### Jack and Laura Dangermond Preserve Invasive Plant Species Action Plan

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# 1. Introduction

## 1.1 Purpose and Scope of the Invasive Plant Species Action Plan

The Nature Conservancy's (hereafter, TNC) Invasive Plant Species Action Plan (hereafter, the Plan) guides invasive plant species management at the Jack and Laura Dangermond Preserve (hereafter, the Preserve) for the next 5 years. The Plan nests within the goals, objectives, and priority actions established for invasive plant species management in TNC's Jack and Laura Dangermond Preserve Integrated Resources Management Plan (hereafter, IRMP) (Butterfield et al. 2019). The Plan does not include the management of pests, pathogens or invasive animals, including wild pigs (*Sus scrofa*), which will be addressed under separate cover. For the purposes of this Plan, we define invasive plant species as those found outside their natural range, and whose introduction causes or is likely to cause economic or environmental harm or harm to human, animal, or plant health.

# 1.2 Natural Resource and Invasive Plant Species Management Philosophy

# 1.2.1 Background

For each resource type in the IRMP, there is 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. For this Plan we refined the IRMP's goals, objectives, and priority actions, developing an invasive plant species action plan at the Preserve for the next 5 years focused on the highest priority threats posed by invasive plant species and on no-regrets management actions. This process will be adaptive and we expect that some species may require separate detailed management plans and implementation strategies. In implementing this short-term action plan, the Preserve team will conduct management activities, monitor their effectiveness, and gather lessons learned that will inform a long-term invasive plant species management program. The Preserve team will also test and develop technology-based solutions to management and monitoring, including the long-term goal to develop a Preserve-wide invasive plant species map. This plan will be updated as new information becomes available.

The currently mapped invasive plant species at the Preserve include non-native grasslands, ice plant (*Carpobrotus spp.*) mats, and stands of black mustard (*Brassica nigra*), poison hemlock (*Conium maculatum*), thistles, and fennel (*Foeniculum vulgare*) (Figure 1). This mapping was completed prior to TNC's ownership and will be updated in the next 5 years to help inform management efforts.

This Plan, as in the Jack and Laura Dangermond Preserve Rangeland Management Plan (Butterfield et al. 2020), lists the implementation of the California Coastal Commission (CCC) mandated restoration projects as a top priority (Althouse and Meade, Inc. 2019, WRA, Inc. 2020, Althouse and Meade, Inc. 2020). This includes removing 300 acres of ice plant and veldt grass (*Ehrharta* spp.), removing six acres of non-native grassland and establishing native species, including Gaviota tarplant (*Deinandra increscens ssp. villosa*). The Plan outlines the overall objectives of this project, and how additional actions can enhance and leverage the CCC-mandated work.



Figure 1. Current Invasive Plant Locations at the Preserve

The Preserve has been grazed for more than 250 years and is currently managed with a year-round cowcalf herd. Our invasive plant species management will thus consider both the positive and negative impacts of cattle grazing on invasive plant distribution and growth. If managed appropriately, cattle grazing can be used to help control invasive plant species but when done inappropriately can also be vectors for invasive plant species spread and cause soil disturbance conducive to additional invasions. This Plan thus incorporates the goals, objectives, and priority actions for invasive plant species management that were developed in the Rangeland Management Plan (Table 1).

<b>Table 1</b> . Invasive Plant Species Management from Rangeland Management Plan (Butterfield et al. 2020).				
Resource	Goal	Objectives	Priority Actions	
Invasive Plant Species Management	Adaptively manage rangeland ecosystems to be resilient (maintain cover and ecosystem processes) to fire and climate change and to support high levels of native plant and animal diversity, ecosystem function, and habitat structure	<ul> <li>Reduce the cover of invasive noxious weed species, including large stands of ice plant and fennel</li> <li>May) cattle grazing combination with mechanical and ch methods – treated separate cover in t Invasive Plant Species grazing operation to native plant and animal diversity</li> <li>Eliminate invasive noxious weed species in areas where direct competition could lead to loss of special-status species</li> <li>Use early season May) cattle grazing combination with mechanical and ch methods – treated separate cover in t Invasive Plant Species priority noxious we other non-native a grass) species befor set seed</li> <li>To complement g efforts, mow fenne populations early- summer before flot and seed set</li> </ul>	- Use early season (Oct- May) cattle grazing (in combination with other mechanical and chemical methods – treated under separate cover in the Invasive Plant Species Action Plan) to graze priority noxious weed (and other non-native annual grass) species before they set seed	
			- To complement grazing efforts, mow fennel populations early- to mid- summer before flowering and seed set	

The Preserve's location makes it susceptible to invasive plant dispersal from a variety of corridors and neighboring properties, including Jalama Road, which bisects the Preserve, terminating at the Jalama Beach County Park, and the Union Pacific Railroad (UPRR), which is adjacent to the Preserve's coastline from Jalama County Park to Hollister Ranch (Figure 2). Invasive plant species are regularly observed on the edges of both Jalama Road and the UPRR right-of-way. Both Santa Barbara County and UPRR manage vegetation within their rights-of-way; however, the Preserve may need to target additional management actions to reduce spread of invasive plant species from the County road and railroad.

Invasive plant species do not respect property boundaries and the Preserve's neighbors harbor different or sometimes higher abundances of invasive plant species. Therefore, it is critical for the Preserve to collaborate with our neighbors on invasive plant species management, and ideally, in future years, to manage shared invasive plant priorities across the region.

