than 500 bird species, 138 terrestrial and marine mammals, 43 reptiles, 17 amphibians, and over 20 freshwater fish species have been documented in Santa Barbara County, including roughly 30 endemic animal species and 35 endemic plant species. As climate conditions change, some of these species may shift their ranges accordingly, possibly to relatively cooler, more mesic areas, provided that underlying abiotic conditions and interspecific competition do not deter their movement and establishment (Loarie *et al*. 2008).

The region the Preserve covers is one of the most natural, least protected parts of the California coast south of Humboldt County (see Figure 4).

The Preserve helps to maintain significant regional connectivity for many species (see Figure 5). Maintaining open and undeveloped land is important for wildlife populations and, over longer time periods, for plants, to ensure that genetically diverse populations can persist. As landscapes become fragmented by habitat loss due to urbanization or agricultural cultivation and through the development of infrastructure such as energy facilities, roads, or transmission lines, wildlife populations suffer (Bennett 1999). This loss and fragmentation of habitat can ultimately threaten the genetic diversity and long-term viability of wildlife. Ensuring that lands are effectively managed to maintain habitat connectivity, either through some permanent conservation action (such as acquiring land for a nature preserve) or through the compatible management of private lands, is a critical conservation goal.

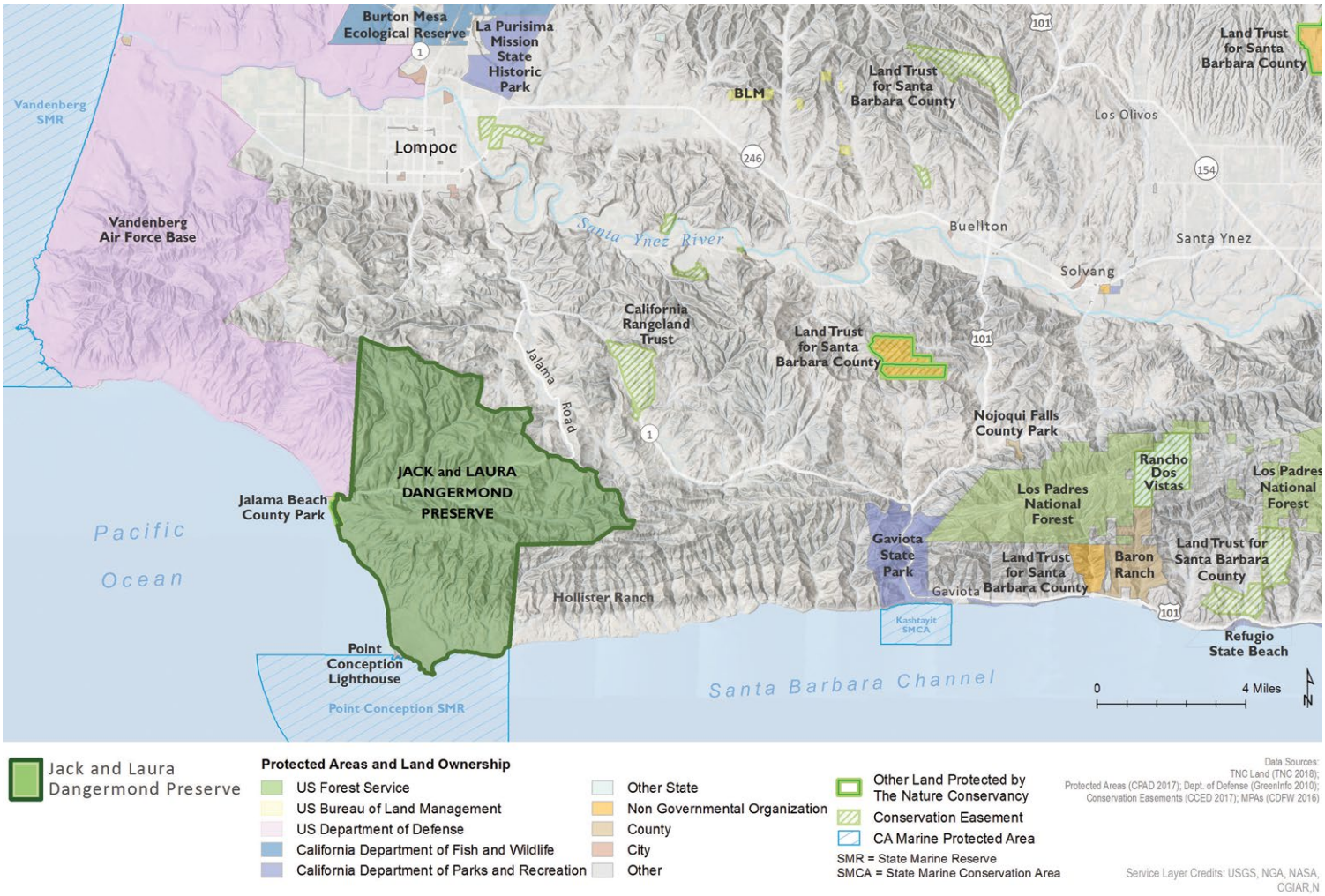


FIGURE 1 Preserve Location and Regional Context Including Proximity to Protected Areas

The Preserve serves as core and migratory habitat for wide-ranging mammal species including mountain lion, bobcat, coyote, deer, black bear, badger, and several species of bats. Riparian woodland, annual grassland, oak woodland, and other habitat areas of the Preserve serve as migratory stopover and breeding areas for neotropical migratory songbirds. The beaches, rocky intertidal, and other coastal habitats support flocks of migrating and over-wintering shorebirds and critical haul-outs for local and wide-ranging marine mammals such as harbor seals and elephant seals. The value of these habitats to wide-ranging and migratory species varies seasonally and by habitat quality but the Preserve, by its size and concentration of high-quality habitats, is a stronghold for these species.

Climate change is making the protection and restoration of habitat connectivity an even more important conservation goal at a regional scale. Plant and animal species are already shifting their distribution in response to changing temperature and precipitation (e.g., Moritz *et al*. 2008). These shifts in distribution are a form of climate adaptation and will likely play out across a broad range of spatial scales. For example, some plants may be able to shift aspects on one mountain (say, from a south-facing slope to a north-facing slope) to find a favorable microclimate to survive, while wide-ranging animals may need to travel much longer distances to find suitable habitat conditions given shifting distribution of prey or some other critical requirement for survival. TNC recently completed an analysis of major habitat connectivity conservation priorities in California (Dickson et al. 2018; Keeley et al. 2018) using a modeling tool called Omniscape (McRae *et al*. 2016). It characterizes the relative constrictions to potential connectivity (e.g., pinch points) while assessing the contribution of non-constrained areas to overall landscape connectivity. The model suggests that the Preserve provides

FIGURE 2 Terrestrial and Marine Ecoregion Context

east-west habitat connectivity between the large public and private land holdings to the east and VAFB to the west (see Figures 1 and 5). We note, however, that the model is not species-specific and does not delineate specific paths through the landscape based on the habitat preferences of wildlife. It is rather a general characterization of the potential habitat connectivity based on the location, arrangement, and size of undeveloped natural areas relative to constrictions in movement from the human environment, topography, or water bodies.

2.1.1 Network of Other Protected Areas

The Preserve is surrounded by a matrix of ranchlands, low-density residential land, and VAFB (see Figure 1). Santa Barbara County, in fact, has fewer developed natural landscapes than any other area of the California Floristic Province, and is considered a global biodiversity hotspot (Myers *et al*. 2000), which demonstrates its global value for conservation (Santa Barbara County Blueprint 2018). The Preserve borders the Surfing Cowboy property and Hollister Ranch to the east, which provides connectivity to Gaviota State Park and the Los Padres National Forest (see Figures 1 and 5). While VAFB, Surfing Cowboy, and Hollister Ranch provide conservation benefit to habitat connectivity and the maintenance of rare vegetation and plant and animal species, they are not permanently protected and therefore their contribution to a connected regional network of lands managed for conservation is uncertain over the long term. But for the foreseeable future, they can be expected to enhance the conservation values on the Preserve and are reasonably secure in terms of a lack of development risk. There are many organizations in Santa Barbara County that include protection of the Gaviota Coast as a mission-critical goal, including the Land Trust of Santa Barbara County, Gaviota Coast Conservancy, and the Surfrider Foundation.

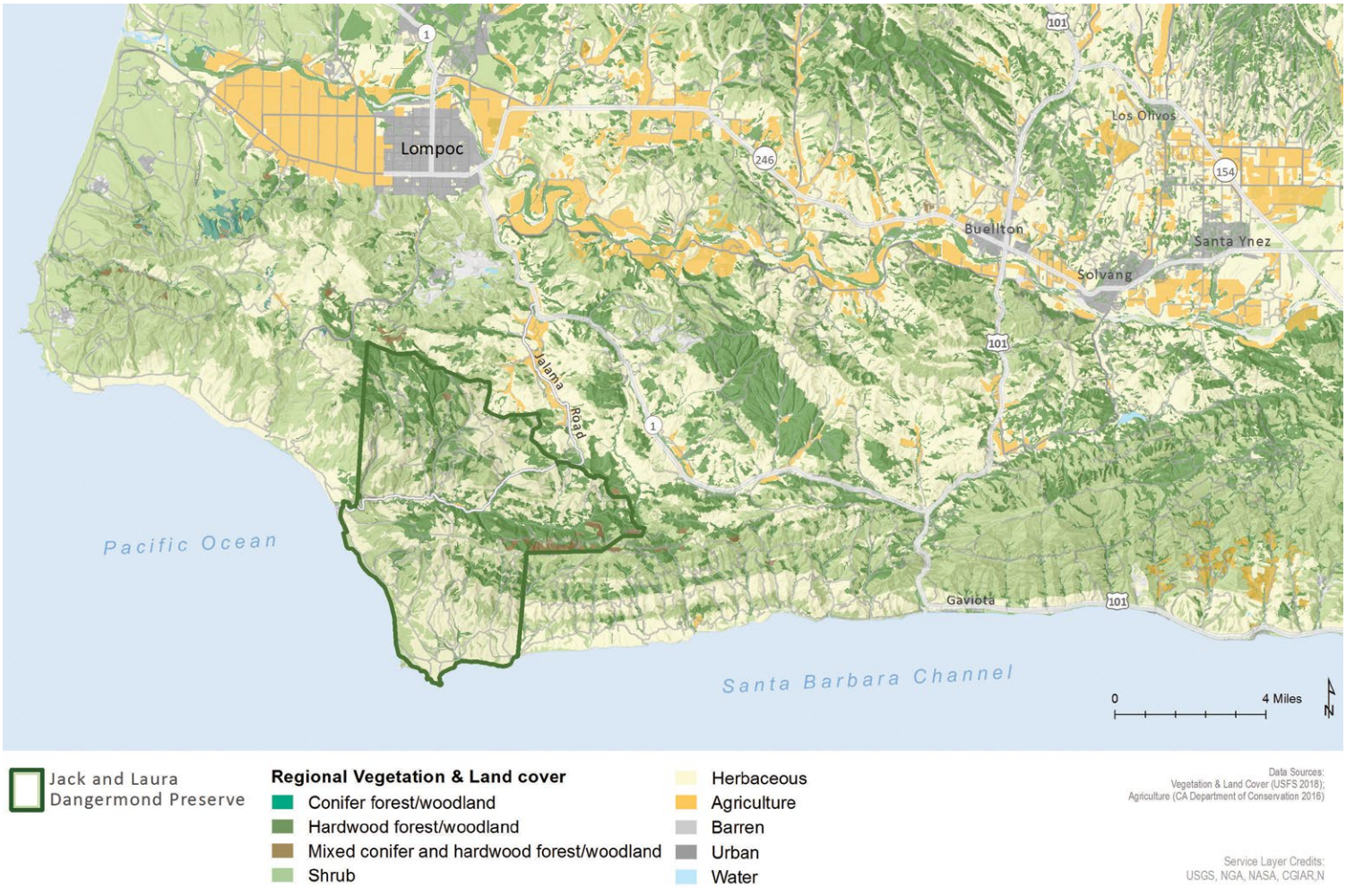


FIGURE 3 Regional Vegetation and Land Cover Context

The Bureau of Land Management (BLM) established the California Coastal National Monument in 2000, which protects resources above mean high water (MHW) of over 20,000 rocks, exposed reefs, islands, and pinnacles along the California coast including those offshore rocks adjacent to the Preserve (BLM 2005).

The Point Conception State Marine Reserve (SMR) was established in 2012 under the Marine Life Protection Act through a science-based and stakeholder-driven public process (Gleason *et al.* 2013) (see Figure 1). This SMR fully protects all intertidal and subtidal species and extends from Point Conception south to the southern edge of the Preserve and out to the 3-nautical mile limit. The Point Conception SMR is 22.52 square miles in size, spans from the intertidal MHW to approximately 490 feet in depth and has an alongshore span of 5.3 miles. The SMR was designed as part of a statewide network of marine protected areas and protects important habitats including an upwelling zone, oil seeps, pinnacles, rocky reefs, kelp forest, deep rock, and marine mammal haul-outs. All species and marine resources are fully protected in the Point Conception SMR; however, the state waters on the northern half of the Preserve (Point Conception to Jalama Beach County Park) are not included in a marine protected area.

The ~30-acre federally owned Point Conception lighthouse property borders the Preserve (see Figure 1) and includes important dunes, grasslands, and rocky cliff and intertidal habitats. The property is currently owned by the United States Coast Guard, which has operated a lighthouse there since 1856.

2.1.2 Land-Sea Context, California Current, and Connectivity to the Channel Islands

Point Conception was called "the Cape Horn of California" by Richard Henry Dana, Jr., in *Two Years Before the Mast*. Indeed, Point Conception is the most important marine biogeographic boundary on the U.S. West Coast where the cold and consistent California Current from the north meets the warmer and more variable California countercurrent from the south, as well as other eddies and gyres within the Santa Barbara Channel and among the Channel Islands (TNC 2006, CA-MLPA 2009, Claisse *et al.* 2018). Strong winds, waves, and currents are common in this area, fueling upwelling of productive deep ocean waters to the coastal environment and connecting the deep Pacific Ocean, the Santa Barbara Channel, the Channel Islands, and the terrestrial areas of the Preserve. Salt air blown

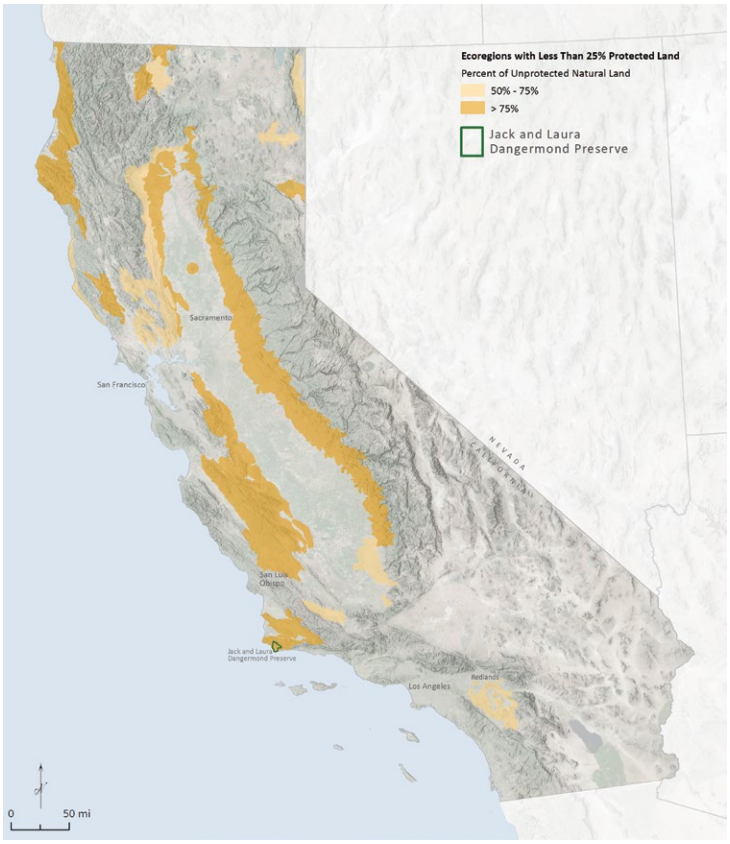


FIGURE 4 Gap Analysis Identifying Ecoregions with Low Amounts of Protected Areas

Rolling hills and coast © Bill Marr/TNC

inland influences plant and animal communities well in from the coast, and marine-enriched fog has been shown to be critically important to coastal grasslands and other terrestrial plant communities (Dawson 1998; Corbin *et al.* 2005). The beaches, dunes, and over 20 coastal drainages of the Preserve are important components of the sandshed and coastal littoral cell along this part of the coast. Steelhead (*Oncorhynchus mykiss*), threespine stickleback (*Gasterosteus aculeatus*), tidewater goby (*Eucyclogobius newberryi*), and staghorn sculpin (*Leptocottus armatus*) all connect the freshwater, estuarine, and sea in and adjacent to the Preserve through their different uses of these environments during their life history stages.

Upwelling, winds, streamflow, and wave action facilitate cross-ecosystem subsidies, delivering nutrients and materials between the land-sea realms. For example, large amounts of kelp and nutrients are observed on the Preserve's beaches, fueling productive and diverse terrestrial and coastal food webs. Tracks of terrestrial animals including top predators, as well as non-native species such as pigs, can regularly be observed on Preserve beaches feeding in this productive marine-based food web. This land-sea connectivity extends along the entire coastline of the Preserve and acts to connect to adjoining open space areas such as VAFB, Jalama Beach County Park, and Gaviota State Park. The importance of longshore land-sea connectivity at the Preserve increases in scale when considering the importance of the "wild" coast habitats to migratory species. Steelhead born in Jalama Creek may migrate across the Pacific Basin to Alaska or Asia. Birds flying along the Pacific Flyway use coastal habitats and nearshore environments associated with the Preserve as resting areas before pushing on with their migrations. As such, the Preserve conserves 8.5 miles of "wild" coast important for land-sea connectivity of both local and global significance.

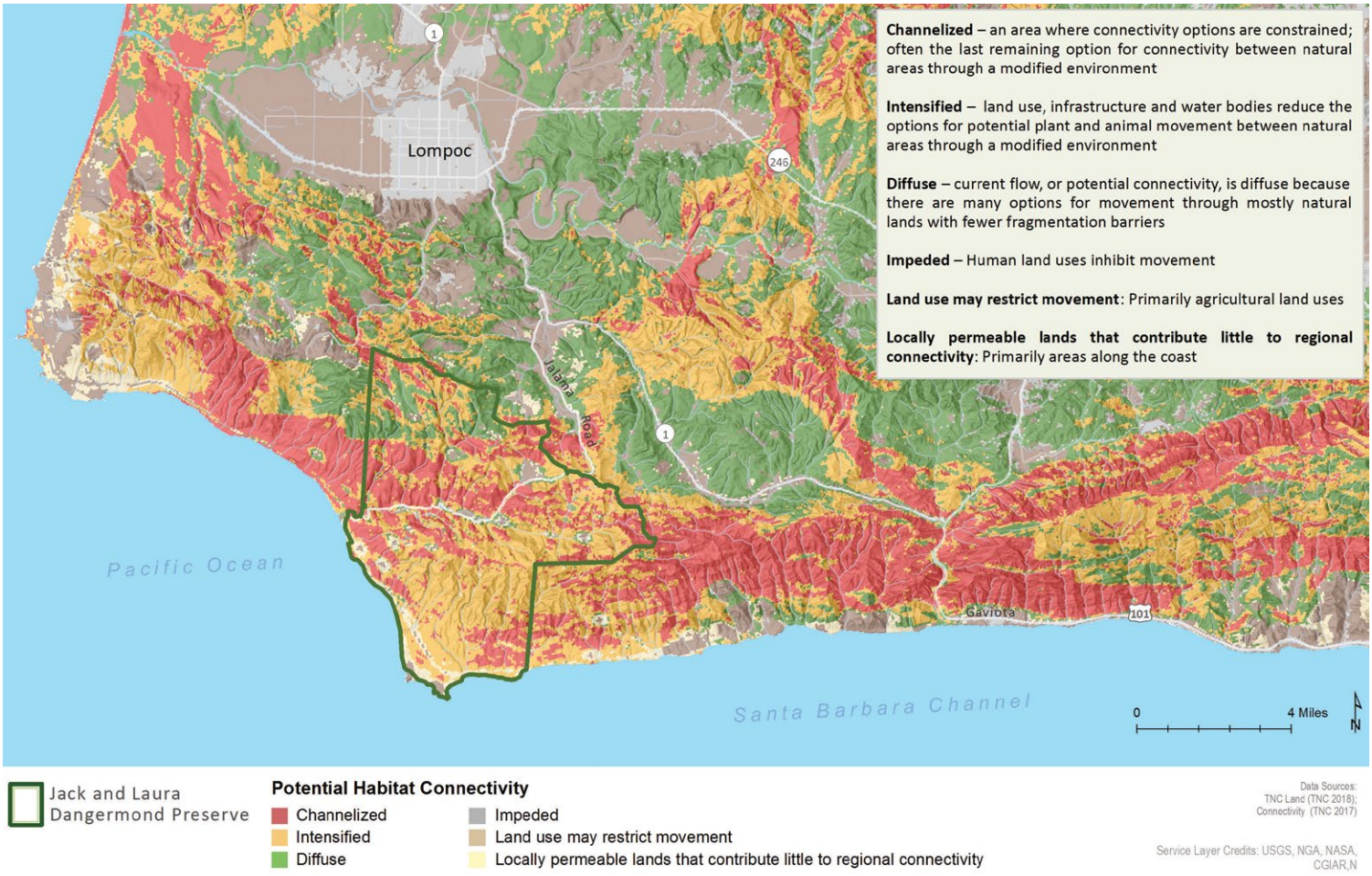


FIGURE 5 Regional Connectivity

2.2 PROPERTY HISTORY

The Preserve and the Point Conception region have a rich and extensive history. Representative of coastal California, the region has historical significance for the Chumash, Spanish and Mexican eras, early California statehood and cattle ranching, maritime and military histories. The following is a very brief sketch of some aspects of historical significance.

2.2.1 Chumash Era

The California Coast has a rich archaeological record, with evidence of human occupation spanning at least 13,000 years. The Channel Islands and mainland coast contain thousands of archaeological sites that provide a record of human environmental interactions, social, political, and cultural developments, technological change, and scores of other information with broad implications. In addition to this exceptional archaeological record, California has remarkable linguistic and tribal diversity, a testament to the Native American tribes that have lived in California for thousands of years. Much like the environmental diversity of California, with its mountain ranges, valleys, forests, grasslands, and coastal ecosystems, people developed a wide range of cultural lifeways in these various habitats, being both influenced by climate and environmental changes and actively altering, managing, and influencing the ecosystems in which they lived.

The Preserve is home to hundreds or thousands of archaeological sites that represent the complete diversity of site types found in California and broader western North America. Sites in the immediate vicinity or on the Preserve date to more than 9,500 years ago. These include rock art sites, coastal shell middens, lithic scatters, Chumash villages and cemeteries. These sites provide an excellent means for addressing questions of value to science and society. They are also the cultural heritage of contemporary Chumash communities throughout the region, including some direct descendants of 18th to 19th century villages at Point Conception.

Arguably the highest density of archaeological sites on the Preserve are located along the coastline, including at least two named historical Chumash villages. The village site of Shisholop is located at Cañada del Cojo Creek on the edge of the Preserve, while the village site of Shilimaqshtush is located just outside the northern edge of the Preserve at Jalama Beach County Park. Historically, these two villages were very important as they appear to represent a divide for Chumash use of the *tomol*, or plank canoe. Chumash at Shisholop in the protected waters of the Santa Barbara Channel actively used plank canoes and were a major trading port, while people at Shilimaqshtush did not have *tomols* on the more surf-swept north-south facing beaches.

The coastline in between these two villages contains numerous recorded shell middens and other sites. The majority of these are located along eroding shorelines that are threatened by climate change-induced sea level rise. These shell midden sites contain artifacts, shellfish, and the bones of birds, mammals, fish, reptiles, and amphibians that provide a key way of understanding both ecological and cultural changes with changes in the marine, terrestrial, and coastal environments of the Preserve over long-time scales. Like in other areas (e.g., Santa Cruz Island), marine erosion is one of the greatest threats to the coastal archaeological record and represents a significant challenge for coastal archaeologists, managers, and Native American communities.

Less is known about the interior archaeological record of the Preserve. Most of the interior of the Preserve has never been systematically surveyed for archaeological sites. The interior of the Preserve likely contains lithic scatters and other workshops, possible quarries for chert, rock art sites, and other habitation at interior rock shelters and caves. The interior also possibly contains villages and more permanent interior habitation sites, which are most likely to occur in productive environmental areas and near reliable freshwater sources and along trade and movement corridors. Inland sites are threatened by a variety of processes, including stream and creek erosion, wind erosion in exposed areas, possible effects of grazing animals (i.e., trampling and fragmentation), burrowing animals (bioturbation), and illicit collection and/or vandalism.

The rich archaeological record of the Preserve, along with the variety of processes that threaten to degrade this record, necessitate an integrated and collaborative cultural management plan. This plan will involve work and consultation with archaeologists with expertise in Santa Barbara County and Central California, who can work to help integrate the management of cultural resources with the comprehensive management of the area's biological resources. This planning will be collaborative, to address the needs and desires of local communities, especially Chumash tribal communities, whose heritage is directly linked to the Preserve and surrounding areas.

From top: Ranch Foreman Justin Cota (tan horse) and Tracy West round up heifers on Hollister Flat above Little Cojo on TNC's Dangermond Preserve. © Bill Marr/TNC; Cojo Gate with Cojo-Jalama brand © Matt Davis/TNC

2.2.2 Spanish and Mexican Era

The first European contact with the Chumash in the Point Conception area was with Juan Rodriguez Cabrillo's voyage of exploration in 1542. Periodic contacts between Europeans and Chumash continued through 1769, when the first Spanish land expedition was led through the area by Gaspar de Portola. The establishment of missions followed in the next 35 years. Many local Chumash were converted to Christianity by the missionaries and moved to the missions at Santa Barbara, Santa Ynez, La Purísima, and San Luis Obispo. Padres from the La Purísima Mission grew crops and cultivated vineyards and orchards in the Jalama Valley.

The Rancho San Julian (48,221 acres) was established in 1816 to raise cattle to provide food to the Spanish garrison at the Santa Barbara Presidio. After Mexico's independence from Spain in 1837, the government secularized the land holdings of the missions and made grants for ranchos, many of which went to soldiers. Rancho Punta de la Concepción (29,992 acres) was granted to Anastasio Carrillo of the Santa Barbara Presidio in 1837. It included the Rancho El Cojo in its southeast corner (8,580-acres, named "Ranch of the Lame" when Juan Crespi, who accompanied the Portola expedition, noted that a local village chief had a lame leg) and a portion of the Jalama Ranch. In the same year, Rancho San Julian was granted by Governor Alvarado to Jose de la Guerra y Noriega, the commander of the garrison at the Presidio.

With the cession of California to the United States following the Mexican-American War, the 1848 Treaty of Guadalupe Hidalgo provided that land grants would be honored. When California was admitted to the Union in 1850, owners of rancho grants were obliged to have their titles confirmed by the U.S. Lands Commission. Anastasio Carrillo's title to Punta de la Concepción was confirmed in 1873; after a Supreme Court case, Noriega's title to San Julian was upheld in 1880.

In 1876, Rancho El Cojo was sold to General P.W. Murphy. Patrick Washington Murphy (1840–1901) operated Rancho Atascadero, the adjacent Rancho Asunción, and Rancho Santa Margarita. Murphy believed that Cojo would be a major port after the arrival of the Southern Pacific Railroad. But the Southern Pacific railroad did not reach Point Conception until 1899, and Murphy would lose Rancho El Cojo through bank foreclosure. Fred H. Bixby purchased Rancho El Cojo in 1913.

The Jalama Ranch (15,813 acres) was formed from part of the San Julian Ranch in 1914 and was bought by Fred H. Bixby in 1939, uniting the Jalama and Cojo ranches under Bixby family operations, which continued through 2007.

2.2.3 Ranching Era

The following section is adapted from an historical ecology synthesis report prepared for TNC by Anderson et al. (2019).

The history of cattle ranching on the Preserve dates to Spanish arrival during the mission era in 1770. Hide and tallow were prized commodities for the Spanish, leading to a rapid growth in coastal cattle populations (Hardwick 2015). Based on livestock records from La Purísima Mission, it is estimated that cattle herds from Gaviota to Cojo increased by 400-500% between 1770 and 1796 (Dartt-Newton and Erlandson 2006).

Anastasio Carrillo lived on Cojo Ranch and, at one point in time, had 1,700 head of cattle and 200 horses (Palmer 1999). Beef production was a significant business in Santa Barbara County during the 1850s, with an estimated 500,000 cattle in the county during that decade. The market for beef was driven by gold miner food demand, but droughts in the 1860s caused cattle numbers to decline by 99% to only 5,000 in Santa Barbara County.

In 1913, Fred H. Bixby stocked the Cojo Ranch with 565 cattle, 143 horses, 9 bulls, and 2 stallions (PHR Associates 1990). Using financial records, journals, and interviews with ranchers, PHR Associates identified four distinct periods of agricultural operations:

1. 1913 to 1941: During this time, the size and value of the cattle herd fluctuated. Dairy cows and chickens were also raised on the property to feed the employees. In 1923, the Bixby family acquired 30-40 goats, which were not pastured. A 1925 survey listed 627 acres devoted to barley, 242 acres to bean, and 25 acres to a walnut orchard.
2. 1942 to 1952: The second ranching era on the property began after the purchase of the Jalama Ranch, which facilitated an increase in cattle numbers. Together, Cojo Ranch and Jalama Ranch had 1,630 cattle in 1943 and 1,296 cattle in 1947. Cojo Ranch was used primarily for crops, while Jalama Ranch supported the cattle operation. The greatest change in crop production from the first period was the addition of red mustard, which was very profitable.
3. 1953 to 1972: Bixby's death marked the beginning of the third ranching period on the property. Cattle numbers were kept around 1,200 on Jalama Ranch and 800 on Cojo Ranch, although this was reduced to 600 during a drought in the 1960s. During this period, less land was used for barley and there was an attempt to grow alfalfa, which required the construction of dams and wells; the alfalfa crop proved unsuccessful.
4. 1973 to 1989: In the 1970s, barley production stopped, and the walnut orchard was removed. By the mid-1980s, crop farming had ceased on Cojo Ranch and the fields reverted to pasture and were used as holding areas.

2.2.4 Maritime History

Point Conception is known by modern mariners as "the Cape Horn" of the Pacific. Considered the demarcation between Northern and Southern California, the coastline bends here, changing from a thousand miles of more or less north-south outer coast shoreline to 60 miles of east-west shoreline inside the Santa Barbara Channel. It is the western entrance to the Santa Barbara Channel. Cold water, following the strong currents from Alaska, meets the warmer waters of the Santa Barbara Channel to create rough swells, high winds, and heavy fog, all of which are challenging to mariners.

When California became a state, the U.S. Coast Survey sent a team to survey the California coast for suitable anchorages, identify hazards to navigation, and look for future lighthouse locations. The first team arrived in 1849, but due to skyrocketing costs brought on by the Gold Rush, field operations were delayed. Finally, in 1850, George Davidson arrived in California and, knowing the survey's importance to mariners, began his work at Point Conception to determine its exact position.

The Point Conception Lighthouse station was built in 1855. The area was already home to numerous shipwrecks and the Yankee Blade wrecked north of Point Conception even as the lighthouse was being built. The station's first-order Fresnel lens, made in Paris and shipped first to San Francisco and then to Cojo Beach, was reassembled and first lit on February 1, 1856. The following year a fog bell was added to the station. There were three keepers assigned to the station, but the first head keeper, George Parkinson, did not last a year. He called Point Conception a "dreadful Promontory of desolation."

In 1872, a steam foghorn replaced the bell, and a fourth keeper was added. Most keepers had a wife and children with them. In 1880, a new lighthouse was built on a lower bluff because the first building, at the top of the hill, began falling apart. This first building was later used to house two of the keeper's families. The lower location was also necessary because fog kept shrouding the light on the higher hillside. Stairs were the main access to the new building, and later a chute was built to drop supplies down the hillside. There was no electricity until 1948. In 1972, the light was automated and the keepers left. In 1999, the Fresnel lens was replaced with a modern light, and in 2013 the Fresnel lens was moved to the Santa Barbara Maritime Museum and placed on public display for the first time.

2.2.5 Military History

With the outbreak of World War II, there was increased military presence in coastal Santa Barbara County. In 1941, a radar station was established on the Cojo Ranch and the bunkers and foundations in the "Army Camp" area of the Preserve are remnants of the operations of this station. The Point Conception Radar Site J-31 (radar type SCR-588) was ~35 acres and was staffed by 65 people. The bunker area contained three structures: a building approximately 20′ x 40′ for housing radar components, a building approximately 20′ x 20′ for power units and switchboard, and a 25′ tower on concrete footing that supported the antenna.

3.0 Existing Conditions and Threats

This section provides a detailed summary of existing conditions of the major resource types—including vegetation, habitat types, and wildlife—found at the Preserve. Resource types are organized into Grasslands, Oak woodlands, Shrublands, Freshwater Ecosystems, Coastal Ecosystems, and Marine Ecosystems. Special-status plants and animals are mentioned within the relevant resource type sections but are also specifically addressed as resource types themselves. In this section, we also describe the Preserve's climate and the anticipated impacts of climate change, and then summarize the geology, soils, and hydrology of the Preserve. For each resource type, we describe its status, including the vegetation and wildlife present and the threats it faces (e.g., human disturbance, invasive species, climate change). Section 4 then focuses on how we plan to manage each resource type to address these threats and meet the goals and objectives outlined in Table 1.

3.1 CLIMATE

The Preserve experiences a Mediterranean-type climate characterized by mild, moist winters and warm, dry summers (e.g., Kottek *et al.* 2006). Point Conception is a major climatic boundary, with relatively cool and moist conditions occurring to the north and warmer, drier conditions occurring to the east and south. The local climate may be most affected by prevailing winds. Strong winds from the Pacific Ocean are common year-round but are particularly prevalent in the spring. Winds are strongest on the west-facing coast north of Point Conception and in the east-west trending Jalama Creek watershed. The south-facing coast east of Point Conception is relatively sheltered from these winds. However, when moderate to strong winds occur, they can spill over the crest of the Santa Ynez Mountains into the Preserve. The regional coastline is also characterized by an atmospheric inversion layer that traps cool, moist air, creating fog in the morning hours (Hendrickson *et al.* 1998). The fog is heaviest and most frequent in the late spring and summer when warm air from interior lands meets cool ocean water and is then drawn over the land. Average temperature in the general area of the Preserve is 59°F, with an average daily high of 70°F and an average daily low of 47°F (Fletcher 1983). Temperatures rarely drop below freezing. Average annual precipitation for the region is 17.98 inches, with the majority falling between November and April (U.S. Department of Agriculture 2017).

Climate Change

Climate change scenarios for California are characterized by increasing temperatures and high variability in precipitation amounts (Pierce *et al.* 2018). Interannual precipitation variability has always been high in California and native plants and animals have developed a range of adaptations to cope with these changes. While ecosystem productivity, species composition, and habitat characteristics may be dramatically different across the state depending on the general trends in precipitation, it is reasonable to expect that this part of California will be buffered from the more extreme changes due to the moderating effect of the ocean (see Figure 6). Regions that have adapted to long periods of snow cover or depend on snowpack for water supply or soil moisture will undergo some of the most significant changes given the high certainty of projected snowpack declines. Regional climate attributes like snow patterns or fog patterns can be ecologically very significant and be spatially very heterogeneous. One study has documented a decline in fog frequency and duration north of the Preserve in the Central and Northern California coast with large effects on fog-dependent tree species such as redwoods (Johnstone and Dawson 2010).

