Dune Protected Areas Network: Short-term Work Plan

3 Year Work Plan
Prepared December 2022

Created by: The Land Conservancy of San Luis Obispo County

Overview

Conservation Strategy Overview

Trust

There is a regional effort underway to manage the entire Guadalupe Nipomo Dunes Complex (GNDC) through a partnership known as the Dunes Collaborative. This partnership is made up of federal, state, private, and non-profit organizations such as US Fish and Wildlife Service (USFWS), the Land Conservancy of San Luis Obispo County (LCSLO), Guadalupe Nipomo Dunes Center, California State Parks - Oceano Dunes State Vehicular Recreation Area, County of Santa Barbara, State of California Coastal Conservancy and California Department of Fish and Wildlife (CDFW).

This partnership has been an important advocate of the restoration and preservation of the GNDC's native ecosystem. It was formed in 2001 in an effort to develop a partnership and maximize resources of federal, state, and private landowners in addressing restoration needs in the dunes following a 1998 settlement between the various State of California agencies and Unocal for injuries from contamination at the Guadalupe Oil Field which is within the GNDC. The Restoration Subcommittee (California Department of Fish and Wildlife, Office of Spill Prevention and Response, and California Coastal Conservancy) oversaw the Trust established following the settlement until late 2022 when it was passed to CDFW's Central Region to administer. Of the remaining Trust, approximately 3.6 million was allocated to restoration efforts in the GNDC. The Restoration Subcommittee and the Dunes Collaborative elected to reorganize the Trust into two phases to better protect pristine landscapes within the GNDC.

> Phase 1: Major Spend Down (1.6 million allocated, ~425,000 remaining)
> A portion of the Trust will be spent in the first 7 years (2022 is year 5) to support major restoration projects that will provide a defensible space for long-term management.
>
> Phase 2: Long-term Endowment (~$2 million)
> The rest will remain intact as an endowment and only the interest (~3.5% depending on market conditions) will be spent annually for maintenance of selected restoration projects.

Conservation Strategy

Restoration funds from the Trust are allocated based on the 2018 Conservation Strategy (The Land Conservancy of San Luis Obispo County, 2018). The Conservation Strategy is comprised of three overlapping components, a *Restoration Plan*, *Work Plan*, and *Monitoring Plan*. This Conservation Strategy will guide the management of both phases of the Trust.

The *Restoration Plan* outlines the concept and design of the Conservation Strategy and answers the question, what will be done? This provides the framework for the work to be accomplished. It is made up of a Vision for future conservation, Goals, and a Strategy to accomplish those Goals. These are fixed for the life of the Conservation Strategy. Also included in the Restoration Plan is a site assessment that identifies existing resources, the threats to those resources and identifies opportunities for conservation and restoration.

The *Work Plan* identifies how the Conservation Strategy is implemented. It answers the essential questions: How much effort will the Conservation Strategy take and what will it cost? The *Work Plan* includes Objectives, Actions and Methods to achieve those Objectives as well as cost estimates. These are time dependent and fluid. Work plans are meant to change over time based on adaptive management.

The *Monitoring Plan* measures progress towards achieving our Conservation Vision and informs subsequent actions. It is essential to knowing if your management actions are working or if you need to do something different. This can also be referred to as "adaptive management".

Vision and Goals

The Dunes Collaborative set forth a vision for future conservation of the Guadalupe Nipomo Dunes Complex:

The Dunes Collaborative promotes connected and continuous coastal dune complexes which support a diverse and healthy native ecosystem where plants and wildlife thrive and the dynamic nature of the dunes is preserved. These dunes will provide places of wonder for the local community, visitors, and future generations to explore and enjoy.

In order to promote this vision, the Dunes Collaborative identified the following goals for effective design of a Conservation Strategy:

Dune Protected Areas Network

The backbone of this Conservation strategy is a network of high priority conservation areas which promote the conservations goals, called the "Dune Protected Areas Network", or DPA Network. The DPA Network is based loosely on the "Green Infrastructure Network" concept (Figure 1) used in urban environments to protect natural habitats and pathways. It is an interconnected system of protected natural areas that conserve ecosystem functions while providing benefits for wildlife (Benedict, Edward, & McMahon, 2002). Each DPA consists of *core areas* and *hubs*, which are connected by *linkages*.

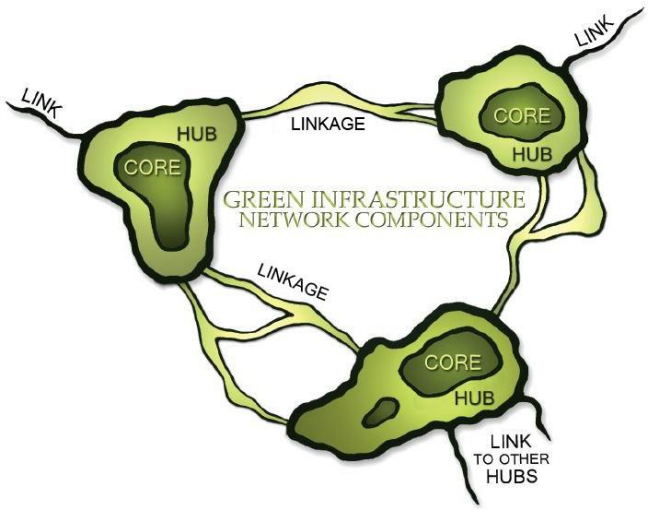


Figure 1: Green Infrastructure Network. The Dune Protected Network is roughly based on the Green Infrastructure Network used to create wildlife pathways through urban areas.

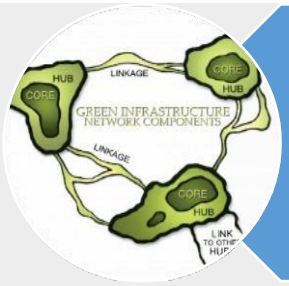
Core areas are the nucleus of the network and are chosen by their biological significance or pristine example of unique habitat. The core areas were first selected using conservation modeling software; a tool being used around the world to efficiently select unbiased areas for conservation. Consultation with local biological experts, professional recommendations and available occurrence data of rare and listed species finalized the selection of each core area. These selected core areas are relatively undisturbed and have low invasive species intrusion.

Hubs buffer the core areas to offer additional protection against invasion and disturbance. These extensions of the core areas allow for less fragmentation of habitat types and offer continuous native cover. Hubs may contain multiple core areas, connecting them together as a unit.

Linkages are linear features connecting hubs together to facilitate wildlife movement, seed dispersal, and gene flow between core areas freely. Connectivity between hubs is essential for preservation of species in perpetuity. Connectivity was analyzed using Linkage Mapper software specifically designed to support regional wildlife habitat connectivity analyses (McRae & Kavanagh, 2011). The output of the software was modified to meet the needs of each DPA.

Management Strategy

Creation and management of this DPA Network is built around four key design elements:



1. Maintain intact (viable) landscapes - The intent of this element is to protect and improve the ecological integrity and long-term viability of the more intact (core) landscapes of the Dunes. Within these areas, priority actions would be to: repair historic impacts, remove threats and reinstate ecological processes.

2. Reverse declines - This element aims to stem species declines and reinstate critical ecological processes (such as ecological succession and pollination). Within these areas, priority actions would reinstate natural dune succession and open space habitat.

3. Recover threatened species and ecological communities - This element ensures the long-term persistence of species and ecosystems at immediate risk of extinction in the wild. The actions required to implement this work are specific to individual species and ecosystems, but typically focus on increasing distribution and abundance and halting declining trends.

4. Control emerging threats - This element addresses threats to our vision of the Dunes before their impacts are fully realised. The more pervasive threats to the Dunes include climate change and invasive species. Actions promoted to adapt to a changing climate include: Passive adaptation to improve resilience of ecosystems by maintaing functional areas (DPAs) and ensuring representativeness of habitats. The other emerging threat is arrival, spread and impact of invasive species. Actions to address this threat include prevention, early detection and rapid response, and containg spread.

Essential to the concept of the DPA Network is flexibility. While initial management may only be able to focus on a handful of priority areas, the concept is that management will expand to other priority areas as resources become available.

Workplan

This work plan supports the restoration and preservation of three DPAs (Figure 2):

- Guadalupe-Nipomo Dunes National Wildlife Refuge/Chevron Successional Dune DPA
- Black Lake Ecological Area DPA
- Point Sal Reserve DPA

The following document describes the objectives and actions that will be implemented to enhance and protect the unique habitats found with the GNDC. Each DPA will be monitored to ensure the objectives are being met following adaptive management protocols given in this document. An annual budget of $125,000 over three years will be used to preserve and promote important ecosystem services within each DPA.

Table 1: Total Annual Cost for Years 1-3.

Task	**Annual Budget**
Task 1: National Wildlife Refuge	$ 57,403.00
1.1 European beachgrass	$ 38,695.26
1.2 Iceplant	$ 18,707.75
Task 2: Black Lake Ecological Area	$ 63,791.00
2.1 Perennial veldt grass	$ 51,702.25
2.2 Nipomo lupine buffers	$ 7,727.50
2.3 European beachgrass	$ 4,361.25
Task 3: Point Sal	$ 3,806.00
3.1 Jubata grass	$ 3,806.00
Total Annual Cost	**$ 125,000.00**

Figure 2: Dune Protected Area Network and the linkages that connect them established in 2018. Purple highlighted DPAs are the focus of this work plan.