#### Figure 2. Preserve Location and Regional Context



- Neighboring Properties
- ----- Railroad

Layer Circlitis: World Topographic Map: Sources: Est. HERE, Gamma p. Increment P. Corp. : CFBCC, USOS, FAO, NPS, NRCAN, GecBase slot NL, Orthanoz Sunco, Erri Japan, METL, Est Obring Hong Kong) (e) OpenSteetMap continuitors, and hold Sk User Community

## **1.2.2 Impacts of Invasive Plant Species**

Invasive plant species are a threat to biodiversity, both locally and globally, by reducing native species richness and abundance. They outcompete native plant species for resources such as light, water, nutrients, and space. Invasive plant species threaten the cultural, economic, and recreational values of the Preserve. Invasive plant species that alter ecosystem processes, including sediment deposition and erosion, fire frequency and intensity, nutrient and hydrological cycling, pollination, can be the most damaging to the Preserve's biodiversity, further increasing what is already a large barrier to restoration. These impacts collectively lead to large economic costs; in California alone, invasive plants cause approximately \$82 million in damages each year. At the Preserve, invasive plant species like black mustard and ice plant form monocultures that provide little forage value to cattle, displace native plant species, and alter and reduce wildlife habitat.

Invasive plant species are spread by wind, water, and wildlife and by anthropogenic activities including transporting equipment and building materials, recreation, and agriculture. Climate change presents an even greater potential challenge for invasive plant species management as it could increase their ability to establish, spread, and cause damage. California's average temperature is likely to increase by 2.7 degrees Fahrenheit above the 2000 average by 2050, and between 4.1- and 8.6-degrees Fahrenheit by 2100. If current emission levels remain the same, it is estimated that between 45 and 56% of California's native vegetation will be climatically stressed, potentially further exacerbating the competitive advantage that non-native invasive plants currently have over native ones. Implementing this Plan will manage the direct impacts of invasive plant species now, but also develop an adaptive management and learning framework that will facilitate long-term goals and objectives.

## 1.2.3 Adaptive Management and Precautionary Approach

Invasive plant species management will be implemented within the same adaptive management framework that was established in the IRMP and based upon frequent monitoring efforts and changing environmental conditions. We plan to review our management strategies regularly as part of annual work plan and budget development and will revise the Plan in 5 years based on new information, including new management techniques, the ecology of the systems and species, our own monitoring data, and available funding (e.g., for a Preserve-wide invasive plant species mapping effort). For all management decisions, we will use a precautionary approach and take changes in human activities slowly and with stepwise increases while monitoring species and habitat impacts. Second, we will use a structured decision-making approach to clearly articulate the elements of decisions including problem statement, potential impacts, consistency with goals, site design, and an evaluation of risks and tradeoffs.

## **1.3 Invasive Plant Species Management Planning Assumptions**

The Plan assumes that staffing and funding will remain relatively flat and will focus on what is feasible to accomplish over the next 5 years. We assume that the work to implement this Plan will be completed primarily by the Preserve team and any large-scale contract work will be dependent on obtaining grant funding. Because of the impacts of invasive plants on conservation targets, we recommend the Preserve include funding for basic invasive plant management in the annual stewardship budget. In the 5-year period of the Plan, the team will work on targeted invasive plant mapping efforts using existing technologies, and work to secure funding for a comprehensive invasive plant survey and map.

#### 1.4 Invasive Plant Species Management Planning Team

- Moses Katkowski, Stewardship Manager, Jack and Laura Dangermond Preserve
- Scott Butterfield, Senior Scientist, TNC-CA
- John Knapp, Senior Island Scientist, TNC-CA
- Kelly Easterday, Lead Conservation Technology Manager, Jack and Laura Dangermond Preserve
- Laura Riege, Restoration Project Manager, Jack and Laura Dangermond Preserve
- Bill Leahy, Deputy Director, Jack and Laura Dangermond Preserve

#### 1.5 Goals, Objectives, and Priority Actions

Plan goals, objectives, and priority actions are consistent with the IRMP, and have been refined to focus on (Table 2):

- 1. CCC Ice Plant/Veldt Grass Restoration Project
- 2. Site-led Priority Invasive Plant Species Management
- 3. Early Detection and Rapid Response (EDRR) and Biosecurity
- 4. Technology-based and Cost-effective Solutions for Invasive Plant Species Management

<b>Table 2</b> . Goals, Objectives, and Priority Actions for the Jack and Laura Dangermond Invasive Plant Species Action Plan.				
Resource	Goal	Objective(s)	Priority Action(s)	
uo	Leverage 300-acre CCC-mandated ice plant/veldt grass restoration project to test methods for ice plant/veldt grass	Use CCC-approved plan to complete 300-acre ice plant/veldt grass restoration project	Implement CCC approved ice plant/veldt grass restoration plan(s)	
estorati	eradication and native plant restoration, including Gaviota tarplant expansion.	Reduce total ice plant cover at the Preserve	Establish Ice Plant Science Working Group	
dt Grass R ject		Reduce total veldt grass cover at the Preserve	Test mechanical, chemical, and biocontrol methods for ice plant/veldt grass treatment within 300-acre CCC project area (including measuring,	
ld Vel		Increase total Gaviota tarplant cover at the Preserve	monitoring, reporting)	
e Plant an		Leverage expertise of the Ice Plant Science Working Group members	Develop outreach/communication materials (report/paper) on restoration methods/results	
CCC Ic			Based on results from 300-acre project, develop a plan for additional ice plant/veldt grass restoration across the Preserve	