Current climate change models allow us to forecast what future conditions across the Preserve could be and to plan for necessary changes to our management actions to support continued natural resource protection. All models forecast an increase in precipitation at the Preserve. The difference in precipitation by the end of the century between a "warmer-drier"

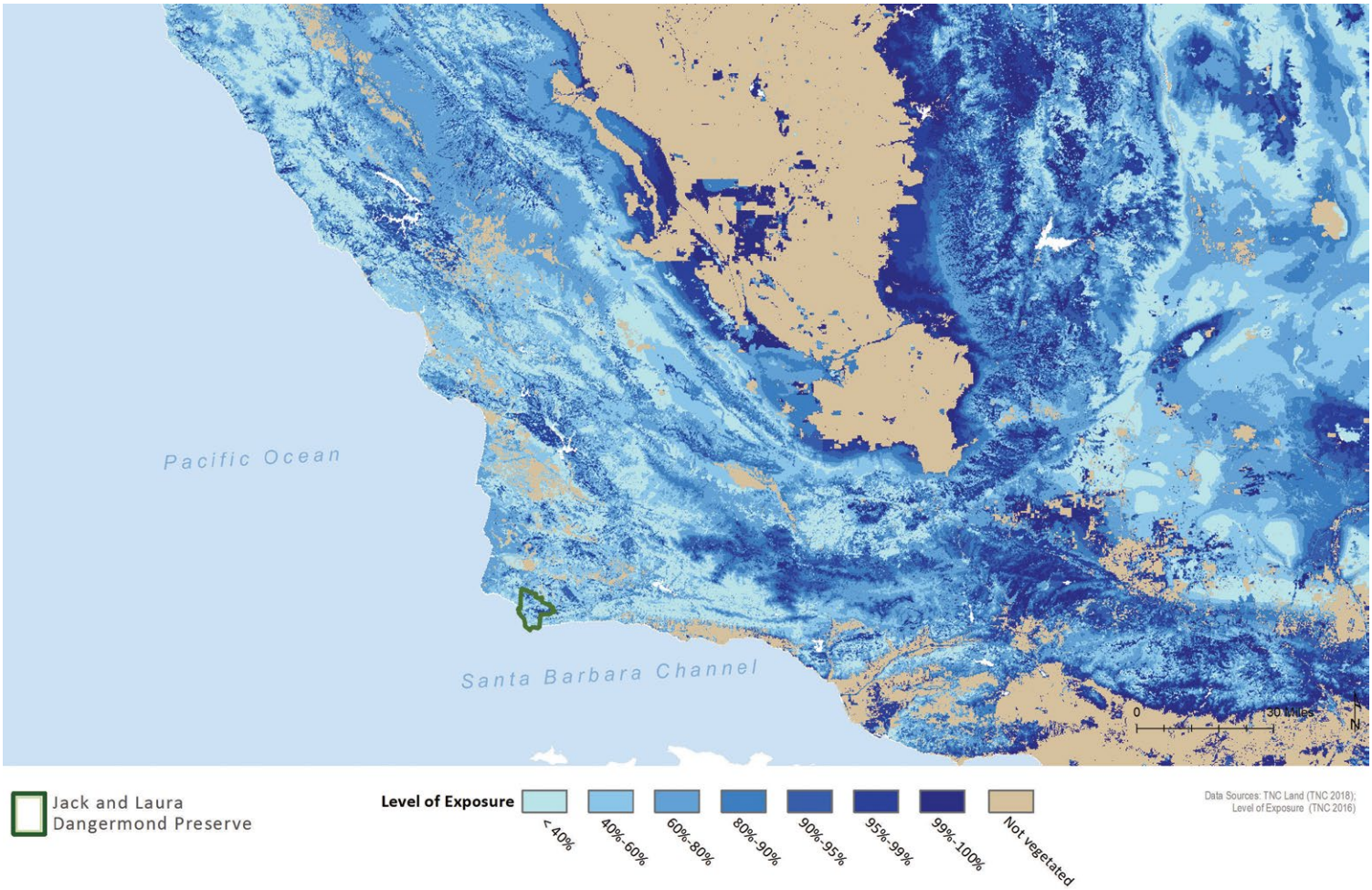


FIGURE 6 Potential Climate Change

(HadGEM2-ES) and a "cooler-wetter" (CNRM-CM5) climate model compared to the historical mean is an increase of 3.9 and 5 inches of rain by the end of the 21st century, respectively. This is assuming a global emissions trajectory like the one that we are on and without future emissions reductions (RCP 8.5). As such, it represents both a business-as-usual trend and a worse-case scenario given available climate modeling. This equals 22% or 28% more precipitation on average for Santa Barbara County. But these changes in precipitation will not necessarily lead to an increase in moisture in the ecosystem due to increased drying from higher temperatures and possibly a shorter rainy season (Daniel Swain, TNC, personal communication). Mean annual maximum and minimum temperatures are projected to go up 8.4°F and 6.8°F respectively for Santa Barbara County, under the "warmer-drier" model by the end of this century. Under the cooler-wetter model, the projected change is more similar for the hottest and coolest times of the year, with an increase of 7.4°F and 7.2°F for maximum and minimum temperatures, respectively.

Extreme Events

An increase in extreme events such as persistent multi-year droughts and intense precipitation through increased atmospheric river events may contribute to the phenomenon of "precipitation whiplash" (Swain *et al.* 2018). For most of California, a higher likelihood of extreme events and a shorter rainy season will make for a longer fire season, as seasonal winds (spring through fall) blow across drier ground. One measure of climate impact that has been shown to be correlated with vegetation community distribution is climatic water deficit (CWD)—the difference between potential and actual evapotranspiration. The change in CWD is a useful indicator for areas that may experience greater vegetation stress because of reduced soil moisture. The Preserve will likely experience a relatively minor increase in CWD associated with climate impacts compared to the broader region (see Figure 6). This suggests that future changes in vegetation will be less dramatic than many other parts of adjacent ecoregions. Yet, climate projections are characterized by high degrees of uncertainty

Cove Panorama © Matthew Davis/TNC

and developing adaptive management frameworks that include monitoring of key climate-dependent indicators and a regular evaluation cycle for management are crucial.

At the land-sea interface, the coastal habitats of the Preserve face potential impacts from both terrestrial- and marine-driven climate change effects. Increased precipitation within a shorter rainy season will affect sediment dynamics within the coastal streams, thereby also affecting sediment supply to the coastal confluences and beaches. The 25 coastal confluences, including Jalama Creek, are all bar-built or seasonally closing estuaries (Heady *et al.* 2014, 2015). Changes in sediment dynamics from extreme winter events may lead to the filling of smaller coastal confluences and may affect the timing and frequency of the mouth opening of larger bar-built estuaries like Jalama Creek. Populations of species dependent on bar-built estuaries such as Jalama Creek may be affected by changes in stream flow and sediment transport. Entire populations of tidewater gobies may be washed to sea by extreme winter events, and juvenile steelhead may not have access to migrate to sea or adult steelhead may not have access to return to their natal stream to spawn if the sandbar isolating the estuary from sea is not open at the right time. Changes in stream mouth breaching and sand bar dynamics will also affect the overall geomorphology of bar-built estuaries, potentially affecting the resulting vegetative habitats and animals they support. Sea level rise further threatens coastal habitats including estuarine marshes, beaches, and rocky intertidal habitats (Heady *et al.* 2018). A majority of the beaches on the Preserve are backed by high cliff walls with no room to migrate inland in response to rising seas. Therefore, the resilience and area of the beaches will rely on ample and unimpeded sediment supply from coastal streams, littoral sources, and healthy and dynamic dunes on the Preserve. Much of the beaches down coast from Point Conception are seasonally eroded to bare rock, which has relatively low densities of rocky intertidal species that either colonize rapidly or can withstand such disturbance. With climate change and sea level rise, these sections of coast may transition away from shallow dynamic beaches and towards sand-influenced rocky intertidal. The perennial rocky intertidal areas of the Preserve may change in area and slope as they climb the steep cliff walls with rising seas. This—coupled with ocean acidification, changes in ocean temperatures, and increased air temperatures—may affect the community composition of species found in the rocky intertidal on the Preserve. Point Conception marks the northern and southern boundary for many rocky intertidal species, with individuals potentially already living at their physiological limits. Thus, the Preserve may be a place of heightened adaptation or change in species composition with climate change. Changes in the area, species composition, and productivity of the beaches and rocky intertidal of the Preserve will have cascading effects on the many species that rely on them, from shorebirds and marine mammals to terrestrial predators.

3.2 GEOLOGY

The Santa Ynez Mountains are composed largely of marine sedimentary rock (Hendrickson *et al.* 1998). The mountains in this region began to uplift about 5 million years ago due to a compressional bend in the San Andreas fault system. Due to their young age, the mountains tend to have rugged, high-relief topography with deep canyons and steep slopes (WRA 2017). Siliceous cherty shale has been quarried near La Tinta Basin on the Preserve and diatomaceous earth is mined north of the Preserve in the Lompoc Hills (WRA 2017).

From top: Dangermond rock and shrubs © Matthew Davis/TNC; Coastal bluff © Karin Lin/TNC; Cattle stock pond © Mark Reynolds/TNC

3.3 SOILS

The USDA Soil Survey of Santa Barbara County, California South Coastal Part (1981), and Soil Survey of Northern Santa Barbara Area, California (1972), describe over 70 soil map units within the Preserve. Four soil associations composed of 11 soil series are described: Concepcion-Botella, Los Osos-Gaviota-Maymen, Nacimiento-Linne-Capitan, and Santa Lucia-Lopez-Crow Hill (WRA 2017).

General characteristics of each soil series are discussed below (adapted from WRA (2017)):

- **Concepcion series:** Soils in this series are well-drained fine sandy loam formed in alluvium or wind-deposited sandy material on terraces adjacent to and near the ocean. These soils are moderately deep, have very slow permeability, and slow to very rapid runoff.
- **Botella series:** Soils in this series are well-drained clay loam formed in alluvial material derived from sedimentary rock in valley bottoms and alluvial fans. The soils are very deep, have moderately slow permeability, and low to high runoff.
- **Los Osos series:** Soils in this series are well-drained loams formed in material weathered from sandstone and shale. The soils are moderately deep, have slow permeability, and very high runoff.
- **Gaviota series:** Soils in this series are well-drained gravelly loam formed in material weathered from hard sandstone or meta-sandstone on hills and slopes. The soils are very shallow or shallow, have moderately rapid permeability, and very low to very high runoff.
- **Maymen series:** Soils in this series are somewhat excessively drained sandy clay loam formed in residuum weathered from shale, schist, greenstone, and conglomerate on mountains. These soils are shallow, have moderate to moderately rapid permeability, and high to very high runoff.
- **Nacimiento series:** Soils in this series are well-drained silty clay loam formed in material weathered from calcareous shale and sandstone on rolling uplands with complex slopes. These soils are moderately deep, have moderately slow permeability, and medium to high runoff.

- **Linne series:** Soils in this series are well-drained clay loam formed in material weathered from fairly soft shale and sandstone on hills and slopes. These soils are moderately deep, have moderately slow permeability, and medium to very rapid runoff.
- **Capitan series:** Soils in this series are somewhat excessively drained cobbly clay loam formed from calcareous shaly conglomerate. These soils are shallow, have moderate permeability, and rapid to very rapid runoff.
- **Santa Lucia series:** Soils in this series are well-drained shaly clay loam formed in material weathered from white shale containing ash, siliceous and diatomaceous material. These soils are moderately deep, have moderate permeability, and very low to very high runoff.
- **Lopez series:** Soils in this series are somewhat excessively-drained shaly clay loam formed in material weathered from hard, fractured diatomaceous shale. These soils are shallow, have moderate permeability, and rapid to very rapid runoff.
- **Crow Hill series:** Soils in this series are well-drained clay loam formed in residuum weathered from diatomaceous shale bedrock on rolling to steep slopes. These soils have moderately slow permeability and medium to rapid runoff.

3.4 WATERSHEDS AND HYDROLOGY

In general, water originating on the Preserve drains toward the west or south, into the Pacific Ocean via ephemeral to perennial flows in steep, deep canyons originating on the south slope of the Santa Ynez Mountains. Water originating on the Jalama Ranch side of the Preserve drains to Jalama Creek via one of several ephemeral to perennial stream systems, including Espada Creek, Gaspar Creek, and Escondido Creek (WRA 2017; see Figures 7 and 8). Jalama Creek is a perennial stream that flows into the Pacific Ocean through a small coastal lagoon at Jalama Beach County Park. The Preserve contains 96.5% of the 20 square-mile Jalama Creek watershed. The Preserve contains high quality aquatic systems, including 10.08 miles of Jalama Creek and 0.58 miles of Cañada Del Cojo Creek, both Aquatic Conservation Areas identified in TNC's California Central Coast Ecoregional Plan Update (TNC 2006), as well as 4.39 miles of Espada Creek, 4.51 miles of Gasper Creek, 3.88 miles of Escondido Creek, 3.48 miles of Wood Canyon Creek, 41.7 miles of additional unnamed streams, 16 identified seeps and springs, and ~323 acres of wetlands (WRA 2017).

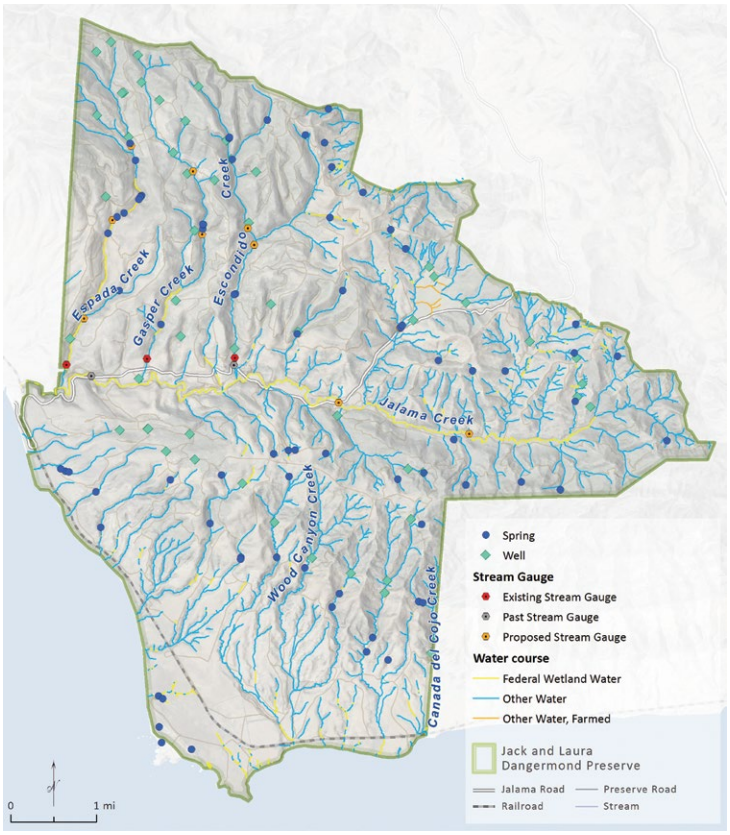


FIGURE 7 Preserve Springs Wells Stream Gauges and Water Courses

FIGURE 8 Preserve Wetlands and Stock Ponds

3.4.1 Springs and Wetlands

Wetlands occur throughout the Preserve in drainages, swales, seeps, vernal depressions, and agricultural ponds (WRA 2017; see Figures 7 and 8). Location, topography, soils, and other factors determine the moisture regime, associated vegetation, and specific habitat and species associations. Some of the larger drainages on the Preserve support small areas of Coastal and Valley Freshwater Marsh, a perennial wetland vegetation type (WRA 2017). Seasonal wetland conditions are found throughout drainages on the Preserve in low gradient stream sections where soils become saturated for at least several weeks a year, some with willow canopy (WRA 2017). Presence of surface water varies widely. Swales occur in low gradient areas between hillsides where mesic grasses, herbs, and short emergent wetland plants may dominate.

Ephemeral wetlands of up to several acres appear in depressions during seasonal storms and wet years along the coastal terrace. Seep wetlands are scattered throughout the Preserve and are distinguished by the presence of lush vegetation within dry grassland habitat. Agricultural and stock ponds have been created to provide water for livestock and vary from seasonal holding areas to perennial ponds with emergent vegetation and rare species (see Figure 8). Some stock ponds are maintained year-round with well water, while others are dependent upon seasonal rainfall. Coastal lagoons on the Preserve occur as small areas of ponded water on or immediately upstream from the beach, usually where wave action has created sand bars that partially impound freshwater streams.

3.4.2 Riparian Resources

Riparian habitat on the Preserve occurs in several forms depending on drainage characteristics. Jalama Creek is the largest stream on the Preserve (see Figures 7 and 8) and it supports diverse riparian habitat types including Mixed Riparian Woodland vegetation comprised of black cottonwood (*Populus balsamifera* ssp. *Trichocarpa*), western sycamore (*Platanus racemosa*), arroyo willow (*Salix lasiolepis*), Southern California black walnut (*Juglans californica*), and coast live oak canopy trees (WRA 2017). In the upper portion of Jalama Creek, riparian habitat is shaded by large mature coast live oaks that are contiguous with adjacent coast live oak forest forming Central Coast Live Oak Riparian Forest. Cottonwoods are sporadic and coast live oaks are the primary canopy tree in upper Jalama Creek. Riparian habitats are wildlife refugia and movement corridors where many species forage, seek cover, nest, and obtain water.

Medium-sized drainages on the Preserve support dense arroyo willow stands forming narrow strips of green vegetation through the adjacent grassland and scrub habitats classified as Arroyo Willow Woodland. Smaller drainages and tributaries support shrubby riparian vegetation composed of willows and upland shrub habitats classified as Central Coast Riparian Scrub (WRA 2017).

3.4.3 Coastal and Valley Freshwater Marsh

Coastal and Valley Freshwater Marsh occurs in small patches in drainages and stock ponds throughout the Preserve (WRA 2017). It is dominated by perennial emergent monocots several meters high and often forming completely closed canopies. It occurs in permanently flooded fresh water, most notably in lower Jalama Creek where perennial water supports dense stands of emergent vegetation.

3.5 VEGETATION AND HABITAT TYPES

3.5.1 Grasslands

There are 5,074 acres of grassland ecosystems on the Preserve—4,829 acres of non-native annual grasslands, 214 acres of purple needlegrass grassland, 31 acres of giant wild rye grassland, and <1 acre of creeping rye grass turfs (see Figure 9), although the acreages may vary by year based on annual precipitation (e.g., purple needlegrass populations have expanded in 2019, likely because of increased precipitation in 2018-2019). In general, grasslands consist of sparse to dense herbaceous cover dominated by grasses and forbs. Subshrubs and shrubs occur at varying abundance within the grassland, with greater abundance occurring in areas where grasslands intergrade with adjacent shrub-dominated communities, including coastal scrub. Similarly, scattered trees have become established within the grasslands from the adjacent forests and woodlands. Within the Preserve grasslands, herbaceous plant density varies and is likely influenced by several factors including microclimate and soil conditions, which interact to influence moisture regimes. Herbaceous plant height depends on the factors affecting productivity, as well as the species pools and aspects of the grazing and fire regimes.

3.5.1.1 Non-native Annual Grasslands

The 4,829 acres of non-native annual grasslands at the Preserve are dominated by ripgut brome (*Bromus diandrus*), soft brome (*B. hordeaceus*), Italian rye grass (*Festuca perennis*), slender oat (*Avena barbata*), and iceplant (*Carpobrotus edulis*)

in the coastal grassland portions of the Preserve. Non-native grasslands occur as an established component of the vegetation throughout California. This community is dominated by non-native herbaceous species adapted to disturbance (Holland 1986, Sawyer *et al.* 2009). Species composition may vary due to exposure, slope, soil, grazing regime, grazing history, rainfall patterns, fire history, and disturbance regime. Non-native annual grasslands at the Preserve have been grazed at the site since the Spanish era. Generally, non-native annual grasslands on the coastal grassland section of the Preserve have a higher proportion of ripgut brome than inland grasslands (WRA 2017). Non-native annual grasslands may contain scattered native and non-native forbs, including California poppy (*Eschscholzia californica*), filarees (*Erodium* spp.), mustards (e.g., *Brassica nigra*, *Hirschfeldia incana*), and non-native thistles (e.g., Italian thistle [*Carduus pycnocephalus*] and milk thistle [*Silybum marianum*]). Non-native annual grassland may also contain inclusions of native bunchgrasses. However, where relative cover of purple needlegrass (*Stipa* (*Nassella*) pulchra) or other native bunchgrasses met or exceeded 10%, it was mapped by WRA (2017) as its own alliance (see Figure 9).

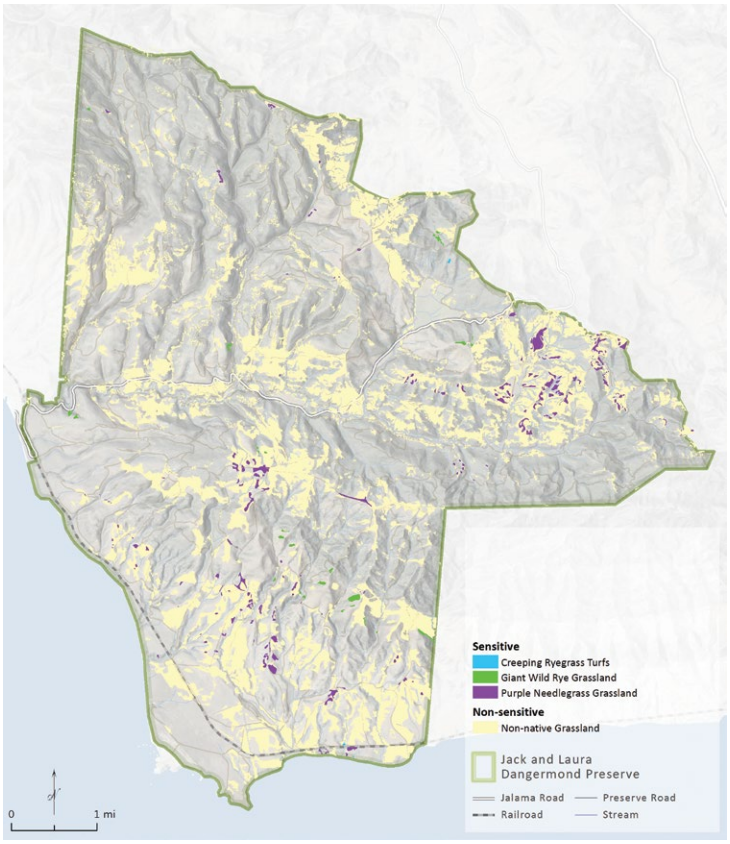


FIGURE 9 Preserve Grassland Ecosystems

3.5.1.2 Purple Needlegrass Grasslands

Purple needlegrass grassland is dominated by *Stipa* (*Nassella*) *pulchra*. Purple needlegrass is a native, cool-season perennial bunchgrass. Purple needlegrass grassland is known from the Peninsular Ranges, the Western Transverse Ranges, the Central Valley, the Sierra Nevada Foothills, the San Francisco Bay Area, and the North Coast Ranges (Baldwin *et al.* 2012). This community is composed of perennial bunchgrasses that re-sprout from basal crowns and have seeds that germinate following low- to moderate-intensity fires (Sawyer *et al.* 2009). On the Preserve, purple needlegrass is commonly observed in openings in coastal scrub habitat, where it intergrades with the California sage scrub alliance. Other species commonly observed within purple needlegrass stands include common gumplant (*Grindelia camporum*), Menzies' goldenbush (*Isocoma menziesii*), California sagebrush (*Artemisia californica*), ladies' tobacco (*Pseudognaphalium californicum*), and a range of non-native annual grasses (WRA 2017).

3.5.1.3 Giant Wild Rye Stands

Giant wild rye (*Elymus* [*Leymus*] *condensatus*) is a native perennial grass with culms growing up to 10 feet in height. Plants are rhizomatous and form large colonies. This alliance occurs sporadically throughout the central and southern coasts of California. Stands tend to be short-lived, as oak trees and shrubs of the coastal sage scrub vegetation alliance often replace the grass stands in time (Sawyer *et al.* 2009). WRA (2017) mapped this alliance where giant wild rye occurs at greater than 50% relative cover in the herbaceous layer (see Figure 9). At the Preserve, giant wild rye stands are generally located on north-facing aspects on moderate slopes within coastal sage scrub or chaparral (WRA 2017). The herbaceous layer is dominated by giant wild rye, with emergent shrubs including California sagebrush (*Artemesia californica*), toyon (*Heteromeles arbutifolia*), and black sage (*Salvia mellifera*).

3.5.1.4 Creeping Rye Grass Turfs

Creeping rye grass (*Elymus* [*Leymus*] *triticoides*) is a native, long-lived perennial grass. Creeping rye grass typically reproduces by underground runners that bind the surrounding soil into a strong turf. Along the Southern California coast, creeping rye grass turfs are typically found adjacent to stands of California sagebrush and purple needlegrass. Creeping rye grass typically occurs in poorly drained floodplains, drainage and valley bottoms, mesic flats and slopes, and salt marsh margins (Sawyer *et al.* 2009). WRA (2017) mapped this alliance where relative cover of creeping rye grass was greater than 50% in

the herbaceous layer (see Figure 9). At the Preserve, there is one small occurrence of this vegetation alliance that is growing adjacent to non-native annual grasslands and California sagebrush scrub (see Figure 9). Associated species included bristly ox-tongue (*Helminthotheca echioides*), bull thistle (*Cirsium vulgare*), and salt grass (*Distichlis spicata*) (WRA 2017).

3.5.1.5 Threats to Grasslands

The threats to grassland habitats and species at the Preserve include (adapted from Mooney and Zavaleta 2016):

1. Incompatible grazing management (e.g., improperly timed grazing, insufficient or too much grazing);
2. Incompatible fire management;
3. Invasive noxious weed species;
4. Pig rooting and foraging;
5. Atmospheric nitrogen deposition; and
6. Climate change.

3.5.2 Oak Woodlands

There are 6,000 acres of oak woodlands at the Preserve (see Figure 10). Coast live oak woodland (*Quercus agrifolia*) is the dominant oak woodland type. WRA (2017) mapped coast live oak woodland where relative cover of coast live oak is greater than 50%. Coast live oak woodland is widespread in both upland and bottomland situations at the Preserve, where it intergrades with many other vegetation alliances. Coast live oak woodlands at the Preserve range from relatively open savannas to dense, closed-canopy old-growth forests. Acreage of oak woodlands at the Preserve has increased historically, but there are fewer trees, particularly fewer small trees, suggesting the oak population is aging with low establishment and survival of new young oaks (Anderson *et al.* 2019). "Establishment windows" have been shown to be declining in oak woodlands across Southern California (Davis *et al.* 2016), possibly also contributing here at the Preserve to low rates of oak tree seedling establishment. Other species observed in coast live oak woodlands include poison oak (*Toxicodendron diversilobum*), black sage, California sagebrush, creeping snowberry (*Symphoricarpos mollis*), pink honeysuckle (*Lonicera hispidula*), hummingbird sage (*Salvia spathacea*), a range of non-native annual grasses, and many other shrub and herbaceous species.

Wild pig © John Stuelpnagel

3.5.2.1 Coast Live Oak Woodlands

Coast live oak is a drought- and fire-resistant evergreen tree that occurs along California's coastal ranges, the Sacramento Valley, and throughout central-western and southwestern California (Sawyer *et al.* 2009; Baldwin *et al.* 2012). Stands vary from upland savannas and woodlands to riparian forests with closed canopies. Acorn production varies greatly by year, and acorns are readily dispersed by small mammals and birds.

3.5.2.2 Threats to Oak Woodlands

The threats to oak woodland habitats and species at the Preserve include (adapted from Mooney and Zavaleta 2016):

1. Incompatible grazing (e.g., cattle browsing on oak seedlings and saplings; cattle consumption of acorns);
2. Pig rooting and foraging of acorns;
3. Oak pests and pathogens, including sudden oak death and goldspotted oak borer;
4. Invasive noxious weed species;
5. Loss of habitat and age structure; and
6. Climate change (e.g., reduced suitability of the landscape for coast live oak woodlands and local impacts to rain and microclimate that lead to reduced "windows of opportunity" for seedling establishment; Davis *et al.* 2016).

3.5.3 Shrublands

There are 10,317 acres of shrublands at the Preserve, 9,101 acres of which are classified as non-sensitive shrubland communities, including (see Figure 11):

- Deer weed scrub (*Acmispon glaber*; 186 acres),
- Chamise chaparral (*Adenostoma fasciculatum*; 192 acres),
- California sagebrush scrub (*Artemisia californica*; 2,666 acres),
- Coyote brush scrub (*Baccharis pilularis*; 1,907 acres),
- Buck brush chaparral (*Ceanothus cuneatus*; 49 acres),
- Summer holly stands (*Comarostaphylis diversifolia* ssp. *planifolia*; <1 acre),
- Coast buckwheat scrub (*Eriogonum parvifolium*; 4 acres),
- California coffeeberry scrub (*Frangula* [*Rhamnus*] *californica*; 467 acres),
- Menzies' goldenbush scrub (*Isocoma menziesii*; 816 acres),
- Silver bush lupine scrub (*Lupinus albifrons*; 65 acres),
- Longleaf bush lupine scrub (*Lupinus longifolius*; 8 acres),
- Redberry scrub (*Rhamnus crocea*; 276 acres),
- Purple sage scrub (*Salvia leucophylla*; 1,260 acres),
- Black sage scrub (*Salvia mellifera*; 1,171 acres), and
- Poison oak scrub (*Toxicodendron diversilobum*; 33 acres).

The remaining 1,216 acres of shrublands are classified as "sensitive" communities by the California Native Plant Society (CNPS 2017, 2017a, 2017b) and include:

- La Purisima manzanita chaparral (*Arctostaphylos purissima*; 334 acres),
- California brittle brush scrub (*Encelia californica*; 28 acres),
- Sawtooth goldenbush scrub (*Hazardia squarrosa*; 56 acres),
- Toyon chaparral (*Heteromeles arbutifolia*; 308 acres),
- Giant coreopsis scrub (*Leptosyne* [*Coreopsis*] *gigantean*; 22 acres),
- Silver dune lupine (*Lupinus chamissonis*; 73 acres),
- Bush monkeyflower scrub (*Mimulus aurantiacus*; 82 acres),
- Holly leaf cherry chaparral (*Prunus ilicifolia*; 32 acres),
- Lemonade berry scrub (*Rhus integrifolia*; 15 acres), and
- Arroyo willow thickets (*Salix lasiolepis*; 266 acres).

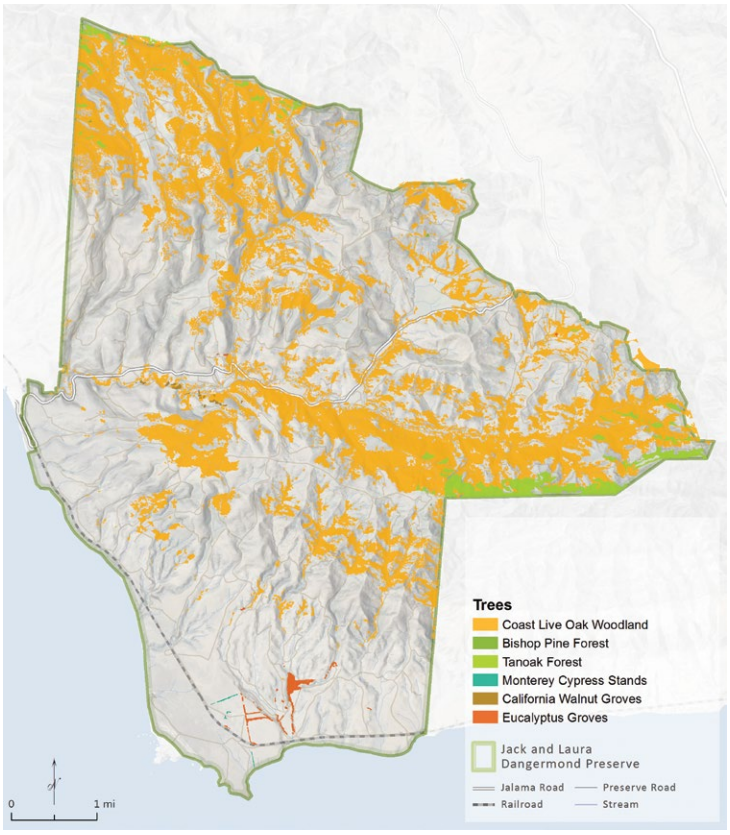


FIGURE 10 Preserve Forested Ecosystems

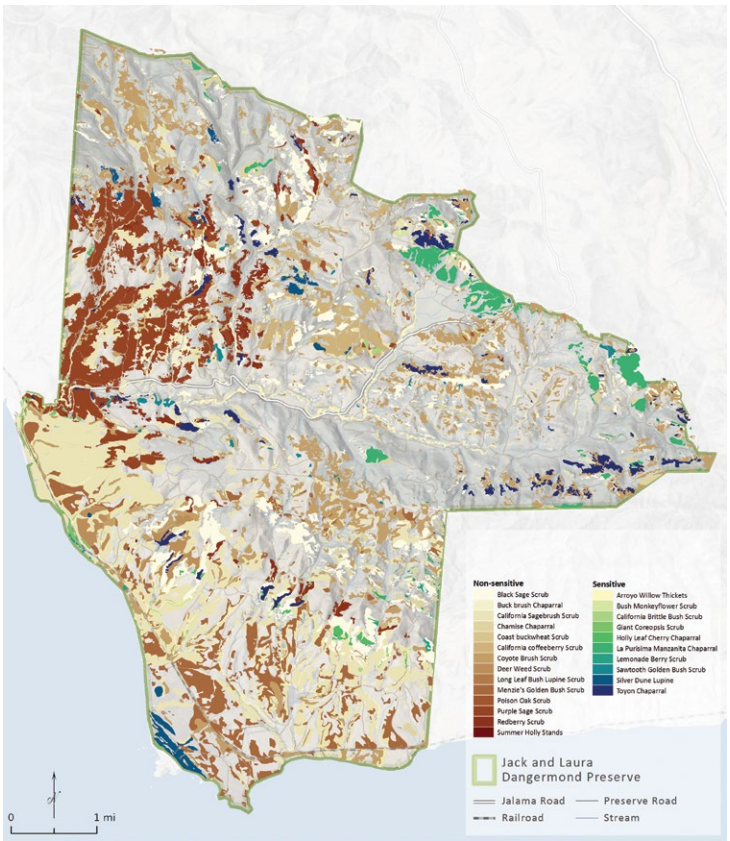


FIGURE 11 Preserve Shrubland Ecosystems

Giant Coreopsis by Jalama Beach State Park near sunset © Bill Marr/TNC

Shrublands and rolling hills © Bill Marr/TNC

Areas within the Preserve that are dominated by short to medium height, soft-woody shrubs are referred to as scrub communities. Areas within the Preserve that are dominated by medium to tall, *sclerophyllous* (hard-leaved), woody shrubs are referred to as chaparral communities. Chaparral supports a dense cover of taller, woody, evergreen shrubs while coastal scrub supports shorter-statured shrubs that are less woody and oftentimes drought-deciduous (Keeley and Keeley 1987). Annual and perennial grasses and forbs occur between and to a lesser extent beneath the shrubs (WRA 2017). The density of shrubs relative to grasses and forbs is likely influenced by abiotic factors including slope, aspect, and soil conditions, as well as disturbance history (i.e., fire, clearing, grazing), with shrub cover increasing over time since disturbance.