Task 1. Guadalupe-Nipomo Dunes National Wildlife Refuge/Chevron Successional Dune DPA

The Guadalupe-Nipomo Dunes National Wildlife Refuge/Chevron Successional Dune, Dune Protected Area (NWR/CSD DPA) spans the entire longitude of the Guadalupe Dunes region of the GDNC including both major properties Guadalupe-Nipomo Dunes National Wildlife Refuge (Refuge) and the Guadalupe Restoration Site (also known as the Chevron Restoration Site) (Figure 3). It includes important shore and foredune habitat to the west and is bordered by agricultural buffer lands to the east. The DPA protects the widest successional dune in the GNDC, reaching 3 miles from shore to the eastern GNDC boundary edge. Preserving the successional changes within the dune habitats is a major element of this DPA. All the habitats from the shore and foredunes, back to the stabilized coastal dune scrub are preserved as one element. This allows for species adaptability, as habitats change successionally and creates natural corridors through this region of the GNDC.

The primary purpose of this task is to perform habitat restoration in the NWR/CSD DPA to maintain intact (viable) landscapes; reverse species and ecological process declines; recover threatened species and ecological communities; and control emerging threats. This task has been identified as a high priority in the Dune Protected Areas Conservation Strategy which identifies critical areas and restoration opportunities to maintain the health of the GNDC (The Land Conservancy of San Luis Obispo County, 2018). This project would build upon a legacy of work done at the site to ensure long-term success and prevent loss of effort. Key work proposed at the site includes European beachgrass (*Ammophila arenaria*) management, and selective iceplant (*Carpobrotus* spp.) control.

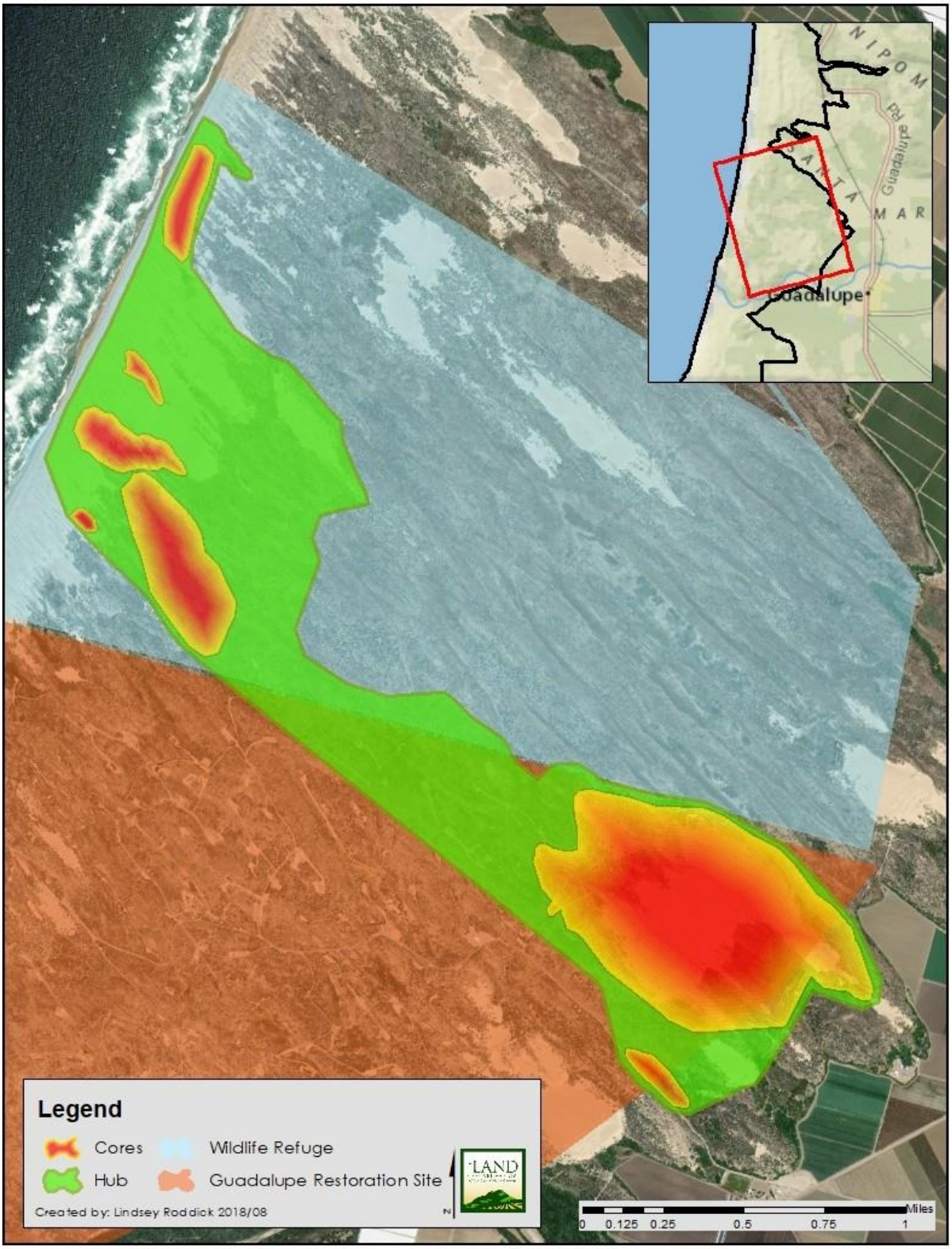


Figure 3: The Guadalupe-Nipomo Dunes National Wildlife Refuge/Chevron Successional Dune, Dune Protected Area (NWR/CSD DPA).

Task 1.1: European beachgrass control

Objective 1A: Reduce and maintain European beachgrass cover to 1-5% cover class by year 3 in the NWR/CSD DPA (Hub & Core).

Action 1A.1: Control European beachgrass within the NWR/CSD DPA (160.96 acres gross).

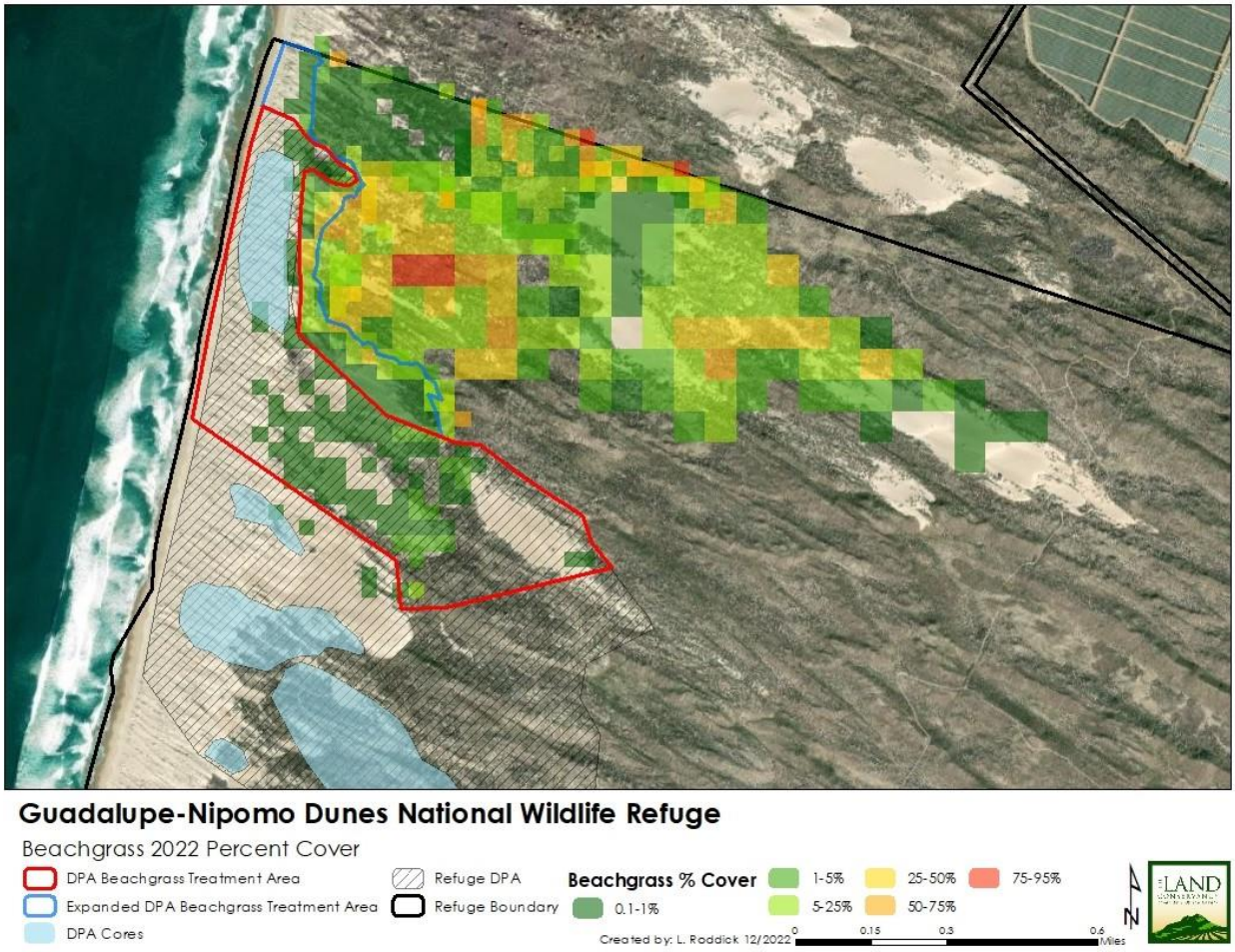


Figure 4: European beachgrass cover within the Refuge based on the most up to date information (initial survey completed in 2016 and has periodically been updated within actively managed areas).