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	Control/eradicate Priority Cal-IPC High	Eradicate Arundo, Pampas grass, and	Develop and annually update a map of
	Alert Species to preserve biodiversity,	Pennisetum species	priority Cal-IPC High Alert species (and
	ecosystem function, and processes		Black Mustard) including: Arundo,
	across the Preserve.	Reduce the cover of fennel and radish	Pampas grass, Fennel, Radish,
			Pennisetum
		Control ice plant populations at the	
		leading edge of expansion	Annually treat known populations of
			Arundo from coastal Management
		Evaluate the feasibility of using	Units (including measuring,
		seasonal grazing/mowing to reduce	monitoring, reporting)
		the cover of black mustard (Cal-IPC	
		Moderate Alert species) because of its	Annually treat known populations of
		potential fire threat to the area around	Pampas grass in the Jalachichi, Black
les		Jalama HQ	Brush, and Cojo Bull Management
eci			Units (including measuring,
Sp			monitoring, reporting)
nt			
Pla			Annually treat known isolated/leading
/e ]			edge populations of ice plant from the
Isiv			Cojo Bull, Airport/Schoolhouse, and
IVa			Cojo Coastal (from Little Cojo to
			Perco's) Management Units
rity			
l			Use targeted mowing and grazing
Pr			before flowering/seed set and outside
			of grass-nesting bird nesting season –
			July/Aug – to treat radish/fennel
			populations in Steve's Flat, Hollister
			Flat, and Cojo Mare.
			Test seasonal grazing practices (heavy
			grazing before black mustard bolts and
			begins to flower in late Spring) and
			mowing in the Venadito and Water
			Canyon Management Units to treat
			black mustard populations and to
			reduce the fuel/fire threat around
			Jalama HQ

Detection Rapid Response (EDRR) and Decontamination Program	Prevent the establishment of Cal-IPC High Alert Species not currently presently at the Preserve or the spread of High Alert Species present but at low levels (e.g. fennel and pampas grass)	Develop EDRR protocols for Sudden Oak Death (SOD) and gold-spotted oak borer (detailed in Integrated Monitoring Plan) Develop EDRR protocols Cal-IPC High Alert Species ( <u>https://www.cal- ipc.org/plants/inventory/</u> ) Develop EDRR protocols for polyphagous shot-hole borer (PSHB) (detailed in Integrated Monitoring Plan) Implement decontamination methodologies for stream gear and equipment to protect against quagga and zebra mussels	Use a combination of citizen science, volunteers, environmental education groups, and Preserve staff to develop and annually update a map of Cal-IPC High Alert Species Annually monitor for presence of SOD, PSHB and gold-spotted oak borer. If present (neither currently present), eradicate. Work with Cal-IPC and local weed management agencies to implement Cal-IPC-based EDRR protocols (https://www.cal- ipc.org/solutions/management/edrr//) Eradicate new populations of Cal-IPC High Alert Species that are detected during annual monitoring (manage, monitor – to prevent re-establishment, report) Coordinate with neighboring
Early Detectio			Coordinate with neighboring properties (including Railroad, VAFB) on EDRR protocols/program and eradication of priority species (e.g., Pampas grass from VAFB)

Lechnologies to better understand where noxious weeds are on the Preserve, how we can manage noxious weeds the most effectively and efficiently, and how lessons learned from these efforts can be quickly and broadly exported Mana feasi throu isolar speci Rese chan, habit	evelop/implement efficient noxious eed/oak pests & pathogens onitoring program leveraging remote nsing and conservation technology anagement/Decision-Making: evelop/implement decision making ol for self-reporting and visual terpretation on monitoring and eatment information. anagement/Research: Investigate the asibility of remote application (e.g. rough UAVs) of herbicides for blated/inaccessible noxious weed ecies	approaches to map noxious weeds from current high spatial resolution aerial photographs Develop/implement a citizen science- based noxious weed mapping effort in order to evaluate the feasibility of using these methods to develop a Preserve-weed weed map Build Dashboard for Invasive Species Monitoring and Management Develop a paper/report that details the tests of the use of UAVs for herbicide application
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#### 2. Strategy Development

## 2.1 Choosing a Strategy

Successful management of invasive plant species is dependent on choosing a strategy that can be implemented and is embedded within the Strategic Vision of the Preserve (available for download at: <a href="https://www.nature.org/en-us/about-us/where-we-work/united-states/california/stories-in-california/dangermond-preserve/">https://www.nature.org/en-us/about-us/where-we-work/united-states/california/stories-in-california/dangermond-preserve/</a>). The Preserve's natural resource management strategies must acknowledge the full scope of work at the Preserve, and ensure that goals, objectives, and priority actions are reasonable, efficient, and cost-effective. Therefore, it is important to develop plans in the early years of TNC's ownership of the Preserve that are focused on learning, partnerships, and management actions that lead the Preserve into fully informed, science-based, long-term management plans and programs.

The most efficient and cost-effective invasive plant species management action is the prevention of colonization and establishment of new species. The establishment of new species can occur in various ways including from Preserve visitors, neighboring properties, and dispersal corridors like Jalama Road and the UPRR. Therefore, developing Early Detection Rapid Response (EDRR) and biosecurity protocols, optimally in a coordinated way with neighbors and Preserve visitors, is a key first step in our management efforts.

Currently, many invasive plant species occur at the Preserve with various degrees of impact to the Preserve's ecological function and biodiversity values. While many of the existing species are known, the Preserve has not completed a comprehensive survey of all invasive plant species. With limited capacity and budget for invasive plant species management, we plan to focus initial efforts on better understanding the presence and distribution of existing invasive plant species and then implementing large-scale, Preserve-wide invasive plant species treatments.

The Preserve is currently conducting large-scale restoration work that is focused on reducing ice plant and veldt grass within the Cojo Coast Management Zone (MZ), near Point Conception (Figure 3). This project, and other CCC-mandated restoration projects are an opportunity to treat invasive plants, and test methods for mapping, treatment, and monitoring at the Preserve. These projects include engagement of a science working group that brings expertise and capacity towards questions of habitat restoration at the Preserve.

The Preserve can both leverage and export lessons learned from the work it is currently doing and incorporate and learn from other TNC preserves across the state. For example, at Santa Cruz Island, TNC has managed invasive plants for decades and has learned many science-based lessons that will improve the Preserve's efforts to manage and monitor invasive plant species.



Figure 3. Dangermond Preserve Management Zones and Pastures.

#### 2.1.1 Site-led vs. Species-led Approach to Invasive Plant Species Management

There are two general strategies one can choose from for invasive plant species management: 1) species-led and 2) site-led approaches. A species-led approach involves the prevention and treatment of new and prioritized species that impact conservation values regardless of the site. A site-led approach focuses on sites across the Preserve with high ecological value, that may contain rare or listed species that require protection from invasive plants, or sites with dispersal corridors that may not have high ecological value but may facilitate the spread of invasive plant species.