Special-status plant species that occur within the Preserve's shrubland communities include nuttall's milkvetch (*Astragalus nuttallii* var. *nuttallii*), Gaviota tarplant (*Deinandra increscens* ssp. *Villosa*), Lompoc yerba santa (*Eriodictyon capitatum*), large-leaved wallflower (*Erysimum suffrutescens*), La Purisima manzanita (*Arctostaphylos purissima*), western dichondra (*Dichondra occidentalis*), Kellogg's horkelia (*Horkelia cuneata* var. *sericea*), ocellated Humboldt lily (*Lilium humboldtii* ssp. *Ocellatum*), cliff aster (*Malacothrix saxatilis* var. *saxatilis*), California spine flower (*Mucronea californica*), and black-flowered figwort (*Scrophularia atrata*) (see Table 2 for status categories).

3.5.3.1 Threats to Shrublands

The threats to shrubland habitats and species at the Preserve include (adapted from Mooney and Zavaleta 2016):

1. Incompatible grazing;
2. Incompatible fire management (e.g., lack of managed fire and accelerated natural fire regimes);
3. Invasive noxious weed species;
4. Atmospheric nitrogen deposition; and
5. Climate change (e.g., reduced habitat suitability).

3.6 COASTAL ECOSYSTEMS

3.6.1 Dunes

The Preserve contains approximately 150 acres of dune ecosystems (Soil Survey Staff 2019; see Figure 12), divided into headland bypass dunes and smaller dune systems, including climbing dunes at the back of beaches, especially at Percos Beach and North Beach. There are other headland bypass dune systems in the state of California, but many have been converted (e.g., city of San Francisco and cities in the Monterey area) and/or have been over-stabilized. Some, as in the case of Humboldt County, are being actively restored. The dune systems at the Preserve, while extremely important as habitat

for native plant and animal species and for sand delivery up and down the west coast, are not well studied or understood. In this section, we summarize what is known about the coastal dune systems at the Preserve, but also emphasize the need for comprehensive evaluation of this system and refinement of short- and long-term management goals and objectives.

The headland bypass dunes on the Preserve are an important component of a larger headland-beach-dune system that is present at the Preserve and like other geographies along the U.S. west coast. At the Preserve, the morpho-dynamics of the coastal beaches are strongly affected by the presence of Point Conception, which interrupts the longshore sand transport, resulting in updrift of sand to headland bypass dunes and in erosion downdrift off the headland (see Claudino-Sales 2017 as an example in Brazil) that refeeds sand to the downcoast beaches in the process. Littoral bypass is also an important process, supplying the littoral cell with new sand, together with the erosion (Claudino-Sales 2017). The headland-beach-dune system is strongly affected by anthropogenic activities, including dams, coastal armoring, and railroad construction and maintenance, which are present on or near the Preserve.

Headland bypass dunes are critically important for sand supply to downcoast beaches and the littoral cell but are currently likely to be "over stabilized" at the Preserve by invasive iceplant. Preserve dune systems are also impacted by other invasive species including European beachgrass (*Ammophila arenaria*) and veldt grass (*Ehrharta* spp.). Both species reduce overall native species richness (Barbour *et al.* 1976) and change the shape and orientation of the dunes, which, like iceplant, alters the hydrology and microclimate of the swales and other habitats behind the dunes (Bossard *et al.* 2000). The magnitudes and timescales of sand transport that occur between some littoral cells via headland bypassing is a topic of current research in the region of the Preserve (see Peterson *et al.* 2010). The strong and consistent northwest winds blowing over Point Conception carry sand from large beaches on the Preserve up onto the headland bypass dunes, deposit the sands on the leeward side of cliffs, and form smaller climbing dunes at the base of bluffs and behind beaches. At the Preserve, these eolian sands are deposited on escarpments of Monterey shale. Sand residence time and corresponding coastal dune sand accumulation increase where beach sand is trapped against bounding headlands (Peterson *et al.* 2010). In Southern California, a decline in epidote (heavy mineral indicator) abundance with distance south of Pismo Beach suggests limited sand transport south to Point Conception (Peterson *et al.* 2010)—although small dune fields located north of Point Arguello and at Point Conception (near or on the Preserve) confirm some southward littoral transport to Point Conception (Peterson *et al.* 2010).

The headland bypass dune systems at the Preserve extend northwest to southeast directly inland of the lighthouse at Point Conception. The dune herbaceous community is dominated by shrubs, with areas of bare sand and a variety of herbaceous species in between. The dominant native shrubs are mock heather (*Ericameria ericoides*), giant coreopsis, seaside golden yarrow (*Eriophyllum staechadifolium*), rush lotus (*Lotus junceus*), bush lupine (*Lupinus arboreus*), dune ragwort (*Senecio blochmaniae*), coyote brush, Menzie's goldenbush scrub, silver dune lupine (*Lupinus chamissonis*), and sand dune sedge swaths (*Carex pansa*). Common herbaceous species include California poppy (*Eschscholzia californica*), Indian paintbrush (*Castilleja affinis*), suncups (*Camissonia* ssp.), and beach bursage (*Ambrosia chamissonis*) (Althouse and Meade, Inc. 2018).

The smaller climbing dunes and coastal strand at the base of the cliffs along the beaches are lightly vegetated, if at all, and, like other dunes, play an important role in the sand budget for the Preserve's beaches and dune systems. Unlike headland bypass dunes, which are more stable across the year, these smaller dune systems are often formed in the spring and summer from consistent winds and are then washed away by winter storms. These winter storms may help transport the resulting sand to nearshore reefs and sand bars, as well as further downcoast. A shift in swell direction the following summer will redeposit the sand back onto beaches to be available for aeolian transport again. Climbing dune systems on the Preserve are mostly devoid of vegetation but provide important sand storage and habitat for shorebirds and other species. Coastal strand fringing coastal confluences, at the base of cliffs and at the margins of some climbing dunes, are vegetated with salt grass (*Distichlis spicata*), red sand verbena (*Abronia maritima*), and European searocket (*Cakile maritima*). Because of the disturbance-prone nature of these dunes, they are generally vegetated by pioneering species and, in current times, often by invasive noxious weed species, such as searocket.

Several rare species occur in dune habitats on the Preserve and/or adjacent Point Conception, including Point Conception Jerusalem cricket (*Ammopelmatus muwu*), silvery legless lizard (*Anniella pulchra pulchra*), western snowy plover (*Charadrius alexandrines nivosus*), red sand verbena, ocean bluff milk-vetch (*Astragalus*

nuttallii var. *nuttallii*), surf thistle (*Cirsium rhothophilum*), large-leaved wallflower (*Erysimum suffrutescens*), Kellogg's horkelia (*Horkelia cuneate* var. *sericea*), California spineflower (*Mucronea californica*), black-flowered figwort (*Scrophularia atrata*), Blochman's ragwort (*Senecio blochmaniae*), seablite (*Suaeda taxifolia*), dune ragwort, and burrowing owl (*Athene cunicularia*).

3.6.1.1 Threats to Dunes

The threats to dune systems at the Preserve include (adapted from Mooney and Zavaleta 2016):

1. Invasive noxious weed species (e.g., iceplant, European beachgrass, veldt grass);
2. Invasive animals via disturbance and herbivory (e.g., feral pigs, turkeys);
3. Impairment of the sand supply in the sandshed (e.g., dams, coastal armoring, invasive plant species, and railroad infrastructure and maintenance);
4. Incompatible cattle grazing (e.g., soil impaction and direct impacts to native plants and habitat);
5. Human disturbance (e.g., foot traffic, wheeled traffic, pets);
6. Sea level rise and increased storm intensity; and
7. Subsidized predation on seeds and animals (e.g., house sparrows and rodents for seeds and ravens, other/all corvids and gulls as predators on sensitive native animals).

3.6.2 Rocky Intertidal

The rocky intertidal communities around Point Conception have high diversity of algal and invertebrate species, likely due to the productive oceanographic conditions and location at the intersection of two major marine biogeographic regions. With limited human disturbance due to lack of access over the past century, the rocky intertidal communities along the shores of the Preserve are in excellent condition, showing little signs of trampling and harboring large populations with diverse size structure of individuals. In this respect, the rocky intertidal habitats and ecological communities are more like those found on the less accessible portions of the northern Channel Islands, than to adjacent more accessible areas on the mainland South Coast.

There are 4.4 miles of rocky shores along the coastal margin of the Preserve and the Point Conception lighthouse property, including two main types of rocky intertidal habitats distinguished by their exposure, geomorphology, and typical species [as mapped by the NOAA Environmental Sensitivity Index (NOAA-ESI)], exposed rocky shores and exposed wave-cut rocky platform (see Figure 12):

- **Exposed rocky shores:** There are 0.74 miles_of exposed rocky shores (NOAA ESI Type 1A), primarily located at Point Conception and Government Point and generally backed by cliffs. Exposed rocky shores are steep (greater than 30° slope) and relatively narrow areas with low sediment accumulation, as waves tend to remove debris. Due to the steepness, there is strong vertical zonation of biological communities, with species composition and diversity varying with tidal height, wave exposure, and underlying geology.
- **Exposed wave-cut rocky platform:** There are 3.66 miles of exposed wave-cut rocky platform (NOAA ESI Type 2A) distributed just south of Jalama Beach County Park, along North Beach, between Point Conception and Government Point, and in several locations between Percos Beach and Little Cojo Beach. In some places, wave-cut rocky platform is backed by beach habitat; in other places these habitats abut steep cliffs. Wave-cut rocky platforms are of variable width and their surface tends to be irregular, with tide pools and crevices common. Some areas of wave-cut rocky platform, such as between Government Point and Percos Beach, are primarily sand-scoured and visible only in winter and spring months, being covered by sand through the summer and fall.

Rocky intertidal communities vary in species composition and community structure with tidal height, wave exposure and underlying geology (Ricketts *et al.* 1985, Foster *et al.* 1988, Denny and Gaines 2007). Rocky intertidal communities are composed of marine species that have adapted to this environment, ever moving landward to avoid the high levels of predation and competition in the ocean. As such, the upper limit of rocky intertidal species is determined by their ability to resist the drying forces and heat associated with being exposed during low tides, while the lower limit of their distribution is generally established by competition or predation (Connell 1961). Within rocky intertidal habitat, physical conditions and resulting biological communities can vary dramatically within very short distances, giving rise to some of the highest biodiversity and density of species found in the world (Ricketts *et al.* 1985).

The rocky intertidal at the Preserve is dominated by consolidated bedrock, with the surrounding areas comprised of a mixture of consolidated bedrock and sandy beach. There are four main zones in the rocky intertidal, all compressed within 2 meters of

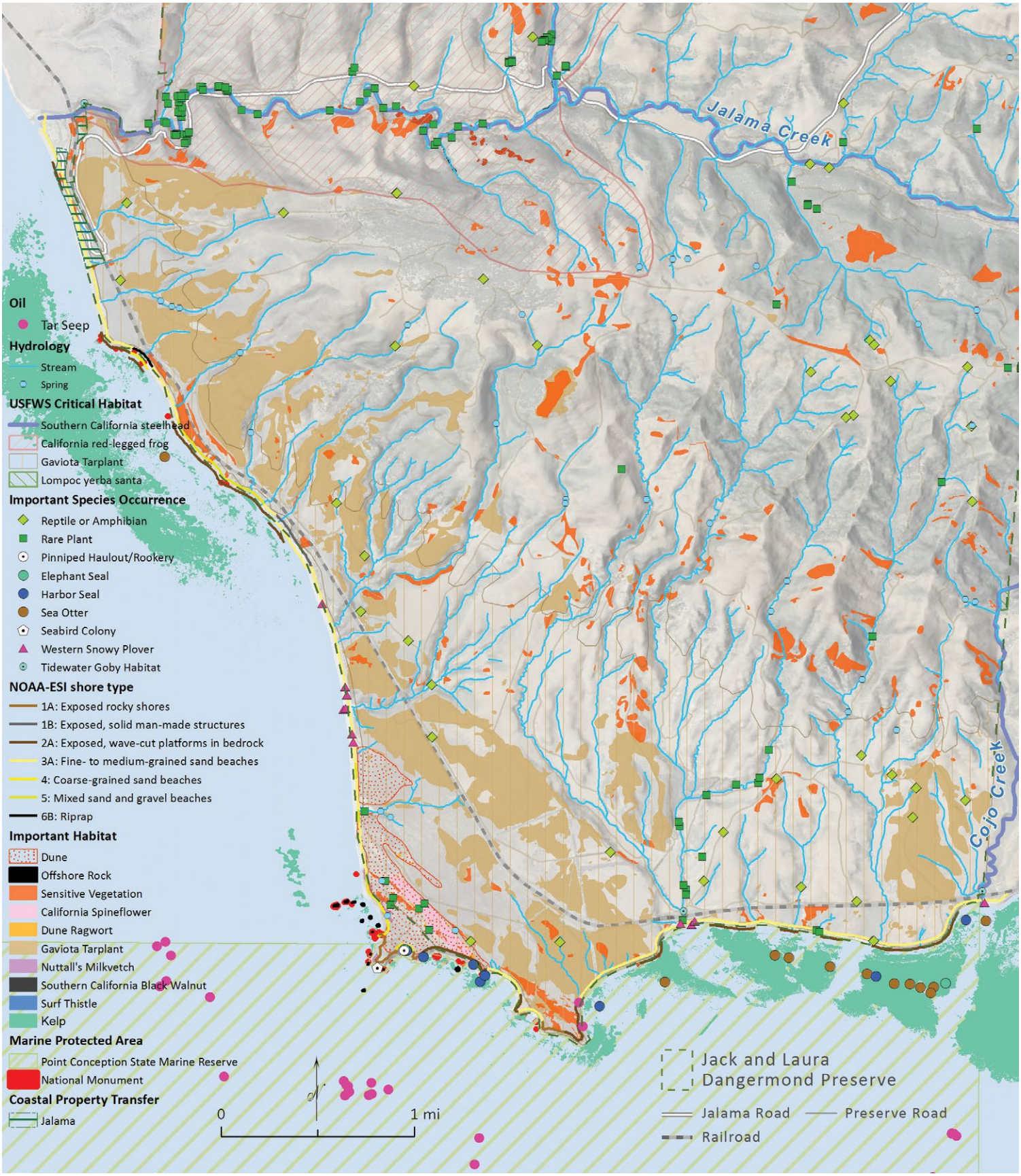
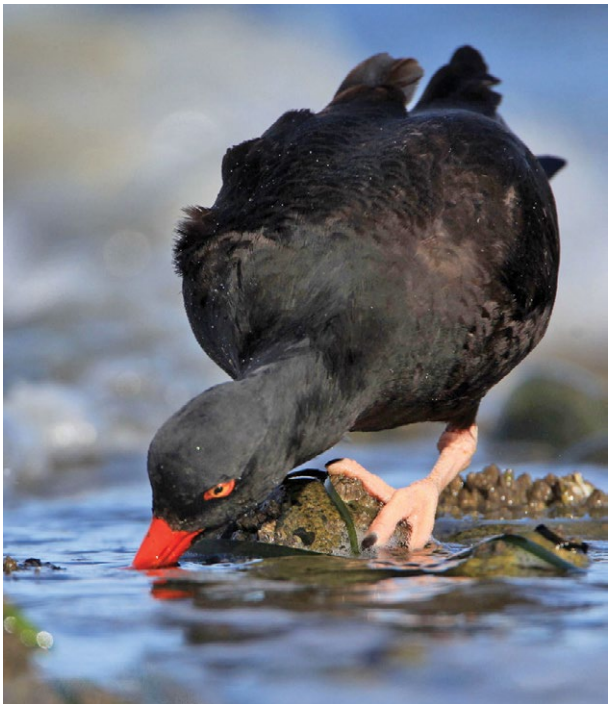


FIGURE 12 Preserve Coastal and Marine Resources

vertical elevation and each with a distinct assemblage of species (see Figure 12). The upper splash zone is largely bare rock often covered in microalgae or sparse growths of green algae (*Ulva* spp.) and hardy species that can withstand long dry periods such as periwinkle snails *(Littorina* spp.*)*, isopods (*Ligia occidentalis*), giant owl limpets (*Lottia gigantea*) and other species of limpets (*Lottia* spp.). At slightly lower elevation, the high intertidal zone has a greater variety and number of species and is more consistently wet, sometimes with persistent tide pools. Algae (*Fucus gardneri* and *Endocladia muricata*) are common and provide shelter to other species. Common invertebrates include limpets, snails (*Tegula funebralis*, *Nucella* spp. and *Littorina* spp.), hermit crabs (*Pagurus* spp.) and crabs (*Pachygrapsus crassipes*), amphipods, isopods and acorn barnacles (*Balanus glandula; Chthamalus fissus/ dalli*). The mid-intertidal zone, below mean sea level, is exposed during most low tides and may have extensive tidepools. Lush growth of algae (*Silvetia compressa*, *Fucus gardneri, Mastocarpus* spp*., Pyropia spp, Ulva* spp*.,)* is common. Dense aggregations of mussels (*Mytilus* spp.) and gooseneck barnacles (*Pollicipes polymerus*) cover the rocks. Limpets, chitons (*Nuttallina* spp.), starfish (*Leptasterias pusilla*, *Pisaster ochraceus*), snails (*Tegula* spp.), nudibranchs, crabs, amphipods, isopods, worms, and many other taxa are present. Fish, predominantly sculpin (*Oligocottus* spp.), remain in tidepools during low tides. The lower intertidal zone is only uncovered by minus tides a few times per month at most. This zone has high diversity as it includes some mid-intertidal species as well as animals unable to withstand much exposure to the air. Algae include a diverse assemblage of red algae, coralline algae, and laminarians (e.g. *Egregia menziesii* and *Laminaria* spp*.)*. Dense beds of surfgrass (*Phyllospadix* spp*.)* are often found in the low intertidal and provide biogenic habitat. Typical invertebrates include dense aggregations of anemones (*Anthopleura elegantissima*), colonial sand tube worms (*Phragmatopoma californica*), and solitary anemones (*Anthopluera xanthogrammica*), snails, starfish (*Patiria miniata, Pisaster ochraceus, Pycnopodia helianthoides*), chitons (*Tonisella* spp*., Katharina* spp*., Mopalia* spp.), urchins (*Strongylocentrotus purpuratus*), abalone (*Haliotis* spp.), crabs, sponges, hydroids, nudibranchs, and many more. Natural tar seeps in the vicinity result in some areas of rocky intertidal habitat being covered with a layer of tar adhered to the rocks, sometimes affecting the abundance and type of organisms present on the rocks.

A distinct feature of the rocky intertidal at the Preserve is the wildlife use of the intertidal due to the limited human presence along the coast. Black oystercatchers (*Haematopus*



Black Oystercatcher © Winnu/Creative Commons

bachmani), brant *(Branta bernicla)* and other shorebirds are commonly observed feeding in the rocky intertidal. Signs of coyote, racoons, mountain lions, pigs, and skunks have been seen on the rocky intertidal and beaches where they forage for food. There are a handful of offshore rocks that are protected (above MHW) by the California Coastal National Monument, some of which are used by seabirds for nesting and/or roosting or marine mammals for haul-out areas (BLM 2005).

Government Point is considered a priority long-term rocky intertidal monitoring site and has been surveyed regularly by the PISCO/MARINe consortium since 1992 (with a gap between 2007-2013). Long-Term MARINe surveys target focal species, such as acorn barnacle, gooseneck barnacle, California mussel *(Mytilus californianus*), golden rockweed *(Silvetia compressa*), turfweed *(Endocladia muricata),* surfgrass *(Phyllospadix* spp.), and ochre Star (*Pisaster ochraceus*). In addition, motile invertebrates, barnacle recruitment, and water temperature are monitored at this site. Biodiversity surveys were conducted by PISCO/ MARINe at Government Point in 2001, 2006, 2016, and 2018 and at Tarantulas Beach in 2018. Additionally, a rapid assessment protocol was conducted to qualitatively assess species presence and abundance in the rocky areas between Government Point and Point Conception in 2018.

Intertidal Zone Dangermond Preserve © Bill Marr/TNC

3.6.2.1 Threats to Rocky Intertidal

The threats to rocky intertidal habitats and species at the Preserve include:

1. Human trampling of intertidal organisms and destruction of habitat;
2. Legal take (outside SMR) or illegal poaching (within SMR) of intertidal species for food or bait (e.g., mussels, owl limpets, snails, gooseneck barnacles, abalone, seaweeds);
3. Human disturbance of wildlife that use rocky intertidal for foraging, resting, or reproduction (e.g., black oystercatcher, other shorebirds, marine and terrestrial mammals);
4. Invasive marine (e.g., seaweeds, ascidians) or terrestrial (e.g., pigs) species;
5. Diseases, die-offs, and harmful algal blooms (e.g., seastar wasting disease, abalone withering syndrome, domoic acid events);
6. Oil spills;
7. VAFB rocket launch failure and crash; and
8. Climate change and changing ocean conditions (Blanchette *et al.* 2016), including:
    a. Increasing frequency and intensity of storms;
    b. Alteration of the frequency and intensity of cyclical patterns (e.g., El Niño Southern Oscillation and upwelling);
    c. Ocean acidification;
    d. Sea level rise;
    e. Changes in water temperature;
    f. Changes in coastal weather, including air temperature, fog, cloud cover, and wind;
    g. Changes in ocean circulation and nearshore currents, affecting larval dispersal and connectivity;
    h. Changes in salinity; and
    i. Increases in UV radiation.

3.6.3 Sandy Beaches

Sandy beaches are common throughout Central and Southern California (CA-MLPA 2009); however, the undisturbed nature of the beaches and their location on either side of Point Conception make the beaches of the Preserve unique along the Southern California mainland (see Figure 12). The limited human presence on the beaches and abundant food resources in the intertidal provide opportunity for wildlife (e.g., mountain lion, coyote, skunk, racoon, feral pig) to forage at the beach—the beaches at the Preserve are notable for the number of wildlife tracks and signs

in the sand and in the drainage areas connecting the beach to the upland habitats. The lack of human disturbance also provides for unique nesting, resting, and rookery grounds for shorebirds and marine mammals. Studies documenting the impacts of human disturbance on nesting western snowy plovers (*Charadrius alexandrinus nivosus*) and other shorebirds (Lafferty 2001; Ruhlen *et al.* 2003; Lafferty *et al.* 2006), and marine mammals (Allen *et al.* 1984) elsewhere have led to recommended or required buffer zones between people and animals or seasonal closures of beaches to protect them from disturbance.

On the exposed and windy coastline of the Preserve, the sandy beach habitats are very dynamic and experience significant wave exposure, tidal range, and seasonal changes that drive their physical and biological characteristics. The shape of a beach is determined by wave energy, wind exposure, tides, grain size, and the presence of other structures such as rocks and headlands (Dugan and Hubbard 2016). Waves drive both the longshore and cross-shore transport of sand onto and off beaches (Dugan and Hubbard 2016). Extreme or episodic events—such as storms, El Niño Southern Oscillations (ENSOs), earthquakes, and tsunamis—also affect the dynamics and cause lasting changes to beaches (Schlacher *et al.* 2014). Sand is generally eroded from beaches in the winter and redeposited in the summer, leading to strong seasonal and interannual differences in width and slope. Much of the sand from Government Point to south of Percos Beach is scoured and transported offshore in winter storms, leaving behind sand-scoured bedrock. This sand is then mobilized from subtidal bars to be redeposited on beaches and dunes in the summer.

At the Preserve and Point Conception there are approximately 7.3 miles of beaches of three main types [as mapped by the NOAA Environmental Sensitivity Index (NOAA-ESI)], distinguished by their grain size and other features (see Figure 12):

- Fine-medium grained sandy beach (ESI Type 3A): This is the most abundant beach type at the Preserve, with a total of 5.96 miles. This beach type is generally flat and wide, with hard-packed sand beaches that exhibit significant seasonal changes. These can occur at the upper intertidal zone above wave-cut rocky platforms and can be backed by dunes or cliffs. Lower beach fauna (e.g., infaunal invertebrates) can be dense, but variable, and provide an important food source for shorebirds.
- Coarse grain sand beach (ESI type 4): At the Preserve, segments of coarse grain sand beach (0.33 miles total) are found at the northern and southern ends of North Beach, the most exposed part of the coast. These are moderate-to-steep beaches of variable width, with soft sediments. These beaches are commonly backed by dunes or rocky cliffs along exposed, outer coasts. They also exhibit significant seasonal changes in the beach sediments. The species density and diversity are generally lower than on fine-grained sand beaches.
- Mixed sand and gravel beach (ESI Type 5): Segments of mixed sand and gravel beaches (1.01 miles total) are found at the central and southern portions of North Beach and at the small cove where elephant seals haul out just south of Point Conception. These are moderately sloping beaches with a mixture of sand and gravel (with the gravel component comprising between 20 to 80% of total sediments). Due to the mix of sediment sizes, there may be sorting and zones of pure sand, pebbles, or cobbles. Like other beaches, there can be large-scale seasonal changes in the sediment components due to the transport of the lighter sand offshore during storms.

To date, there have been limited surveys of the geomorphology, biodiversity, or condition of sandy beach systems at the Preserve, representing a significant data gap. With just preliminary information, sandy beaches at the Preserve appear to be mostly intermediate between reflective and dissipative types; generally, macrofaunal abundance, biomass, and species richness tend to increase from beaches characterized as reflective to dissipative (Dugan *et al.* 2000). Southern California's sandy beaches have a relatively high diversity of intertidal macrofauna compared to other beaches that have been studied globally (Dugan and Hubbard 2016). The exposed sandy beaches at the Preserve appear to have an abundant invertebrate fauna, including bivalves, snails, polychaetes, isopods, amphipods, decapods, and insects that provide food for a diversity of foraging shorebirds, seabirds, and fishes.

Sandy beaches are characterized by two main habitat types defined by tidal height: swash beach and upper beach. Swash beach habitat is found between mean lower low water (MLLW) and mean higher high water (MHHW). Swash beach is a dynamic habitat within a high wave energy environment cycling between periods of exposure to air and fully submerged by tidal

waters (or wave runup) throughout each day. Swash beach is composed of unconsolidated sand and is devoid of vegetation. Infaunal abundances vary seasonally but swash beach may have high abundances and diversity of macroinvertebrates. This productivity provides important feeding habitats for shorebirds at low tide and fishes at high tide, with the quality of foraging habitat varying among beaches over space and time (Schlacher *et al.* 2014). Macrofauna present in the wet sand include mole crabs (*Emerita analoga*), and the rarer spiny mole crab (*Blepharipoda occidentalis*), bivalves, amphipods, and polychaetes. Surfperches (*Embiotocidae* spp.) and other nearshore fishes feed on swash zone invertebrates and are an important recreational fishery. Surf fishermen are regularly seen along North Beach in the Preserve, primarily entering from Jalama Beach County Park and likely fishing for species such as barred surfperch (*Amphistichus argenteus*). California grunion (*Leuresthes tenuis*) spawn in the high intertidal zone on Central and Southern California beaches during the spring-summer months; however, it is not known whether grunion is present and spawning on beaches at the Preserve. Presence of grunion is likely, given their range and beach conditions, especially at Percos Beach or Cojo Beach.

Upper beach habitat stretches from MHHW inland into dunes, bluffs, or other adjacent habitats. Upper beach is typically drier than swash beach, only periodically washed by high tides or strong waves that shape and maintain its area and form. Generally, upper beach has little vegetation; however, waves deposit logs, seaweed, shells, kelp, or other "wrack" (marine vegetation). Species richness and abundance of selected taxa on beaches has been positively correlated with macrophyte wrack cover and other characteristics (Dugan *et al.* 2000). Intertidal insects such as kelp flies (*Fucellia* and *Coelopa* spp.), beetles (*Phalaria rotundata*, *Epantius obscurus*, Tenebrionidae), and crustaceans (*Megalorchestia* spp.) and other amphipods are associated with and feed on the abundant wrack that is composed of stranded drift kelp, seagrass, and other macrophytes. Wrack is critically important to the beach food web, including secondary consumers and predators (Dugan *et al.* 2000; Neuman *et al.* 2008). Abundant wrack has been observed throughout Preserve beaches, including under the sediments of upper beach. This wrack is believed to form the basis of productive and diverse subtidal, beach, and terrestrial food webs. Dead marine organisms along beaches also provide important food sources for beach invertebrates, as well as terrestrial scavengers including large mammals, turkey vultures (*Cathartes aura*), and California condors (*Gymnogyps californianus*). From the surf zone through the beach and to the coastal dunes, there is an exchange of sand, organic matter, nutrients and organisms through biotic (e.g., animal movement) and abiotic (e.g., sand movement) mechanisms. Energy flows bridge the land-sea divide with energy sources like phytoplankton, dune plants, and marine wrack and carrion transferred up through fish, shorebirds, terrestrial mammals, raptors, and other consumers and predators (after Schlacher *et al.* 2014).

There have been observations of both breeding and wintering western snowy plovers along the coastline at the Preserve. Recently hatched chicks have been observed on Preserve beaches north of Point Conception. Additionally, four pre- and post-breeding flocks ranging from 5-12 individuals have been documented (WRA 2017). A variety of shorebirds use beaches for foraging and resting, including sanderlings (*Calidris alba*), willets (*Tringa semipalmata*), marbled godwits (*Limosa fedoa*), long-billed dowitchers (*Limnodromus scolopaceus*), wandering tattler (*Tringa incana*), and several species of gulls (*Larus* spp.; Dugan and Hubbard 2016). Shorebird use of Southern California beaches varies seasonally (Lafferty *et al.* 2013). Beaches (and rocks as a supplement) are important resting grounds for migratory species, especially in geographies like Point Conception where there are no big sheltered marshlands (J. Dugan, personal communication). Migrating shorebirds tend to accumulate in high densities south of Point Conception on their northward migration, waiting for good conditions to get around the headland and subsequent often windy section of coast. Beaches with laid-back bluffs have more room and tend to have more shorebirds and less raptor predation than tall cliff-backed beaches. Groups of brants have been regularly observed resting on the beach along the southern shoreline in relatively small numbers, particularly during spring migration, though wintering is unlikely given the lack of sheltered bays with abundant eelgrass, and this species does not breed in the region (WRA 2017). Caspian terns and California brown pelicans are regularly seen singly or in small groups flying over the coast or resting on the beaches (WRA 2017).

3.6.3.1 Threats to Sandy Beaches

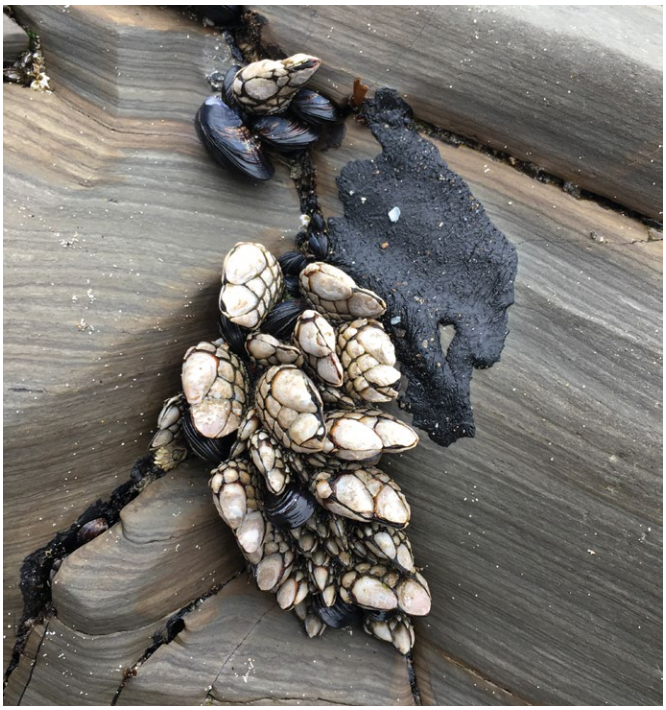
The threats to sandy beaches at the Preserve include:

1. Human presence (e.g., walking, pets, accessing surf, surf fishing, bicycles and eBikes, boat launches and landings) that can disturb wildlife;
2. Illegal harvest of intertidal species for food or bait (e.g., clams and mole crabs);
3. Invasive species (e.g., European beachgrass, feral pigs);
4. Disruption of natural sand supply or sand movement through activities or conditions on the Preserve, on adjacent properties, or up the coast within the littoral cell (e.g., iceplant over-stabilization of dunes, hardening and damming of streams or altered hydrologic/sediment regimes, coastal armoring);
5. Disruption of natural erosional and depositional processes due to armoring, roads and railroads, and culverts;
6. Oil spills;
7. Marine debris and ocean plastics pollution, with both macro- and micro-plastics potentially affecting coastal habitats and species;
8. VAFB rocket launch failure and crash;
9. Climate change and changing ocean conditions (Blanchette *et al.* 2016), including:
    a. Change in frequency and intensity of storms;
    b. Alteration of the frequency and intensity of cyclical patterns;
    c. Ocean acidification;
    d. Changes in water temperature;
    e. Changes in coastal weather, including air temperature, fog, cloud cover, and wind;
    f. Changes in ocean circulation and nearshore currents, affecting larval dispersal and connectivity;
    g. Changes in salinity; and
    h. Increases in UV radiation; and
    i. Sea level rise (especially on bluff-backed beaches or beaches without adequate sand supply).

3.6.4 Natural Tar Seeps

Tar seeps are naturally occurring ancient oil deposits that have been slowly pushed to the surface by shifting tectonic plates in this geologically active area (Hodgson 1987, Lorenson *et al.* 2009). Along the Preserve shoreline, these seeps are observed oozing out of the cliffs or rocky intertidal (e.g., at the southern end of North Beach and at Government Point) (see Figure 12). Offshore oil seeps have been observed to form mounds that vary in size from only a few yards across to very large mounds covering hundreds of yards over nearly 1.5 square miles of seafloor inside the SMR. Some oil from the onshore and offshore seeps ends up as large and small tar balls on the beach and covering parts of the rocky intertidal. In the rocky intertidal, tar covered rock generally has a less diverse and abundant assemblage of attached species as tar may smother intertidal organisms; interfere with settlement, recruitment, and grazing by intertidal animals; and perhaps impact growth and survival.

Determining the signature of local natural oil seeps and more accurate mapping of the extent of oil seeps and intertidal/beach tar would be very informative to distinguish natural tar in case of an anthropogenic oil spill in the area. Further understanding of the dynamics of tar deposits on the beaches and rocky intertidal areas of the Preserve will help inform potential impacts to wildlife and management actions.



Tar seep on coastal rocks and gooseneck barnacles © Mary Gleason/TNC

3.6.4.1 Threats to Natural Tar Seeps

The threats to natural tar seeps at the Preserve include:

1. Oil spills;
2. Offshore or onshore oil extraction and fracking;
3. Climate change and changing ocean conditions (Blanchette *et al.* 2016), including:
    a. Increasing frequency and intensity of storms;
    b. Alteration of the frequency and intensity of cyclical patterns (e.g. El Niño Southern Oscillation and upwelling);
    c. Ocean acidification;
    d. Sea level rise;
    e. Changes in water temperature;
    f. Changes in coastal weather, including air temperature, fog, cloud cover, and wind;
    g. Changes in ocean circulation and nearshore currents, affecting larval dispersal and connectivity;
    h. Changes in salinity; and
    i. Increases in UV radiation.

3.7 MARINE ECOSYSTEMS

While the marine ecosystems and species occurring offshore are not on the Preserve nor managed under this Plan, they warrant highlighting as the Point Conception geography provides a unique setting and opportunity to advance the science, stewardship, and management of marine ecosystems and land-sea connectivity. Further, half of the Preserve coast being in the SMR provides opportunities to consider conservation and management across land-sea realms. Point Conception is the most important marine biogeographic boundary on the U.S. West Coast, with high biodiversity due to the meeting of the Northern and Southern California Current marine ecoregions.

Nearshore habitats (0-30 m depth) include surfgrass beds, kelp forests, nearshore rocky-reefs, soft-bottom habitats, and tar seeps. The nearshore subtidal environment has not been formally surveyed. South of Point Conception, the bedding grains of rocks are perpendicular to the coast, with dolomitic hard veins resulting in high relief "hogback" rocks—a long, narrow ridge or series of hills with a narrow crest and steep slopes of nearly equal inclination on both flanks—that extend from the beach to the offshore areas and are very different from similar habitats in the Santa Barbara area. North of Point Conception, the nearshore is primarily soft-bottom habitat, with intermittent rocky reefs covered by kelp.