Methods:

European beachgrass predominantly spreads through underground rhizomes with a limited seedbank. This buried rhizome system can be very dense and can survive sand burial of up to 3.3 m. Successful control of the plant depends heavily on the ability to kill this underground rhizomatous root structure.

Much work has been done evaluating the effects of different treatments on beachgrass in coastal dune systems. Hand removal has proven to be expensive and relatively ineffective as one needs to continually remove biomass until the below ground root system becomes starved. Burning above ground biomass followed by herbicide treatments have proven successful but is difficult in this area due to nearby residences and air quality restrictions in the area. Unfortunately, grass specific herbicides have also proven to be ineffective. Foliar applications of glyphosate can be effective if timed correctly when the plant is actively growing, and the phloem is translocating downward into the roots. But experience has shown glyphosate applications alone require a high application rate and require several years of follow-up treatment due to re-sprouting from the root-mass.

The most effective method currently used involves a foliar application of herbicides containing glyphosate mixed with those containing imazapyr. Imazapyr is an amino acid synthesis inhibitor that has soil residual activity that is able to move into the soil profile and kill the extensive root system. This typically requires one large application followed by several years of follow-up treating re-spouts. The level of effort drops off significantly after the first year. Because imazapyr is a broad-spectrum herbicide, off target damage must be expected. Monitoring native plant regeneration after treatment is necessary to ensure good recovery of the native plant community. If this is not happening, supplemental seeding may be required.

In foredune situations, rhizomes should be "ripped" with a bulldozer to break up the unnaturally stabilized dunes and re-establish natural dune processes. This process would be difficult to implement on the Refuge due to access and the density of rare species found within the foredune habitat.

Treatment Schedule:
Herbicide Treatments will involve one treatment event per year. Treatment over the last 4 years have considerably decreased the precent cover within the DPA. Annual treatment will involve follow-up monitoring and spot treatments of any re-sprouts. The treatment area will be expanded if time and resources allow. The table below highlights the expected timing of treatment strategies.

Table 2: Seasonal treatment strategies for European beachgrass.

Treatment Strategies for Invasive Plants in Guadalupe Nipomo Dunes Complex																
Species Name	Treatment Method(s)	Specific Conditions	Minimum Treatment Duration	WINTER			SPRING			SUMMER			FALL		
				Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
European beachgrass (*Ammophila arenaria)*	Perennial Grass -- Life cycle:			Reduced growth			Active growth				Flower		Fruit		
	Chemical	not water stressed	2+ Years				Tank Mix Roundup Pro Conc 2.0 % - Imazapyr 1% v/v foliar spray								

Task 1.2: Highway Iceplant (*Carpobrotus edulis*) and Sea fig (*C. chilensis*) control

Objective 1.2: Reduce and maintain iceplant cover to 1-5% cover class by year 3 in the selected treatment area.

Action 1.2: Control iceplant within the purposed treatment area (72.22 acres gross) to build on already established iceplant work.

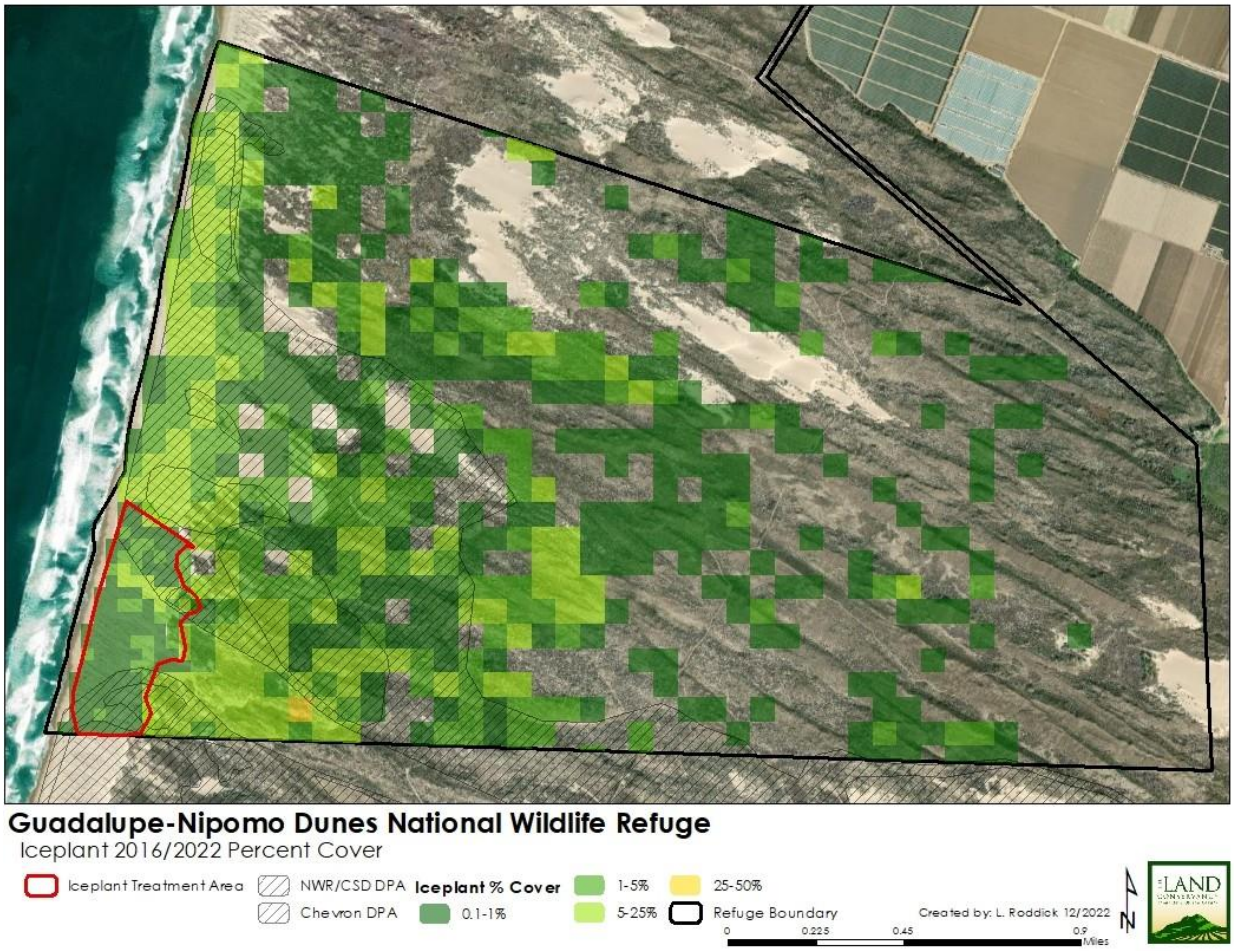


Figure 5: Iceplant cover within the Refuge based on the most up to date information (initial survey completed in 2016 and has periodically been updated within actively managed areas).

Methods:

Iceplant reproduces both vegetatively through stem fragments and by seed. Seeds are inside "berry-like" capsules that may persist for months on the plant. Fruits primarily spread when animals such as deer, rabbits and rodents feed on them. Seeds that pass through an animal's gut germinate more readily than those that do not. Fruits not eaten become hard making seeds

dormant until the fruit decomposes in about three years (DiTomaso, J.M., G.B. Kyser et. Al 2013).

Hand removal has proven effective but is labor intensive. Removal can also be done with heavy machinery if available, like a skid steer. All live plants and stem fragments must be removed from contact with soil to remove re-sprouts. For the initial treatment, we recommend herbicide applications of glyphosate containing products. This has proven to be the most effective control strategy in CA. Applications should be made to actively growing plants. This will be timed to avoid nesting season for Western snowy plover and CA least tern (March-September). The dead biomass from iceplant can make the normally harsh dune system more susceptible to secondary invaders. It will be important to monitor treated areas to ensure secondary invaders don't replace the iceplant.

Treatment Schedule:
Broadcast applications will occur within dense patches and spot treatments within areas of previous treatment. Areas of previous treatment will need to be scanned carefully for any hidden sprouts.

Table 3: Seasonal treatment strategies for iceplant species.