Due to the complexity and size of the Preserve, and without a comprehensive invasive plant survey, using only a species-led approach to management may increase the likelihood that time and money is used inefficiently during the Preserve's early years of invasive plant species management. Without understanding what species are present and where they exist, a species-led approach may lead to managers missing species that have significant impacts but are not known.

Therefore, this Plan uses both site-led and species-led approaches. With our current knowledge of species distribution and abundance, the species-led approach will prevent the establishment of incipient, prioritized species across the Preserve. The site-led approach will use Management Zones (MZs) to rank areas within the Preserve for their conservation values, including occurrences of rare and/or threatened species (Figure 3). Additionally, MZs with dispersal corridors will be prioritized due to their likelihood that new species will first become established in those MZs.

The Preserve's Management Zones (with pastures) are ranked below:

- 1. **Cojo Coast** (Hollister Flat, Steve's Flat, Cojo Mare, Cojo Bull, 54, Schoolhouse, Airport, Perry's Field, Cojo Horse, Walnut Field).
- 2. Cojo Canyons (Cojo Cow, Cojo Steer, Green Tank)
- 3. Army Camp (Little Cojo, Jalama Bull, Jalama Mare, #36)
- 4. East End Ridge (Number 10, East End)
- 5. Jalachichi (Jalachichi, Blackbrush, Diamond Holding Field)
- 6. **Tinta Basin** (West Tinta, East Tinta, Water Canyon, Escondido, Jalama Mare)
- 7. **Ramajal** (Venadito, Cuesta, Ramajal, Ramajal Holding, Ramajal Field)

#### 2.2 Identifying and Mapping Priority Invasive Plant Species

Successful invasive plant species management starts with comprehensive baseline data that identifies and prioritizes species, develops strategic actions, and documents the effectiveness of weed management. This Plan addresses the need for baseline vegetation data for the Preserve by using existing data and monitoring tools, as well as new technologies that provide efficient and cost-effective data collection.

The Plan is also an opportunity to fulfill the Preserve's objective of utilizing conservation technology to create a "Digital Twin" of the Preserve. A "Digital Twin" for the Preserve is a virtual representation of the Preserve that uses real-time data and other sources to enable learning, reasoning, and dynamically recalibrating for improved decision making. Mobile data collection applications, remote sensing, and

other technologies can be used to implement control methods, map invasive plant species, monitor management effectiveness, and communicate invasive plant species data to preserve managers and scientists.

## 2.2.1 Invasive Plant Species Mapping Tools

For the past 30+ years, many attempts have been made to use remote sensing – satellite and aerial approaches – to detect and map invasive plant species. While some approaches have shown promise locally or for specific species in specific locations during specific times of the year (e.g., during flowering), they rarely have been generalizable across different sites and species. Because of this, traditionally, invasive plant species management has relied on field- and aerial-based surveys, which tend to be expensive and labor intensive, especially in large, remote, and high relief areas like we see at the Preserve. To address these issues, TNC plans to engage research partners to develop and test technology-based solutions for detecting, mapping, and monitoring (e.g., the impact of management treatments) invasive plant species, with the goal to have remote and cost-effective methods within 5 years.

Currently, the Preserve is using the Invasive Plant Mobile Monitoring System (IPMMS), an ESRI Collectorbased application to map invasive plant species occurrences and management treatments. IPMMS will continue to serve as a field-based mapping tool for occurrences, assessments, and treatment areas.

## 2.3 Species Ranking

The Plan uses the Delphi method to rank priority invasive plant species (Table 3). The Delphi method uses existing species rankings from the California Invasive Species Council (Cal-IPC) and local, expert opinion to rank species and prioritize management actions. Cal-IPC maintains a state-wide ranking of invasive plant species based on multiple factors including impact, invasiveness, and distribution. Cal-IPC categorizes invasive plant species by their ecological impact on California's wildlands. Rankings are based on the best available science and expert knowledge to designate a High, Moderate, or Limited rank based on each plant's cumulative impacts across the state. Since Cal-IPC rankings are based on statewide impacts it is important to consider that regional or local impacts may be greater or less than statewide impacts.

Known infestations of High ranked species occur primarily in the Cojo Coast Management Zone (Figure 3); however, the comprehensive distribution of most invasive plant species at the Preserve is not known.

Scientific Name	Common Name	Cal-IPC Ranking	Family	Provenance
Tropaeolum majus	Garden nasturtium	Assessed-not listed	Tropaeolaceae	non-native (invasive)
Arundo donax	Giant reed	High	Poaceae	non-native (invasive)
Carpobrotus edulis	Iceplant	High	Aizoaceae	non-native (invasive)
Carthamus lanatus	Woolly distaff thistle	High	Asteraceae	non-native (invasive)
Centaurea solstitialis	Yellow starthistle	High	Asteraceae	non-native (invasive)