Deep-water rocky reefs and soft-bottom habitats (30-200 m depth) and associated fish and invertebrate species have been surveyed in some areas around Point Conception with Remotely Operated Vehicles (ROVs) and other tools.

Many marine species that occur here (e.g., starfish, seaweeds, fishes) are at the edge of their geographic range and can be considered sentinel species for distributional changes anticipated with climate change. Point Conception provides a range boundary landmark that has been expanded beyond in past episodic events (e.g., señoritas, sheephead, and Humboldt squid moving north of Point Conception in past El Niño events) and is worth monitoring in this era of changing climate. The kelp beds offshore of the Preserve are extensive and provide biogenic habitat for numerous species, including the southernmost population of southern sea otters (*Enhydra lutris nereis*) along the mainland. Southern sea otter densities at the Cojo Anchorage are now approaching equilibrium levels reported for Central California (Lafferty and Tinker 2014). The waters just south of Point Conception have been important for southern sea otter range expansion, as they provide extensive kelp forests, food resources, and a refuge from bad weather. Great white shark (*Carcharodon carcharias*) predation may be one factor limiting

Underwater Sea Lion in Monterey Bay, CA © Tyler Schiffman/TNC Photo Contest 2019

their southward expansion. A variety of megafauna, such as gray whales (*Eschrichtius robustus*), sharks, and sea turtles (e.g., leatherback sea turtle, *Dermochelys coriacea*) migrate through or feed in offshore waters.

3.7.1 Threats to Marine Ecosystems

The threats to marine ecosystems adjacent to the Preserve include:

1. Oil spills;
2. Destructive fishing or overfishing outside Point Conception SMR and illegal fishing and poaching inside SMR;
3. Ship strikes;
4. Noise from shipping, Navy activities, and acoustic surveys of seabed for energy development;
5. Marine debris and ocean plastics (macro and micro) pollution;
6. VAFB rocket launch failure and crash; and
7. Changing ocean conditions (e.g., ocean acidification, changing currents or temperatures, storm frequency, species distribution shifts).

3.8 SPECIAL-STATUS PLANTS

The Preserve has exceptionally high plant biodiversity and over 20 listed (by CNPS, CDFW, and the state and federal government) plant species (see Table 2 and Figure 13). Because of the Preserve's location, there is a high likelihood that the Preserve will remain a location for climate-induced plant species re-distributions and genetic mixing. For this same reason, the Preserve will likely be a place where TNC evaluates plant species re-introductions and translocations at places and for species with potential suitable habitat under future climate scenarios. These specific management goals and objectives will be developed by TNC as part of the Reintroductions and Translocations Plan (see Table 1). Plant species lists will be updated as plant surveys are completed at the Preserve.

Note: All plant and animal species descriptions were adapted from WRA (2017).

Table 2. Special-Status Plant Species Present at the Preserve

Species	Listing Status
Gaviota tarplant (*Deinandra increscens* ssp. *Villosa*)	FE, SE, Rank 1B.1, LR
Lompoc yerba santa (*Eriodictyon capitatum*)	FE, SR, Rank 1B.2, LR
Surf thistle (*Cirsium rhothophilum*)	ST, Rank 1B.2, LR
Red sand verbena (*Abronia maritima*)	Rank 4.2, LR
La Purisima manzanita (*Arctostaphylos purissima*)	Rank 1B.1, LR, LC
Nuttall's milkvetch (*Astragalus nuttallii* var. *nuttallii*)	Rank 4.2
Late-flowered Mariposa lily (*Calochortus fimbriatus*)	Rank 1B.3, LR
Umbrella larkspur (*Delphinium umbraculorum*)	Rank 1B.3, LR
Western Dichondra (*Dichondra occidentalis*)	Rank 4.2, LR
Large-leaved wallflower (*Erysimum suffrutescens*)	Rank 4.2, LR, LC
Kellogg's Horkelia (*Horkelia cuneate* var. *sericea*)	Rank 1B.1, LR
Southern California black walnut (*Juglans californica*)	Rank 4.2, LR
Ocellated Humboldt lily (*Lilium humboldtii* ssp. *Ocellatum*)	Rank 4.2, LR
Cliff aster (*Malacothrix saxatilis* var. *saxatilis*)	Rank 4.2, LR, LC
California spineflower (*Mucronea californica*)	Rank 4.2
Hubby's phacelia (*Phacelia hubbyi*)	Rank 4.2
Hoffman's bitter gooseberry (*Ribes amarum* var. *hoffmanii*)	Rank 3, LR
Black-flowered figwort (*Scrophularia atrata*)	Rank 1B.2
Dune (Blochman's) ragwort (*Senecio blochmaniae*)	Rank 4.2, LR
Wooly seablite (*Suaeda taxifolia*)	Rank 4.2, LR

Special-status plant species include those species that have been formally listed, are proposed as endangered or threatened, or are candidates for such listing under the federal Endangered Species Act (ESA) or the California Endangered Species Act (CESA).

Plant species on the California Native Plant Society's (CNPS) Inventory of Rare and Endangered Plants (CNPS 2017a) with a California Rare Plant Rank (Rank) of 1 through 4 are also considered special-status plant species. CNPS Rankings are defined as (CNPS 2017, 2017a, 2017b):

- 1A: Presumed extirpated or extinct because they have not been seen or collected in the wild in California for many years. A plant is extinct if it no longer occurs anywhere. A plant that is extirpated from California has been eliminated from California but may still occur elsewhere in its range.
- 1B: Rare throughout their range with the majority of them endemic to California. Most of the plants ranked 1B have declined significantly over the last century.
- 2A: Presumed extirpated because they have not been observed or documented in California for many years. This list only includes plants that are presumed extirpated in California, but more common elsewhere in their range.
- 2B: Would be 1B except for being common beyond the boundaries of California.
- 3: Lack the necessary information to assign them to one of the other ranks or to reject them. Nearly all of the plants constituting California Rare Plant Rank 3 are taxonomically problematic.
- 4: Limited distribution or infrequent throughout a broader area in California.
- 0.1: Seriously threatened in California (over 80% of occurrences threatened/high degree and immediacy of threat).
- 0.2: Moderately threatened in California (20-80% occurrences threatened/moderate degree and immediacy of threat).
- 0.3: Not very threatened in California (less than 20% of occurrences threatened/low degree and immediacy of threat or no current threats known).

FIGURE 13 Preserve Rare Plant Occurrences and USFWS Mapped Critical Habitat

There are two federally listed endangered plant species located at the Preserve, Gaviota tarplant (FE, SE, Rank 1B.1, LR) and Lompoc yerba santa (FE, SR, Rank 1B.2, LR) (see Table 2 and Figure 13). Gaviota tarplant is an annual herb in the sunflower family (Asteraceae) that blooms May to October. It occurs in coastal bluff scrub, coastal scrub, and valley and foothill grasslands from 60 to 1,290 feet in elevation in Santa Barbara County (CNPS 2017b). There is U.S. Fish and Wildlife Service (USFWS) mapped critical habitat for Gaviota tarplant on the Preserve (see Figure 13). Within the Preserve, Gaviota tarplant has been observed in extensive populations mixed with the more common grassland tarweed (*Deinandra increscens* ssp. *increscens*) on coastal grasslands and extending north into the westernmost portion of the Preserve (WRA 2017). Lompoc yerba santa is a perennial evergreen shrub in the forget-me-not family (Boraginaceae) that blooms May to September. It typically occurs in coastal bluff scrub, closed-cone coniferous forest, and maritime chaparral on sandy soils in Santa Barbara County (CNPS 2017b). Within the Preserve, Lompoc yerba santa was observed in a single small population adjacent to a little-used ranch road at the northeastern boundary (see Figure 13; WRA 2017).

In addition to Gaviota tarplant and Lompoc yerba santa, there is one state-listed threatened plant species present at the Preserve, surf thistle (*Cirsium rhothophilum*) (ST, Rank 1B.2, LR) (see Table 2 and Figure 13). Surf thistle is a perennial herb in the sunflower (Asteraceae) family that blooms April through June. It typically occurs in coastal bluff scrub and coastal dunes at elevations ranging from 10 to 90 feet in Santa Barbara and San Luis Obispo County (CNPS 2017b). There are three mapped occurrences of surf thistle on the Point Conception property, collected in 1978 and 1990 (CDFW 2017). Within the Preserve, WRA (2017) mapped surf thistle in two locations, both in pockets of open sand in coastal bluff habitat north of Point Conception; the first location was located at the edge of an eroding bluff scarp, and the second was on a sandy bluff shoulder that is being invaded by iceplant (see Figure 13).

WRA (2017) also documented 17 CNPS ranked plant species at the Preserve, including (see Figure 13):

- Red sand verbena (*Abronia maritima*; Rank 4.2, LR)
- La Purisima manzanita (*Arctostaphylos purissima*; Rank 1B.1, LR, LC)
- Nuttall's milkvetch (*Astragalus nuttallii* var. *nuttallii*; Rank 4.2)
- Late-flowered Mariposa lily (*Calochortus fimbriatus*; Rank 1B.3, LR)
- Umbrella larkspur (*Delphinium umbraculorum*; Rank 1B.3, LR)
- Western Dichondra (*Dichondra occidentalis*; Rank 4.2, LR)
- Large-leaved wallflower (*Erysimum suffrutescens*; Rank 4.2, LR, LC)
- Kellogg's Horkelia (*Horkelia cuneate* var. *sericea*; Rank 1B.1, LR)
- Southern California black walnut (*Juglans californica*; Rank 4.2, LR)
- Ocellated Humboldt lily (*Lilium humboldtii* ssp. *Ocellatum*; Rank 4.2, LR)
- Cliff aster (*Malacothrix saxatilis* var. *saxatilis*; Rank 4.2, LR, LC)
- California spineflower (*Mucronea californica*; Rank 4.2)
- Hubby's phacelia (*Phacelia hubbyi*; Rank 4.2)
- Hoffman's bitter gooseberry (*Ribes amarum* var. *hoffmanii*; Rank 3, LR)
- Black-flowered figwort (*Scrophularia atrata*; Rank 1B.2)
- Dune (Blochman's) ragwort (*Senecio blochmaniae*; Rank 4.2, LR)
- Wooly seablite (*Suaeda taxifolia*; Rank 4.2, LR)

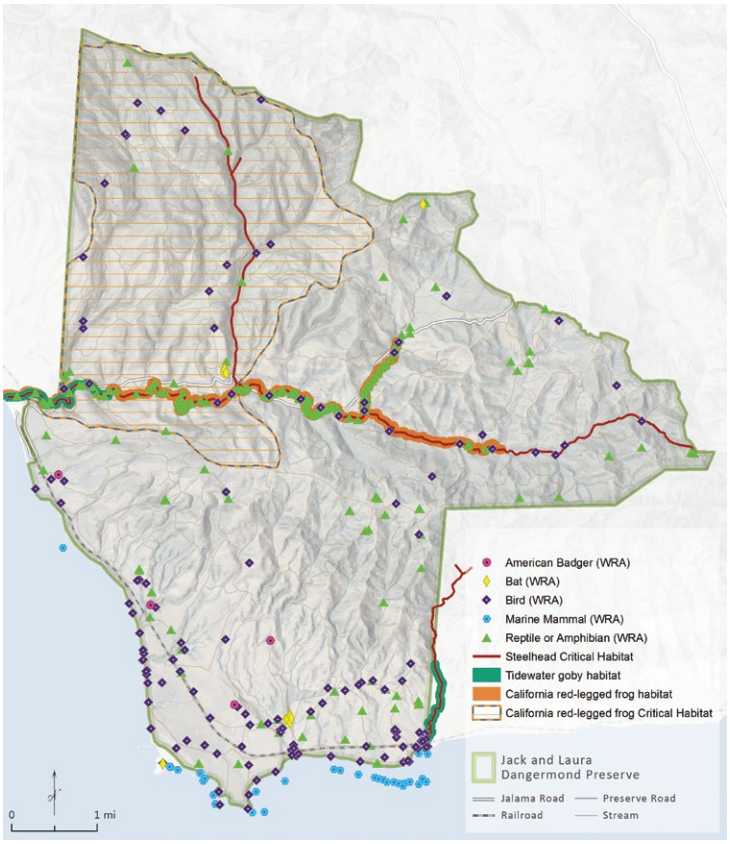


FIGURE 14 Preserve Rare Wildlife Locations and USFWS Mapped Critical Habitat

Red sand verbena

Red sand verbena (*Abronia maritima*) is a perennial forb in the four o'clock family (Nyctaginaceae) that blooms from June to October. It typically occurs on sandy substrate in foredunes and interdunes with sparse cover in coastal dune and coastal strand habitat at elevations ranging from 0 to 35 feet (CNPS 2017b; CDFW 2017). Known associated species include yellow sand verbena (*Abronia latifolia*), iceplant, beach suncup (*Camissoniopsis cheiranthifolia*), European sea rocket, beach sage (*Artemisia pycnocephala*), silver beachweed (*Ambrosia chamissonis*), and beach knotweed (*Polygonum paronychia*) (CDFW 2017). Within the Preserve, WRA (2017) mapped two locations within coastal strand habitat east of Point Conception.

Nuttall's milkvetch

Nuttal's milkvetch (*Astragalus nuttallii* var. *nuttallii*) is a perennial herb in the legume family (Fabaceae) that blooms from January to November. It typically occurs in coastal bluff scrub or on coastal dunes at elevations ranging from 10 to 390 feet (CNPS 2017b). Within the Preserve, WRA (2017) mapped this species in large stands within grasslands on the coastal terrace near Point Conception.

Large-leaved wallflower

Large-leaved wallflower (*Erysimum suffrutescens*) is a perennial herb in the mustard (Brassicaceae) family that blooms January through July. It typically occurs in coastal bluff scrub, maritime chaparral, coastal dunes, and coastal scrub at elevations from 0 to 450 feet (CNPS 2017b). WRA (2017) mapped this species in a limited number of locations on rocky, sandstone outcrops in the southeastern portion of the Preserve.

Kellogg's horkelia

Kellogg's horkelia (*Horkelia cuneate* var. *sericea*) is a perennial forb in the rose family (Rosaceae) that blooms from April to September. It typically occurs on gravelly or sandy soils in openings in closed-cone coniferous forest, maritime chaparral, and coastal scrub habitats at elevations ranging from 30 to 660 feet (CNPS 2017b). WRA (2017) observed this species in several locations throughout the Preserve, primarily in rocky outcrops and old roadbeds, often co-occurring with late-flowered Mariposa lily.

Cliff aster

Cliff aster (*Malacothrix saxatilis* var. *saxatilis*) is a perennial herb in the sunflower (Asteraceae) family that blooms from March through September. It typically occurs in coastal bluff scrub and coastal scrub (CNPS 2017b). WRA (2017) observed this species in several locations in rocky outcrops and grasslands across the Preserve.

California spineflower

California spineflower (*Mucronea californica*) is an annual herb in the buckwheat (Polygonaceae) family that blooms from March through July. It typically occurs in chaparral, cismontane woodland, coastal dunes, coastal scrub, and valley and foothill grassland (CNPS 2017b). At the Preserve, WRA (2017) observed this species as a single, sizable population on the stabilized dunes near Point Conception.

Dune (Blochman's) ragwort

Dune (Blochman's) ragwort (*Senecio blochmaniae*) is a perennial herb in the sunflower (Asteraceae) family that blooms from May through October. It typically occurs in coastal dunes (CNPS 2017b). WRA (2017) observed this species as a sizable population on the stabilized dunes near Point Conception.

Wooly seablite

Wooly seablite (*Suaeda taxifolia*) is a perennial shrub in the goosefoot (Chenopodiaceae) family that blooms from January through December. It typically occurs in coastal bluff scrub, coastal dunes, and margins of coastal salt marshes (CNPS 2017b). WRA (2017) observed this species as a single individual in coastal strand habitat east of Point Conception.

La Purisima manzanita

La Purisima manzanita (*Arctostaphylos purissima*) is a perennial evergreen shrub in the heath (Ericaceae) family that blooms from November through May. It is narrowly distributed in Santa Barbara County in chaparral on sandy soils or coastal scrub at elevations ranging from 180 to 1,200 feet. Within the Preserve, WRA (2017) mapped large stands of La Purisima manzanita at the northeastern property boundary, as well as in scattered stands throughout the property. La Purisima manzanita is typically found on sandstone outcrops and sandstone-derived soils, intergrading with coast live oak woodland and chamise chaparral.

La Purisima Manzanita © Tanner Harris/WRA

Late-flowered Mariposa lily

Late-flowered mariposa lily (*Calochortus fimbriatus*) is a perennial bulbiferous herb in the lily (Liliaceae) family that blooms June through August. It typically occurs in chaparral, cismontane woodland, and riparian woodland on serpentine soils at elevations ranging from 825 to 5,715 feet. Within the Preserve, WRA (2017) mapped this species in a number of locations, primarily on old road beds and trails with compacted soils.

Umbrella larkspur

Umbrella larkspur (*Delphinium umbraculorum*) is a perennial herb in the buttercup (Ranunculaceae) family that blooms from April through June. It typically occurs in chaparral and cismontane woodland at elevations ranging from 1,200 to 4,800 feet (CNPS 2017b). Within the Preserve, WRA (2017) mapped this species on a hillside above a ranch road in the southeastern portion of the property.

Western Dichondra

Western Dichondra (*Dichondra occidentalis*) is a perennial herb in the morning glory (Convolvulaceae) family that blooms from March through July. It typically occurs in chaparral, cismontane woodland, coastal scrub, and valley and foothill grassland (CNPS 2017b). At the Preserve, WRA (2017) mapped this species in the lawn in front of the Cojo Ranch guest house.

Southern California black walnut

Southern California black walnut (*Juglans californica*) is a deciduous tree in the walnut family (Juglandaceae) that blooms from March to August. It typically occurs on alluvial substrates in washes and alluvial fans in chaparral, cismontane woodland, and coastal scrub at elevations ranging from 160 to 2925 feet (CNPS 2017b). WRA (2017) mapped this species in several locations along major streams within the Preserve, with the largest populations occurring along Jalama Creek. The population at the Preserve is a "range disjunct population," representing one of the northern-most populations of this species (Griffin and Critchfield 1972).

Ocellated Humboldt lily

Ocellated Humboldt lily (*Lilium humboldtii* ssp. *Ocellatum*) is a bulbiferous perennial forb in the lily family (Liliaceae) that blooms from March to August. It typically occurs in openings in chaparral, cismontane woodland, coastal scrub, lower montane coniferous forest, and riparian woodland habitat at elevations ranging from 95 to 5850 feet (CNPS 2017b). WRA (2017) observed this species in numerous locations along major streams within the Preserve, generally with an overstory of coast live oak or tan oak.

Hubby's phacelia

Hubby's phacelia (*Phacelia hubbyi*) is an annual forb in the forget me-not family (Boraginaceae) that blooms from April to June. It typically occurs on gravelly substrate and rock talus in chaparral, coastal scrub, and valley and foothill grassland at elevations ranging from 0 to 3250 feet (CNPS 2017b). WRA (2017) observed this species in rocky outcrops adjacent to ranch roads in several locations on the Preserve.

Hoffman's bitter gooseberry

Hoffmann's bitter gooseberry (*Ribes amarum* var. *hoffmanii*) is a perennial shrub in the gooseberry (Grossulariaceae) family that blooms from March through April. It typically occurs in chaparral and riparian woodland (CNPS 2017b). WRA (2017) mapped this species in a single location within coast live oak woodland habitat at the eastern edge of the Preserve.

Black-flowered figwort

Black-flowered figwort (*Scrophularia atrata*) is a perennial herb in the figwort family (Scrophulariaceae) that blooms from April to July. It is found on calcium or diatom-rich soils on coastal dunes and in scrub, riparian scrub, chaparral, and closed-cone coniferous forest habitats from 30 to 1,640 feet in elevation (CNPS 2017b). WRA (2017) observed this species as scattered individuals in several scrub habitats on the Preserve, primarily in association with coyote brush scrub, bush monkey flower scrub, and California sagebrush scrub.

Additional potential special-status plants

WRA (2017) determined that there were an additional ~50 special-status plants with the potential to occur at the Preserve, including federally listed salt marsh bird's-beak (*Chloropyron maritimum* spp. *Maritimum*; FE, CE, Ranch 1B.2, LR), la graciosa thistle (*Cirsium scariosum* var. *loncholepis*; FE, ST, Rank 1B.1), Vandenberg monkeyflower (*Diplacus vandenbergensis*; FE, Rank 1B.1, LR), beach layia (*Layia carnosa*; FE, SE, Rank 1B.1, LR), Gambel's watercress (*Nasturtium gambelii*; FE, ST, Ranch 1B.1, LR), and state-listed seaside bird's-beak (*Cordylanthus rigidua* ssp. *Littoralis*; SE, Rank 1B.1, LR), and beach spectaclepod (*Dithyrea maritima*; ST, Rank 1B.1, LR).

Table 3. Special-Status Animal Species Present at the Preserve

	Species	Listing Status
Birds	Southwestern willow flycatcher (*Empidonax traillii extimus*)	Federal Endangered (FE) State Endangered (SE)
	Least Bell's vireo (*Vireo bellii pusillus*)	FE, SE
	White-tailed kites (*Elanus leucurus*)	California Department of Fish and Wildlife (CDFW) Fully Protected Species
	Golden eagle (*Aquila chrysaetos*)	CDFW Fully Protected Species
	American peregrine falcon (*Falco peregrinus anatum*)	CDFW Fully Protected, U.S. Fish and Wildlife Service (USFWS) Bird of Conservation Concern, Federal Delisted, State Delisted
	Bald eagle (*Haliaeetus leucocephalus*)	SE, USFWS Bird of Conservation Concern, CDFW Fully Protected Species, Federal Delisted
	California brown pelican (*Pelecanus occidentalis californicus*)	CDFW Fully Protected Species, Federal Delisted, State Delisted
	Western snowy plover (*Charadrius alexandrinus nivosus*)	Federal Threatened (FT), USFWS Bird of Conservation Concern, CDFW Species of Special Concern
	Grasshopper sparrow (*Ammodramus savannarum*)	CDFW Species of Special Concern
	Burrowing owl (*Athene cunicularia*)	USFWS Bird of Conservation Concern, CDFW Species of Special Concern
	Brant (*Branta bernicula*)	CDFW Species of Special Concern
	Northern harrier (*Circus cyaneus*)	CDFW Species of Special Concern
	Loggerhead shrike (*Lanius ludovicianus*)	USFWS Bird of Conservation Concern, CDFW Species of Special Concern
	Yellow warbler (*Setophaga petechia*)	USFWS Bird of Conservation Concern, CDFG Species of Special Concern
	Yellow-headed blackbird (*Xanthocephalus xanthocephalus*)	CDFW Species of Special Concern
	Tricolored blackbird (*Agelaius tricolor*)	State Threatened; Under Review for Threatened or Endangered Federal Status
	Caspian tern (*Hydroprogne caspia*)	Migratory Bird Treaty Act (MBTA)
	Least tern (*Sternula antillarum*)	MBTA
	Brandt's cormorant (*Phalacrocorax penicillatus*)	MBTA
	Black oystercatcher (*Haematopus bachmani*)	MBTA
	Osprey (*Pandion haliaetus*)	MBTA

	Species	Listing Status
Mammals	Mountain lion (*Puma concolor*)	CDFW Specially Protected Species
	Pallid bat (*Antrozous pallidus*)	CDFW Species of Special Concern, Western Bat Working Group (WBWG) High Priority
	Townsend's big-eared bats (*Corynorhinus townsendii*)	State Candidate, CDFW Species of Special Concern, WBWG High Priority
	Western red bats (*Lasiurus blossevillii*)	CDFW Species of Special Concern, WBWG High Priority
	American badger (*Taxidea taxus*)	CDFW Species of Special Concern
	Northern elephant seal (*Mirounga angustirostris*)	MMPA
	Pacific harbor seal (*Phoca vitulina richardsi*)	MMPA
	California sea lion (*Zalophus californianus*)	MMPA
	Southern sea otter (*Enhydra lutris nereis*)	FT, MMPA
Herpetofauna	California red-legged frog (*Rana draytonii*)	FT, CDFW Species of Special Concern
	Pacific pond turtle (*Actinemys marmorata*)	CDFW Species of Special Concern
	Two-striped gartersnake (*Thamnophis hammondii*)	CDFW Species of Special Concern
Fish	Tidewater goby (*Eucyclogobius newberryi*)	FE, CDFW Species of Special Concern
	Steelhead (*Oncorhynchus mykiss*)—*not currently present because of Jalama Creek migration barriers*	FE, CDFW Species of Special Concern
Invertebrates	Monarch butterfly (*Danaus plexippus*)	CDFW Special-Status Invertebrate
	Point Conception Jerusalem cricket (*Ammopelmatus muwu*)	CDFW Special-Status Invertebrate
	Black abalone (*Haliotis cracherodii*)	FE, SE

3.9 SPECIAL-STATUS ANIMALS

The Preserve has exceptionally high animal biodiversity (see Table 3 and Figure 14), with over 300 animal species (WRA 2017). Because of the Preserve's general terrestrial connectivity values (north-south and east-west, see Figure 5) and its topographical diversity, the Preserve will remain an important area for animal species movements and re-distributions in response to climate change. For this same reason, the Preserve will likely be a place where TNC evaluates animal species re-introductions, translocations, and assisted migration. These specific management goals and objectives will be developed by TNC as part of the Reintroductions and Translocations Plan (see Table 1). Animal species lists will be updated as surveys are completed at the Preserve.

Note: All plant and animal species descriptions were adapted from WRA (2017).

Of the >650 documented species at the Preserve (WRA 2017), almost 10% have some sort of special-status designation. The Preserve contains 34 documented special-status species, including 21 bird species, 5 mammals, 3 herpetofauna (reptiles and amphibians), 1 fish species, and 3 invertebrates (see Figure 14). The Preserve also has habitat for steelhead, although occurrence has not been documented.

Threatened or endangered by California Department of Fish and Wildlife (CDFW) or United States Fish and Wildlife Service (USFWS).

An endangered species is an animal or plant that is considered at risk of extinction. A species can be listed as endangered at the state, federal, and international level. On the federal level, the endangered species list is managed under the Endangered Species Act (ESA), enacted by Congress in 1973. Under the ESA, the federal government has the responsibility to protect endangered species (species that are likely to become extinct throughout all or a large portion of their range), threatened species (species that are likely to become endangered in the near future), and critical habitat (areas vital to the survival of endangered or threatened species). The ESA has lists of protected plant and animal species both nationally and worldwide. When a species is given ESA protection, it is said to be a "listed" species. Many additional species are evaluated for possible protection under the ESA, and they are called "candidate" species.

Other categories of protection include:

- California Department of Fish and Wildlife (CDFW) Fully Protected Species: These are species that are rare or face possible extinction. Fully protected species have been listed as threatened or endangered and may not be taken or possessed at any time and no licenses or permits may be issued for their take, except for collection of these species for necessary scientific research.
- CDFW Species of Special Concern: Species, subspecies or distinct populations native to California that meet any of the following criteria: is extirpated from the state or, in the case of birds, is extirpated in its primary season or breeding role; is listed as federally-, but not state-, threatened or endangered; meets the state definition of threatened or endangered but has not formally been listed; is experiencing, or formerly experienced, serious (non-cyclical) population declines or range retractions (not reversed) that, if continued or resumed, could qualify it for state threatened or endangered status; and/or has naturally small populations exhibiting high susceptibility to risk from any factor(s) that, if realized, could lead to declines that would qualify it for state threatened or endangered status.
- United States Fish and Wildlife Service (USFWS) Birds of Conservation Concern: Identifies species, subspecies, and populations of all migratory nongame birds that, without additional conservation actions, are likely to become candidates for listing under the ESA
- Migratory Bird Treaty Act (MBTA): Identifies bird species that are illegal to take, possess, import, export, transport, sell, purchase, barter, including the parts, nests, or eggs of such a bird except under the terms of a valid permit issued pursuant to federal regulations. The Act covers over 2,000 species of birds found in the United States and U.S. territories including most migratory birds found at the Preserve.
- Western Bat Working Group (WBWG) High Priority: Identifies species considered the highest priority for funding, planning, and conservation actions, and those species that are imperiled or are at high risk of imperilment.
- Marine Mammal Protection Act (MMPA): Protects all marine mammals, including cetaceans (whales, dolphins, and porpoises), pinnipeds (seals and sea lions), sirenians (manatees and dugongs), sea otters, and polar bears within the waters of the United States. The Act makes it illegal to "take" marine mammals without a permit. This means people may not harass, feed, hunt, capture, collect, or kill any marine mammal or part of a marine mammal.

3.9.1 Birds

At the Preserve, there are 21 known special-status bird species. Two bird species are federally endangered, including the southwestern willow flycatcher (*Empidonax traillii extimus*; FE, SE) and least Bell's vireo (*Vireo bellii pusillus*; FE, SE). Two species are fully protected by the U.S. Fish and Wildlife Service, including the white-tailed kite (*Elanus leucurus*) and golden eagle (*Aquila chrysaetos*). Three more bird species are fully protected by the California Department of Fish and Wildlife (CDFW), including the American peregrine falcon (*Falco peregrinus anatum*), bald eagle (*Haliaeetus leucocephalus*), and California brown pelican (*Pelecanus occidentalis californicus*), and one species is listed as federally threatened, the western snowy plover (also listed as CDFW Species of Special Concern). There are seven birds of special concern according to CDFW, including the grasshopper sparrow (*Ammodramus savannarum*), burrowing owl, brant, northern harrier (*Circus cyaneus*), loggerhead shrike (*Lanius ludovicianus*), yellow warbler (*Setophaga petechia*), and yellow-headed blackbird (*Xanthocephalus xanthocephalus*). Additionally, there are six protected bird species listed under the Migratory Bird Treaty Act, including caspian tern (*Hydroprogne caspia*), least tern (*Sternula antillarum*), pigeon guillemot (*Cepphus columba*), brandt's cormorant (*Phalacrocorax penicillatus*), black oystercatcher, and osprey (*Pandion haliaetus*). Bird species lists will be updated as surveys are completed at the Preserve.

Southwestern willow flycatcher

Southwestern willow flycatcher (*Empidonax traillii extimus*; FE, SE) is a neotropical migrant and summer resident in the American southwest, including Southern California. Once a common breeder throughout much of lowland Southern California, the destruction or alteration of riparian systems within the region during the twentieth century greatly reduced their population; a total of only 256 breeding territories were documented to exist in the state by 2001, following several years of intensive surveying (USFWS 2002). Breeding habitat consists of riparian forest or woodland, usually in floodplains. Although variable across sites, the dominant vegetation is usually willows (*Salix* spp.), with cottonwoods (*Populus* spp.), box elder (*Acer negundo*), and/or sycamores (*Platanus* spp.) also often present, and shrubs and herbaceous species generally present in the understory. Riparian areas dominated by introduced species, primarily tamarisk (*Tamarix ramosissima*), may also be used when the vegetation is suitably dense. Other principal components are: 1) dense vegetation in the habitat patch interior, usually from the ground up to approximately 13 feet, and 2) the nearby presence of still or slow-moving water, or at least saturated soil, during the breeding season. Riparian zones with steep gradients and/or that are less than approximately 35 feet wide are generally not used by southwestern willow flycatcher. Nest height varies greatly, although the average is approximately 6.5 to 23 feet above the ground. The greater breeding season occurs from early May to mid-August. WRA (2017) incidentally captured an individual willow flycatcher (though not confirmed to be the southwestern subspecies) while mist-netting at the Preserve. Given its relatively wide riparian zone, perennial nature, and varied, stratified riparian canopy in many sections, the Jalama Creek mainstem from the confluence of its north and south forks to near the creek mouth is considered potentially suitable habitat.

Least Bell's vireo

Least Bell's vireo (*Vireo bellii pusillus*; FE, SE, CDFW Species of Special Concern) is a neotropical migrant and summer resident in California and northern Baja California, wintering in southern Baja California (Brown 1993). Least Bell's vireo breeding habitat consists of riparian vegetation, usually in an early successional state (i.e., between 5-10 years old) and near water (USFWS 1998). Such habitat is preferred because it provides both dense cover in the lower shrub layer for nest concealment and a stratified canopy structure favorable to insect abundance and thus least Bell's vireo foraging (USFWS 1998). Riparian habitat types used for breeding include those dominated by willows, cottonwood, and/or oaks, with a dense understory of species such as willows (*Salix* spp.), mulefat (*Baccharis salicifolia*), California wild rose (*Rosa californica*), poison oak, and mugwort (*Artemisia douglasiana*) (USFWS 1998). Nests are typically placed within 3.5 feet of the ground. Least Bell's vireo may attempt multiple broods during the breeding season from mid-March to late September, although one brood is typical (Brown 1993). Habitats such as chaparral and coastal sage scrub adjacent to riparian areas are used for foraging and even nesting, and thus provide another potentially important habitat component (Kus and Miner 1989). No nesting has been confirmed within the Preserve. The Jalama Creek mainstem from the confluence of its north and south forks to near the creek mouth is considered potentially suitable habitat (WRA 2017).

White-tailed kite

White-tailed kites (*Elanus leucurus*; CDFW Fully Protected Species) occur in low elevation grassland, agricultural, wetland, oak woodland, and savanna habitats. Riparian zones adjacent to open areas are also used. Vegetative structure and prey

availability are more important than specific associations with plant species or vegetative communities. Lightly grazed or ungrazed fields generally support large prey populations and are often preferred to other habitats. Kites primarily feed on small mammals although birds, reptiles, amphibians, and insects are also taken. Nest trees range from single isolated trees to trees within large contiguous forests. Preferred nest trees are extremely variable, ranging from small shrubs (<10 feet tall) to large trees (>150 feet tall; Dunk 1995). White-tailed kites have been consistently observed foraging on the coastal grasslands of the Preserve (WRA 2017).

Golden eagle

Golden eagle (*Aquila chrysaetos*; CDFW Fully Protected Species) is found in open and semi-open areas from sea level to nearly 12,000 feet in elevation, in habitats including tundra, shrublands, grasslands, mixed woodlands, and coniferous forests. Golden eagles are usually found in mountainous areas, but may also nest in wetland, riparian, and estuarine habitats (Kochert *et al.* 2002). Golden eagles typically nest in large isolated trees or cliffs and typically forages over large areas, feeding primarily on ground squirrels, rabbits, large birds, and carrion. Several golden eagle individuals have been observed foraging at the Preserve. Although a nest has yet to be found, based on the regularity of observations and behavioral cues of the birds, golden eagles presumably nest in low numbers (one to three pairs) in the mature oaks within the Preserve (WRA 2017).

American peregrine falcon

American peregrine falcon (*Falco peregrinus anatum*; CDFW Fully Protected, USFWS Bird of Conservation Concern, Federal Delisted, State Delisted) occurs as a generally uncommon resident as well as a winter visitor and migrant throughout much of California. Occupied habitat (both breeding and non-breeding) is highly variable, but this species is typically associated with open areas and/or bodies of water. Nesting typically occurs on the ledges of steep cliffs or man-made structures with ledges above sheer faces, such as bridges and the tops of buildings (White *et al.* 2002). Peregrine falcon prey upon a wide variety of animals, mostly birds (White *et al.* 2002). Foraging occurs over wide areas, including during the breeding season. Suitable nesting habitat is present on the steep canyon walls along drainages and along the north crest of the Santa Ynez range. Several individual peregrine falcons have been observed consistently at the Preserve near Point Conception (WRA 2017). In spring 2019, TNC documented a likely nesting pair.