Treatment Strategies for Invasive Plants in Guadalupe Nipomo Dunes Complex																
Species Name	Treatment Method(s)	Specific Conditions	Minimum Treatment Duration	WINTER			SPRING			SUMMER			FALL		
				Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
PERENNIALS & BIENNIALS															
Sea fig (*Carpobrotus chilensis*)	Perennial Herb -- Life cycle:				Active Growth			Flower						Senescence	
	Manual	before seeding	2+ Years		Hand remove plants including root before fruiting. Plants left on-site may re-root										
	Chemical	not water stressed	2+ Years		Roundup Pro Conc (glyphosate) @ 1.6 qt/acre broadcast or 1.6% v/v foliar spot spray										
Iceplant (*Carpobrotus edulis*)	Perennial Herb -- Life cycle:			Growth	Flower			Fruit							Active
	Manual	not water stressed	2+ Years		Hand remove plants including root before fruiting. Plants left on-site may re-root										
	Chemical	not water stressed	2+ Years		Roundup Pro Conc (glyphosate) @ 1.6 qt/acre broadcast or 1.6% v/v foliar spot spray										

Task 1 Cost Estimates:

Table 4: Cost estimates for annual work completed within the NWR/CSD DPA.

Task	Annual Budget
Task 1: National Wildlife Refuge	$ 57,403.00
1.1 Beachgrass	$ 38,695.26
1.2 Iceplant	$ 18,707.75

Task 2. Black Lake Ecological Area DPA

Black Lake Ecological Area DPA is owned and managed by The Land Conservancy of San Luis Obispo County (LCSLO) and is bordered by Oceano Dunes State Recreational Area to the south and Dune Lakes Limited (privately owned) to the north (Figure 6). This DPA is at the western terminus of Black Lake Canyon, with a relatively intact wetland and creek to the east. Highway 1 and the California Pacific Railway divide the DPA and offer significant challenges to faunal movement throughout the GNDC. A stand of old blue gum eucalyptus (*Eucalyptus globulus*) trees still surrounds what used to be an agricultural field neighboring Black Lake.

The main goal of LCSLO's management of the Black Lake Ecological Area (BLEA) is to preserve wildlife habitat and protect rare and special status species. It is the conservation site for a satellite population of the Nipomo lupine overseen by the Cheadle Center for Biodiversity and Ecological Restoration of University of California, Santa Barbara. Nipomo lupine (*Lupinus nipomensis*) was first described near this DPA, but natural populations have since become extirpated. The plant is now present and currently reproducing within BLEA thanks to efforts of the UCSB's Cheadle Center. The reintroduction was part of a strategy identified by the US Fish and Wildlife Service to better protect the species from extinction due to habitat conversion and climate change.

This task would build upon a legacy of work done at the site to ensure long-term success and prevent loss of effort. Key work proposed at the site includes perennial veldt grass (*Ehrharta calycina*) and European beachgrass control as well as invasive species control near known Nipomo lupine locations.

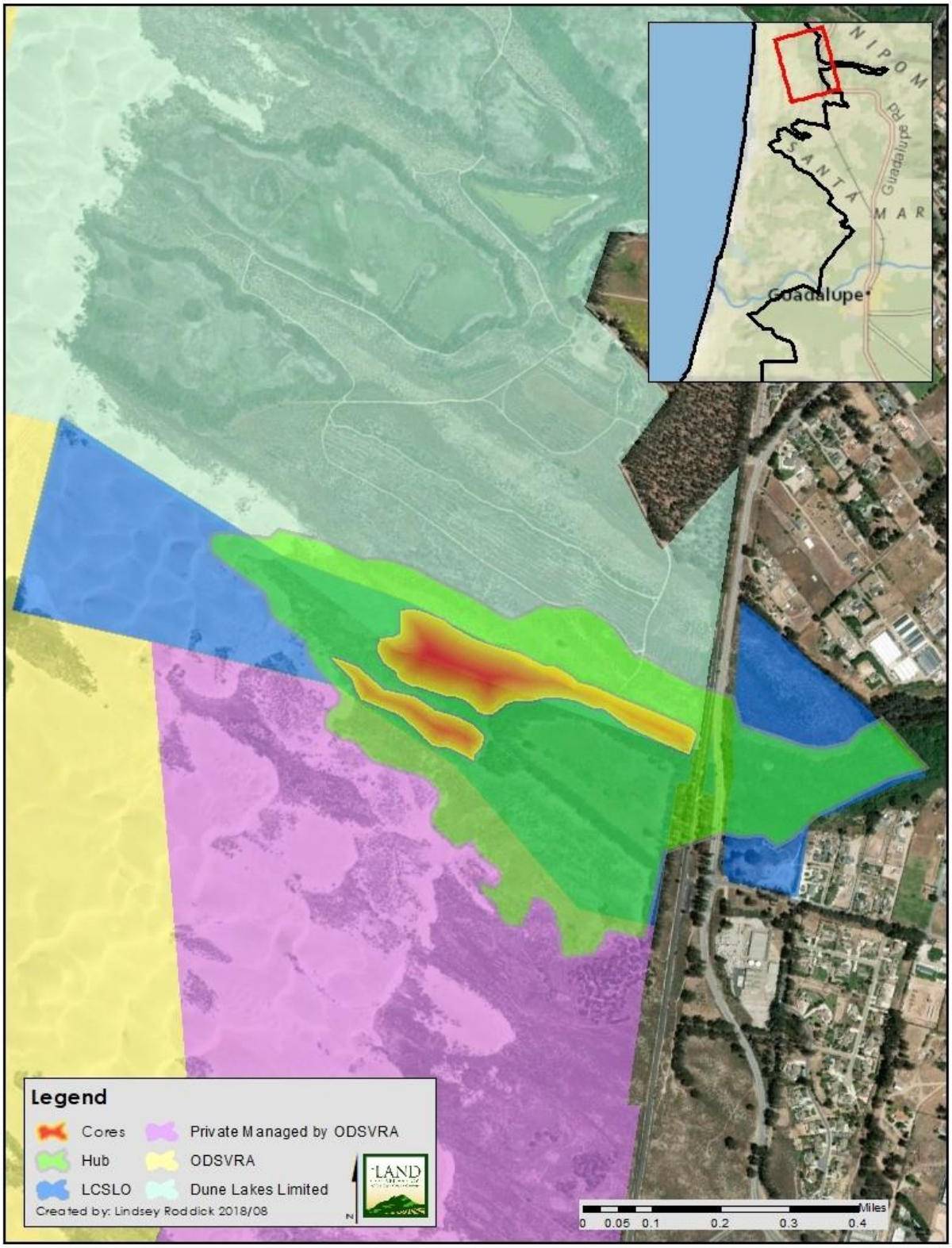


Figure 6: Black Lake DPA

Task 2.1: Perennial veldt grass (*Ehrharta calycina*) control

Objective 2.1: Reduce and maintain perennial veldt grass cover to 1-5% cover class by year 3 in the BLEA DPA (Hub & Core).

Action 2.1: Control perennial veldt grass within the BLEA DPA (Cores and Hub) (129.19 acres gross) while creating defensible spaces to minimize reintroduction from plant propagules.

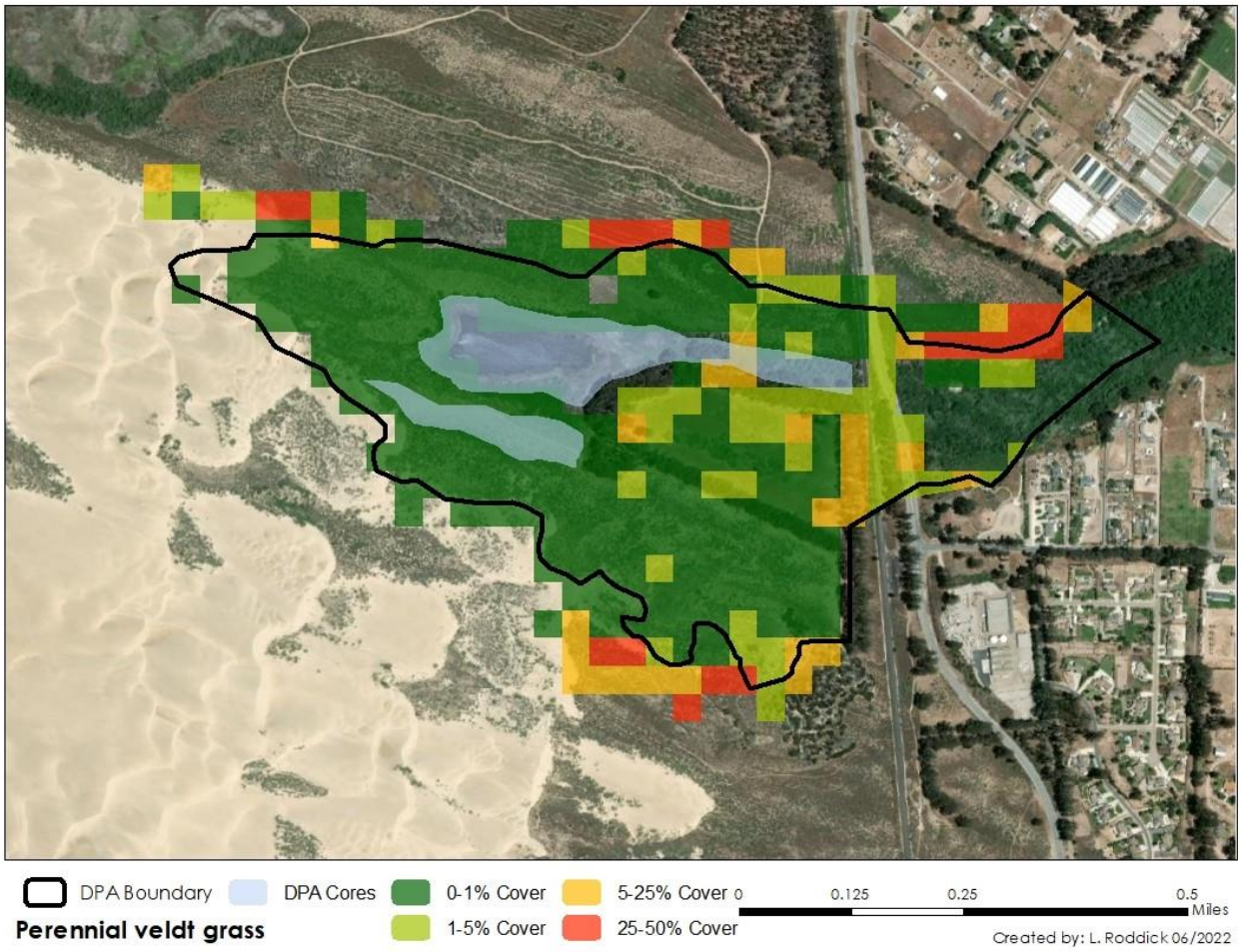


Figure 7: Perennial veldt grass cover within the BLEA DPA based on the most up to date information (surveyed in February 2022).