**Table 3**. Invasive Plant Species at the Jack and Laura Dangermond Preserve.

Cortaderia jubata	Andean pampas grass	High	Poaceae	non-native
Ehrharta calvcina	Perennial veldt grass	High	Poaceae	non-native
			1 ouccue	(invasive)
Hedera helix	English ivv	High	Araliaceae	non-native
				(invasive)
Lepidium latifolium	Perennial	High	Brassicaceae	non-native
	pepperweed			(invasive)
Rubus armeniacus	Himalayan blackberry	High	Rosaceae	non-native
				(invasive)
Tamarix sp.	Tamarisk	High	Tamaricaceae	non-native
				(invasive)
Cakile maritima	Sea rocket	Limited	Brassicaceae	non-native
				(invasive)
Carduus tenuiflorus	Slender flowered	Limited	Asteraceae	non-native
	thistle			(invasive)
Cenchrus cladenstinus	Kikuyu grass	Limited	Poaceae	non-native
				(invasive)
Dactylis glomerata	Orchardgrass	Limited	Poaceae	non-native
				(invasive)
Echium candicans	Pride of madeira	Limited	Boraginaceae	non-native
				(invasive)
Eucalyptus globulus	Blue gum	Limited	Myrtaceae	non-native
				(invasive)
Euphorbia terracina	Carnation Spurge	Limited		
Marrubium vulgare	White horehound	Limited	Lamiaceae	non-native
				(invasive)
Olea europaea	Olive	Limited	Oleaceae	non-native
				(invasive)
Phoenix canariensis	Canary island date	Limited	Arecaceae	non-native
	palm			(invasive)
Salsola tragus	Russian thistle	Limited	Chenopodiaceae	non-native
California	Denniserentere	I have the set	A	(invasive)
Schinus molie	Peruvian pepper tree	Limited	Anacardiaceae	non-native
Cilubura marianuna	Mille thistle	Limitod	Astorogogo	(invasive)
		Limited	Asteraceae	(invasivo)
Sting miligeog var	Smilo grass	Limitod	Poacoao	(illuasive)
stipu miliacea	SITINO grass	Linned	PUALEAE	non-native
Atriplex comibaccata	Australian salthush	Modorato	Chananadiacaaa	non nativo
Amplex Semibucculu		Moderate	chenopoulaceae	(invasive)
Brassica niara	Black mustard	Moderate	Brassicaceae	non-native
Drassica mgra		Woderate	Drassicaceae	(invasive)
Carduus	Italian thistle	Moderate	Asteraceae	non-native
pvcnocephalus				
Carpobrotus chilensis	Sea fig	Moderate	Aizoaceae	non-native
				(invasive)
Centaurea melitensis	Tocalote	Moderate	Asteraceae	non-native
				(invasive)
Cirsium vulgare	Bullthistle	Moderate	Asteraceae	non-native
				(invasive)
Conium maculatum	Poison hemlock	Moderate	Apiaceae	non-native
				(invasive)
Cotoneaster lacteus	Milkflower	Moderate	Rosaceae	non-native
	cotoneaster			(invasive)
Festuca arundinacea	Tall fescue	Moderate	Poaceae	non-native

Foeniculum vulgare	Fennel	Moderate	Apiaceae	non-native
Hirschfeldia incana	Mustard	Moderate	Brassicaceae	(invasive) non-native
				(invasive)
Nicotiana glauca	Tree tobacco	Moderate	Solanaceae	non-native (invasive)
Oxalis pes-caprae	Bermuda buttercup	Moderate	Oxalidaceae	non-native (invasive)
Phalaris aquatica	Harding grass	Moderate	Poaceae	non-native (invasive)
Vinca major	Vinca	Moderate	Apocynaceae	non-native (invasive)
Lepidium chalepense	Lens-podded hoary cress	Moderate- alert	Brassicaceae	non-native
Mesembryanthemum crystallinum	Crystalline iceplant	Moderate- alert	Aizoaceae	non-native (invasive)
Pinus pinea	Italian stone pine	Pending assessment	Pinaceae	non-native
Tragopogon porrifolius	Salsify	Pending assessment	Asteraceae	non-native
Acacia longifolia	Golden wattle	Watch	Fabaceae	non-native
Acacia saligna	Orange wattle	Watch	Fabaceae	non-native
Myoporum laetum	Ngaio tree	Watch	Scrophulariaceae	non-native (invasive)
Paraserianthes Iophantha	Plume acacia	Watch	Fabaceae	non-native (invasive)
Aloe maculata	Soap aloe		Asphodelaceae	non-native
Atriplex suberecta	Peregrine saltbush		Chenopodiaceae	non-native
Cenchrus longisetues	Feathertop		Poaceae	non-native (invasive)
Cenchrus setaceus	Fountaingrass		Poaceae	non-native (invasive)
Juglans regia	English walnut		Juglandaceae	non-native
Opuntia ficus-indica	Tuna		Cactaceae	non-native
Salsola australis	Russian thistle		Chenopodiaceae	non-native

#### 2.4 Management Feasibility

#### 2.4.1 Dangermond Invasive Plant Team Roles and Responsibilities

Invasive plant species management at the Preserve is led by the Stewardship Manager with close collaboration with the Preserve's Science and Conservation Technology staff and Restoration Manager on specific goals, strategies, and priority actions. Science and Conservation Technology staff assist with mapping, monitoring, and research. In addition, the Stewardship Manager, Restoration Manager, and Science and Conservation Technology staff will work together on obtaining public and private funding for invasive plant species management. The Stewardship Manager is responsible for developing annual work plans, budgets, and reporting on progress and lessons learned.

The Preserve's stewardship staff has the required California state pesticide licenses to purchase, store, and use pesticides at the Preserve. The Preserve's Stewardship Manager maintains a Qualified

Applicators License (QAL) with the State of California, and at least one staff member on the Preserve team must always maintain these certifications.

Preserve leadership (Preserve Deputy Director, Point Conception Institute (PCI) Director), and Development and Operations staff are key to obtaining private funding and ensuring that invasive plant species management is included in the Preserve's budget over the long-term. In addition, Preserve leadership is key to supporting partnerships with preserve neighbors, research institutions, government agencies, and for-profit stakeholders in the management of invasive plants.