Bald eagle

Bald eagle (*Haliaeetus leucocephalus*; State Endangered, USFWS Bird of Conservation Concern, CDFW Fully Protected Species, Federal Delisted) winters throughout most of California at lakes, reservoirs, river systems, and some rangelands and coastal wetlands. The breeding range is mainly in mountainous habitats near reservoirs, lakes, and rivers, and mostly in the northern two-thirds of the state, in the Central Coast Range, and on Santa Catalina Island. Bald eagle nests in large, old-growth, or dominant live trees with open branch work, especially ponderosa pine where present (Zeiner *et al.* 1990). Bald eagle is an opportunistic forager, usually feeding on fish or waterfowl, but it will also eat other small animals and carrion. Individuals of this species have been observed flying over the Preserve, but nesting has not been confirmed (WRA 2017).

California brown pelican

California brown pelican (*Pelecanus occidentalis californicus*; CDFW Fully Protected Species, Federal Delisted, State Delisted) inhabits coastal marine areas and is found year-round in Southern California. Nesting is highly colonial and occurs on undisturbed marine or estuarine islands. Along the California coast, this species does not breed north of the Channel Islands (Shields 2002). Brown pelicans forage for surface-shoaling fishes in open water by plunge-diving, and roost in groups on coastal rocks, sandbars, and man-made structures such as jetties and piers. This species is consistently seen flying up and down the coast, just offshore of the Preserve (WRA 2017).

Western snowy plover

Western snowy plover (*Charadrius alexandrinus nivosus*; Federal Threatened, USFWS Bird of Conservation Concern, CDFW Species of Special Concern) breeds primarily above the high tide line on coastal beaches, sand spits, dune-backed beaches, sparsely vegetated dunes, beaches at creek and river mouths, and salt pans at lagoons and estuaries. Less common nesting habitats include bluff-backed beaches, dredged material disposal sites, salt pond levees, dry salt ponds, and river bars (USFWS 2007). Nests typically occur in flat, open areas with sandy or saline substrates where vegetation and driftwood are usually sparse or absent. Nests consist of a shallow scrape or depression, sometimes lined with beach debris (e.g., small pebbles, shell fragments, plant debris, and mud chips (USFWS 2007). Nesting season extends from early March through late September. Snowy plovers winter mainly in coastal areas from southern Washington to Central America. In winter, snowy plovers are found on many of the beaches used for nesting

as well as on beaches where they do not nest, in man-made salt ponds, and on estuarine sand and mud flats (USFWS 2007). WRA (2017) observed both breeding and wintering western snowy plovers along the coastline at the Preserve. In addition, WRA (2017) observed recently hatched chicks on the Jalama Coast north of Point Conception, and four pre- and post-breeding flocks ranging from 5-12 individuals have also been observed. Snowy plovers have been well-documented nearby at Vandenberg Air Force Base (Robinette *et al.* 2015), Coal Oil Point Reserve (Lafferty *et al.* 2006), and across the Santa Barbara coast (Page and Stenzel 1981).

Grasshopper sparrow

Grasshopper sparrow (*Ammodramus savannarum*; CDFW Species of Special Concern) generally prefers moderately open grasslands and prairies with patchy bare ground. They typically avoid grasslands with extensive shrub cover, although some level of shrub cover is important for birds in western regions (Vickery 1996). Grasshopper sparrows are ground-nesting birds, and the nest cup is domed with overhanging grasses and a side entrance. Eggs are usually laid in early to mid-June and hatch 12 days later. Males and females provide care to the young and second broods are common. This species feeds primarily on insects (Vickery 1996). WRA (2017) documented this species throughout suitable grassland habitats at the Preserve.

Burrowing owl

Burrowing owl (*Athene cunicularia*; USFWS Bird of Conservation Concern, CDFW Species of Special Concern) typically favors flat, open grasslands or gentle slopes and sparse shrub-land ecosystems. These owls prefer annual or perennial grasslands, typically with sparse or nonexistent tree or shrub canopies. Burrowing owls exhibit high site fidelity and usually nest in abandoned burrows of ground squirrels or pocket gophers. Burrowing owl is a small ground-dwelling owl with a round head and no ear tufts. It has white eyebrows, yellow eyes, and long legs. It is sandy-colored on the head, back, and upper wings with barring on the breast and belly and a prominent white chin stripe. The young are brown on the head, back, and wings with a white belly and chest. Burrowing owls are comparatively easy to see because they are often active in daylight and are often bold and approachable. WRA (2017) observed burrowing owls in grasslands at the Preserve during winter, spring, and late summer.

Burrowing Owl © Gary S. Meredith

Brant

Brant (*Branta bernicula*; CDFW Species of Special Concern) is a species of goose that is a winter visitor and migrant to California's coastal marine habitats. Eelgrass (*Zostera marina*) is the primary food source for this species during the non-breeding season and strongly influences its distribution. Although brants occur the length of California during migration, wintering occurs principally in four coastal bays with substantial eelgrass populations: Humboldt, Tomales, Morro, and San Diego/ Mission bays (Shuford and Gardali 2008). Spring migration occurs along the immediate coast, whereas fall migration occurs predominantly offshore (Shuford and Gardali 2008). Groups of brants have been regularly observed loafing on the beach along the southern shoreline of the Preserve (WRA 2017). This species regularly occurs in relatively small numbers within the intertidal and marine habitats of the Preserve, particularly during spring migration (WRA 2017).

Northern harrier

Northern harrier (*Circus cyaneus*; CDFW Species of Special Concern) inhabits open wetlands, including marshy meadows; wet, lightly grazed pastures; old fields; freshwater and brackish marshes. They also frequent dry uplands, including upland prairies, mesic grasslands, drained marshlands, croplands, cold desert shrub-steppe, and riparian woodland throughout

California (MacWhirter and Bildstein 1996). Harriers typically nest on the ground in open (treeless) habitats that provide dense, often tall, vegetation. Nests can be found among extremely varied vegetative cover, even within a single area. Soil types include drained and non-drained wetlands as well as uplands (MacWhirter and Bildstein 1996). WRA (2017) observed this species foraging over the Preserve. Portions of the Preserve contain suitable nesting and foraging habitat; however, this species has not yet been documented to breed onsite (WRA 2017).

Loggerhead shrike

Loggerhead shrike (*Lanius ludovicianus*; USFWS Bird of Conservation Concern, CDFW Species of Special Concern) is a common resident of lowlands and foothills throughout California. This species prefers open habitats with scattered trees, shrubs, posts, fences, utility lines or other perches. Nests are usually built on a stable branch in a densely foliaged shrub or small tree. This species is found most often in open-canopied valley foothill hardwood, conifer, pinyon-juniper, or desert riparian habitats. Although this species eats mostly arthropods, it also takes amphibians, small reptiles, small mammals, or birds, and is also known to scavenge on carrion. Loggerhead shrike has been observed throughout the coastal terrace portions of the Preserve (WRA 2017).

Yellow warbler

Yellow warbler (*Setophaga petechia*; USFWS Bird of Conservation Concern, CDFG Species of Special Concern) breeds most commonly in wet, deciduous thickets, especially those dominated by willows, and in disturbed and early successional habitats (Lowther *et al.* 1999). This species is found at elevations between 300 to 9,000 feet in California and at higher elevations along watercourses with riparian growth (Lowther *et al.* 1999). Yellow warbler populations have declined due to brood parasitism by brown-headed cowbirds (*Molothrus ater*) and habitat destruction. This species' diet is primarily comprised of insects supplemented with berries. At the Preserve, yellow warblers are regularly observed in the dense stands of willows associated with coastal lagoons (WRA 2017).

Yellow-headed blackbird

Yellow-headed blackbird (*Xanthocephalus xanthocephalus*; CDFW Species of Special Concern) occurs as a summer resident and migrant in Southern California, with a patchy breeding distribution. This species nests colonially or semi-colonially in marshes dominated by tall emergent vegetation (e.g., cattails, tules) and with relatively deep water. Because of the latter requirement, marshes utilized for nesting are often along the edges of lakes and larger ponds (Shuford and Gardali 2008). During the breeding season, adults forage primarily for large aquatic insects such as dragonflies and damselflies. During the spring of 2012, at least six male yellow-headed blackbirds were observed exhibiting breeding behavior at Jon's Pond at the Preserve, where stands of dense, tall tules provide suitable nesting habitat (WRA 2017). Shuford and Gardali (2008) show no recent breeding occurrences within Santa Barbara County, so the confirmation of nesting within the Preserve is noteworthy.

Tricolored blackbird

Tricolored blackbird (*Agelaius tricolor*; State Threatened; Under Review for Threatened or Endangered Federal Status) have declined by nearly 90% since the 1930s, mainly due to the loss of marsh and foraging habitats. Comprehensive statewide surveys found only 145,000 in 2014. In May 2018, a tricolored blackbird colony was documented on Coho Ranch at Jon's Pond, where 30-50 breeding pairs were documented (Andrea Jones, personal communication). Tricolored blackbirds have largely disappeared from coastal habitats, so their presence at the Preserve is significant.

Caspian tern

Caspian tern (*Hydroprogne caspia*; Migratory Bird Treaty Act) is the largest tern in the world. Caspian terns nest in California, then winter in Baja and southern Mexico. Nesting at the Preserve is as yet undocumented.

Least tern

Least tern (*Sternula antillarum*; Migratory Bird Treaty Act) is a species of tern that breeds in North America and locally in northern South America. Nesting at the Preserve is as yet undocumented.

Pigeon guillemot

Pigeon guillemot (*Cepphus columba*; Migratory Bird Treaty Act) is found in coastal waters, from Siberia through California to Alaska. The pigeon guillemot breeds on rocky shores, cliffs, and islands close to shallow water. Nesting at the Preserve is as yet undocumented.

Brandt's cormorant

Brandt's cormorant (*Phalacrocorax penicillatus*; Migratory Bird Treaty Act) breeds along the Pacific Coast from Alaska to Mexico. Their main breeding range is between California and Washington. Brandt's cormorants nest in colonies on the ground including cliffs, islands, and offshore rocks. Nesting at the Preserve is as yet undocumented.

Black oystercatcher

Black oystercatchers (*Haematopus bachmani*; Migratory Bird Treaty Act) range along the Pacific Coast from the Aleutian Islands to Baja California, primarily within rocky shores.

Osprey

Osprey (*Pandion haliaetus*; Migratory Bird Treaty Act) are found along the coast of California. The osprey is the second-most widely distributed raptor species, after the peregrine falcon. The osprey breeds near freshwater lakes and rivers, and sometimes on coastal brackish waters.

3.9.2 Mammals

There are nine special-status mammal species at the Preserve, including mountain lion, pallid bat, Townsend's big-eared bat, western red bat, American badger, southern sea otter, northern elephant seal, Pacific harbor seal, and California sea lion. Mammal species lists will be updated as surveys are completed at the Preserve.

Osprey © Mary Gleason/TNC

Mountain Lion © WRA

Mountain lion

Mountain lions (*Puma concolor*; CDFW Specially Protected Species) are a rarely seen and uncommon cat, yet they are the most widely distributed cat in the Western Hemisphere, ranging from Chile to British Columbia, and are adapted to virtually any habitat that contains their primary prey sources of deer and other large mammals. They can be active night or day but switch to nocturnal activity near human development to avoid contact with humans. Litters of one to six kittens can be born at any time of year, usually in dens concealed by thick vegetation. Adults are solitary and territorial. Although not traditionally considered a special-status species, mountain lions are protected as a specially protected species under the California Wildlife Protection Act, which makes it unlawful to possess, transport, import or sell any mountain lion or part or product thereof (including taxidermy mounts). WRA (2017) documented mountain lions at camera stations across the Preserve.

Pallid bat

Pallid bats (*Antrozous pallidus*; CDFW Species of Special Concern, WBWG High Priority) are distributed from southern British Columbia and Montana to central Mexico, and east to Texas, Oklahoma, and Kansas. This species occurs in several habitats ranging from rocky arid deserts to grasslands, and into higher elevation coniferous forests. Pallid bats often roost in colonies of between 20 and several hundred individuals. Roosts are typically in

rock crevices, tree hollows, mines, caves, and a variety of man-made structures, including vacant and occupied buildings. Pallid bats are primarily insectivorous, feeding on large prey that is taken on the ground or sometimes in flight. Pallid bats were the most commonly captured species during mist-netting efforts by WRA (2017). Searches of the non-residential buildings on the Preserve by WRA (2017) identified several structures at both the Cojo and Jalama Ranch headquarters that contained roosting bats, or accumulations of guano and prey remains from pallid bats. The horse barn at the Jalama Ranch headquarters contained the largest aggregation with approximately 60 individuals. It is presumed that this population represents a maternity roost where females come together to give birth and raise their young. Several other roost locations, including day and night roosts, have also been documented at the Preserve (WRA 2017).

Townsend's big-eared bat

Townsend's big-eared bats (*Corynorhinus townsendii*; State Candidate, CDFW Species of Special Concern, WBWG High Priority) are typically associated with caves but are also found in man-made structures, including mines and buildings. Although many bats wedge themselves into tight cracks and crevices, big-eared bats hang from walls and ceilings in the open. Males roost singly during the spring and summer months and females aggregate in the spring at maternity roosts to give birth. Females roost with their young until late summer or early fall, until young become independent, flying and foraging on their own. Hibernation roosts tend to be made up of small aggregations of individuals in Central and Southern California. No big-eared bats were captured during any of the mist-netting surveys by WRA (2017); however, they have been acoustically detected at multiple locations throughout the Preserve. Searches of the non-residential buildings on the Preserve by WRA (2017) identified a barn loft at the Cojo Ranch headquarters that contained accumulations of guano from Townsend's big-eared bat.

Western red bat

Western red bats (*Lasiurus blossevillii*; CDFW Species of Special Concern, WBWG High Priority) are highly migratory and broadly distributed, reaching from southern Canada through much of the western United States. Western red bats are believed to make seasonal shifts in their distribution, although there is no evidence of mass migrations. They are typically solitary, roosting primarily in the foliage of trees or shrubs. Day roosts are common in edge habitats adjacent to streams or open fields, in orchards, and sometimes in urban areas possibly in association with riparian habitat (Pierson *et al.* 2006). It is believed that males and females maintain different distributions during pupping, where females take advantage of warmer inland areas and males occur in cooler areas along the coast. The species was acoustically detected at sites across the Preserve (WRA 2017).

American badger

American badger (*Taxidea taxus*; CDFW Species of Special Concern) is a large, semi-fossorial (burrowing) member of the weasel family (Mustelidae). It is found in drier, open stages of most scrub, grassland, forest, and herbaceous habitats where friable soils and prey populations are present. Badgers are typically solitary and nocturnal, digging burrows to provide refuge during daylight hours. Burrow entrances are usually elliptical, and each burrow generally has only one entrance. Young are born in the spring and become independent by the end of summer. Badgers are carnivores, preying on a variety of mammals (especially ground squirrels) and occasionally other vertebrates and eggs. Badgers have been documented at multiple camera stations across the Preserve (WRA 2017).

Southern sea otter

Southern sea otter (*Enhydra lutris nereis*; FT, MMPA, CDFW Fully Protected) inhabits shallow, nearshore coastal ecosystems within 1.5 miles from shore. This species is typically found in rocky marine habitats where there is a high abundance of kelp canopy, an important habitat component used for resting and foraging (The Otter Project ["TOP"] 2012). Typically, this species is found in water depths of 65 feet or less but occasionally sea otters are seen further offshore in water depths of between 130 and 200 feet, and on rare occasions in deeper offshore areas where there is an abundance of food (TOP 2012). The current range for the species extends from north of Half Moon Bay in San Mateo County south along the California coast to Point Conception in Santa Barbara County. Groups of sea otters are consistently seen foraging in the kelp beds along the eastern portion of Cojo Beach, and another group of otters can typically be seen from Cojo Road foraging among the kelp beds. 2019 survey results found that there were approximately 38 southern sea otters and pups along these Cojo Beach stretches (G. Sanders, BOEM, personal communication).

Northern elephant seal

Northern elephant seal (*Mirounga angustirostris*; MMPA) is found in the Pacific Ocean ranging from Alaska to Mexico. They typically breed in the Channel Islands of California or Baja California in Mexico, and a few mainland sites including Año Nuevo and San Simeon (NOAA 2012b). Elephant seals haul out on land in the winter to give birth and mate, and in the spring and summer for molting. While on land, they prefer sandy beaches. During the breeding season, northern elephant seals utilize beaches on offshore islands and a few spots on the mainland. Northern elephant seals are known to occur on the beaches of Point Reyes National Seashore, Southeast Farallon Islands, Año Nuevo, Cape San Martin, Gorda, San Simeon, and Channel Islands National Park during certain times of the year (National Park Service 2012). Elephant seals have been consistently observed hauled out in the isolated cove east of Point Conception. Individual elephant seals have been observed in the waters offshore, along various portions of the western and southern shorelines of the Preserve and in a protected cove east of Point Conception (WRA 2017).

Pacific harbor seal

Pacific harbor seal (*Phoca vitulina richardsi*; MMPA) is a common, nonmigratory pinniped inhabiting coastal and estuarine waters from Alaska to Baja California, Mexico. They are a year-round resident in the San Francisco Bay Area (Codde *et al.* 2010). They haul out on rocks, reefs, and beaches, and feed in marine, estuarine, and occasionally fresh waters (National Marine Mammal Laboratory 2012). Harbor seals are easily disturbed and only haul out in areas free from human disturbance. Harbor seals have been consistently observed hauled out on three adjacent inaccessible beach/inshore rock areas east of Point Conception (WRA 2017).

California sea lion

California sea lion (*Zalophus californianus*; MMPA) is found from Vancouver Island, British Columbia, to the southern tip of Baja California in Mexico. They breed mainly on offshore islands, ranging from Southern California's Channel Islands south to Mexico, although a few pups have been born on Año Nuevo and the Farallon Islands in Central California (NOAA 2012c). Sandy beaches are preferred for haul-out sites although, in California, they haul out on marina docks as well as jetties and buoys (TMMC 2012b). Sea lions have been seen in the waters along various portions of the western and southern shorelines of the Preserve (WRA 2017).

3.9.3 Herpetofauna

There are three special-status herpetofauna (reptiles and amphibians) present at the Preserve: the federally threatened California red-legged frog (*Rana draytonii*) and two other CDFW Species of Special Concern, the Pacific pond turtle (*Actinemys marmorata*) and two-striped gartersnake (*Thamnophis hammondii*). Herpetofauna lists will be updated as surveys are completed at the Preserve.

California red-legged frog

California red-legged frog (*Rana draytonii*; Federal Threatened, CDFW Species of Special Concern) (see Figure 15) historically occurred along the coast of Marin County and inland from Shasta County southward to northwestern Baja California in Mexico. There are four habitat elements considered to be essential for the conservation of the species (USFWS 2006): aquatic breeding habitat; non-breeding aquatic habitat for foraging and shelter; upland habitat for foraging; and dispersal habitat for movement to other breeding habitats. Aquatic breeding habitat consists of low-gradient freshwater bodies, including natural and man-made (e.g., stock) ponds, backwaters within streams and creeks, marshes, lagoons, and dune ponds. Aquatic breeding habitat must hold water for a minimum of 20 weeks in most years. However, the species is adapted to the commonly ephemeral nature of water bodies in California, and such dynamism allows them to persist where invasive species such as bull frogs need permanent water for their 2-year larval duration. Aquatic non-breeding habitat may or may not hold water long enough for this species to hatch and complete its aquatic life cycle, but it provides shelter, foraging, predator avoidance, and aquatic dispersal for juvenile and adult California red-legged frog. Non-breeding aquatic features enable California red-legged frog to survive drought periods (USFWS 2006). Upland habitats include areas within 200 feet of aquatic and riparian habitat and are composed of grasslands, woodlands, and/or vegetation that provide shelter, forage, and predator avoidance (USFWS 2006). Dispersal habitat includes accessible upland or riparian habitats between occupied locations within 0.7-2.0 miles of each other (Bulger *et al.* 2003; Fellers and Kleeman 2007) that allow for movement between these sites. Dispersal habitat includes various natural and altered habitats such as agricultural fields, which do not contain barriers to dispersal. Moderate to high-density urban or industrial developments, large reservoirs, and heavily traveled roads without bridges or culverts are considered barriers to dispersal (USFWS 2006). All life-stages of California red-legged frog have been detected in the Preserve, with detections in many of the stock ponds, throughout Jalama Creek and other

major creeks on the site, in cattle troughs, and at several coastal lagoons and other locations (WRA 2017) (see Figures 14 and 15). Most of the western half of the Preserve is designated as Critical Habitat by USFWS (see Figures 14 and 15).

Western (Pacific) pond turtle

Western (Pacific) pond turtle (*Actinemys marmorata*; CDFW Species of Special Concern) is the only native freshwater turtle in most of California and may actually be two species of turtle (Spinks *et al.* 2014). This turtle is uncommon to common in suitable aquatic habitat throughout California, west of the Sierra-Cascade crest and Transverse Ranges. Pacific pond turtle inhabits annual and perennial aquatic habitats, such as coastal lagoons, lakes, ponds, marshes, rivers, and streams from sea level to 5,500 feet in elevation. Pacific pond turtle also occupies man-made habitats such as stock ponds, wastewater storage, percolation ponds, canals, and reservoirs. This species requires low-flowing or stagnant freshwater aquatic habitat with suitable basking structures, including rocks, logs, algal mats, mud banks, and sand. Warm, shallow, nutrient-rich waters are ideal as they support prey items that include aquatic invertebrates and occasionally fish, carrion, and vegetation. Pacific pond turtles often occupy creeks, rivers, and coastal lagoons that become seasonally unsuitable. To escape periods of high-water flow, high salinity, or prolonged dry conditions, Pacific pond turtle may move upstream and/or take refuge in vegetated upland habitat for up to 4 months (Rathbun *et al.* 2002). Although upland habitat is utilized for refuging and nesting, this species preferentially utilizes aquatic and riparian corridors for movement and dispersal. Pacific pond turtles nest from late April through July and requires open, dry upland habitat with friable soils. They prefer to construct their nests on unshaded slopes within 15 to 330 feet of suitable aquatic habitat (Rathbun *et al.* 1992). Females venture from the water for several hours in the late afternoon or evening during the nesting season to excavate a nest, lay eggs, and bury them to incubate and protect them. Nests are well concealed, although native mammals are occasionally able to locate and predate upon eggs. Hatchlings generally emerge in late fall but may overwinter in the nest and emerge in early spring of the following year. Pacific pond turtle has been detected at multiple locations in high numbers throughout the Preserve including many of the stock ponds, the Jalachichi basin, throughout Jalama Creek and other major creeks, and at several coastal lagoons (WRA 2017).

Pond Turtle © Laura Riege/TNC

Two-striped gartersnake

Two-striped gartersnake (*Thamnophis hammondii*; CDFW Species of Special Concern) commonly inhabits perennial and intermittent streams with rocky beds bordered by willow thickets or other dense vegetation. During the day, this species is often found basking on stream rocks or along densely vegetated banks. The two-striped gartersnake is highly aquatic, using the water and stream banks to forage and often taking to the water when threatened. Their primary food sources are fish, amphibians, and amphibian larvae, but small mammals and various invertebrates like leeches may be taken also (CDFG 2005). The rocky channel bottom and dense riparian vegetation within the Preserve provide high quality habitat for the two-striped gartersnake. Two-striped gartersnakes have been consistently detected along Jalama Creek and at wetted stock ponds (WRA 2017).

3.9.4 Fish

Tidewater goby

Tidewater goby (*Eucyclogobius newberryi*; Federal Endangered, CDFW Species of Special Concern) (see Figure 15) is the only special-status fish species currently documented as present at the Preserve. Tidewater goby are found within estuaries, marshes, lagoons, and streams along the California coast ranging from Del Norte to San Diego counties (USFWS 2005). Water depth and velocity are strong indicators of a habitat's capacity to support this species. Tidewater goby is generally found in waters less than 4 feet deep and within areas of little to no current. Unique among fishes of the Pacific Coast, this primarily annual species prefers waters with low salinity in coastal estuaries but can tolerate periods of high salinity. They feed along the bottom, preferring clean, shallow, slow-moving waters. They can tolerate a wide range of abiotic conditions. Although substrate and vegetation composition varies among occupied habitats, spawning generally occurs in unvegetated areas with sand or slightly coarser material (Swenson 1999). Spawning can occur virtually year-round, with peak spawning typically occurring in the spring and a smaller peak in late summer or early fall (Lafferty *et al.* 1999; Swenson 1999). WRA (2017) visually confirmed tidewater goby at two locations where the species had been previously documented: at the Jalama Creek and Cañada del Cojo lagoons (see Figures 14 and 15). Within the lower reaches of Jalama Creek, presence was confirmed using an underwater camera (WRA 2017). In Cañada del Cojo, presence was confirmed when two adult gobies were observed stranded on a thick mat of mosquito fern (*Azolla faliculoides*) (WRA 2017). This behavior allowed WRA biologists to positively identify the species. In addition to direct surveys for the species, WRA conducted a tidewater goby habitat assessment to determine the locations of potentially suitable habitat. Habitat assessment surveys for tidewater goby were conducted in 2012 by WRA. Three coastal lagoons along the southern boundary of the Preserve were identified by WRA (2017) as supporting or potentially supporting tidewater goby habitat. The lower portion of Jalama Creek, along the western boundary of the Preserve, supports tidewater goby habitat. Two coastal lagoon features along the southern boundary of the Preserve were identified as potentially suitable habitat where the species has not previously been documented.

Steelhead © Thomas Dunklin

Steelhead

Coastal rainbow trout or steelhead (*Oncorhynchus mykiss; Federal Endangered; CDFW Species of Special Concern*) is an amazingly plastic and adaptable species with individuals within populations expressing a resident (rainbow trout) or an anadromous (steelhead) life history. This genetic variability and plasticity allowed for populations to persist in the extreme interannual variability of California's coastal streams with a historical range from Baja California, Mexico, throughout coastal North America and across into Asia (Augerot and Foley 2005). Given this large range of a plastic species across such environmental variability, *Oncorhynchus mykiss* is managed in Distinct Population Segments (DPS). The Preserve is within the Southern California steelhead DPS), with several streams of the Preserve, including Jalama Creek, being historically important to the species. Steelhead were last observed in Jalama Creek in 1994 and the last recorded steelhead run was in 1969. USFWS has designated Critical Habitat for steelhead along Jalama and Escondido creeks (see Figure 15). Small coastal estuaries like Jalama Creek have been shown to provide a nursery role to *Oncorhynchus mykiss* by providing increased growth and survival relative to upper watershed rearing habitats, thereby increasing marine survival (Hayes *et al.* 2011). Resident rainbow trout are known to exist above barriers in Jalama Creek (Stoecker and Conception Coast Project 2002). Removing known barriers on Jalama Creek and restoring reliable connectivity between the ocean and upstream spawning habitat could "passively" re-establish anadromous steelhead populations on the Preserve, either by allowing existing resident individuals to migrate to sea or strays from nearby anadromous populations access to spawning habitat in Jalama Creek. Specific steelhead restoration prescriptions will be evaluated by TNC as part of the development of a Reintroductions and Translocations Plan for the Preserve (see Table 1).

3.9.5 Invertebrates

There are three special-status invertebrate species that are potentially present at the Preserve: the monarch butterfly (*Danaus plexippus*), Point Conception Jerusalem cricket (*Ammopelmatus muwu*), and black abalone (*Haliotis cracherodii*).

Monarch butterfly

Monarch butterfly (*Danaus plexippus*; CDFW Special-Status Invertebrate) is a large, showy butterfly found throughout the United States, southern Canada, and Central America. It also occurs in parts of South America and other continents. In North America, this species spends spring and summer months breeding and foraging across much of its range. Monarch butterfly generally use milkweed (*Asclepias* spp.) for both breeding and nectaring, although nectar may also be obtained from a variety of additional plant species. From August to October, monarchs will migrate thousands of miles to winter roost sites located along the California coast and central Mexico. Winter roost sites are in wind-protected tree groves, with nectar and water sources nearby. Several potential winter roost sites for monarchs have been documented within the Preserve, primarily within riparian vegetation associated with coastal drainages and along the lower reaches of Jalama Creek (WRA 2017, Xerces Society 2018). Monarch butterfly numbers have drastically declined across their entire range over the last few years (Schultz *et al.* 2017). Scientists have hypothesized that these declines have been caused by climate change and reductions in milkweed.

Point Conception Jerusalem cricket

Point Conception Jerusalem cricket (*Ammopelmatus muwu*; CDFW Special-Status Invertebrate) is only known to occur in the immediate surrounding areas of Point Conception, primarily in association with coastal sand dunes (WRA 2017). Several individuals of this species were identified by WRA (2017) among the coastal dunes, though the extent and distribution of this species across the Preserve is not currently known.

Black abalone

Black abalone (*Haliotis cracherodii*; Federal Endangered; State Endangered) is a plant-eating marine snail that is critically endangered throughout its range. Black abalone populations are healthy along the Central and North-Central California coast, but persist at low densities or have become locally extinct in most locations south of Point Conception. Black abalone have been observed for the first time in many years at several sites throughout Southern California and have even

FIGURE 15 California Red-Legged Frog Steelhead and Tidewater Goby Mapped Habitat

increased in numbers at a few locations. Black abalone inhabit rocky substrate from the high intertidal zone to 6 meters depth but are most abundant in the mid-low intertidal. They have historically been overfished, but the fishery was closed in 1993. Populations of black abalone are currently very low at the Preserve, likely due to fatal withering syndrome that reduced the populations at Government Point by 97% between 1992 and 1995 (Allstatt *et al.* 1996). An Abalone Recovery Management Plan was adopted by the state of California in 2005 and critical habitat for black abalone was designated by the National Marine Fisheries Service (NMFS) in 2011.

Monarch Butterflies © Jesse Alstatt

4.0 Resource Management

Resource management will be implemented to meet the Preserve goals and objectives outlined in Table 1. For each resource type, we have developed an overall long-term goal and a set of long-term (>5 years) objectives, near-term (1-5 years) objectives, and priority actions that we will use to meet this goal (see Table 1). Near-term objectives are focused on supporting California Coastal Commission (CCC) priority restoration projects (see Section 5.3), reducing fuel loads and the overall fire threat to the Preserve, and limiting potential cattle (and other management) impacts to natural resources. We have also developed a set of management methods and recommendations for each resource type and goal. For Table 1 and Section 4, Coastal and Marine Ecosystems have been combined in to one resource type, except for Dune Ecosystems, which are treated separately because of the combination of their rarity and high potential habitat value at the Preserve and TNC's current focus on dune research and restoration (associated with iceplant eradication and Gaviota tarplant re-establishment).

Management will be implemented within an adaptive management framework (Holling 1978). Management methods and recommendations will be implemented, adapted, and refined based on our annual monitoring efforts and changing environmental conditions. Management strategies will be revised to incorporate new information, including new management techniques, and the ecology of the systems and species. We will develop an annual work plan to assess achievement of goals and objectives, funding, and available staff.

For all management decisions (for all resource types), we will use a precautionary approach and take changes in human activities slowly and with stepwise increases while monitoring habitat impacts and responses by wildlife. Second, we will use a structured decision-making approach (Conroy and Peterson 2013) to clearly articulate the elements of decisions, including the problem statement, potential impacts, consistency with goals, site design, and an evaluation of risks and trade-offs. We plan to approach the management of the Preserve in a precautionary manner, with the short-term aim of "doing no harm" to secure our longer-term goals (see Table 1).

For the coastal and marine resource types, which have been less thoroughly evaluated and assessed than the terrestrial resource types, over the next 1-5 years we will conduct annual, or more frequent, assessments and establish a baseline understanding of the habitats, processes, and priority species present, which will guide future management. This will require working closely with partners who may already have long-term monitoring in place (e.g., PISCO/MARINe for the rocky intertidal system) and establishing new partnerships and new monitoring sites and methods for other habitats and species. This may involve the use of contracted field surveys, remote sensing, environmental sensors, and other tools. We will develop a monitoring framework, monitoring plan, and database for coastal and marine habitats and species that will guide our annual work plans with the goal of establishing this baseline understanding of coastal ecosystems. The coastal ecosystems are some of the most unique and high-value conservation assets of the Preserve and decisions on activities that have potential impacts to the coast will receive the highest level of scrutiny and informed decision-making.

4.1 GRASSLAND MANAGEMENT

California's iconic grassland ecosystems cover more than 25% of the state and are a biodiversity hotspot, providing habitat for 90% of the state's rare and endangered species and a diversity of ecosystem services, including water capture and release. At the Preserve, there are more than 5,000 acres of grasslands (see Figure 9), which are used by a large and diverse group of plants, mammals, birds, reptiles, amphibians, and insects, including the endangered Gaviota tarplant as well as sensitive species like American badger, grasshopper sparrow, and burrowing owl. In springtime of years with abundant rainfall, like in 2019, the grasslands of the Preserve

are painted orange, blue, yellow, purple, and pink by abundant wildflowers. Like most of California's grasslands, those at the Preserve are dominated by non-native grasses introduced by European ranchers and their livestock in the late 18th and early 19th centuries. Smaller pockets of pristine native grassland, dominated by purple needlegrass, creeping rye grass turf, and giant wild rye dot the Preserve (see Figure 9).

4.1.1 Management Goal

At the Preserve, the long-term goal is to adaptively manage grasslands to be resilient to catastrophic fire and climate change and to support high levels of native plant and animal diversity, ecosystem function, and habitat structure.

Specific long-term objectives (>5 years) to support this management goal include:

1. Increase the current acreage of native perennial bunchgrass populations through compatible management and restoration.
2. Create a mosaic of grassland structure—which includes both open, short-grass conditions and dense, tall-grass conditions—to support native plant and animal diversity.
3. Increase the absolute cover and species richness of native grassland herbs by reducing the cover of herbaceous exotic plants.
4. Reduce the cover of invasive noxious weed species, including large stands of black mustard, milk thistle, bull thistle, iceplant, and fennel.

Specific near-term priority objectives (1-5 years) to support this management goal include:

1. Use cattle grazing to reduce fine fuel loads and decrease fire threat.
2. Use cattle grazing to support 300-acre iceplant eradication project (CCC priority), including potential management of veldt grass, European beachgrass, and other invasive noxious weed species.
3. Use cattle grazing to encourage re-establishment and expansion of Gaviota tarplant within 300-acre CCC iceplant eradication project.

Priority actions to support this management goal include:

1. Develop 5-year Grazing and Fire Management Plan.
2. Develop Invasive Species Action Plan.
3. Develop Reintroductions and Translocations Plan that includes an evaluation of whether natural grazers (e.g., elk) can be safely and effectively introduced to play complementary and/or supplementary grazing roles.
4. Develop and implement efficient rangeland monitoring program that leverages remote sensing and conservation technology.

4.1.2 Management Methods and Recommendations

At the Preserve, we will continue to use livestock grazing to meet the grassland community management goals and objectives. We will use vegetation management (e.g., mowing) and prescribed burning, when possible, to supplement the effects of grazing to reduce fine fuel loads, prevent shrub encroachment in areas we want to maintain as grassland, and control invasive noxious weed species.

As part of TNC's overall goal to evaluate reintroductions and translocations at the Preserve, we will develop a comprehensive plan that determines whether natural grazers (e.g., elk) can be safely and effectively introduced to play complementary and/or supplementary roles in meeting grassland goals and objectives.

Recommended methods for managing the grassland ecosystems include:

- Use livestock for large-scale vegetation management, including invasive noxious weed control.
- In years of exceptional native forb expression and seed set, limit livestock grazing within flowering periods to allow seeds to reach the seed bank.
- In management units with mapped areas of Gaviota tarplant, Lompoc yerba santa, and surf thistle, remove grazing during periods of flowering and seed set.
- Annually maintain an average of 800 lbs/acre of residual dry matter (RDM) within each management unit, with no areas with less than 500 lbs/acre and no areas with more than 3,000 lbs/acre.