Methods:
Perennial veldt grass is a cool season perennial grass with a C3 photosynthetic pathway. Reproduction is by seed and short rhizome. Dispersal mechanisms include wind, water, birds and mammals. It develops large, but relatively short-lived seedbanks. The seedbank can be significantly reduced within 5 years. The rhizomes are used as a strategy to survive periods of drought and can be a source of resprouting after herbicide treatments. New plants can flower and set seed within 1 year and there can be multiple seeding events throughout the year.

For small infestations, manually remove the plants ensuring crown removal. Dense infestations will be treated with a broadcast application of a grass specific herbicide such as Arrow 2EC (clethodim) to minimize off-target damage to natives. Once the population is reduced to spot treatments, herbicides can be switched to a non-selective herbicide such as Roundup Pro Conc (glyphosate). Treatments typically occur in two large spraying events with follow-up spot treatments or hand removal to eliminate any plants that escaped the initial treatments. Of the three grass herbicides available for use on veldt grass, Arrow 2EC (clethodim) shows the most promise for control. It is also important to note that herbicide resistance to clethodim by an *Ehrharta* species has been documented in Australia after 7 years of use. This is a good reminder to switch up the herbicide mode of action periodically to ensure herbicide resistance does not develop in the GNDC.

Grass herbicide treatment timing typically occurs in the wetter winter season. These herbicides are most effective on actively growing plants before the "boot stage" when flower heads begin to form in the grass. After this time, glyphosate based herbicides becomes much more effective than the grass herbicides.

After three years of control, areas not successfully recolonizing through the native seedbank should be augmented with additional native seed applications. Seeding rates will vary based on the species being broadcast.

The DPA is surrounded by dense, previously untreated areas of perennial veldt grass which provides a constant influx of new seed to the edges of the project area. Areas along the border will be treated with an aerial application of herbicide to save money until the population is brought to a manageable level. Follow-up in those areas will be done using ground based applications.

Treatment Schedule:
Herbicide treatments will involve two broadcast treatment events per year. Consistent treatment over the last 4 years has significantly reduced veldt grass cover within the DPA. Treatment will now focus on maintaining low cover and reducing cover along the boundaries. Although the seedbank is short-lived, the chance for re-introduction is high. Treatment of perennial veldt grass anywhere in the GDNC should be considered a long-term endeavor requiring diligent follow-up. The table below highlights the expected timing of treatment strategies.

Table 5: Seasonal treatment strategies for perennial veldt grass.

Treatment Strategies for Invasive Plants in Guadalupe Nipomo Dunes Complex																
Species Name	Treatment Method(s)	Specific Conditions	Minimum Treatment	WINTER			SPRING			SUMMER			FALL		
				Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
PERENNIALS & BIENNIALS															
Perennial Veldtgrass (*Ehrharta calycina*)	Perennial Grass -- Life cycle:			Reduced growth			Active growth				Flower		Fruit		
	Manual	before seeding	5+ Years		Hand remove plants including root before fruiting. Plants left on-site may re-root										
	Chemical	not water stressed, applied to early growth stage of plant	5+ Years	Poast 1.5 pt product/acre - foliar spray			Poast 1.5 pt product/acre - foliar spray								
	Chemical	not water stressed	5+ Years		Roundup Pro Conc 1.5% v/v foliar spray			Roundup Pro Conc 1.5% v/v foliar spray							
	Chemical	not water stressed, applied to early growth stage of plant	5+ Years	Fusilade DX 1-1.5 pt product/acre - foliar spray			Fusilade DX 1-1.5 pt product/acre - foliar spray								

Task 2.2: Nipomo lupine reintroduction

Objective 2.2: Reduce and maintain invasive plant cover to 0-1% within a 25-foot buffer of Nipomo lupine populations by year 3.

Action 2.2: Control invasive plants within the 25 ft. buffer area of Nipomo lupine population (90 plots, approximately 4 acres)

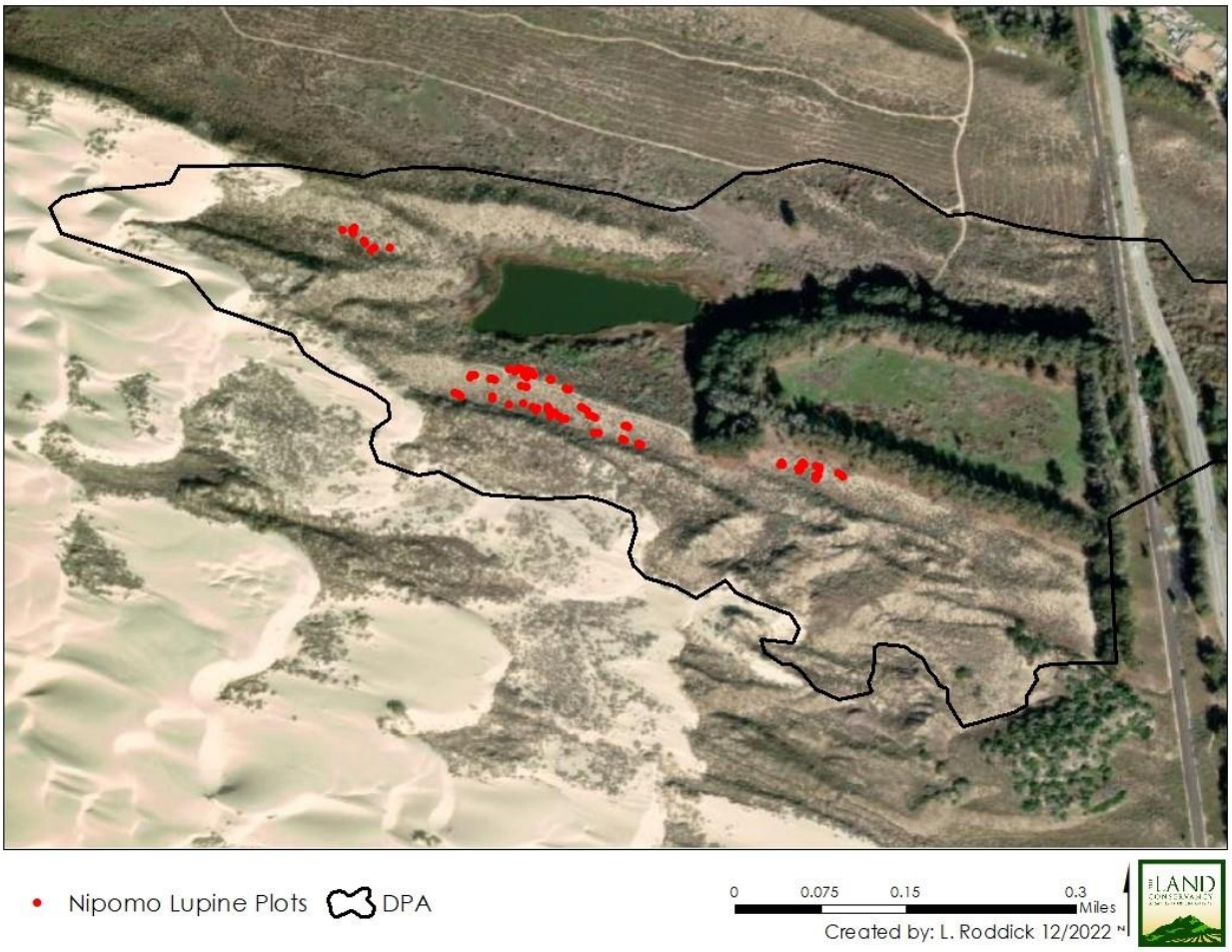


Figure 8: Nipomo lupine plots within the BLEA DPA.

Methods: According to the Land Conservancy's 2081(a)-15-003-RP Permit with the CA Department of Fish and Wildlife, invasive plant control with a 15-25 ft. buffer of Nipomo lupine plants can only be performed using manual removal techniques. Hand pulling invasive plants can be an effective strategy in small areas, however the site must be revisited several times during the year, especially after big rain events. The predominant weeds impacting Nipomo lupine are perennial veldt grass and Saharan mustard.