# 2.4.2 Decision Making and Team Communication

The Invasive Plant Species Management Team makes decisions based on the guiding principles for management and decision making outlined in the Preserve's IRMP. These include:

- 1) Activities should advance and contribute to Preserve vision, goals, and objectives
- 2) Decisions should be semi-structured or structured to address impacts, risks, and uncertainties
- 3) Decisions should promote adaptive management and learning

The Invasive Plant Species Management Team ensures that all management actions are science-based, and any potential negative impacts to natural or cultural resources are minimized. During the implementation of this Plan, complex decisions may need to be made that will require structured decision-making. For example, if management actions such as the use of herbicides have the potential to impact other natural resources the team will discuss and document why the decision was made. Invasive Plant Species Management Team discussion and decision making will be conducted during quarterly team meetings throughout the year. Meetings include, at a minimum, the Stewardship Manager, Preserve Scientist, and Restoration Manager. Meeting topics include budgeting and funding, annual work planning, monitoring and reporting, and adaptive management. The Stewardship Manager is responsible for scheduling, agenda setting, and leading team meetings.

## 2.4.3 Stakeholders and Partners

Strong public and private partnerships, including with our neighbors and other NGOs, are key to accomplishing the invasive plant species management vision for the Preserve. Partnerships will enhance the plan's implementation including control/treatment, research, funding, mapping/monitoring, and volunteerism. The Preserve is in a unique position for establishing conservation partnerships in California. Jack and Laura Dangermond and TNC have established a vision for 21<sup>st</sup> Century conservation research, including the development of the Point Conception Institute. PCI is dedicated to using cutting edge technology and partnerships across technology companies, research universities, other nature preserves, other NGOs, and government agencies to address the most pressing environmental challenges. The partnerships created through PCI offer opportunities to advance many of the Preserve's management and stewardship goals and objectives, including those for invasive plant species management.

The Preserve has a large variety of neighbors including Vandenberg Space Force Base (VSFB), Jalama Beach County Park (Santa Barbara County), Hollister Ranch (private), UPRR, and private cattle ranches (Figure 2). As part of this Plan, the Preserve will establish a clear communication plan with our neighbors to gain agreement on the need for developing common and mutually beneficial goals around invasive plant species management. To that end, we have already had initial conversations with VAFB about protection of listed plants from invasive plants, and plan to initiate conversations with surrounding

landowners about management of artichoke thistle (*Cynara cardunculus*). We will identify and leverage the places where multiple neighbors can achieve their varied goals through a collaborative approach to invasive plant species management.

The Santa Barbara Weed Management Area (WMA) group is an organization that brings together state and local agencies, conservation organizations, private consulting firms, and landowners in the County to discuss and collaborate on invasive plant species management and grant funding applications. Other local environmental NGOs, like the Gaviota Coast Conservancy, Santa Barbara Botanic Garden (SBBG), Coastal Ranches Conservancy, and Land Trust of Santa Barbara County are important partners.

## 2.4.3 Funding

Invasive species management is a long-term endeavor that requires a commitment to consistent management and, consequently, funding. The Preserve's budget should reflect the importance of invasive plant species management by including annual funding. At a minimum, annual funding should include staff time and resources to monitor high priority invasive plant species, adaptively manage existing treatment projects, and communicate with neighbors and regional partners. However, to be effective, dedicated funding for research, and large-scale monitoring and treatments employing contractors will be important to maintain and increase the effectiveness of the Plan's implementation.

In addition to the Preserve's endowment and private fundraising, the Invasive Plant Species Management Team will look to public funding opportunities to implement the Plan. Public funding could come from several sources including California Department of Fish and Wildlife (CDFW), California Coastal Conservancy (CCC), Natural Resources Conservation Service (NRCS), and U.S. Fish and Wildlife Service (USFWS).

## 2.4.4 Volunteerism

Volunteerism is one way in which the Preserve can accomplish multiple natural resource management, public visitation, environmental education, and donor engagement goals. At the Preserve, volunteers will help manage and monitor invasive plant species, specifically assisting with activities that are led by Preserve staff and/or contractors and are aided by large groups of people (e.g., mechanical removal of ice plant). We currently have a pilot volunteer ice plant removal project (started in the Fall of 2020) that enlists Preserve supporters to hand-pull ice plant in the Cojo Bull pasture (Figure 3). So far, we have removed approximately a 3/4acre of ice plant using volunteers. Preserve staff have begun to engage local volunteer experts on the monitoring of this project. The goals of this pilot project are to 1) quantify the amount of ice plant that can be mechanically removed per amount of volunteer labor, and 2) identify native and non-native plant species that emerge after ice plant removal. If successful, the Preserve will continue to use volunteers to mechanically remove ice plant and monitor results, expanding the footprint and scope of this work annually.

## 3. 5-year Strategy for Invasive Plant Species Management

The 5-year strategy for invasive plant species management at the Preserve builds the foundation for a long-term management program that can support the larger Preserve and PCI vision, and includes:

- 1. Leverage 300-acre, CCC-mandated ice plant and veldt grass restoration project to test methods for invasive plant removal and native plant restoration, including expansion Gaviota tarplant and perennial bunchgrasses
- Prevent the establishment of Preserve-identified priority invasive plant species, not currently
  present at the Preserve, or the spread of species present but at low levels through an EDRR
  program
- 3. Map, prioritize and begin treatment of invasive plant species to preserve biodiversity, ecosystem function, and processes across the Preserve
- 4. Leverage current and emerging technologies to better understand where invasive plant species are on the Preserve, how we can manage invasive plants most effectively and efficiently, and how lessons learned from these efforts can be broadly exported.

# 3.1 CCC Ice Plant and Veldt Grass Restoration Project

Once approved by the CCC, the Preserve will implement the 300-acre ice plant and veldt grass restoration project at Point Conception with a goal of expanding coverage of native perennial bunchgrasses and other native plant species. This project, mandated by CCC, will be leveraged into further restoration, aimed first at the 1,000 acres of ice plant and veldt grass that dominate the coastal prairie, wetlands, and dunes in the Cojo Coast MZ (Figure 3).