Cows grazing © Karin Lin/TNC

- Eradicate, using mechanical (weed wrench, pulling, mowing) and chemical (application of topical herbicides) methods, areas mapped by WRA (2017) as upland mustards, upland thistle stands, and fennel patches.
- Manage and reduce populations of feral pigs with hunting, fencing, and other methods.
- Use prescribed fire on a rotational basis across each management unit (for planning purposes, a management unit is assumed to be a fenced pasture on the Preserve) to reduce fine fuel loads and the threat of catastrophic fire and to encourage native species diversity by reducing the cover and density of exotic annual grasses.

4.1.3 Monitoring and Adaptive Management

Grassland ecosystems can degrade when subjected to overgrazing—becoming more dry, devoid of vegetation, and susceptible to erosion and invasive noxious weeds. Overgrazed pastures can lose not only their conservation value for habitat and ecosystem services, but also their economic and societal values, sometimes permanently. Moderate, well-managed livestock grazing, on the other hand, can have a positive effect on grasslands by controlling non-native species, allowing native plants to flourish, and maintaining habitat conditions preferred by many species of wildlife (Marty 2005; Hayes and Holl 2003; Gennet *et al.* 2017). In fact, a certain amount of disturbance from grazing is often essential for healthy grassland ecosystems and can even benefit the establishment and growth of certain endangered native annual forb species like Gaviota tarplant. Cattle grazing can also reduce the threat of catastrophic wildfire by decreasing fine fuel loads (Russell and McBride 2003).

To ensure that livestock grazing continues to be compatible with the Preserve's grassland and oak woodland communities, as well as with the goals and objectives for special-status animal species, we will monitor RDM in each management unit annually in the fall (Sept-Oct). Photo points within each management unit will be used to visually document RDM conditions. TNC monitors RDM on ~225,000 acres of rangeland conservation lands in California. At the Preserve, TNC will monitor RDM using ground-based methods (Guenther and Hayes 2008) to establish a RDM and grazing baseline. In the first year, TNC established initial RDM terms for the grasslands and oak woodlands based on UC guidelines (Bartolome *et al.* 2006). After 1 year of monitoring, TNC plans to assess if these RDM terms/goals make sense for Preserve-wide goals and objectives, with a specific emphasis on pastures that are close to the coast, where TNC will assess if higher RDM terms/goals make sense. After 5 years, TNC will monitor RDM remotely using RDMapper, TNC's web-based grassland monitoring tool (Tsalyuk *et al.* 2015; Ford *et al.* 2017).

RDM is a measurement of the aboveground plant material left standing or on the ground just prior to the first autumn rains and the start of a new growing season (Bentley and Talbot 1951). RDM has been shown to be a good predictor of rangeland productivity and overall rangeland condition (Bartolome *et al.* 2007). Quantitative evidence, qualitative observations made over time, and inference from other ecological systems suggests that keeping sufficient RDM levels benefits rangeland conservation values, helping slow or stop invasion of noxious and other introduced flora, conserving existing native species richness and cover, encouraging the maintenance of preferred wildlife habitat conditions, and protecting watersheds and streams from excessive soil erosion (Bartolome *et al.* 2006). Each year after annual RDM monitoring, we will adjust grazing timing and intensity, as necessary, to meet RDM goals within each management unit.

Every other year we will conduct grassland bird species monitoring across the Preserve to document bird presence and to better understand how habitat use by birds may change with management actions. Grassland bird species of interest include grasshopper sparrows and burrowing owls. If we determine that grasshopper sparrow populations grow

as native perennial grassland populations grow, then we will strongly consider a restoration strategy that focuses on purple needlegrass population expansion.

Every 5 years, we will use fine-scale remote sensing data and field evaluation to monitor the areal extent of purple needlegrass grassland, giant wild rye grassland, and creeping rye grass turfs. If areal extent declines for any one of these vegetation alliances, we will consider more focused management actions, including targeted livestock grazing (or the removal of grazing), prescribed burning, and re-seeding to encourage population expansion.

Every 5 years or in years of significant rainfall/native wildlfower expression, we will conduct a full botanical inventory to document rare/sensitive native grass and forb occurrences, including extent and density of federal- and state-listed plant species, such as Gaviota tarplant, Lompoc yerba santa, and surf thistle. If the extent or density of listed species, especially those that are federally endangered, declines, we will evaluate the impacts of our management actions, such as from livestock grazing, and adjust to ensure these species persist and expand across the Preserve. We will evaluate opportunities to expand populations of listed species through re-seeding in appropriate non-native, degraded annual grassland sites.

4.2 OAK WOODLAND MANAGEMENT

Coast live oaks are iconic trees of coastal California and are unique among California's oak trees in the ability to thrive along the coast. Coast live oaks are drought resistant and adapted to fire. Widespread in the uplands and bottomlands, there are over 6,000 acres of coast live oak woodlands at the Preserve (see Figure 10). Evergreen with a dense, hemispherical crown and magnificent and complex architecture of twisted and gnarled limbs and branches, coast live oak is the keystone species of coastal woodlands. Acorns and habitats provided by coast live oaks support the greatest diversity of terrestrial wildlife species in the region. Native Americans harvested and consumed acorns as a dietary staple.

A diversity of native shrubs—including black sage, California sagebrush, creeping snowberry, pink honeysuckle, hummingbird sage—are associated with coastal live oak woodland at the Preserve. Representative wildlife species include acorn woodpecker (*Melanerpes formicivorus*), western scrub-jay (*Aphelocoma californica*), arboreal salamander (*Aneides flavipunctatus*), western gray squirrel (*Sciurus griseus*), and dusky-footed woodrat (*Neotoma fuscipes*). Larger animals, such as mountain lion and black bear, also use forested oak landscapes at the Preserve.

Coast Live Oak © Matthew Davis/TNC

4.2.1 Management Goal

At the Preserve, the long-term goal is to adaptively manage oak woodlands to be resilient to catastrophic fire and climate change and to support high levels of oak regeneration and recruitment and native plant and animal diversity, ecosystem function, and habitat structure.

Specific long-term objectives (>5 years) to support this management goal include:

1. Increase the current acreage of coast live oak woodlands through active restoration and compatible management.
2. Develop an early detection and rapid response protocol for oak pests and pathogens to help reduce the threats to oak regeneration, recruitment, growth, and overall survival.

Specific near-term priority objectives (1-5 years) to support this management goal include:

1. Complete the 200-acre oak restoration project (CCC priority).
2. Use cattle grazing, when possible, to prepare sites for oak plantings.
3. Use cattle grazing to reduce fine fuel loads and decrease fire threat.
4. Manage the cattle grazing operation to maintain high levels of native plant and animal diversity.

Priority actions to support this management goal include:

1. Develop 5-year Grazing and Fire Management Plan.
2. Develop Invasive Species Action Plan.
3. Develop Pig Management Plan.
4. Develop Reintroductions and Translocations Plan.
5. Develop and implement efficient rangeland and oak woodland monitoring program that leverages remote sensing and conservation technology.

4.2.2 Management Methods and Recommendations

At the Preserve, we will use livestock grazing, vegetation management (including re-planting of oaks and removal of diseased oaks), fire management, and management of invasive animal species (including pigs and turkeys) to meet the oak woodland community management goals and objectives.

Recommended methods for managing the oak woodland ecosystems include:

- Use compatible livestock grazing for large-scale vegetation management.
- Annually maintain an average of 800 lbs/acre of RDM within each management unit, with no areas with less than 500 lbs/acre and no areas with more than 3,000 lbs/acre.
- In pastures dominated by mature oaks, oak restoration plots, and in areas identified as important for oak seedling establishment and expansion, use seasonal livestock grazing to minimize livestock impacts on juvenile oaks.
- Experimentally fence Army Camp site or portions thereof to evaluate whether removal of acorn consumers (e.g., pigs, turkeys, cattle, rabbits) can lead to increased oak recruitment and regeneration.
- Where oak seedlings are present and recruitment to sapling and adult stages desirable, options include: increasing minimum RDM levels, seasonally excluding livestock (and other acorn consumers, including pigs and rabbits) during the driest months, and/or protecting seedlings and saplings with protective shelters until they are above browse height (approximately 6 feet).
- Based on levels of natural recruitment, develop a plan to adjust management to influence the establishment and growth of oak seedlings and saplings.
- Biannually monitor for the presence of oak pests and pathogens, including sudden oak death and goldspotted oak borer, and implement management strategies where and when there is a reasonable chance of successful control or eradication.
- Eradicate, using mechanical (weed wrench, pulling) and chemical (application of topical herbicides) methods, any significant populations of noxious weeds that establish within oak woodland communities, especially those that are directly competing with oaks and/or that are increasing the risk of catastrophic fire.
- Use prescribed fire on a rotational basis (e.g., 1-2 management units burned each year, so as not to negatively impact the grazing regime, with a minimum of 10 years return cycle for each unit) across each management unit to reduce fine fuel loads and the threat of catastrophic/stand-replacing fire and to encourage native species diversity by reducing the cover and density of exotic annual grasses.
- Model future habitat suitability under different climate scenarios of coast live oak woodlands to inform our management and restoration efforts.

4.2.3 Monitoring and Adaptive Management

To ensure that livestock grazing continues to be compatible with the Preserve's grassland and oak woodland communities, as well as with the goals and objectives for special-status animal species, we will monitor residual dry matter (RDM) in each management unit annually in the fall (Sept-Oct). Methods used to monitor grasslands, described above, can be applied to herbaceous understory.

Biannually we will monitor the coast live oak woodlands for sudden oak death and goldspotted oak borer. Coast live oak woodlands are extremely susceptible to both. We will remove diseased/infected trees and re-plant in areas free of disease/pests that we have modeled as being suitable habitat under future climate conditions.

Every 5 years, we will use fine-scale remote sensing data and field evaluation to monitor the areal extent of coast live oak woodlands. If areal extent declines significantly, we will consider more focused management actions, including re-planting, to encourage population expansion. Biannually, we will evaluate opportunities to expand these populations through re-planting in appropriate sites where these species do not currently exist but could exist based on climate tolerances, soil types, and other environmental conditions, and where oak woodland expansion does not adversely impact the goals and objectives for other community types.

Every 5 years we will conduct a recruitment survey to assess changes in population numbers, density, and population structure to ensure that we are maintaining a healthy, sustainable age structure. Based on levels of natural recruitment, we will develop a plan to adjust management to influence the establishment and growth of oak seedlings and saplings. We will also assess whether strategies such as increasing minimum RDM levels, seasonally excluding cattle during the driest months, and/or protecting seedlings and saplings with protective shelters until they are above browse height (approximately 6 feet) are having the desired positive impact on recruitment and growth of coast live oak woodland seedlings and saplings.

4.3 SHRUBLAND MANAGEMENT

Drought-adapted shrublands are extensive in Southern California. At the Preserve, sensitive shrubland communities blanket the coastal hillsides (see Figure 11). The two most extensive shrubland communities are coastal sage scrub and chaparral. Coastal sage scrub is dominated by aromatic semi-woody, and semi-deciduous drought-tolerant shrubs including California sagebrush, coyote brush, purple sage (*Salvia leucophylla*) and black sage. Chaparral is a community of summer-drought-tolerant plants with sclerophyllous (hard) evergreen leaves. Chaparral communities are dominated by California lilac (*Ceanothus*), manzanita (*Arctostaphylos* spp.), chamise (*Adenostoma fasciculatum*), California coffeeberry (*Frangula californica*), black sage, coast live oak and coastal scrub species. At the Preserve there is a chaparral community found only in western Santa Barbara County called burton mesa chaparral, which contains La Purisima manzanita. It occurs on sandstone outcrops and sandy soils in maritime chaparral habitats. Coastal sage scrub and chaparral communities are biodiversity hotspots, supporting some of the highest concentrations of rare species for any ecosystem type in California. Badgers, bobcats, mule deer, mountain lions, lizards, snakes, and a variety of avian species are characteristic of shrubland communities at the Preserve.

Shrubland communities are resilient and adapted to wildfire. Historically, Native Americans burned chaparral to promote grasslands for textiles and food. Though adapted to infrequent fires, shrubland communities are threatened by frequent fires, especially with climate change-induced drought.

Fox © John Stuelpnager

4.3.1 Management Goal

At the Preserve, the long-term goal is to adaptively manage shrublands to be resilient to catastrophic fire and climate change and to support high levels of native plant and animal diversity, ecosystem function, and habitat structure.

Landscape from Black Canyon Road © Bill Marr/TNC

Specific long-term objectives (>5 years) to support this management goal include:

1. Maintain the current acreage of sensitive shrubland communities with compatible management and consideration of active restoration.
2. Conduct biannual surveys to increase our understanding of the distribution of special-status plant and animal species within shrubland communities.
3. Model future habitat suitability of sensitive shrubland communities under different climate scenarios to inform our management efforts.
4. Evaluate planting of sensitive shrubland communities in areas projected to be suitable under future climate scenarios.
5. Determine what the natural fire return cycle is for the Preserve's shrubland communities and then seek to restore that fire cycle using prescribed burning to encourage high levels of native plant and animal diversity and reduce the overall threats from catastrophic fire.

Specific near-term priority objectives (1-5 years) to support this management goal include:

1. Use cattle grazing to reduce fine fuel loads and decrease fire threat.

Priority actions to support this management goal include:

1. Develop 5-year Grazing and Fire Management Plan.
2. Develop and implement efficient shrubland monitoring program that leverages remote sensing and conservation technology.
3. Develop Invasive Species Action Plan.

4.3.2 Management Methods and Recommendations

Areas supporting shrubland communities should be managed to support high levels of native plant and animal diversity. Sensitive shrubland communities will be managed to be resilient to catastrophic fire, climate, and exotic plant invasions.

Recommended methods for managing the shrubland ecosystems include:

- In management units dominated by sensitive shrubland communities, limit livestock grazing and other vegetation management (e.g., mowing) to early parts of the season before shrubs begin to flower.
- Use prescribed burning on a rotational basis within management units dominated by shrubland communities to restart the natural fire return cycle, reduce fuel loads and the overall threat of catastrophic fire, and encourage native plant species diversity, shrub density and health by reducing the cover and density of exotic annual grasses.

4.3.3 Monitoring and Adaptive Management

Every 5 years use fine-scale remote sensing and field surveys to monitor the areal extent of sensitive shrubland communities. If declining significantly over time, consider planting sensitive shrubland individuals in areas mapped as being suitable under future climate scenarios.

Lower Jalama Creek © Brendan Belby/ICF

4.4 FRESHWATER ECOSYSTEMS MANAGEMENT

Water is essential for all life, and fresh water is especially important for ecosystems in arid lands like the Mediterranean-type habitats of coastal California. California's coastal watersheds contain important aquatic resources that support abundant freshwater biodiversity. At the Preserve, there are extensive wetland and riparian habitats, ~16 miles of perennial streams and ~62 miles of intermittent streams (see Figure 7). The ~328 acres of wetlands include seeps, springs, seasonal wetlands, wetland swales, in-stream wetlands, perennial marshes, and artificial ponds (see Figure 7). Notable wetland habitats include a large seasonal wetland complex on the coastal terrace at Point Conception, emergent marsh vegetation around ponds and in-stream wetlands, extensive lengths of dense willow vegetation along streams and creeks and dense patches of rushes at seeps and along ephemeral and intermittent streams. Jalama Creek is a major perennial stream in the region (see Figure 7); the Preserve contains almost the entirety of the Jalama Creek watershed. All precipitation that falls on the Preserve resulting in surface water runoff eventually flows to the Pacific Ocean through streams located within the boundaries of the Preserve. In addition to Jalama Creek, the Preserve contains major named perennial streams Escondido Creek, Gasper Creek, and Espada Creek (see Figure 7).

Wetland, riparian, and in-stream biodiversity includes Pacific (western) pond turtle, California red-legged frog, Pacific chorus frog, two-striped gartersnake and tidewater goby (see Figures 12, 14, 15).

4.4.1 Management Goal

At the Preserve, the long-term goal for the freshwater ecosystems is to preserve their biodiversity, ecosystem function, and processes.

Specific long-term objectives (>5 years) to support this management goal include:

1. Maintain or restore 10+ miles of healthy and diverse instream and riparian habitats in Jalama Creek and Cañada del Cojo Creek.
2. Maintain or restore healthy and diverse in-stream and riparian habitat in Espada Creek, Gasper Creek, Escondido Creek, Wood Canyon Creek and unnamed creeks including special-status species.

3. Maintain or restore healthy freshwater habitat in seeps, swales, springs, ponds, and natural and artificial wetlands.
4. Restore degraded freshwater ecosystems, including removal of invasive species and restoration of natural hydrographic features.
5. Maintain or restore terrestrial, riparian, in-stream, and other freshwater-dependent wildlife use of coastal habitats that is reflective of "wild" coastal freshwater ecosystems with little human disturbance.

Specific near-term priority objectives (1-5 years) to support this management goal include:

1. Manage human and livestock access and prevent trampling, illegal take of freshwater resources, and human disturbance of wildlife.
2. Manage for healthy ecological processes and ecological functions that support wildlife of freshwater ecosystems.
3. Eradicate populations of giant reed (*Arundo donax*) and pampas grass (*Cortaderia selloana*).
4. Restore natural freshwater ecosystem processes by excluding livestock access, adapting and minimizing human infrastructure and, where needed, restoring natural habitat and species.

Priority Actions to support this management goal include:

1. Develop 5-year Grazing and Fire Management Plan.
2. Develop Invasive Species Action Plan.
3. Develop Freshwater Ecosystem Baseline Assessment.
4. Develop Reintroductions and Translocations Plan that evaluates whether steelhead can be re-introduced, along with barrier removal, within Jalama Creek and the Jalama Creek watershed.
5. Develop and implement wetlands monitoring program that leverages remote sensing and conservation technology.

4.4.2 Management Methods and Recommendations

Areas supporting freshwater ecosystems should be managed to support high levels of native plant and animal diversity. Sensitive freshwater ecosystems will be managed to be resilient to drought and climate change.

Recommended methods for managing the freshwater ecosystems include:

- Conduct a comprehensive baseline assessment of all freshwater ecosystems, which will be repeated every 5 years.
- In streams, riparian areas, and wetlands, limit or exclude livestock grazing with fencing to reduce negative impacts.
- Restore hydrologic function of streams and wetlands through bank stabilization, riparian and wetland vegetation restoration, and other strategies in areas with impaired hydrologic function.
- Encourage native plant species diversity and shrub density and health by reducing the cover and density of exotic plants.

4.4.3 Monitoring and Adaptive Management

Every 5 years use fine-scale remote sensing and field surveys to monitor the areal and linear extent and condition of freshwater ecosystems. Develop a well monitoring program to monitor groundwater levels at the Preserve. Develop in-stream flow and temperature monitoring program for the Jalama Creek watershed. If declining significantly over time, consider strategic intervention. Evaluate the use of fog monitoring to better understand the role of fog for freshwater ecosystems at the Preserve.

4.5 COASTAL AND MARINE ECOSYSTEMS MANAGEMENT

The Preserve's coastline stretches over more than 8 miles of relatively untouched shores that include the iconic headland of Point Conception, where the cold, southward flowing California Current meets the warmer and weaker California countercurrent (see Figure 12). Due to its location and geography, Point Conception forms a major marine biogeographic boundary, where the ranges of species from the north and south overlap, resulting in high biodiversity. This is a rich and productive area characterized by strong upwelling of cold, nutrient-rich waters that fuels an ocean ecosystem providing food for hundreds of species of invertebrates, fish, seabirds, and marine mammals.

The Preserve's coastal areas are relatively undisturbed and have very high intrinsic conservation value and sensitivity. Increased human access has the potential to disrupt coastal habitat values and impact the broad array of species that depend upon the coastal and marine ecosystems, including

terrestrial and marine wildlife use of the sandy beaches, rocky intertidal, and coastal confluences. The presence of special-status species, such as western snowy plover, harbor seals, and elephant seals, warrants careful planning of coastal access and activities to minimize disturbance, especially during breeding and resting periods. At the boundary of two marine ecoregions, this area is also anticipated to be a sentinel site for climate change, making coastal research an essential ingredient for long-term adaptive management.

4.5.1 Management Goal

At the Preserve, the long-term goal is to adaptively manage coastal and marine ecosystems to preserve the biodiversity, ecosystem processes and functions, and wildlife use of the coast and adjacent marine ecosystems.

Specific long-term objectives (>5 years) to support this management goal include:

1. Maintain or restore terrestrial and coastal (e.g., coastal dunes and scrub) wildlife habitat and important ecological processes to promote and maintain wildlife access and use of coastal habitats reflective of a "wild" coast with little human disturbance.
2. Maintain or restore the health of coastal confluences and their associated species (e.g., tidewater goby) and ecosystem services by maintaining and managing for appropriate natural processes (e.g., environmental flows, sand and sediment supply) and land-sea connectivity.
3. Restore natural dynamic coastal processes by removing, adapting, and minimizing human infrastructure and, where needed, restoring natural habitat and species in the coastal realm.
4. Track coastal changes and ocean conditions to promote the resilience of coastal ecosystems by minimizing other stressors in the face of sea level rise, changing ocean conditions, and other direct anthropogenic impacts.
5. Monitor, inform, and adapt coastal access to maintain the wild coast aspect of habitats unique to the Preserve.

Specific near-term priority objectives (1-5 years) to support this management goal include:

1. Conduct a comprehensive baseline assessment of the coastal ecosystems and their dynamics (e.g., habitats, biodiversity, land-sea connectivity, cross-ecosystem subsidies, wildlife use) to inform best management and restoration of coastal resources on and off the Preserve.
2. Assess current levels of human access and develop a Managed Access Plan to guide Preserve activities and human access to the coastal portion of the Preserve, with the goal of minimizing disturbance of wildlife and trampling of intertidal resources, and trespass.
3. Develop partnerships and a long-term research agenda that leverages the unique geographic and "wild" coast context of the Preserve, and the adjacent Point Conception SMR, to advance understanding of coastal/marine biodiversity, ecological processes and functions, and land-sea connectivity in the face of climate change.

Priority Actions to support this management goal include:

1. Develop Coastal Ecosystems Baseline Assessment.
2. Develop Managed Access Plan.
3. Develop and implement coastal ecosystem monitoring program that leverages remote sensing and conservation technology.

4.5.2 Management Methods and Recommendations

At the Preserve, TNC has direct management control only over the coastal areas above MHW, as well as access to the coast through the Preserve. Therefore, it will be important to partner with local, state, and federal agencies who manage intertidal and subtidal resources to achieve our management goals of protecting coastal and marine resources.

Recommended methods for managing the coastal and marine ecosystems include:

- Conduct a comprehensive baseline assessment of coastal ecosystems (beaches, dunes, rocky intertidal, coastal confluences), including species composition and community structure, special-status species, shorebird and wildlife use of coast, and cross ecosystem function.

- Develop and implement an annual coastal monitoring plan, with a focus on tracking seasonal and interannual dynamics and trends in biodiversity, habitat distribution, and species use (e.g, invertebrates, fish, birds, and mammals) to improve science needed for management.
- Provide access and support for existing long-term monitoring studies (e.g., UCSC/MARINe), but also establish new monitoring studies along the coast and in the marine environment.
- Establish a Preserve Managed Access Plan that clearly identifies desired outcomes and established limits and guidelines for site use and visitation.
- Monitor trends in people accessing the Preserve coast, including legal public access below MHW, Conservancy-sponsored and approved access (e.g., visitors, scientists), and trespass across the Preserve.
- Track through observations or cameras, wildlife and human use of the coast and make management adjustments or coordinate with enforcement partners as necessary to address issues of human disturbance of wildlife.
- Minimize human visitation near marine mammal rookeries and haul-outs, especially during breeding and molting seasons, and employ buffer distances to avoid disturbance. Temporary closures of overlooks during the breeding season, restrictions on pets, installation of fences, and signage may be required to protect breeding mammals. Conduct surveys to determine the times of year when marine mammals use haul-out and/or rookery areas on the Preserve coast.
- Minimize human visitation and disturbance near western snowy plover nesting or resting areas on beaches during breeding season and employ distance buffers from resting shorebirds/seabirds. Temporary closures of beaches during the breeding season, restrictions on pets and wheeled vehicles, installation of fences, and signage may be required to protect breeding or resting birds. Beach surveys should be conducted to identify important areas for snowy plovers, as well as the presence of other beach nesting birds on the Preserve.
- Minimize human visitation and disturbance near and employ distance buffers from seabird and nesting and roosting areas (e.g., black oystercatchers, cormorants, and pelicans). Temporary closures near bluffs and cliffs, restrictions on pets and vehicles, installation of fences, and signage may be required to protect breeding or resting birds.
- Develop guidelines and best practices to avoid trampling impacts in rocky intertidal.
- Assess the habitat and biodiversity values of the 24 coastal confluences, plus Jalama Creek estuary, to better understand natural environmental flows, biophysical parameters, and natural resource management needs.
- Work with Santa Barbara County Park District on co-management of the Jalama Creek watershed and estuary to restore environmental flows, habitat values, and priority species (e.g., tidewater goby and steelhead).
- Document "natural" tar on beaches and rocky intertidal, including its distribution, abundance, and chemical fingerprint to provide a baseline in case of catastrophic oil spill.
- Collaborate with partners to assess the rates of cliff erosion, sea level rise, and changes in rocky intertidal and beach area along the coast both seasonally and inter-annually, to inform adaptation plans.
- Assess coastal infrastructure (e.g., roads, railroads, armoring) to identify potential impacts to natural hydrologic and sediment regimes or habitat connectivity that may need to be addressed.

4.5.3 Monitoring and Adaptive Management

Management methods and recommendations described above will be implemented, adapted, and refined through an adaptive management framework (Holling 1978), but also based on changing environmental/ocean conditions and emerging threats that may not be anticipated now. Seasonal and annual monitoring (including human disturbance at the coast) will be critical to capture and enhance our understanding of coastal dynamics and trends. Management strategies and tactics will be revised based on monitoring and new information streams. Importantly the Preserve Managed Access Plan will be assessed and adapted at least annually relative to trends in human access, coastal dynamics and trends, and wildlife use of the coast to meet the multiple goals of the Preserve.

4.6 DUNE MANAGEMENT

The dune system at the Preserve is incredibly important as habitat for native plant and animal species. (see Figure 16) However, the dune system is highly invaded by iceplant, veldt grass, and European beachgrass, and is not well studied or understood. Therefore, restoration (i.e., starting with the 300-acre CCC iceplant project), baseline assessment, and research are major near-term priority objectives.

4.6.1 Management Goal

At the Preserve, the long-term goal is to adaptively manage and restore dune communities and natural sand shed processes to support biodiversity.

Specific long-term objectives (>5 years) to support this management goal include:

1. Reduce total iceplant cover.
2. Reduce total veldt grass cover.
3. Conduct a geomorphological study of the sandshed with a focus on sand sources, supply, and transport in the littoral cell and across the headlands.
4. Work with neighbors in adjacent watersheds along the littoral cell to restore natural sand supplies by identifying and removing obsolete dams and armoring, as well as minimizing use of hardened infrastructure or practices that impact sand transport and environmental flows.
5. Conduct biannual surveys of coastal dune vegetation to increase our understanding of the distribution of special-status plant species and dune dynamics.
6. Model future habitat suitability under different climate scenarios for federal- and state-listed plant and animal species, like surf thistle, to inform future management and restoration efforts.

Specific near-term priority objectives (1-5 years) to support this management goal include:

1. Complete 300-acre CCC iceplant eradication project.
2. Identify and protect current nesting and potential grounds for the western snowy plover.

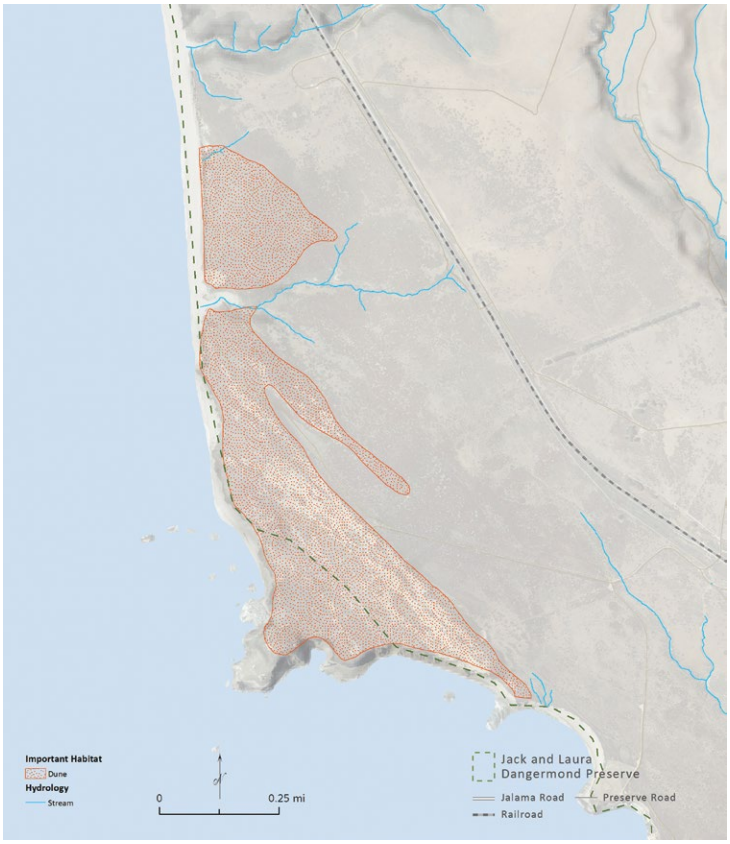


FIGURE 16 Preserve Mapped Dune Ecosystems

3. Assess current levels of human access and develop a Managed Access Plan to guide Preserve activities and human access to the coastal portion of the Preserve, with the goal of minimizing disturbance of wildlife, trampling of intertidal resources, and trespass.

Priority actions to support this management goal include:

1. Develop Dune Management Plan.
2. Develop Managed Access Plan.
3. Develop geomorphological study of the sandshed.
4. Research and map historical, current, and potential dune habitat throughout the Preserve.

4.6.2 Management Methods and Recommendations

Recommended methods for managing the dune systems:

- Proactively treat for additional invasive species, like veldt grass, European beachgrass, and sea rocket after treatment for iceplant to encourage successful native restoration planting efforts.

- Limit disturbance of dune vegetation unless no other alternative is available, including from motor vehicles, foot traffic, and cattle grazing.
- Conduct coastal dune-associated management activities outside of the bird (e.g., western snowy plover) nesting season.
- In areas with surf thistle (or the potential to have surf thistle), remove livestock during periods of flowering and seed set.
- Restore populations of surf thistle to areas modeled as potentially suitable under future climate scenarios, which should include active seed collection and propagation at the Preserve.

4.6.3 Monitoring and Adaptive Management

Biannually conduct a dune system survey for special-status plant and animal species. Annually, at known occurrence locations, conduct presence/absence surveys during flowering periods for federal- and state-listed special-status plant species, such as surf thistle. Annually monitor for western snowy plovers to track changes in population numbers. Annually conduct a drone flight (timed appropriately to avoid the western snowy plover nesting season) to collect aerial imagery and point cloud data to track changes in dune morphology and vegetation and provide useful data for adaptive management.

4.7 SPECIAL-STATUS PLANTS MANAGEMENT

4.7.1 Management Goal

At the Preserve, the long-term goal is to adaptively manage to support the recovery, resilience, and long-term persistence of >20 special-status plant species known to occur on-site and to allow for the expansion of special-status species known to be present on adjoining properties that also have the potential to occur on-site.

Specific long-term objectives (>5 years) to support this management goal include:

1. Conduct biannual surveys to increase our understanding of the distribution of special-status plant species.
2. Model future habitat suitability under different climate scenarios for federal- and state-listed plant species to inform our management and restoration efforts.
3. Where compatible with climate change projections, maintain current collection of special-status plant species.
4. Restore populations and promote recovery of federal- and state-listed plant species to areas projected to be suitable under future climate scenarios.
5. Eliminate invasive noxious weed species in areas where direct competition could lead to loss of special-status species.
6. Ensure that the 5-year Grazing and Fire Management Plan is compatible with recovery of special-status plant species
7. Conduct road and trail management that supports the recovery of special-status plant species.

Specific near-term priority objectives (1-5 years) to support this management goal include:

1. Complete 300-acre CCC iceplant eradication project, to support expansion of Gaviota tarplant and surf thistle populations.

Priority actions to support this management goal include:

1. Incorporate new special-status plant discovery into management efforts.
2. Develop 5-year Grazing and Fire Management Plan.
3. Develop Invasive Species Action Plan.
4. Develop Dune Management Plan.
5. Develop Reintroductions and Translocations Plan.
6. Develop Road Management Plan.

4.7.2 Management Methods and Recommendations

At the Preserve, we will use active restoration to meet special-status plant species management goals and objectives. We will use livestock (and other natural grazers, if introduced and appropriate to meet our goals) grazing, prescribed burning, and vegetation management (especially for invasive noxious weeds) to support these efforts.

Recommended methods for supporting the management of special-status plant species and associated habitat include:

- In years of exceptional native forb expression and seed set, limit livestock grazing within flowering periods to allow seeds to reach the seed bank.
- For specific occurrences of special-status plant species along roads, including documented Lompoc yerba santa individuals (WRA 2017), limit additional road disturbance and consider moving or retiring the road or translocating the individual plant species.
- Implement a prescribed burning program that reduces the cover and density of exotic annual grasses and encourages expansion of special-status plant species populations.
- Restore populations of Gaviota tarplant, Lompoc yerba santa, and surf thistle to areas modeled as potentially suitable under future climate scenarios.

4.7.3 Monitoring and Adaptive Management

Annually, at known occurrence locations, conduct presence/absence surveys during flowering periods for federal- and state-listed special-status plant species (Gaviota tarplant, Lompoc yerba santa, and surf thistle).

Every 5 years or in years of significant rainfall/native wildflower expression, conduct a full botanical inventory to document rare/sensitive native grass and forb occurrences, including extent and density of federal- and state-listed plant species, such as Gaviota tarplant, Lompoc yerba santa, and surf thistle. If the extent or density of listed species, especially those that are federally endangered, declines, evaluate the impacts of management actions, such as from livestock grazing and prescribed burning, and adjust to ensure these species persist and expand across the Preserve. Evaluate opportunities to expand populations of listed species through re-seeding in appropriate non-native degraded annual grassland sites.

4.8 SPECIAL-STATUS ANIMALS MANAGEMENT

4.8.1 Management Goal

At the Preserve, the long-term goal is to adaptively manage to support the recovery of >30 special-status animal species known to occur on-site and allow for the expansion of special-status species known to be present on adjoining properties that also have the potential to occur on-site.

Specific long-term objectives (>5 years) to support this management goal include:

1. Conduct biannual surveys to increase our understanding of the distribution of special-status animal species.
2. Model future habitat suitability under different climate scenarios for all special-status animal species to inform our management and restoration efforts.
3. Where compatible with climate change projections, maintain populations of special-status animal species.
4. Restore habitat and promote recovery of federal-listed animal species to areas projected to be suitable under future climate scenarios.
5. Maintain and restore wildlife connectivity.
6. As part of Reintroductions and Translocations Plan, assess the re-establishment of steelhead and expansion of special-status animal species, including least Bell's vireo, at Jalama Creek and its tributaries.
7. Manage instream and adjacent riparian habitat for special-status herpetofauna by preventing the establishment of non-native aquatic animal species, maintaining basking sites, and maintaining breeding habitat.
8. Eliminate populations of invasive noxious weed species (e.g., iceplant) in areas where their presence and expansion could lead to decline or loss of special-status animal species.
9. Ensure that the 5-year Grazing and Fire Management Plan is compatible with recovery of special-status animal species.
10. Reduce total veldt grass cover.

Specific near-term priority objectives (1-5 years) to support this management goal include:

1. Complete 300-acre CCC iceplant eradication project.
2. Ensure human access and visitation does not cause disturbance of nesting/resting special-status animals on beaches and rocky intertidal habitats.