Treatment Schedule:

Table 6: Seasonal timing of manual removal for perennial veldt grass and saharan mustard.

Treatment Strategies for Invasive Plants in Guadalupe Nipomo Dunes Complex																
Species Name	Treatment Method(s)	Specific Conditions	Minimum Treatment Duration	WINTER			SPRING			SUMMER			FALL		
				Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
Saharan mustard (*Brassica tournefortii*)	Annual Herb -- Life cycle:			Active Growth		Flower	Fruit							Emergent	
	Manual	before seeding	3+ Years		Hand remove plants including root before fruiting.										
Perrenial Veldtgrass (*Ehrharta calycina*)	Perennial Grass -- Life cycle:			Reduced growth			Active growth				Flower		Fruit		
	Manual	before seeding	5+ Years		Hand remove plants including root before fruiting. Plants left on-site may re-root										

Task 2.3: European beachgrass control

Objective 2.3: Reduce and maintain European beachgrass cover to 0-1% cover class by year 3 in the BLEA DPA (Hub & Core).

Action 2.3: Control European beachgrass within the BLEA DPA (31.09 acres gross) and coordinate with neighboring State Parks to control beachgrass on their property along the boundary of the DPA.

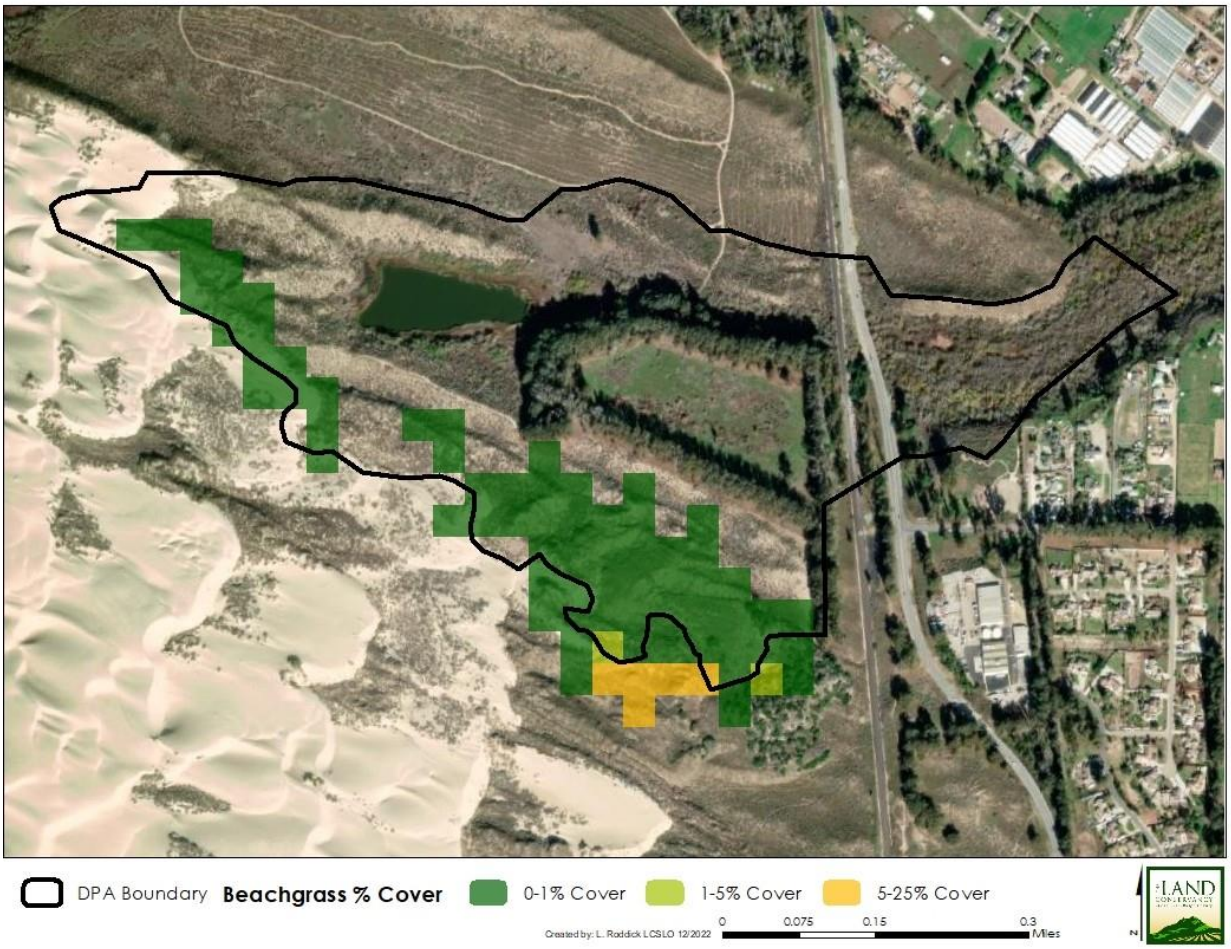


Figure 9: European beachgrass cover within the BLEA DPA based on the most up to date information (surveyed in February 2022).

Methods:

European beachgrass predominantly spreads through underground rhizomes with a limited seedbank. This buried rhizome system can be very dense and can survive sand burial of up to 3.3 meters. Successful control of the plant depends heavily on the ability to kill this underground rhizomatous root structure. Much work has been done evaluating the effects of different treatments on beachgrass in coastal dune systems. Hand removal has proven to be expensive and relatively ineffective as one needs to continually remove biomass until the below ground root system becomes starved. Burning above ground biomass followed by herbicide treatments have proven successful, but is difficult in this area due to nearby residences and air quality restrictions in the area. Unfortunately, grass specific herbicides have also proven to be ineffective. Foliar applications of glyphosate can be effective if timed correctly when the plant is actively growing, and the phloem is translocating downward into the roots. Unfortunately, glyphosate applications alone require a high application rate and require several years of follow-up treatment due to re-sprouting from the root-mass. The most effective method currently used involves a foliar application of herbicides containing glyphosate mixed with those containing imazapyr. Imazapyr

is an amino acid synthesis inhibitor with soil residual activity that is able to move into the soil profile and kill the extensive root system. This typically requires one large application followed by several years of follow-up treating re-sprouts. The level of effort drops off significantly after the first year. Because imazapyr is a broad-spectrum herbicide, off target damage is expected. Monitoring native plant regeneration after treatment is necessary to ensure good recovery of the native plant community. If this is not happening, supplemental seeding may be required.

In foredune situations, rhizomes should be "ripped" with a bulldozer to break up the unnaturally stabilized dunes and re-establish natural dune processes. However, at this site, the habitat is coastal dune scrub and soil stabilization is desirable. Although extensive ripping of the root structure is not recommended, some biomass removal and raking is needed to facilitate native plant recruitment.

Treatment Schedule:
Herbicide treatments will involve one treatment event per year. Treatment in the last 4 years has significantly reduced the population. Efforts will now focus on follow-up monitoring and spot treatments of any re-sprouts. The table below highlights the expected timing of treatment strategies.

Table 7: Seasonal treatment strategies for European beachgrass.

Treatment Strategies for Invasive Plants in Guadalupe Nipomo Dunes Complex																
Species Name	Treatment Method(s)	Specific Conditions	Minimum Treatment Duration	WINTER			SPRING			SUMMER			FALL		
				Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
	Perennial Grass -- Life cycle:			Reduced growth			Active growth				Flower		Fruit		
European beachgrass (*Ammophila arenaria)*	Chemical	not water stressed	2+ Years				Tank Mix Roundup Pro Conc 2.0 % - Imazapyr 1% v/v foliar spray								

Task 2 Cost Estimates:

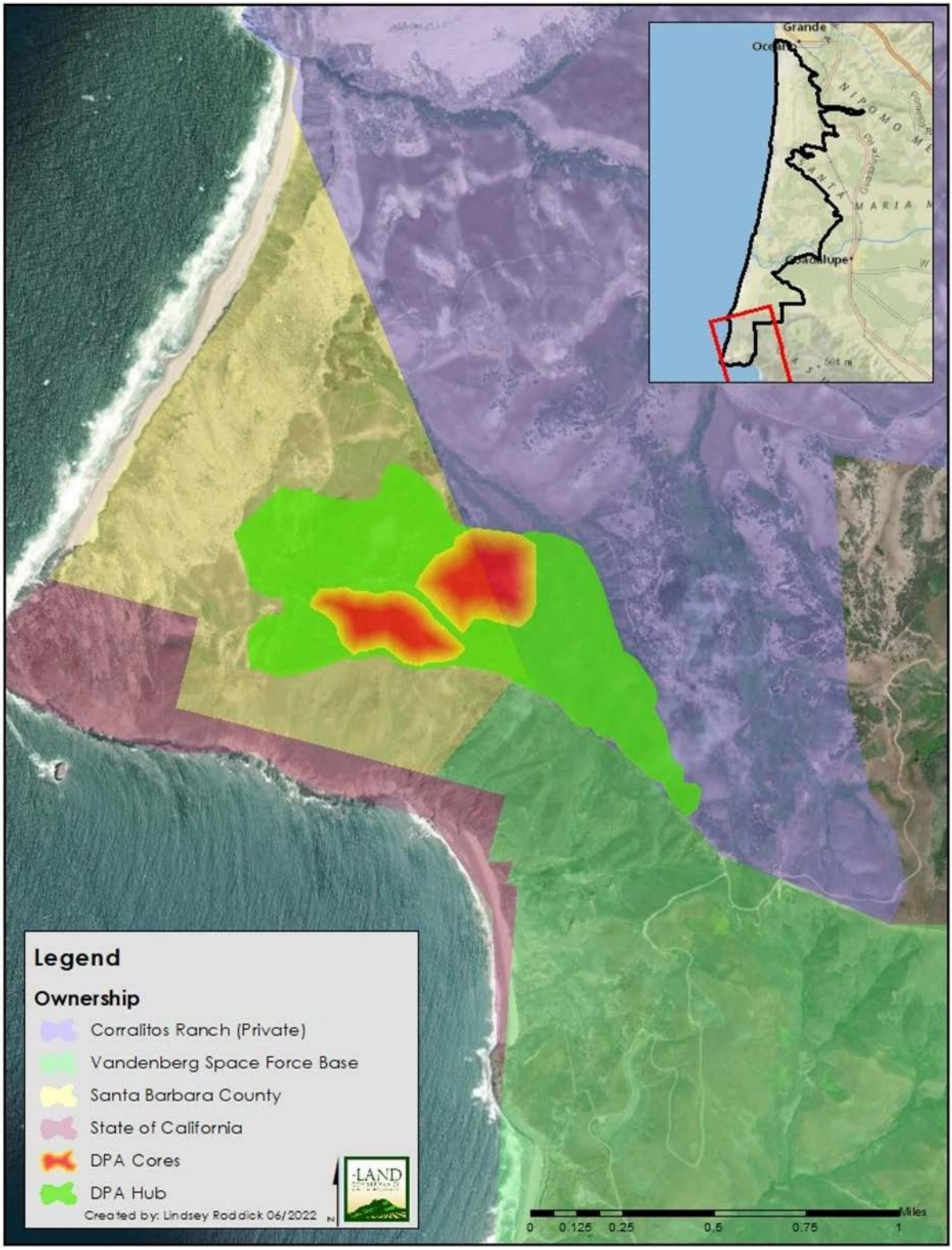
Table 8: Cost estimates for annual work completed within the BLEA DPA.

Task	Annual Budget
Task 2: Black Lake Ecological Area	$ 63,791.00
2.1 Perennial Veldt grass	$ 51,702.25
2.2 Nipomo lupine buffers	$ 7,727.50
2.3 European Beachgrass	$ 4,361.25

Task 3. Point Sal Reserve DPA

Point Sal Reserve is located at the very southern extent of the GNDC and is home to unique maritime chaparral habitat which provides important habitat to a variety of species. Approximately half of this DPA is privately owned and the other half is shared by publicly owned State Parks and Santa Barbara County Parks. South of this DPA is Vandenberg Space Force Base. Access to this region is difficult as you must pass through private property to reach it. An informal agreement is currently in place for access to this site with neighboring private landowners. Hikers recreate in the area through an old trail system and abandoned roads that provide access to the beach and beautiful overlooks. The terrain is difficult, with some areas over 1000 feet in elevation.

While surrounding areas have been altered, maritime chapparal habitat persists within this DPA. Maritime chaparral is a unique habitat which is only found on fog-ridden ridges of the coast. In general, chaparral tends to be less susceptible to human disturbance than coastal dune scrub because it occurs in more stable soils (*Point Sal Reserve Final Management Plan*, 1991). Point Sal Reserve was selected as a DPA because of this maritime chaparral plant community that cannot be found elsewhere in the GNDC. Rare manzanita species, sand mesa manzanita (*Arctostaphylos rudis*) and La purisima manzanita (*Arctostaphylos purissma*) are found in this DPA. This DPA is also located at the confluence of many southern and northern species distributions, offers a unique overlap in species distributions.


Grande
Ocean
NIPOMO
SANTA MARIA
Guadalupe
Legend
Ownership
Corralitos Ranch (Private)
Vandenberg Space Force Base
Santa Barbara County
State of California
DPA Cores
DPA Hub
Created by: Lindsey Roddick 06/2022
N
LAND
Miles
0
0.125
0.25
0.5
0.75
1

Task 3: Jubata grass (*Cortaderia jubata*) eradication:
Objective 3: Eradicate jubata grass within the Point Sal Reserve DPA by year three.

Action 3.1: Control jubata grass within the Point Sal Reserve DPA (1.45 acres gross)

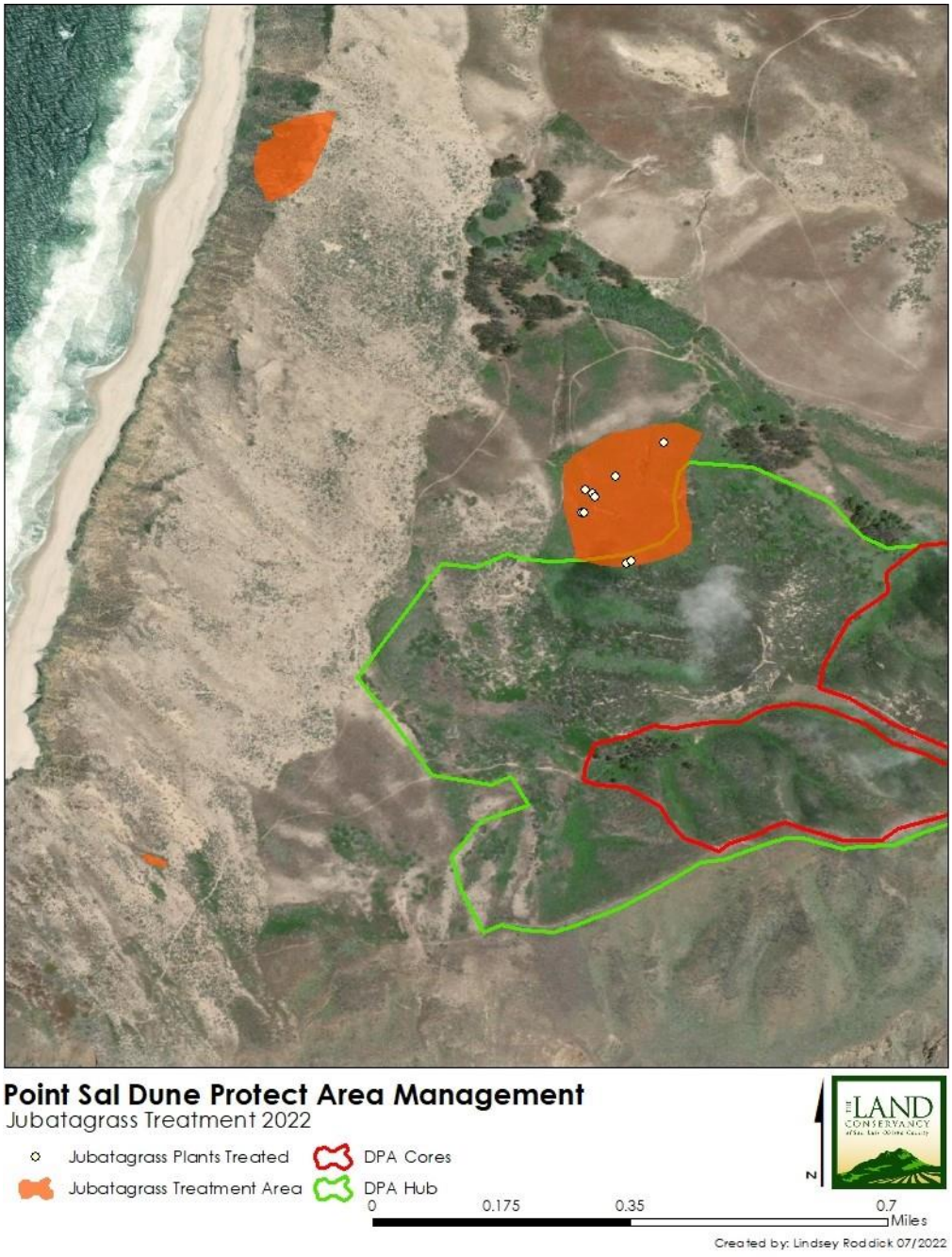


Figure 10: Jubata grass cover near the Point Sal DPA based on the most up to date information (surveyed in June 2022).

Methods:
Jubata grass (*Cortaderia jubata*) is a large perennial grass with a C3 photosynthetic pathway. It spreads by wind dispersed seed. Seed set in the plant is shown to be 100%. The grass requires about 1 year to reach flowering size. The grass can also reproduce vegetatively by stolons, but this seems to be infrequent. The seeds have no dormancy, making the seedbank short-lived. Experiments done by Researches at UC Davis on Vandenberg Airforce Base have shown that the best success was achieved by wiper applications of glyphosate. Due to the short-lived seedbank, eradication can be achieved in three years. However, some populations considered eradicated in San Luis Obispo County had emergence from the seed bank occur 7 years after control, indicating that maybe a few seeds do in fact lay dormant in the seedbank (Jon Hall, Pers. Obs). Although control techniques are fairly simple, jubata grass typically grows on steep inaccessible slopes, making actual control logistics difficult.