The Preserve established an Ice Plant Science Working Group (SWG) in 2020 to lead science and communication of the restoration project, and to expand the project's reach beyond the 300-acre site, the Preserve, and the region. The SWG is composed of TNC science staff and external science partners in academia, governmental and non-governmental agencies, and the private sector that have experience and expertise in coastal restoration in California. The SWG, along with Preserve staff, will design, implement, and monitor experimental projects that test mechanical and chemical methods for ice plant and veldt grass removal. Communication is essential to whether we are successful in leveraging the CCC-mandated restoration projects. Communication will be conducted through TNC developed materials, and scientific publications on restoration methods and results led by the SWG.

## 3.2 Site-Led Invasive Plant Mapping, Monitoring, and Treatment

Management Zone profiles are being developed for overall management of the Preserve. Each MZ profile will describe the known invasive plant species, sensitive vegetation communities, and rare plants along with a summary of programmatic activities and existing infrastructure. While each MZ will have specific priority actions, all invasive plant species management will require monitoring and reporting on actions taken and results.

# 3.2.1 Cojo Coast Management Zone

Due to the presence of the ice plant and veldt grass restoration project and many sensitive vegetation communities, particularly wetlands, beaches, and dunes, and rare plants like Gaviota tarplant the Cojo Coast MZ (Figure 3) is the Preserve's highest priority for invasive plant species management. The Cojo Coast MZ also contains the UPRR, a major dispersal corridor for invasive plant infestations.

In addition to the presence of sensitive vegetation and rare plants, the Cojo Coast MZ grasslands contain the largest known populations of grass-nesting bird species at the Preserve, including grasshopper sparrow (*Ammodramus savannarum*), horned lark (*Eremophila alpestris*), and Western meadowlarks

(*Sturnella neglecta*). Many of these bird species occur in the southeastern coastal pastures (Cojo Mare, Steve's Flat, Hollister Flat) (Figure 3). These pastures are also threatened by Cal-IPC Moderate ranked species like fennel (Figure 4), Harding grass (*Phalaris aquatica*), and thistle species. In the first two years of Plan implementation, we will focus on annual mapping of fennel, and test mowing and cattle grazing treatments.

Giant reed (*Arundo donax* L.) is a Cal-IPC High ranked species that occurs at less than ten locations in the Cojo Coast MZ along the beach between Percos Beach and Little Cojo Beach. The largest infestation, which is less than 1 acre, is in the small lagoon, south of the railroad crossing, at Damsite Canyon Creek. The Preserve will work to obtain public funding to eradicate these small infestations in the Cojo Coast MZ. One potential funding source for this project could be the U.S. Fish and Wildlife Service's (USFWS) Partners of Coastal Program.



# Figure 4. Fennel populations in the Cojo Coast Management Zone

There are approximately 51 acres of gum tree (*Eucalyptus spp.*) within the Cojo Coast MZ. The populations occur as planted windbreaks along the Cojo Terrace to protect historic farming operations, along the driveway into Cojo Ranch Headquarters, and the largest acreage is north of Cojo Ranch Headquarters. The gum tree groves are a documented Monarch butterfly overwintering site with counts numbering in the thousands in the 1990's and early 2000's; however, monarch butterflies are experiencing severe declines in California, including at the Preserve. In 2020, the Preserve took steps to manage monarch butterfly overwintering habitat through management of our gum tree groves. Gum trees do present management challenges for natural resource, infrastructure, and fire risk; however, any management of gum trees should be reviewed by stewardship, science, and restoration staff before proceeding. For the purposes of this Plan, gum trees in the Cojo Coast MZ are considered wildlife habitat and will not be managed as an invasive species.

The UPRR runs through the Preserve from the Cojo Gate at the western midpoint of the Preserve, along the coast, past Point Conception and into Hollister Ranch on the southeastern Preserve boundary. In many places the UPRR is within a quarter mile, and sometimes directly adjacent to the coastal bluff of the Preserve. Preserve staff have identified multiple invasive plants within the UPRR corridor that threaten the Preserve, including Pampas grass (*Cortaderia selloana*) and Fountain grass (*Pennisetum setaceum*). However, it is likely that other invasive plant species occur within the UPRR corridor that have not been identified and that could threaten biodiversity and ecosystem function at the Preserve. The Preserve has multiple objectives in building a relationship with the UPRR. One objective is to influence invasive plant species management within the UPRR corridor. Influence could take many forms, including UPRR treating species identified by Preserve staff or UPRR funding invasive plant species management at the Preserve.

## 3.2.2 Jalachichi Management Zone

The Jalachichi MZ (Figure 3) contains the headwaters of Jalama Creek, the Preserve's largest populations of native perennial bunchgrasses, and other significant freshwater resources, including year-round habitat for California red-legged frogs (*Rana draytonii*) and Western pond turtles (*Actinemys marmorata*), in the Jalachichi Ponds. The Jalachichi Ponds CCC restoration project is located in this MZ.

To date, the known Cal-IPC High ranked invasive plant species in the Jalachichi MZ are Pampas grass and salt cedar (*Tamarix* spp.). Approximately five small (less than 1 acre) known infestations of Pampas grass occur within the MZ, and about 10-20 individual plants occur on the opposite side of our northern boundary fence line between the Preserve and the San Julian Ranch. However, larger infestations of Pampas grass grass exist to the north (up wind) of the Preserve on multiple privately-owned parcels.

The Preserve staff will map Pampas grass in the Jalachichi MZ annually and treat known infestations either mechanically with Preserve staff and volunteers or chemically through a contractor or Preserve staff. Reducing the chances of Pampas grass spread requires developing working relationships with our Preserve neighbors that are infested with the possible source populations of the species. Partnerships with our neighbors could include joint funding to map, treat, and monitor and permission from the landowner for Preserve staff to manage Pampas grass on their lands.

Known salt cedar infestations occur in the Jalachichi Ponds and will be addressed in the CCC-mandated restoration project; however, post-restoration maintenance, including careful monitoring and treatment of new infestations are critical to long-term restoration success.

Due to its ecological importance for Jalama Creek and other freshwater resources, the Jalachichi MZ is a priority for comprehensive invasive plant surveys and mapping.