Priority actions to support this management goal include:

1. Develop 5-year Grazing and Fire Management Plan.
2. Develop Invasive Species Action Plan.
3. Develop Reintroductions and Translocations Plan.
4. Develop Dune Management Plan.
5. Complete analysis of WRA (2017) wildlife camera data.
6. Establish and re-establish wildlife monitoring camera survey.

4.8.2 Management Methods and Recommendations

At the Preserve, we will use active restoration to meet special-status animal species management goals and objectives. We will use livestock (and other natural grazers, if introduced and appropriate to achieve our goals) grazing, prescribed burning, vegetation management, and fencing to support these efforts.

Recommended methods for supporting the management of special-status animal species and associated habitat include:

- In pastures with a significant native perennial grassland and which support special-status bird species, implement a compatible grazing program that maintains a minimum of 1,200 lbs/acre RDM and that focuses grazing in winter/early spring prior to nesting.
- Manage invasive noxious weed species using a combination of mowing, timed grazing, manual removal, and selective herbicide.
- Evaluate and remedy any barriers to wildlife movements and connectivity.
- Use prescribed burning to maintain grassland ecosystems for special-status animal species.
- Follow best management practices designed to prevent the spread of disease among ponds, especially those with special-status animal species.
- Monitor ponds annually to detect exotic animal colonization (exotic animals should be eradicated using methods that will minimize negative effects on native pond animals and pond habitat conditions).
- Minimize sediment transport into breeding ponds.
- Develop and implement an early detection and rapid response protocol for non-native animal species.
- Implement pig, red fox, and wild turkey management to shift their activities to less sensitive areas to reduce predation and habitat damage.
- Fence Jalama Creek and limit grazing/mowing/other vegetation management within these units to specific actions that promote expansion of riparian woodlands and maintenance/expansion/recovery of special-status animal species, including especially those that are federally listed.
- Maintain winter roost sites for monarch butterflies.
- Manage Cañada del Cojo for expansion of tidewater goby populations.

4.8.3 Monitoring and Adaptive Management

Every 5 years conduct a Preserve-wide survey for special-status animal species. Develop research partnerships for population monitoring of special-status animals. Annually monitor ponds for special-status species and their habitat (including invasive plants and animals). Establish camera stations at beaches, upland and riparian habitats to monitor wildlife movements and connectivity. Annually monitor RDM for grassland bird and upland California red-legged frog habitat.

Giant Wild Rye © Laura Riege/TNC

4.9 REGIONAL CONNECTIVITY AND CLIMATE CHANGE ADAPTATION

4.9.1 Management Goal

At the Preserve, the long-term goal is to adaptively manage to promote regional connectivity, land-sea connections, and resilience of species, habitats, and ecosystems.

Specific long-term objectives (>5 years) to support this management goal include:

1. Leverage existing data to inform management in a changing climate.
2. Establish climate change research and monitoring program to support adaptive management.
3. Establish coastal climate change research and a monitoring program to inform "wild" coast responses to changing ocean conditions and adaptive management.
4. Identify and restore habitat connectivity for focal wildlife dependent on different specific or unique habitat features at different life history stages that may take generations (aquatic to upland).
5. Identify rare plants for which leading edge dispersal is needed (or translocations) or facilitate northern expansion of things leaving the Preserve (inbound and outbound).
6. Maintain and enhance keystone species for their food and shelter and for their influences on community structure.
7. Monitor and manage function of beach and rocky intertidal areas as corridors connecting to adjacent open space areas.
8. Model future habitat suitability under different climate scenarios for federal- and state-listed plant species to inform our management and restoration efforts.

Specific near-term priority objectives (1-5 years) to support this management goal include:

1. Manage infrastructure to facilitate redistribution of plant and animal species responding to a changing climate.
2. Manage water infrastructure to mitigate the negative impact of drying conditions.

Priority actions to support this management goal include:

1. Identify priority conservation actions to maintain regional connectivity and climate change adaptation and resilience.

4.9.2 Management Methods and Recommendations

At the Preserve, we will leverage existing data and develop infrastructure in a way that supports wide-ranging wildlife movement and informs management in a changing climate.

Recommended methods for supporting regional connectivity and climate change adaptation:

- Partner with key statewide and regional data producers (e.g., USGS for marine benthic mapping, seabirds, and marine mammals; PISCO for oceanographic and biological dynamics; Point Blue Conservation Science for seabirds, shorebirds, and climate change) for baseline information of channel, nearshore, and coastal regions and how the Preserve fits into a larger continental scale.
- Through monitoring, enable early awareness of potential new uses of the Preserve by wildlife (e.g., nesting of birds, fish, or sea turtles; reproductive haul-outs of pinnipeds) and new invasive species.
- Maintain ranch water infrastructure, including ponds, troughs, and managed seeps and springs, as well as wells and pumps, storage tanks, and pipes that connect them.
- Manage fencing to maintain connectivity for wide-ranging animals.
- Maintain and enhance keystone species for their food and shelter (e.g., oaks, seagrasses, kelp) and for their influences on community structure (e.g., sea stars, otters).

4.9.3 Monitoring and Adaptive Management

Monthly, monitor ranch water infrastructure to ensure it is functioning properly both for the cattle operation and for wildlife. Annually, monitor fencing to ensure connectivity for wide-ranging animals, while still ensuring that it functions to keep cattle in pastures. At appropriate intervals, monitor population extents of keystone species, including oaks, seagrasses, and kelp (e.g., sea stars and kelps have shorter life spans so warrant monitoring more often than oaks). Establish camera stations at beaches, upland and riparian habitats to monitor habitat dynamics (including documenting changes from rocky shore and other highly dynamic changes) and wildlife movements and connectivity.

4.10 CULTURAL RESOURCES MANAGEMENT

4.10.1 Management Goal

At the Preserve, the long-term goal for cultural resources management is to develop a model for integrating perspectives from researchers, resource managers, Chumash communities, and other stakeholders.

Specific objectives to support this management goal include:

1. Identify archaeological sites and other cultural resources through systematic survey.
2. Evaluate and inventory the condition of identified archaeological sites and the threats from natural and anthropogenic processes (e.g., marine erosion, illicit collecting/looting).
3. Prioritize sites that are of greatest research potential or significance to contemporary Chumash communities, as well as those sites that are the most vulnerable to erosion and other processes.
4. Integrate cultural resources management with biological resources management for a holistic approach to management.
5. Facilitate appropriate archaeological research that provides benefits to science and society, enhances management of cultural resources, and dovetails with the goals and perspective of Chumash communities.

4.10.2 Management Methods and Recommendations

A variety of approaches, methods, and different types of research are needed to accomplish the management goals outlined above. These include bringing state-of-the-art technology, as well as archaeological thinking and indigenous perspectives, on the management and research of California archaeological sites.

Recommended methods to accomplish cultural resources management goals include:

- Produce a comprehensive GIS coverage of the location, size, and distribution of archaeological sites for both the management of cultural resources and to explore questions about past human settlement, land use, territoriality, and other issues.
- Perform an extensive radiocarbon dating of archaeological sites to help anchor sites in time and space and prioritize management and potential research.
- Use predictive modeling to prioritize protection and management actions, and to highlight and prioritize research questions.
- Conduct a systematic inventory and identification of legacy collections across the region to help prioritize research and management.
- When appropriate, excavation of cultural sites should be performed in consultation with Chumash communities. Excavating is important for obtaining information of high research value. It is also a crucial management tool to effectively gather information from threatened archaeological sites before they are damaged, altered, or lost. All excavation should follow state-of-the-art archaeological methods, using fine mesh screens (1/8 and 1/6-inch mesh), sampling strategies, and have plans for the dissemination of research results and the long-term curation of excavated materials.

4.10.3 Monitoring and Adaptive Management

The management goals, methods, and issues identified above will promote a holistic and integrated approach to managing cultural resources at the Preserve. This management process is designed to enhance research, involve communities and stakeholders in all stages of this process, and to disseminate research results to a range of audiences. A key initial part of the implementation is ongoing consultation and conversations with Chumash community members, other local stakeholders and commissions. The second step will involve survey and identification of archaeological researchers as the foundation for inventorying and monitoring archaeological sites. Concurrent projects to identify legacy collections should also be an early part of the implementation strategy. Finally, planning for appropriate and needed excavation and other testing should be implemented.

5.0 Stewardship and Programs Management

This section is divided into five categories, including: 1) Operations and Maintenance, 2) Integrated Monitoring, 3) Restoration, 4) Grazing and Fire Management, and 5) Invasive Species Management. Specific plans for each of these programs will be developed under separate cover. In the interim, we have captured the current vision for these programs, including our current specific efforts to use each to meet our goals and objectives at the Preserve, and have established what a future vision could look like for each.

5.1 OPERATIONS AND MAINTENANCE

There are several assumptions associated with our initial vision for operations and maintenance management at the Preserve, including:

1. The infrastructure operations and maintenance plan is in service of the other Preserve goals.
2. Phase 1 will focus on maintaining and improving existing infrastructure at the Preserve.
3. Phase 2 will be developed as programming is developed and funding is secured.
4. Best practices in environmentally friendly infrastructure management will be implemented when possible.
5. Improvements to energy efficiency will be incorporated when possible.
6. Infrastructure improvement to the grazing operation will be developed and implemented in coordination with Preserve goals and objectives and those of the 5-year Grazing and Fire Management Plan.

5.1.1 Roads and Trails

TNC will manage and maintain the road network on the Preserve with the goal of reducing and minimizing its impact on conservation values. An environmentally sensitive road and trail network avoids vulnerable landscapes where possible, has the smallest footprint needed to serve its functions, and minimizes its hydrologic connectivity to nearby water bodies.

5.1.1.1 Existing road network

The existing road network was developed and maintained over many decades by prior owners and users of the property. The road network has traditionally been used to support livestock grazing, other agricultural uses, maintenance of agricultural and utility infrastructure, fire and other emergency management, and periodic access by neighbors.

The Preserve has 245.3 miles of roads, with 10.6 miles of paved road, and 234.7 miles of unpaved roads of various road classes (see Figure 17). There are a total of 316 stream crossings of various type, condition, and environmental sensitivity.

The primary paved road on the property runs from the Cojo Gate, near Jalama Beach County Park, to the gate at the southeast end of the property, known as the "Back Gate." A paved road extends out to the USCG property at Point Conception, with a spur to a decommissioned petroleum facility near Government Point. The portion of the paved road extending from the Cojo Gate to the intersection with the road to Point Conception is known as Cojo Bay Road. From this intersection (near the old school house) to the Back Gate, the paved road is known as Cojo Road. In addition to GIS data representing roads and stream crossings, the presence and condition of drainage structures along Cojo Bay Road are documented in a report titled "Cojo Bay Road Storm Drains" (Althouse and Meade 2016).

Jalama Road, a Santa Barbara County public two-lane road, runs through the Preserve for approximately 9 miles. From the east, Jalama Road enters onto the Preserve near the Jalachichi Gate to its ultimate destination at Jalama Beach County Park. Jalama Beach County Park is a popular public recreation destination, which results in heavier vehicular use on Jalama

Ranch road © Aliya Rubinstein/TNC

Road than might be expected for similar rural and remote public roads in the region. Jalama Road is also commonly used by recreational bicyclists.

There are no trails developed on the Preserve. Existing roads may be used as trails in the future. An assessment of trail needs will be considered as programming for managed access and environmental education is developed.

5.1.1.2 Regulations governing roads and stream crossings

Below represents only a general summary of some of the regulations applicable to roads and stream crossings. TNC staff or contractors would need to review current, applicable regulation to ensure project compliance.

Construction, repair, maintenance, functional changes, closure, and removal activities of roads and stream crossings are governed by a range of regulatory programs at the county, state and federal levels. Various regulations apply depending on the type of work being conducted, the time of year it is conducted, the location of work, and the sensitivity of environmental features associated with the location.

The entire Preserve is zoned and designated for agricultural lands use by Santa Barbara County. Most of the Preserve lies within the coastal zone. Significant county-designated environmentally sensitive habitat (ESH) areas occur on the property.

Specific county ordinances that apply to road maintenance and repair include the Coastal Zoning Ordinance and the Grading Ordinance. The Coastal Zoning Ordinance generally requires coastal development permits (CDPs) for a broad range of activities proposed in the coastal zone. However, it does provide some exemptions to CDP requirements for agricultural uses, including the maintenance and repair of roads. Exemptions to CDP requirements may apply when the activities do not lead to the enlargement or expansion of the road, and for grading work that would not otherwise require a grading permit.

The Grading Ordinance broadly exempts agricultural grading activities from permitting requirements, including the maintenance of existing agricultural roads. This exemption does not apply within the ESH areas. The ordinance would require an erosion control permit under limited circumstances for grading on slopes exceeding 30% and greater than 50 cubic yards of earth work, or when excavation or fill exceeds 3 vertical feet. A grading permit may also be required when work is conducted within 200 feet of the property boundary or under a limited set of additional circumstances.

Repair or construction of structures such as bridges may require permits from the Building and Safety Division of the Planning and Development Department.

Prior owners of the property secured a Lake and Streambed Alteration Agreement (LSAA) with the CDFW in 2013 for all stream crossing and stock ponds on the property. The LSAA is a type of permit that prescribes measures needed to protect fish and wildlife resources when repair, maintenance, and replacement work is conducted. The LSAA describes stream crossings in three tiers related to the hydrology of the streams: Tier 1—ephemeral, Tier 2—seasonal, Tier 3—perennial. The LSAA provides varying requirements of due diligence for each tier prior to conducting permitted work. Due diligence includes the timing of when work can be conducted, types of pre-construction biological monitoring that must be conducted, and specific best practices that must be used to minimize impacts to the site during construction.

Road or stream crossing work conducted in a water of the United States may require a U.S. Army Corps of Engineers section 404 permit, or determination that the project fits within an existing nationwide permit. Work conducted within the potential habitat of a federally listed species may require USFWS consultation. Projects that include excavation or placement of fill in a stream channel may require a discharge permit from the Regional Water Quality Control Board.

5.1.1.3 Managing Road Infrastructure

Beyond documenting road class, condition, and maintenance needs, TNC will conduct a full road assessment. The assessment will propose and prioritize alternative road maintenance and repair practices for each road segment to reduce erosion potential and hydrologic connectivity to adjacent water bodies. The assessment will also evaluate the function and potential redundancy of each road segment to determine if any road segments should be decommissioned and reclaimed. The assessment will evaluate the design and function of each stream crossing and propose and prioritize alternative crossing structures.

5.1.1.4 Environmentally Sensitive Management Principles and Practices

The Preserve's road system will be maintained using established environmentally sensitive management (ESM) principles and practices that serve the goal of reducing and minimizing impacts to the conservation values of the Preserve.

5.1.2 Signage

Existing signs on the Preserve will be maintained and additional signage may be developed for navigation and identification purposes.

5.1.3 Fences and Gates

Fencing on the Preserve is primarily used for livestock management. Fencing exists along most of the exterior property boundary, as well as along the railroad boundary and along the Jalama Road right-of-way (see Figures 17 and 18). Gates are positioned in locations throughout the road system to allow access to various pastures (management units). Fences and gates will be maintained throughout the Preserve with an effort to minimize impacts to natural resources and wildlife movement.

FIGURE 17 Preserve Infrastructure

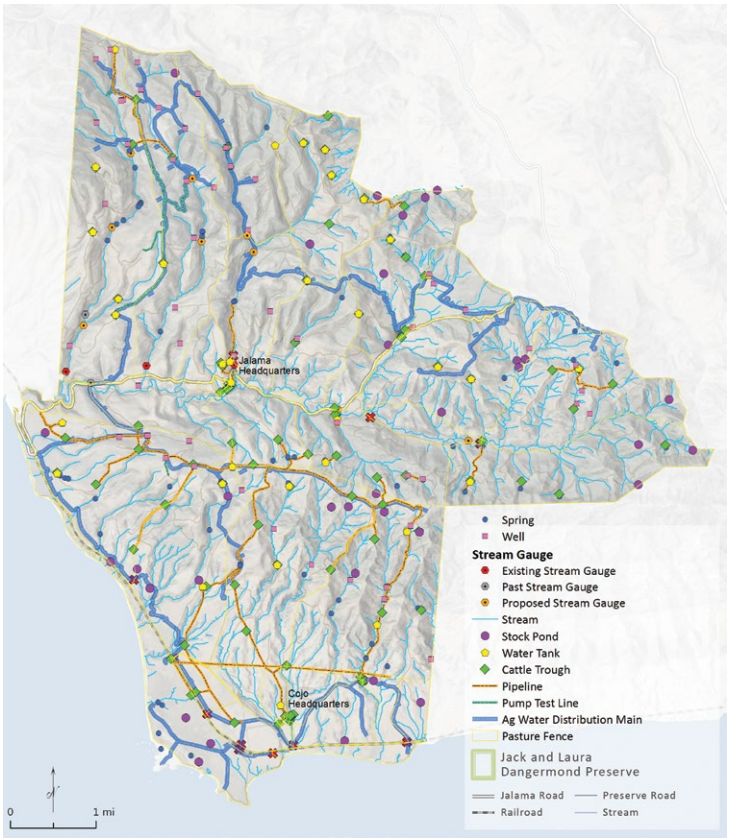


FIGURE 18 Preserve Cattle Operation Infrastructure

5.1.4 Structures

There are currently structures located in the Cojo and Jalama headquarters (see Figure 17). These structures include staff housing, guest facilities, barns, and shops. Additional structures exist at the Jalama Corrals for agricultural purposes.

5.1.5 Potable and Livestock Water Resources

Domestic water is provided by springs and those springs also support livestock water resources (see Figure 18). The Animus Spring provides water for the Cojo headquarters. The Palo Alto water system also provides water for the Cojo headquarters. The Palo Alto water originates from the Alegria and Vaqueros Wells and is pumped to an underground tank. The Palo Alto water system also supplies water to the Schoolhouse and Teacher's house. A box built into the alluvium of Water Canyon and Escondido Creek supplies water for the Jalama headquarters.

5.1.6 Wells

Wells are located throughout the Preserve and are used for livestock operations (see Figure 18). Forty-one wells were drilled by prior owners. These wells can be repurposed for research and monitoring; however, retroactive permitting will be required.

5.1.7 Property Easements and Encumbrances

The Preserve is encumbered by an easement that was established in 1992 with Vandenberg Air Force Base that limits development (see Figure 19).

5.1.8 Railroad Infrastructure and Ownership

Union Pacific Railroad (UPRR) owns a narrow corridor of property that separates the Preserve into two distinct blocks (see Figures 17 and 18). This property is the location of a railroad line primarily used by UPRR and Amtrak. About 7 miles of the railroad corridor property is adjacent to the Preserve on one or both sides of the corridor. The width of the railroad property ranges from 50-300 feet. Portions wider than 50 feet include a 1.25-mile long siding located near the Concepcion Terrace, a former potential train stop in the same area, and a widened area south of Tarantulas Beach, where coastal erosion appears to be at its highest potential. The distance of the railroad property to the coast (estimated mean high tide line) ranges from 200 feet to about 0.7 miles.

The railroad crosses at least 19 stream crossings that enter the railroad property from the Preserve and then re-enter the Preserve as they flow off the railroad property. The railroad stream crossings were filled with earthen and rock material, as opposed to being constructed with span structures. Stream flows are passed through culverts. Visible culverts appear to be undersized for the potential flows they conduct. A full assessment of impacts of the railroad on stream impacts has not been conducted by TNC.

5.1.9 Coastal Armoring

There is coastal armoring along North Beach including two segments of seawall (totaling 0.32 miles in length) and one segment of 0.13 miles of riprap near Tarantulas Beach (see Figure 12; NOAA ESI category 1B: Exposed, solid man-made structures). These structures will be evaluated for the degree to which they provide benefit to human infrastructure (e.g., railroad) as well as impact to natural processes and ecosystems.

5.2 INTEGRATED MONITORING

At the Preserve, we recommend three types of monitoring (adapted from work done by McGraw 2007 at Palo Corona Regional Park in Monterey County, California):

1. Implementation monitoring to evaluate whether the management techniques are being implemented as prescribed;
2. Biological effectiveness monitoring to evaluate progress toward the biological goals and objectives for the conservation targets; and
3. Individual project monitoring to evaluate the effectiveness of specific management projects.

Monitoring protocols to evaluate the effects of specific management projects will be developed on a project-by-project basis using an adaptive management approach.

For each monitoring type, TNC will develop a Monitoring Objective, Monitoring Methods, Frequency of Monitoring, Seasonality of Monitoring, and Personnel (e.g., TNC staff, Preserve staff, contractors).

5.2.1 Implementation Monitoring

Implementation monitoring is recommended to evaluate whether Plan components are being implemented as prescribed and identify deviations from Plan strategies. This monitoring component is essential to the success of biological effectiveness monitoring, which relates changes or differences in the observed communities to the management strategies that

are implemented. If the strategies are not implemented as described, then such deviations need to be considered when evaluating the effectiveness of management at attaining the biological goals and objectives.

5.2.2 Biological Conditions Monitoring

Biological conditions monitoring is designed to determine the effectiveness of management toward attaining the biological goals and objectives across the Preserve.

5.2.3 Individual Project Monitoring

Individual project monitoring would be associated with specific restoration or research projects at the Preserve including, for example, the 300-acre CCC iceplant removal and restoration project.

5.3 RESTORATION

TNC is focused on addressing the California Coastal Commission (CCC) Cease and Desist Order CCC-17-CD-03 and Consent Restoration Order CCC-17-RO-01 (the "Orders") that were issued for portions of the Cojo and Jalama Ranches (now the Preserve) and approved by the CCC on November 9, 2017. These Orders came with the Preserve when it was purchased. The Orders specify that certain unpermitted development activities cease and that restoration plans be developed and implemented to restore the areas impacted by the unpermitted development and to further compensate for loss of habitat and unpermitted actions. The Orders require the development of the following six restoration/mitigation plans: Inland Roads, Jalachichi Stock Ponds, Cojo Marine Terminal, Bluff Road, Oaks Mitigation, and "Additional Habitat Enhancement" consisting of iceplant removal and habitat restoration on the Cojo Terrace (see Figure 20). Each restoration plan includes an implementation period and a 5-year monitoring period to assure criteria are met and the projects are considered in compliance with the Orders.

FIGURE 19 Preserve Easements

Source material (seed, acorns, and container plants) are being collected from the Preserve for use in the restoration work. Three thousand oak trees and seedlings currently in the Jalama Nursery will be used in the restoration work.

Oak planting © Laura Riege/TNC (Both photos)

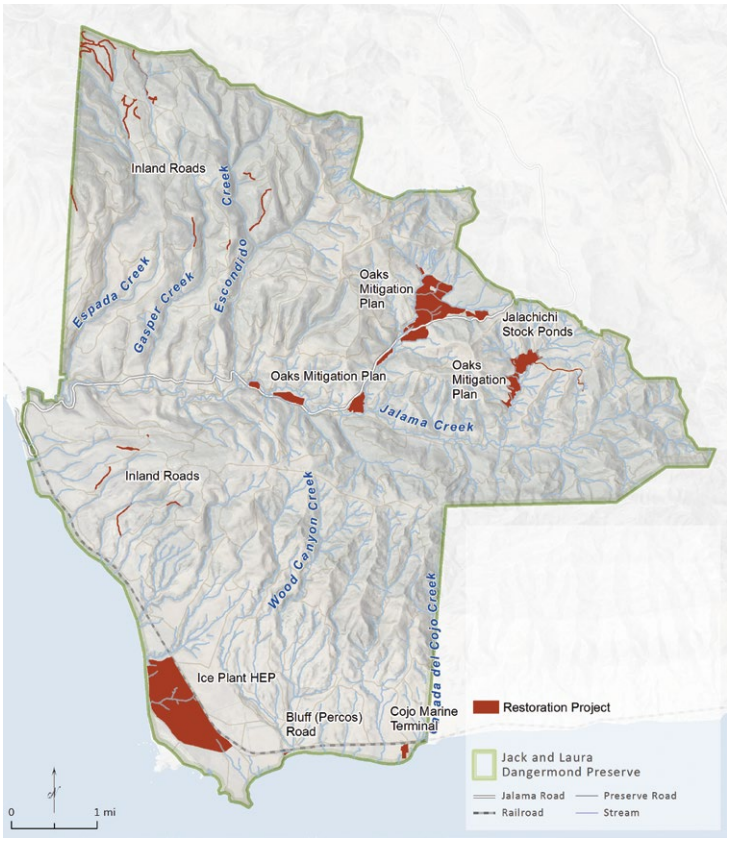


FIGURE 20 Preserve Restoration Projects

5.3.1 Inland Roads Project

Sixteen roads or road segments will be restored to reference conditions, typically adjacent to the existing roads. Most of these roads are in the oak woodlands in the northwestern portion of the Jalama side of the Preserve. These road segments are within designated USFWS Critical Habitat for the California red-legged frog. Four of the roads are in the western portion of the Cojo side of the Preserve in rolling grassland and coastal sage scrub habitat. The road segments on the Cojo side are outside of designated USFWS Critical Habitat for Gaviota tarplant; however, preliminary surveys of these road segments have identified the presence of the species. Total project area is 5.9 miles of linear disturbance encompassing a total of 7.6 acres.

5.3.2 Jalachichi Stock Pond Restoration and Mitigation Project

This project is designed to reverse the following actions: removal of riparian and oak woodland vegetation in and around the stock ponds and associated downstream riparian corridors; placement of fill in the stock ponds and downstream watercourse; installation of culverts and a concrete spillway; grading in the riparian watercourse downstream from the stock ponds; and installation of riprap associated with the substantial alteration of a stock pond and downstream watercourse. The project will reconstruct and reconnect the unnamed creek that flowed through the area before the unpermitted development occurred. The area will be revegetated with riparian, oak woodland, and upland species. The restoration area includes approximately 33 acres of land surrounding the Jalachichi Stock Ponds on the Jalama side of the Preserve and includes development of a water delivery system extending from the Buckhorn wells to the stock ponds.

5.3.3 Cojo Marine Terminal Project

This project will restore a 5.9-acre area on the Cojo Terrace northwest of the Little Cojo Beach that was previously restored with Gaviota tarplant, coastal sage scrub, and other native and non-native grasses. The project includes treatment of non-native weeds and grasses through strategic livestock grazing, mowing and herbicide applications, drill seeding, and planting of container plants. This project area is within designated USFWS Critical Habitat for Gaviota tarplant.

5.3.4 Bluff Road Project

This project is designed to remove non-native vegetation and hydroseed the dirt road that approximately parallels the railroad tracks located on the coastal bluff leading down to Percos Beach. The goal of the 0.51-acre project is to prevent general road access to the beach area and to restore vegetation composition to coastal sage scrub. Due to the cultural sensitivity of the area, only hand tools and hydroseeding will be used in this restoration work. This project area is within designated Critical Habitat for Gaviota tarplant.

5.3.5 Coast Live Oak Revegetation and Mitigation Project

To mitigate for the temporal loss of native habitat resulting from unpermitted development, this project will plant a total of 200 acres with coast live oak acorns and seedlings collected from the Preserve. The restoration area is comprised of a 20-acre fallow field south of Jalachichi ponds included in the Orders and six additional former agricultural fields in the Jalama Valley along Jalama Road (Ramajal, South Ramajal, Narrow, Triangle, Venadito, and West). The field sizes range from 4 acres to 146 acres.

5.3.6 Iceplant Removal Project

The Habitat Enhancement Plan provides for the removal of non-native vegetation, specifically including iceplant, and the planting of native plant species endemic to and appropriate for the site across 300 acres on the Cojo Terrace located on the Preserve up coast of Point Conception. Reference site conditions include California sagebrush scrub and dune habitats. This project area is within designated USFWS Critical Habitat for Gaviota tarplant. Preliminary surveys of the restoration area documented Gaviota tarplant in areas of mild disturbance, such as along roads and in areas unoccupied by iceplant but subject to cattle use.

5.4 GRAZING AND FIRE MANAGEMENT

Research demonstrates that livestock grazing in California grasslands can be an effective and efficient tool for controlling invasive species and fire risk, and typically supports plant species richness. The moderate level of grazing currently applied at the Preserve is in the recommended range for ecological and other management goals. Outcomes of grazing management are highly variable and responses can occur slowly relative to climate factors; land-use history and soil conditions are also strong influences on grassland community composition and function. Grazing research or monitoring data applicable to site-level decisions that balance the wide range of ecological targets' needs at the Preserve is currently sparse; TNC will therefore develop a monitoring protocol with appropriate controls and management feedback to inform livestock grazing activities over time.

TNC's current 5-year vision for using livestock grazing at the Preserve is to enhance resilience of grassland, oak woodland, scrub, freshwater, and riparian habitats to rapidly changing climate conditions, including exacerbated drought, wildfire risk, and other major unforeseen disturbances. TNC seeks to maintain or improve, where possible, overall stand condition, age structural diversity and recruitment of shrubs and trees, and native species diversity including new arrivals and novel assemblages resulting from changing climatic conditions. TNC will use livestock grazing and prescribed fire as first-order management tools, where and when it is appropriate, due to their versatility, relative efficiency, and beneficial historical use on the landscape to enhance ecological function. TNC will also evaluate, as part of a reintroductions and translocations project, whether natural grazers (e.g., elk) can play complementary and/or supplementary roles in grazing and fire management across the Preserve.

Iceplant and veldt grass © Amelia Remeta/TNC

Currently, fuel management at the Preserve is carried out by livestock grazing. Grazing reduces the fuel load, minimizing the risk of wildfire spread. TNC is also reducing fire risk by maintaining roads as fire breaks, creating safe perimeters around structures, and coordinating these measures with neighbors and local agencies.

Santa Barbara County Fire Department (SBFD) is the agency responsible for wildfire at the Preserve. The SBFD is headquartered in the city of Santa Barbara and has 16 stations located across the county. Santa Barbara County does not have a CAL FIRE operational unit; however, coordination with CAL FIRE will occur as necessary. TNC will ensure that SBFD is familiar with the Preserve, its roads and access points, and has the necessary data and information they need to respond if wildfire occurs.

The primary focus during a wildfire at the Preserve is to ensure the safety of the people that are on the Preserve. When a wildfire occurs, evacuation may be necessary. The Preserve has two main roads that transect the Preserve: Jalama Road is a county road that starts at Highway 1, about 4 miles south of Lompoc, and ends at the Jalama Beach County Park; Cojo Bay Road is the main ranch road that begins at mile 12 on Jalama Road (right before the railroad crossing) and travels east to the Cojo Ranch headquarters and eventually connects with Hollister Ranch. Cojo Bay Road and Jalama Road are the primary evacuation routes during wildfire. In addition, there are unpaved roads that could be utilized to exit the Preserve if wildfire limited travel on the main, paved roads. The primary evacuation route will be determined by the location of the fire. If evacuation is necessary, a fire to the west or north of the Cojo Ranch headquarters, people on-site will travel to Hollister Ranch by Cojo Bay Road. During a fire to the east or south of the Cojo Ranch headquarters, people on-site will travel west on Cojo Bay Road to Jalama Road and north to Highway 1.

Due to the large size and hilly terrain of the Preserve, there is very limited ability for livestock to be moved during a wildfire. In case of a wildfire, Preserve staff may not be able to access the Preserve for multiple days. In general, there is an adequate supply of water for livestock for about 3 days. However, the location of the fire, location of the livestock, and how much water was available before a fire will determine how much water is available for livestock.

Water is a limiting factor on the Preserve. Most of the Preserve's water supply comes from electrically pumped wells. Water is stored in a 60,000-gallon cistern on the top of the main ridge that is gravity fed to troughs at Cojo Ranch and a small portion of Jalama Ranch. In the event of a fire, the water system could supply some water to fight the fire; however, most of the water would need to be trucked in.

Prescribed fire is a tool that can be used to reduce the threat of catastrophic fire by reducing the Preserve's fine fuel load. Prescribed fire can also be used to reduce non-native plant species cover and promote native plant species. Prescribed fire has been conducted on the Preserve in the past as a range improvement tool and to reduce the threat of wildfire. However, due to broad concerns about destructive fire and poor air quality associated with fire, prescribed fires have not been conducted on the Preserve since the early 2000s.

5.5 INVASIVE SPECIES MANAGEMENT

TNC will conduct an invasive species management planning process to produce an Invasive Species Action Plan. TNC will use principles of early detection and eradication to prevent the invasion and spread of new invasive species. For those that are known to exist, TNC will assess which can be eradicated from the Preserve, and which are too widespread to eradicate but could still be controlled and limited from spreading further. TNC's plan is to focus on those species that have a high current negative impact on conservation values at the Preserve, and therefore high potential benefit from their control. The main goal for invasive species management at the Preserve is to find cost-effective strategies, methodologies, and tools to eradicate invasive plants as quickly as possible. When possible, TNC will coordinate eradication efforts with VAFB and other neighbors.

Based on early survey efforts and those from WRA (2017), some of the priority invasive species are pampas grass, fennel, veldt grass, iceplant, and pig. Surveys will also focus on early identification and eradication of invasive species not currently at the Preserve, including European beachgrass.

Dangermond Preserve coastline © Peter Montgomery/TNC

6.0 Science and Research Agenda

The Preserve's setting—a biodiverse, wild area in urbanizing southern California, at a dynamic, ecological crossroads at Point Conception—presents extraordinary opportunities for science, conservation and as a center for learning. Through formal research, citizen science, discovery, and transdisciplinary collaboration the Preserve can play a pivotal role in understanding, quantifying, and promoting the value of wildness in an increasingly human-dominated world. TNC is partnering with research institutions to foster leading-edge collaborative conservation science, technologies, tools and open data to increase the pace and scale of conservation. The Preserve is poised to take advantage of technology applications, data science and information management innovations to improve the efficiency and effectiveness of conservation strategies.

Two overarching learning goals have emerged that leverage the intact ecosystems at the Preserve:

1. What is necessary to protect the represented biodiversity and natural systems in a time of change?
2. How do human systems surrounded by and dependent on these resources build resiliency in this time of change?

TNC is working with academic researchers and other partners to develop a Science and Research Agenda for the Preserve. Initial focal research areas include:

1. **Climate change across ecological boundaries**—research to understand effects of extreme events, changing environmental conditions on species distributions, connectivity for species redistribution, wildlife movements, and ecosystem processes;
2. **Coastal biodiversity management**—research to support strategies for protecting coastal biodiversity and the Preserve's natural and cultural systems;
3. **Freshwater systems, climate change, and extreme events**—research to understand interactions between extreme events and groundwater, surface water ecosystems, and human water use within a coastal watershed;
4. **Landscape-scale management and restoration**—research on management efficiency and efficacy (e.g., dune restoration, managing feral pigs, iceplant and other invasive species, restoring steelhead trout and other species of conservation interest);
5. **Historical human ecology and climate change**—learning from nearly 10,000 years of human history and coastal resource use at the Preserve.

7.0 Conservation Technology

7.1 VISION

The Preserve offers a unique platform to pursue conservation science research that is enabled by technology. Conservation science is increasingly generating and sharing an immense volume of data enabled by technology. Trends in technology have led to the creation of data and products that are relevant to understanding the conservation of natural ecosystems. In this domain are a set of core, extended, and emerging technologies commonly referred to as Conservation Technology (see Figure 21). The vision is to fully utilize conservation technology to create a "Digital Twin" of the Preserve with an ecoinformatics framework (Michener and Jones 2012) that will enable access to information regardless of where someone is physically located. The Digital Twin will be a working model of the property in unprecedented detail—constantly being updated by a network of sensors—that will allow researchers to study how its ecosystems evolve due to climate change and ongoing natural processes, such as fire dynamics, coastal erosion, and wildlife utilization. The aspiration of the Preserve is to support data intensive methods for conservation science by leveraging advances in technology more generally and creating a world-class, "smart" reserve to understand the natural environment.