Treatment Schedule:
An annual herbicide treatment will take place in the spring or summer.

Table 9: Seasonal treatment strategies for jubata grass.

Treatment Strategies for Invasive Plants in Guadalupe Nipomo Dunes Complex																
Species Name	Treatment Method(s)	Specific Conditions	Minimum Treatment Duration	WINTER			SPRING			SUMMER			FALL		
				Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
PERENNIALS & BIENNIALS															
Jubata grass (*Cortaderia jubata*)	Perennial Grass -- Life cycle:			Reduced growth			Active growth				Flower		Fruit		
	Manual	seedlings	3+ Years				Hand-pull seedlings								
	Chemical	after flowering	3+ Years										8% Roundup Pro Conc- Low-volume foliar spray		

Task 3 Cost Estimates:

Table 10: Cost estimates for jubata grass control at the Point Sal Reserve DPA (3 years).

Task	Annual Budget
Task 3: Point Sal	$ 3,806.00
3.1 Jubata grass	$ 3,806.00

Monitoring Plan

For the DPA Network Conservation Strategy, formal program evaluations will occur in year 3 coinciding with years that monitoring occurs. In those years, monitoring reports will be prepared to evaluate:

- What happened (Management Activity Monitoring),
- Are we meeting our stated Objectives (Monitoring to Inform Management),
- Is our Conservation Strategy working (Baseline Monitoring).

Procedure:

1. Management Activity Monitoring
Management activities will be monitored using a reputable GPS-linked management software. Information will be collected each day work is completed. This data will provide information for reporting, assisting in adaptive management, and measuring success.

Products of activity monitoring include:

- photos from selected photo points (before and after)
- specific amount (acres) and location in which restoration has taken place
- amount of each chemical applied (if applicable)
- notes on restoration activity effectiveness

The preferred activity management software is AgTerra Technologies GIS data management platform. The AgTerra platform integrates mobile mapping, data collection and reporting solutions. Data is collected in the field each day using smartphones or tablets and then uploaded to a cloud-based server. Data is then easily exported into an ESRI ArcGIS format or GoogleEarth. This occurs at the end of each work day and is considered part of daily management activities. A screenshot of the project interface using AgTerra is given in Figure 11.

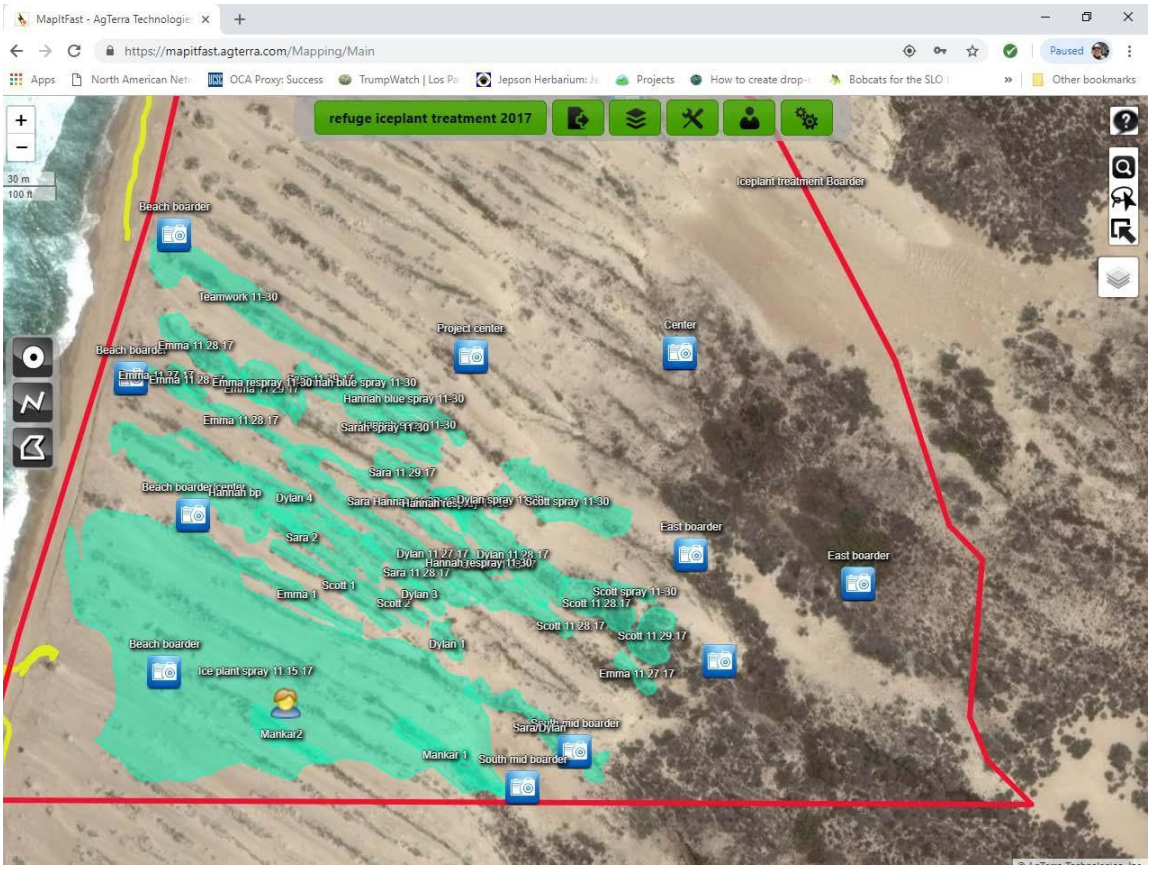


Figure 11: AgTerra project interface for management activity monitoring.

2. Monitoring to Inform Management (Grid Survey)

The objectives outlined in this proposal focus on control or eradication of invasive species to a certain percent cover. When monitoring the success of these objectives, site assessments will use the set grid, polygon, point site assessment method outlined in Appendix A. Percent cover of each invasive species threat will be updated in year 3 and compared to pre-project levels.

3. Baseline Monitoring (Relevé Survey)

To determine if the Conservation Strategy is achieving its higher-level goals, it is important to set up a monitoring program that will track changes over time. Ecosystems are dynamic, none more so than the coastal dune environment. There will be multiple successional trajectories that are possible but tracking species composition and functional groups as they change through time will help us evaluate if our management actions are indeed keeping the dune ecosystem viable and sustainable through time.

The most efficient way to achieve this is by setting up and monitoring vegetation relevés. All relevé monitoring will follow California Native Plant Society standardized relevé protocols. This monitoring method allows for quick classification over a large area. It relies on ocular estimates of plant cover rather than counts of the “hits” of particular species along a transect line or precise

measurements of cover/biomass by planimetric or weighing techniques. Monitoring will take place in year 3 to assess how native biodiversity is changing throughout management as well as assist in adaptive management.

4. Final Reporting
Formal program evaluations will occur in year 3 coinciding with monitoring events. Monitoring reports will be prepared to evaluate:

- What happened (Management Activity Monitoring),
- Are we meeting our stated Objectives (Monitoring to Inform Management),
- Is our Conservation Strategy working (Baseline Monitoring).

Products: Monitoring Report following year 3 summarizing the findings of each of the subtasks described in this procedure. Monitoring Reports will be submitted to the California Department of Fish and Wildlife concluding monitoring and will include a summary of the following:

- A description of the restoration project and its objectives
- Methodology
- Summary of monitoring results
- Description of current state of restoration site
- Conclusions and future adaptive management recommendations

All monitoring data, occurrence updates, and filled data gaps will be housed with The Land Conservancy and shared with partners whenever necessary.

Adaptive Management

Adaptive management is essentially a process for evaluating how well the methods of a plan are meeting the stated objectives and using these evaluations to refine future methods and approaches of the plan. In real life, this happens in the field. On a day to day basis, land practitioners are evaluating the tools and techniques they are using and determining ways to increase productivity while meeting the desired goals. Decisions are made quickly and typically by those that are present. Adaptive management essentially happens without having to name it or formalize the process. However, there is also merit in having a formalized way of gathering information to have more formal processes to reflect on the success of a program and if changes in method, strategy or direction are warranted. This allows more time to work with experts to ensure management is based on the best available science and critical thought.

References

Benedict, M. A., Edward, T., & McMahon, J. D. (2002). Green Infrastructure: Smart Conservation for the 21st Century.

DiTomaso, J. M., Kyser G.B., Oneto, S. R., Wilson, R. G., Orloff, S. B., Anderson, L. W., Mann, J. J. (2013). Weed Control in Natural Areas in the Western United States. Weed Research and Information Center, University of California.

McRae, B. H., & Kavanagh, D. M. (2011). Linkage Mapper Connectivity Analysis Software. Seattle WA: The Nature Conservancy. Retrieved from http://www.circuitscape.org/linkagemapper

Point Sal Reserve Final Management Plan. (1991). Santa Barbara, CA.

The Land Conservancy of San Luis Obispo County. (2018). Dune Protected Areas Network: Creating a Blueprint for Restoration in the Nipomo Dunes Complex Restoration Plan. San Luis Obispo, CA.