## 3.2.3 Tinta and Ramajal Management Zones

The Tinta and Ramajal MZs, located in the northern portion of the Preserve (Figure 3) include our largest infestations of black mustard. The MZs also include populations of Gaviota tarplant, La Purissima manzanita (*Arctostaphylos purissima*), and tan oak (*Notholithocarpus densiflorus var. echinoides*). The Tinta MZ contains three of the primary tributaries of Jalama Creek: Espada Creek, Gaspar Creek, and Escondido Creek. These tributaries contain extensive amounts of Arroyo willow (*Salix lasiolepis*) and Southern California black walnut (*Juglans californica*) in their lower reaches.

The CCC-mandated oak restoration project occurs primarily in the Ramajal MZ, on 150 acres of abandoned farm fields (Figure 4). You can find out more about this oak restoration project on the Preserve's Oak Restoration Dashboard:

https://tnc.maps.arcgis.com/apps/opsdashboard/index.html#/d23a3c459cfb45b1bb306fd00017c71c. Invasive plant species are managed extensively within the 150-acre restoration sites/invasive plant species assessment areas (Figure 4).

Jalama Road runs along the southern boundary of the Tinta and Ramajal MZs for approximately 7.5 miles. Jalama Road is a major dispersal corridor for invasive plant species due to the frequent vehicle traffic traveling to Jalama Beach County Park. Santa Barbara County mows and chemically treats vegetation within the rights-of-way, approximately 5-10 feet from the edge of the pavement, at least one time per growing season; however, much of the roadside is covered in invasive plant species, particularly black mustard. The county road maintenance department has been receptive to working with the Preserve to reduce the risk of invasive plant infestations into our oak restoration sites. Continued proactive communication will continue to encourage additional treatments and coordinate management.

While it is unlikely that the Preserve can control vehicle use traveling to Jalama Beach County Park, Preserve staff will work with the County Public Works Department to identify Best Management Practices that reduce the risk of new invasive plant infestations along the road. Additionally, EDRR may be focused along Jalama County Road.

Longer-term management goals in the Tinta and Ramajal MZs include the potential use of prescribed fire to treat invasive plant species. The Preserve is currently working with UC Cooperative Extension and UC Santa Barbara to better document our fire and grazing history, develop fuel maps and fire behavior models, and to design prescribed burning prescriptions. We hope to have prescribed burning plans in place within the 5-year planning window of this Plan.

## 3.2.4 Army Camp Management Zone

The Army Camp MZ is the western most MZ (Figure 3) along the coast and includes the lower Jalama Creek from the river mouth to above the confluence of Escondido Creek with Jalama Creek, near the

Jalama Headquarters. The lower Jalama Creek is critical for our Southern California steelhead (*Oncorhynchus mykiss*) recovery and it contains the majority of our Southern California black walnut. Along the coast, it is probably the Preserve's best representation of native coastal sage scrub habitat.

Coast live oak woodlands (*Quercus agrifolia*), commonly referred to as the Army Camp oak woodland, occur on the west side of the ridge, south of Jalama Creek and appear to be in poor condition. Lack of oak regeneration, coverage of invasive plants, and dead trees and limbs have all been observed within the Army Camp MZ. While the causes of its condition are not fully known it is likely that factors related to cattle grazing, deer herbivory, wild pig rooting, drought, and historic land management activities have contributed to the oak woodland's poor condition. We are currently working with the Oak Woodland SWG to identify research, management, and restoration prescriptions for oak woodlands in this MZ.

Priority actions within the Army Camp MZ include monitoring for new invasive plant infestations that threaten the MZ's sensitive vegetation communities and rare plants and sensitive shrub communities.

## 3.2.5 Cojo Canyons Management Zone

Cojo Canyons MZ (Figure 3) is the primary rangeland and grazing habitat on the Cojo side of the Preserve, dominated by non-native annual grasslands and native shrublands. A few rare plants and sensitive vegetation communities exist within the MZ. Invasive plant species management will focus on mapping and monitoring invasive plants that threaten rare plants and sensitive vegetation communities. We will continue to use cattle grazing, as prescribed in the RMP, to help manage invasive plants, such as black mustard.

### 3.2.6 East End Ridge Management Zones

The East End MZ (Figure 3) contains most of the Preserve's tan oak populations and expansive populations of La Purissima manzanita. The MZ is dominated by oak woodlands on the ridge between the Preserve and Hollister Ranch to the south (Figure 2). Invasive plant species distribution is not well known within the MZ; therefore, the primary action of this Plan within this MZ is to map invasive plant species and monitor for threats to rare plants and vegetation communities.

## 3.3 Biosecurity

To effectively manage varied sources of invasive plant species, the Preserve will need to establish biosecurity protocols that permeate into its day-to-day operations. The priority action for this goal is to develop these protocols and consistently implement them, including purchasing equipment and supplies, decontaminating equipment (including shoes and clothing), educating staff and visitors, and requiring compliance within our contracts, agreements, and waivers.

Currently, the Preserve uses biosecurity provisions in our contracts and in our Preserve rules that are shared with contractors and visitors; however, the effectiveness and enforcement of biosecurity to date is limited. Development of long-term protocols for biosecurity must take into consideration staff capacity in enforcement and monitoring. For example, signage should be installed in key locations across the Preserve as frequent reminders to staff and visitors. All staff should be knowledgeable and empowered to communicate effectively.

The Preserve will learn from and adapt materials and protocols already developed at Santa Cruz Island. While not an island, the Preserve faces similar challenges to biosecurity and will ensure that lessons learned at Santa Cruz Island are applied here. A primary focus will be on equipment and vehicles that are entering the Preserve. While one biosecurity checkpoint may not be feasible, having discrete areas for vehicle and equipment cleaning at each headquarters and/or visitor check-in location should be implemented. The Preserve will also ensure that supplies are available and on-hand for vehicle and equipment cleaning.

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