Objectives to support the vision:

1. Utilize an ecoinformatics framework that uses modern, best-in-class technologies to collect, manage, visualize, and share data about the Preserve.
2. Leverage professional relationships and social networks provided by world-class academic (e.g., UCSB) and technical partners (Esri) to encourage both sectors to solve for conservation.
3. Define a technology roadmap that documents and prioritizes use cases addressing critical conservation science research.
4. Establish a "plug and play" framework for Internet of Things (IoT) applications that reduce the barrier to entry for *in situ* sensor-based research.
5. Establish policy for Preserve data that benefits the largest number of users (i.e., open) with clear timebound expiration embargoes for academic research.

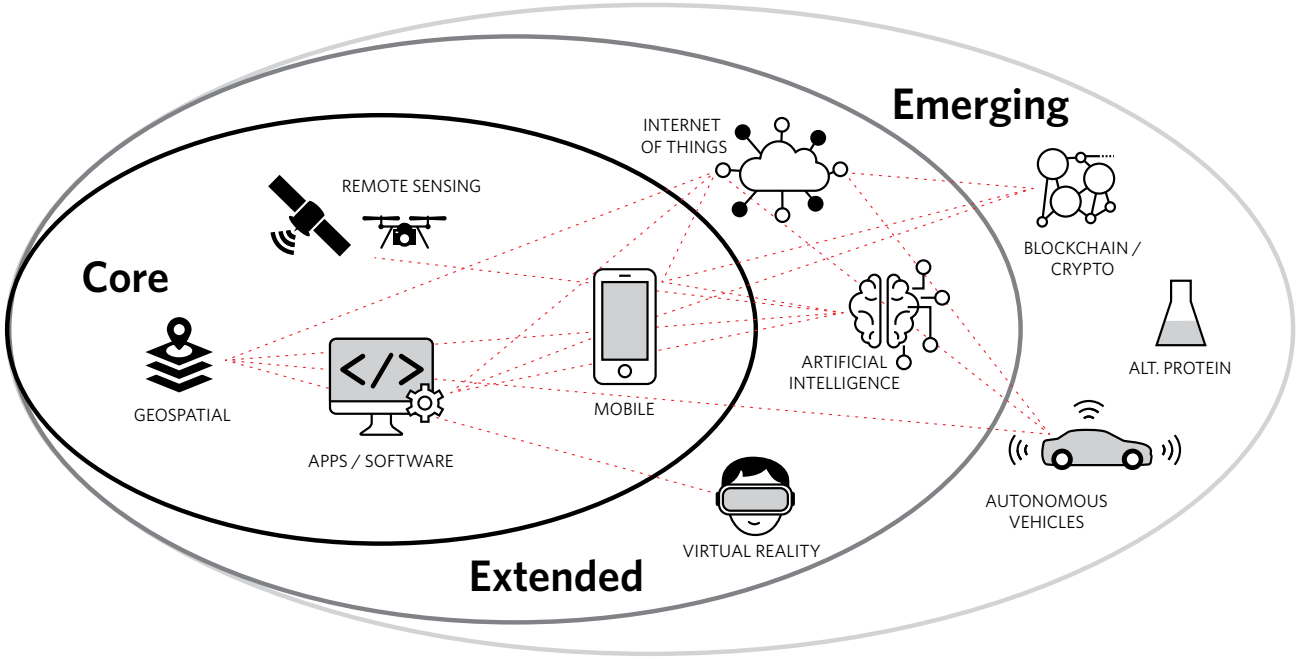
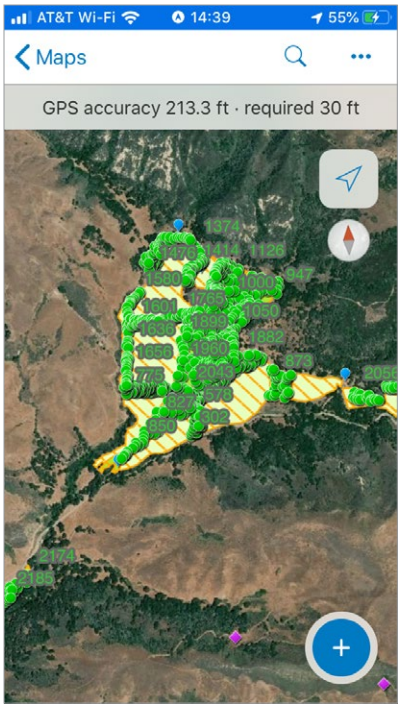
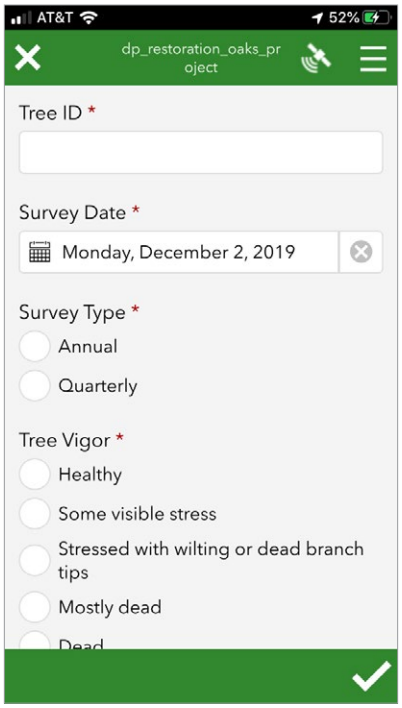


FIGURE 21 Components of Conservation Technology

Opposite: UCSC MARINe collecting biodiversity data in Dangermond Preserve tidepool © Walter Heady/TNC





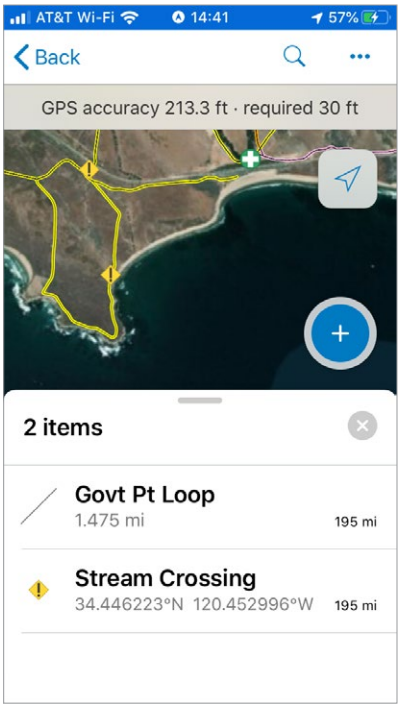


FIGURE 22 Collector App Components

7.2 CURRENT TECHNOLOGY SYSTEMS AT THE PRESERVE

Currently, the Preserve has a somewhat *ad hoc* set of technology systems developed to support planning, operation, and, to a lesser extent, academic research. Those systems are comprised of cloud-based computer platforms, mobile apps and web apps for visualization and discovery, and physical on-premise network and sensor infrastructure.

Below are more details on the current technology systems at the Preserve. See the Technology Roadmap (section 7.5) for future technology systems we plan to utilize at the Preserve.

TNC has compiled over 90 GIS layers across 10 categories, a historical aerial image archive, camera trap images, and almost 50 reports with thousands of data points covering the ecology, history, and management of the Preserve.

TNC's cloud computing resources have two primary components: 1) a private workspace on ArcGIS Online (AGO) comprising numerous map services and map-centric web applications and operations dashboards, and 2) a computer resource built on Amazon Web Services Elastic Compute Cloud (AWS EC2) that allows staff—regardless of geographic location—to remotely log-in to a desktop environment for desktop analytical applications (e.g., ArcGIS, Python, R). This system has elastic data storage capacity (EBS) and serves as our canonical repository for all data about the Preserve.

At the Preserve, TNC has been utilizing a suite of mobile apps that run on smartphones or tablets to collect data at the Preserve (see Figure 22). TNC is utilizing and configuring existing off-the-shelf mobile apps (e.g., Survey123, Avenza, eBird, iNaturalist) and has no plans to develop custom native apps as they are costly and difficult to maintain.

Applications deployed over the web allow people to visualize and discover information about the Preserve. To date, TNC has developed these applications in a somewhat *ad hoc* manner to support the primary use cases of management and spatial planning. Others are prototype examples developed by Esri APL staff to demonstrate potential. TNC anticipates a large ecosystem of web applications for various purposes at the Preserve (see Figure 23). Currently TNC has no public web applications, and all require credentials (login/password) for access. TNC anticipates a need for public-facing web applications in the future (see Technology Roadmap, section 7.5).

TNC has established workflows for imagery collected with drones that addresses georeferencing, orthorectification, and ingest into central GIS repository as well as oblique aerial photography and videography (e.g., non-GIS assets). TNC

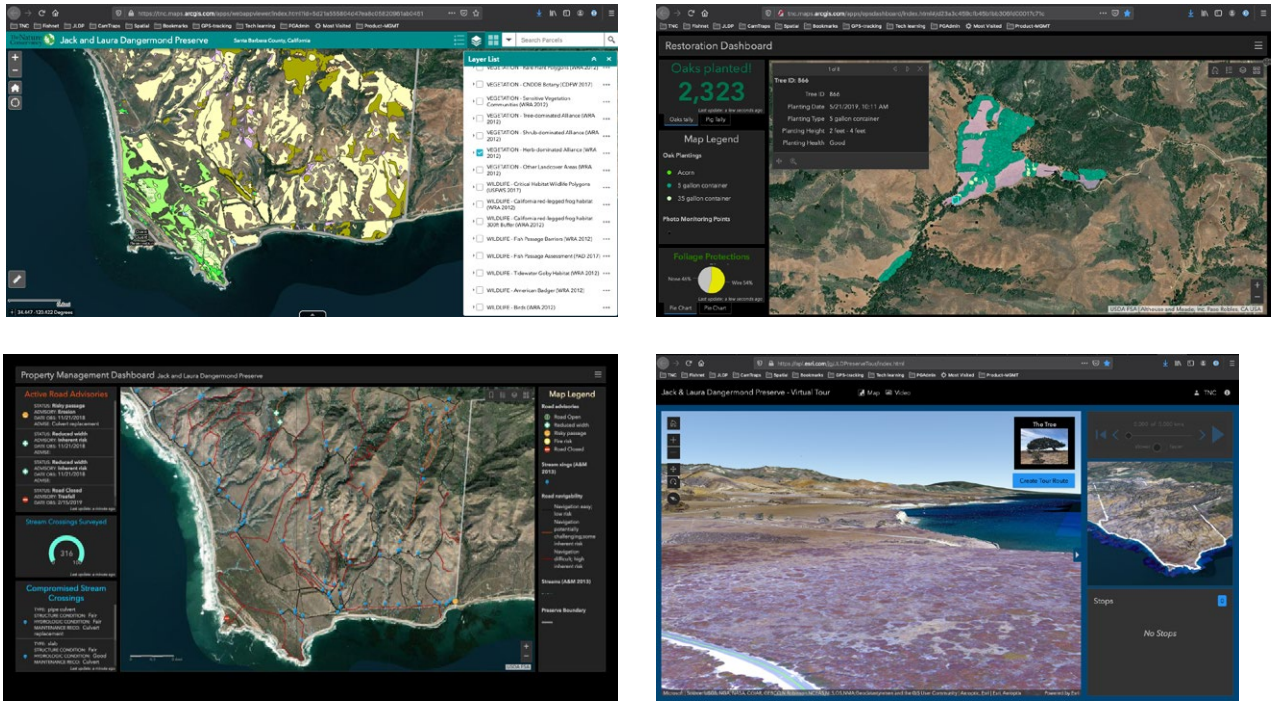


FIGURE 23 Web Based Data Viewing Apps

also has a set of protocols for drone operation at the Preserve by field staff and has a *de facto* no-fly policy for all visitors. Researchers who are interested in collecting data with drones will be provided direction in the research permitting process.

Physical technology infrastructure includes the *in situ* network hardware and sensors, including: relay towers for communications and internet connectivity, network routers and UPC to support LANs at Cojo and Jalama Ranches, display monitors for office and social spaces for data visualization, and a suspected fiber optic cable and regeneration station that needs more investigation

7.3 SNAPSHOT OF CURRENT DATA

TNC currently manages what could loosely be called a 'data lake' for Preserve data. TNC has amassed a large amount of data, both structured (GIS files, tabular) and unstructured (reports, map scans) and has centralized that information in the cloud. The unique geography of the Preserve has provided TNC with a relatively rich source of historical and current data. Historically, the U.S. Coast Survey used Point Conception as their point of origin' for survey work in the 1850s. And recently, WRA (2017) generated comprehensive biological surveys of the property and created an enormous amount of geospatial data on the ecology of the Preserve. See Data Workflows and Management (section 7.4) for details for that strategy. Below are high-level details for all data TNC holds for the Preserve.

TNC has a spatial database that is comprised of 90 GIS layers across 10 categories (e.g., Archeology, Wildlife, Vegetation, Coastal and Marine, Ranch Operations), mostly collected by WRA (2017). Esri has curated and compiled historical aerial imagery for the Preserve dating back to 1938, with a cadence of roughly 10 years. In 2018, AerOptix provided aerial imagery (2-inch spatial resolution, RGB) for the southern portion of the Preserve. TNC has also collected aerial imagery and video with drones for various locations across the Preserve, including the nearshore coastal zone, Cojo and Jalama Ranch complexes, and oak woodland and grassland habitats. In 2018, TNC sponsored a UCSB Bren School of Environmental Science and Management Group Master's Project focused on identifying management recommendations informed by the historical ecology of the Preserve. This work discovered material dating back to 1791 and includes documents like land grant records, early map sketches, U.S. Coast Survey T-Sheets, county assessor and vegetation maps. WRA (2017) placed camera traps at 158 locations on the Preserve in 2014-15, which generated almost 500,000 images. Roughly 9,000 of those images have been labeled (e.g., animal or object identified), which will prove to be extremely valuable to a set of efforts around utilizing artificial intelligence (AI) to filter and predict content in camera trap data.

7.4 DATA WORKFLOWS AND MANAGEMENT

Managing all aspects of Preserve data will require understanding the following: 1) types of data that will be produced (e.g., observational, experimental, raw or derived, models, images), 2) when, where, and how data will be acquired (e.g., sensors, mobile apps, paper), 3) required metadata and how it will be generated (e.g., machine or human), 4) licensing for data and code that articulates policy for access, sharing, and re-use, and 5) establishing canonical repositories for long-term storage and front-facing dashboards for visualization and discovery.

TNC anticipates two primary domains of data in the near term: 1) moderately static structured (e.g., tabular, GIS) and unstructured (papers, reports) data assets, and 2) sensor-derived data streams, both snapshots (e.g., camera traps, timebound deployments of hydrological sensors) and live feeds (weather data, security cameras). Efforts related to Preserve operations and research will contribute to these data domains. See Technology Roadmap (section 7.5) for more task-level data management details.

7.5 TECHNOLOGY ROADMAP

Build-out of the initial technology infrastructure and function for the Preserve will occur in generally three phases, anticipated to take roughly 3 years.

Phase 1:

- Curate all existing data (unstructured and structured), compile appropriate metadata, add DOIs, publish in a well-known web-based catalog
- Develop data editing and publishing workflow protocols for TNC staff and contractor data
- Craft data licensing policy and make available through 'click-through' agreements on the web
- Deploy a community metadata catalog for Preserve data using an existing framework like https://knb.ecoinformatics.org/ and ensure syndication with larger efforts like DataONE and publish non-sensitive data on the web in common formats (shp, csv, geojson) to ensure usability by other software packages (desktop GIS, R, Python / PANDAs) and web frameworks (NodeJS, React)
- Launch v1 of dangermondpreserve.org with only public facing content
- Deploy v1 Conservation Intelligence Platform
- Establish relay using UC/HPWREN system for internet connectivity
- Deploy Thermal FireCam

Phase 2:

- Establish notional metadata standards that are achievable and do not create sufficient friction that limits a typical contributor's ability to publish data
- Establish canonical classification system for vegetation, review WRA (2017) methods and classification and determine repeatability with a nominal goal of wall-to-wall vegetation map at a cadence of once every 5 years using AI
- Establish Extract/Translate/Load (ETL) protocols from existing biodiversity data stores (GBIF, iNaturalist, Clean Swell, CNDDB)
- Establish partnerships with aerial image vendors to continually acquire and archive high spatial, spectral, and temporal resolution georeferenced imagery for remote sensing mapping applications (e.g., vegetation mapping and monitoring with change detection) and posterity at a regular cadence (every 1-3 years)
- Deploy Conservation Intelligence-driven Operations Dashboard at offsite locations (e.g., TNC offices in San Francisco and Los Angeles, and the NCEAS office in Santa Barbara)

Phase 3:

- Establish high bandwidth internet backbone (e.g., Fiber) on the Preserve
- Establish plug and play local network (e.g., LORAWAN) for IoT applications
- Establish notional data models and cloud-based frameworks for IoT derived data (e.g. camera traps, hydro sensors, weather stations, audio)
- Establish a network of 100 *in situ* sensors (cameras, hydro flow, groundwater, weather) utilizing a single IoT framework
- Establish workflows for camera trap data that auto filter and generate new training data for AI models

High school students from Lompoc explore Dangermond Preserve. © Karin Lin/TNC

8.0 Environmental Education

The primary goals of the environmental education program at the Preserve are: 1) to educate and inspire the next generation of environmental leaders, and 2) to increase access to nature for underserved communities. Exposure to nature in childhood is a leading indicator of environmental behavior and stewardship in adults. TNC hypothesizes that young people who experience the wildness of a nature preserve will more fully appreciate why it is so critical to protect nature. While many environmental education providers work in public parks teeming with visitors, the unspoiled nature of the Preserve offers an important opportunity for field science, exploration, and inspiration. TNC seeks to align environmental education programming with scientific research and restoration activities to ensure students meaningfully contribute to citizen science initiatives and hands-on conservation outcomes.

To advance these environmental education program goals for the Preserve, TNC plans to work with best-in-class partners to reach underserved public school students who would otherwise have limited exposure to wilderness and create culturally relevant field trips. For example, students of Santa Barbara Unified School District are majority Latino (59.4% are listed as Hispanic district-wide with some schools up to 94% Hispanic). This means it is critically important that programming be relevant to a Latino audience. To this end, TNC has hosted and will continue to host group discussions to design the program with experts in environmental education, teachers, local community members, and organizations aimed at diversity in the outdoors.

Lead Scientist, Mark Reynolds provides ecosystem overview of Dangermond Preserve. © Karin Lin/TNC

9.0 Decision-Making in an Adaptive Management Context

There are few places remaining on the coast of Southern California where highly biodiverse terrestrial, coastal, and marine ecosystems remain largely intact. Most coastal protected areas in California were established, in part, to provide public access to the coast. Only a small fraction of the entire coast of California protects fully functioning ecosystems, limits or restricts access, and provides refuge for wildlife and sensitive natural and cultural resources relatively free of human disturbance. California needs such places, exemplified by the Preserve, where intact nature can thrive, be studied and experienced. The Preserve has the potential to serve as a resilient stronghold for biodiversity that has been lost throughout Southern California and as a large protected land-seascape at Point Conception that is a sentinel site for understanding climate change impacts on marine and terrestrial ecosystems. The Preserve also encompasses sensitive cultural sites and resources reflecting more than 9,500 years of human presence that provides learning opportunities and inspiration for future generations.

Preservation of the wildness, biodiversity, and ecosystem function at the Preserve through threat abatement, restoration, and adaptive management is foundational to achieving the broader vision and goals for the Preserve. The Preserve goals extend beyond biodiversity and cultural preservation to include advancing conservation science for broad scale impact and inspiring the next generation of conservation leaders. By protecting, conserving, and restoring the natural and cultural resources of the Preserve, we will be able to study and learn how wild and functioning ecosystems can fulfill their full potential for biodiversity conservation and benefits for people. A Preserve with intact and restored natural ecosystems creates an opportunity to use this special place to pioneer next-generation conservation solutions and leaders that will drive local, regional, and global efforts to protect the natural world and ensure resilient human and natural systems. The Preserve, at the boundary of Southern and Northern California terrestrial and marine ecoregions, is also a unique platform for scientific research and learning that can advance conservation science, resource management, and environmental education in a time of significant environmental challenges for both people and nature.

9.1 MANAGEMENT PHILOSOPHY AND APPROACH

The management goals of the Preserve focus on: 1) protecting and restoring natural and cultural resources, 2) advancing a conservation science agenda for broad impact, and 3) educating the next generation of conservation leaders. Long-term protection of natural and cultural resources in a largely intact functioning wild coastal landscape is foundational to achieving the science and educational opportunities the Preserve can provide. Yet, given that resources for management activities are limited, managers often need to make trade-offs among different management objectives. It is also not uncommon for different objectives to be in conflict with one another; for example, one priority species may require management actions that disadvantage another priority species. Natural and cultural resources may also be impacted by other Preserve activities, like scientific research and education/outreach programs. It is therefore important to have a robust framework for evaluating impacts and trade-offs as management decisions are made.

Management will be based on the best available science, an adaptive management approach, and will incorporate monitoring of management effectiveness. Key to this will be developing a decision-making approach that includes an

explicit evaluation of potential impacts of proposed activities to natural and cultural resources, as well as the contribution of proposed activities to achieving the broader vision for the Preserve. The overall goal of this decision-making process is to ensure that potentially negative impacts are avoided or minimized and that the contribution of a proposed activity to Preserve goals (including preservation of natural and cultural resources) outweighs those potential negative impacts. We recommend more investment in monitoring when potential impacts are uncertain or non-trivial.

Careful decision-making will be required to manage trade-offs among goals and objectives while simultaneously implementing resource protection/restoration activities, programmatic activities focused on conservation science, environmental education, public engagement, and other Preserve activities (e.g., grazing, fire, invasive species management, and infrastructure management). Program priorities and information on natural and cultural resources will also change over time. An adaptive management approach for the Preserve will require a process for making informed decisions on management and programmatic activities, monitoring changes due to management actions to evaluate effectiveness, and incorporating lessons learned over time. Adaptive management is an ongoing cycle of learning comprised of a structured, iterative process of robust decision-making in the face of uncertainty, with an aim to reduce uncertainty over time via system monitoring (Walters 2002). Management or programmatic activities should be designed with explicit hypotheses of how actions will lead to desired outcomes, as well as monitoring of changes in resource condition over time to understand the effectiveness of management actions, especially in the context of a changing climate.

Decisions about resource management and programmatic activities at the Preserve will follow a set of guiding principles to ensure that actions are consistent with the Preserve goals and objectives and broader vision, decisions are made using a structured or quasi-structured approach, and that outcomes are monitored to promote learning and adaptive management (see Table 4). Most management decisions can be resolved quickly through clear thinking that is consistent with these guiding principles and addresses a handful of key questions (i.e., a quasi-structured approach). However, a smaller number of more complex or recurring decisions may require a more formal and robust structured analysis (Keeney 2004; Conroy and Peterson 2013).

Potential impacts of programmatic activities on natural and cultural resources can vary in a diversity of ways. Impacts can range in spatial extent and location, intensity, timing, duration, frequency, and reversibility. Examples of potential impacts include but are not limited to: infrastructure development and habitat destruction and fragmentation, vehicle traffic, trampling, disturbance of soil, vegetation, and wildlife. Alternatives for minimizing impacts can include modifying location, intensity, duration and/or frequency of proposed activity, mitigating impact, or simply not pursuing the proposed activity.

9.2 SPATIAL CONTEXT FOR DECISION-MAKING

Decisions on resource management and programmatic activities should also be considered in a spatially explicit manner based on where the activity (or associated impacts) will take place relative to sensitive natural and cultural resources on the Preserve. Spatially explicit representations of Preserve resources will be revised over time, as new information becomes available.

9.2.1 Sensitive and Priority Natural and Cultural Resources

Spatial data on habitats, special-status species, and cultural resources at the Preserve were compiled and characterized into high, medium, and low sensitivity based on their legal protected status and/or sensitivity to impacts of human activities (see Table 5). Areas of the Preserve were then mapped as one of three land categories, based on presence of sensitive resources (see Figure 24).

The presence of and potential impacts to sensitive natural or cultural resources should be evaluated as decisions are being made about management and programmatic activities. In many cases, alternative siting of activities or timing of activities may help to reduce or mitigation potential impacts (e.g., avoiding sandy beach areas in use seasonally by species such as western snowy plover or northern elephant seal). In addition, it will be important to evaluate potential impacts of activities or management actions on "wildness," intactness, and habitat fragmentation across the Preserve.

It will also be important to consider whether Preserve management or programmatic activities will have the potential for adverse impacts on (or benefits to) adjacent properties and associated resources including the railroad property, adjacent

private ranches (e.g., Hollister Ranch and Surfing Cowboy), public roads (e.g., Jalama Road), VAFB, the Point Conception lighthouse property, Jalama Beach County Park, and the adjacent marine environment (Point Conception SMR and adjacent waters). Engagement with neighboring landowners will be key in cases of potential "off Preserve" effects on resources.

9.2.2 Site Design

As more information on natural and cultural resources is gathered and programmatic priorities are defined and scoped, TNC will develop a Site Design to zone different types of activities to both better meet goals/objectives and guide siting of activities to minimize adverse impacts. The Site Design map will build off information on types of sensitive resources and infrastructure and will identify priority areas on the Preserve for protection, restoration, and various programmatic activities (e.g., research, environmental education, visitation, invasive species removal).

Areas of highest sensitivity (see Figure 24) for natural and cultural resources will be zoned for protection and, potentially, restoration, along with other priority restoration areas. Some areas that are not as sensitive now could have high value for restoration (e.g., extensive iceplant areas) or be used to support research and experimentation or future conservation translocations. Less sensitive areas with key features such as viewpoints or educational value could be zoned for environmental education, visitation, and potentially additional infrastructure (upon regulatory approval). Different types of scientific research—from low impact to more manipulative studies—could similarly be zoned across the landscape based on resource sensitivity and the potential scientific impact of the research.

9.3 DECISION-MAKING FRAMEWORK

Most decisions potentially impacting resources at the Preserve can be made using the guiding principles described above (see Table 4) and by addressing some key questions in a semi-structured approach. Some Preserve decisions, with higher risks or uncertainties, may require a more formal analysis, such as structured decision-making (Conroy and Peterson 2013). Structured decision-making approaches are most appropriate for complex problems where a decision is not clear and where there are potentially significant impacts or risks that need to be evaluated, as well as for recurring decisions where learning can contribute to adaptive management.

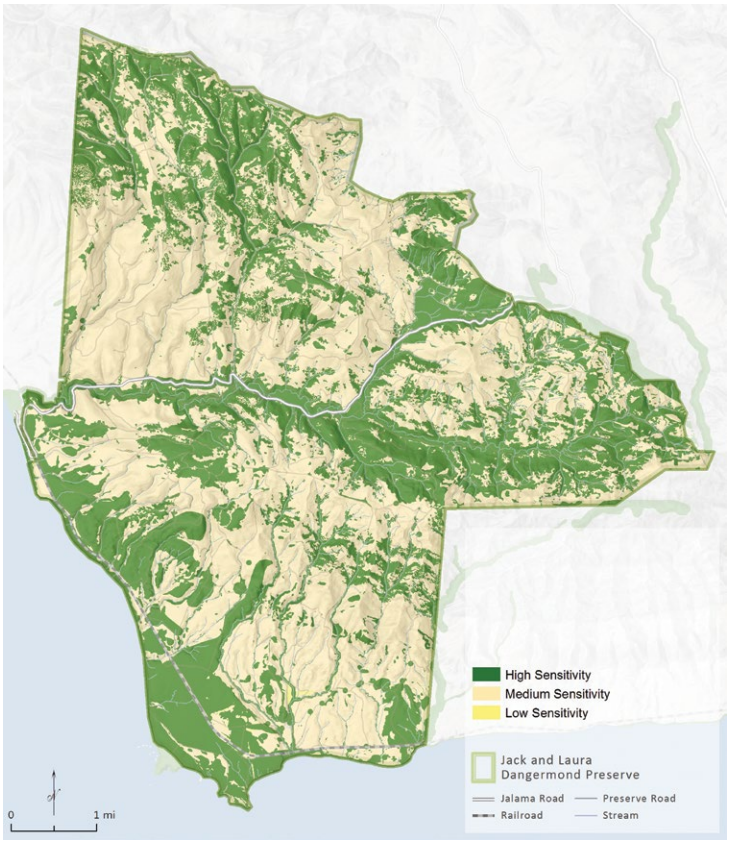


FIGURE 24 An Assessment of the Sensitivity of Preserve Natural and Cultural Resources

There are a variety of structured decision-making frameworks for natural resource management; however, the PrOACT framework used by many U.S. federal resource management agencies provides a framework for defining the problem, objectives, alternatives, and potential consequences and trade-offs that could be used to support decision-making at the Preserve (Moore and Runge 2012). Decisions, both large and small, on resource and program management activities should be based on a clear problem statement that includes an articulation of goals/objectives and alternatives, as well as an evaluation of consistency with Preserve goals/objectives and potential consequences to natural and cultural resources. Most decisions can be made with careful consideration of just those key components; however, more complex decisions may require a more structured approach with more analyses. An overall commitment to document decisions, outcomes and lessons learned will inform adaptive management of the Preserve. Formally assessing the value of new information to better inform decisions will help to guide investments in science and monitoring to prioritize information gathering that will support better management actions at the Preserve over time (Runge *et al.* 2011; Runge and McDonald-Madden 2018).

Table 4. Guiding Principles for Management and Decision-Making

Guiding Principles	Considerations
Activities should advance and contribute to Preserve vision, goals, and objectives	1. Assess contribution to broader vision/goals/objectives of the Preserve, including resource protection, science and learning, and inspiration of future conservation leaders. 2. Decisions should be made to minimize impacts and maximize benefits to sensitive natural and cultural resources that are the foundation for the broader vision/goals/objectives for the Preserve. 3. Decisions should incorporate an evaluation of potential impacts of alternatives and consideration of trade-offs among goals/objectives. 4. The spatial context of sensitive natural and cultural resources should be considered in the siting of activities to minimize adverse impacts.
Decisions should be semi-structured or structured to address impacts, risks, and uncertainties	1. Use a semi-structured and evidence-based approach to evaluate potential impacts, risks, and uncertainties associated with all resource-management decisions. 2. Use a more rigorous structured decision-making approach for more complex or recurring decisions. 3. Invest in science and monitoring where it will improve decision-making.
Decisions should promote adaptive management and learning	1. Use pilot projects and small investments to test new ideas. 2. Prioritize and phase activities to promote learning and adaptation. 3. Document decisions and monitor outcomes to support adaptive management and incorporation of lessons into future decisions.

Table 5. Spatial Data Layers Incorporated into Mapping of Sensitive Natural and Cultural Resources

Description	Resource Elements Included
High sensitivity natural communities and cultural resources	Coastal habitats (dunes, sandy beaches, rocky intertidal, natural tar seeps), sensitive shrub communities, sensitive grassland communities, coast live oak woodlands, bishop pine forest CCC restoration areas Creeks, streams, seeps, springs Special-status plant and animal species Cultural resource sites
Moderate sensitivity natural communities	Non-sensitive shrub, grassland, and forested areas
Low resource sensitivity	Ruderal and non-sensitive natural vegetated areas

9.3.1 Problem Statement, Objectives, Alternatives

Good decision-making begins with a clear articulation of the resource management problem or programmatic goal that needs to be addressed, the fundamental objective for the activity (*sensu* Conroy and Peterson 2013), and alternatives for how to achieve the objective (Conroy and Peterson 2013). Every decision at the Preserve that has the potential to have impacts on natural or cultural resources should start with this important step. Some questions to address include:

- What is the problem we are trying to solve or programmatic goal we want to achieve?
- What are the fundamental objectives we want to achieve from this activity?
- What are the range of solutions/alternatives we should consider?

9.3.2 Consequences and Trade-offs

A qualitative evaluation of potential consequences and trade-offs should be made for all decisions. Decisions should be evaluated in the context of their consistency with Preserve goals/objectives and trade-offs among goals/objectives, evaluation of potential direct and indirect impacts to natural and cultural resources, and siting considerations.

Consistency with Preserve Goals/Objectives and Evaluation of Trade-offs

Given the size of the Preserve and complexity of management issues, decisions on resource management or programmatic activities need to consider the overall Preserve goals and objectives. Many programmatic or natural resource management decisions will require explicit trade-offs among goals/objectives and/or among resource elements. Some questions to consider include:

- What Preserve goals or objectives are served by this activity?
- What Preserve goals or objectives are potentially impaired by this activity?
- What are the trade-offs and risks that should be considered?

Evaluation of Potential Impacts

Decisions on resource management or programmatic activities should consider the potential direct and indirect impacts to key natural and cultural resources of the proposed activity or management measure. A clear articulation of the timing, frequency, siting, and scale of the activity or management measure is helpful to understand potential impacts. To guide decision-making, proposed or planned activities could be qualitatively categorized by their potential for adverse impacts to cultural and natural resources, with more decision analysis focused on activities with higher potential for adverse impacts. Some questions to consider include:

- When, where, and how often will this activity take place?
- Will it take place in a sensitive area?
- What are potential direct and indirect impacts on sensitive natural and cultural resources? What is the level of certainty (e.g., well-documented by published studies vs. unknown)?
- How could potential impacts to natural/cultural resources be avoided or minimized?

9.3.3 More Decision Analysis for Complex Problems

For more complex or recurring decisions, especially those with high risks or uncertainty, a more formal, structured analysis may be necessary. Some decisions may require the use of analytical models and evaluation of uncertainty through a more formal structured-decision making approach (Conroy and Peterson 2013). This would require a bigger investment in time and resources and should be considered for decisions that:

- have a high degree of uncertainty and/or risk;
- involve significant and/or irreversible potential impacts or trade-offs among goals; and/or
- may need an investment in more information/data to make an informed decision.

Generally, structured-decision making has three main components: (1) explicit quantifiable objectives, (2) explicit management actions or alternatives that can be taken to meet the objectives, and (3) models or analyses used to predict the effect of management actions on the objectives. In this context, models include any conceptualization of the relationship between decisions, outcomes and other factors. Uncertainty is incorporated through the evaluation of alternative models for how the system may respond and use of statistical distributions to represent error and environmental variability (Conroy and Peterson 2013).

9.3.4 Making and Monitoring Decisions

Employing a semi-structured decision framework provides a clear connection between Preserve goals and objectives and decisions, as well as more documentation and transparency in decision-making and opportunities for learning (Conroy and Peterson 2013). This semi-structured approach to decision-making can also provide context to evaluate the value of investing in more information to be able to make a better decision (Runge *et al.* 2011). If enough information is available to make an informed decision, a decision should be made and documented (including any restrictions or conditions placed on the activity, such as siting and timing). If there is not enough information to make an informed decision, new investments in monitoring or research can be prioritized and small pilot efforts can be initiated. Some questions to consider at this stage include:

- Do we know enough to make a decision?
- Would an investment in new information lead to better decisions?
- Should this activity proceed, and if so, under what conditions?

TNC will make management decisions for the Preserve, acknowledging that some decisions will benefit from outside consultation or expertise. Decision-making authority should be clear and dependent on the potential for impacts and the risks and uncertainties involved, with more complex decisions elevated for additional review and/or a more structured analytical approach. Decision-making responsibility and authority at the Preserve resides within TNC, with the Preserve Director and the Preserve Leadership Team (Deputy Director, Lead Scientist(s) and Preserve Management Team). Other TNC subject matter experts and TNC legal council may be consulted as part of any decision-making process.

Decisions that are recurring, are based on predictions of how systems will respond, and have monitoring in place provide an opportunity for learning and adaptive management (Conroy and Peterson 2013). Monitoring of resource condition and outcomes of decisions should be prioritized and used to inform adaptive management over time. Once a management decision is made and acted upon, the decision context should be documented to inform learning. Components of a decision-tracking system could include:

- Evidence and approach used to make decisions;
- Decisions that were made and monitoring implemented;
- Effects of decisions relative to objectives; and
- Outcomes and learnings.

Black-tailed Deer at Dangermond Preserve © Peter Montgomery/TNC

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TNC's Dangermond Preserve, California. Coast live oaks frame the distant rolling hills. © Bill Marr/TNC