Dune Protected Areas Network: A Blueprint for Conservation in the Guadalupe Nipomo Dunes

A project of The Dunes Collaborative (Written by Jon Hall)

Background

The 22,000-acre Guadalupe Nipomo Dunes Complex (GNDC) is an ecological treasure which provides important habitats for hundreds of coastal species. In 1974, the US Secretary of the Interior designated the GNDC as a National Natural Landmark for containing the largest, relatively undisturbed coastal dune tract in California and exhibiting one of the highest rates of endemism of any dunes in North America. Following this, a 1980's inventory of sensitive resources within California, produced by the U.S. Fish and Wildlife Service, described the GNDC as "the most unique and fragile ecosystem in the state…" and ranked it 1st on a list of 49 habitat areas in need of protection statewide (U.S. Fish and Wildlife Service, 2000). The GNDC is home to a wide diversity of species and provides protection for 63 federal and state listed species.

Although there are many threats to these fragile ecosystems, one of the most pervasive threats to the GNDC is the loss of habitat to invasive species. The greatest impact has been the rapid and widespread invasion from South African veldtgrass (*Ehrharta calycina*), European beachgrass (*Amophila arenaria*), and iceplant (*Carpobrotus spp.*). With blowing sands, strong winds and salty air the native dune condition provides successional stages from heavily disturbed/pioneer near the ocean to stabilized back-dunes and oak woodlands farther inland. These successional processes allow for an incredibly diverse community. Unfortunately, widespread invasion by non-native plants are altering these successional processes. Figure 1 shows an excellent example of the effect *E. calycina* has on the coastal scrub community.

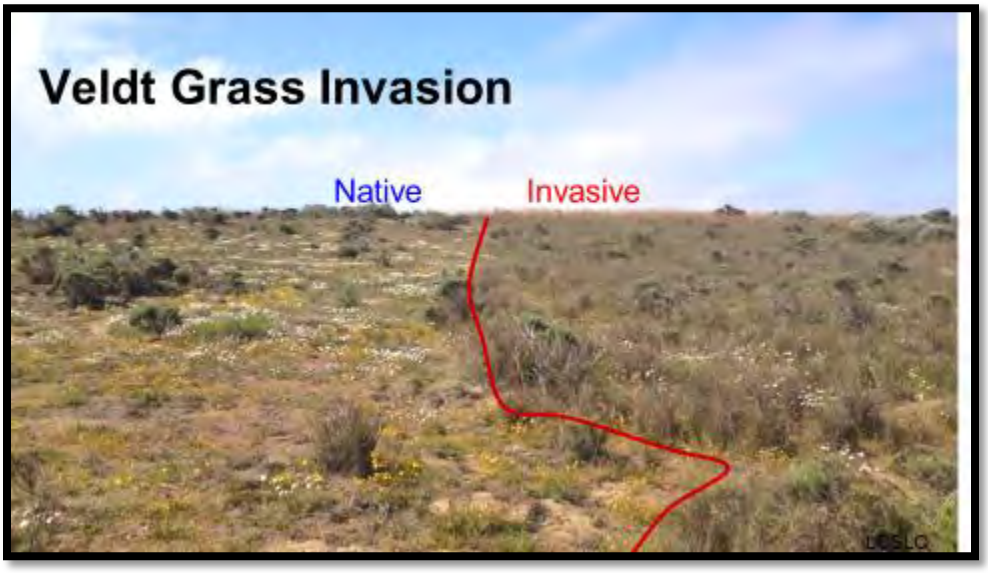


Figure 1: South African veldt grass invasion of coastal scrub habitat (on the right) and under treatment (on the left) releasing the native biodiversity.

Concept and Approach

Although there are continual new invasive species introductions into the GNDC that make early detection and rapid response a high priority, the population size of the three most aggressive invaders has made the possibility of focusing solely on eradicable species infeasible. According to the invasive species growth curve, widespread species fall under a control strategy termed "asset-based protection" (Figure 2). Asset-based protection means controlling only those invasive species populations that directly threaten high-value conservation targets. This is typically the approach with widespread invasive species, for which the only cost-effective approach is localized control to protect nearby valued assets.

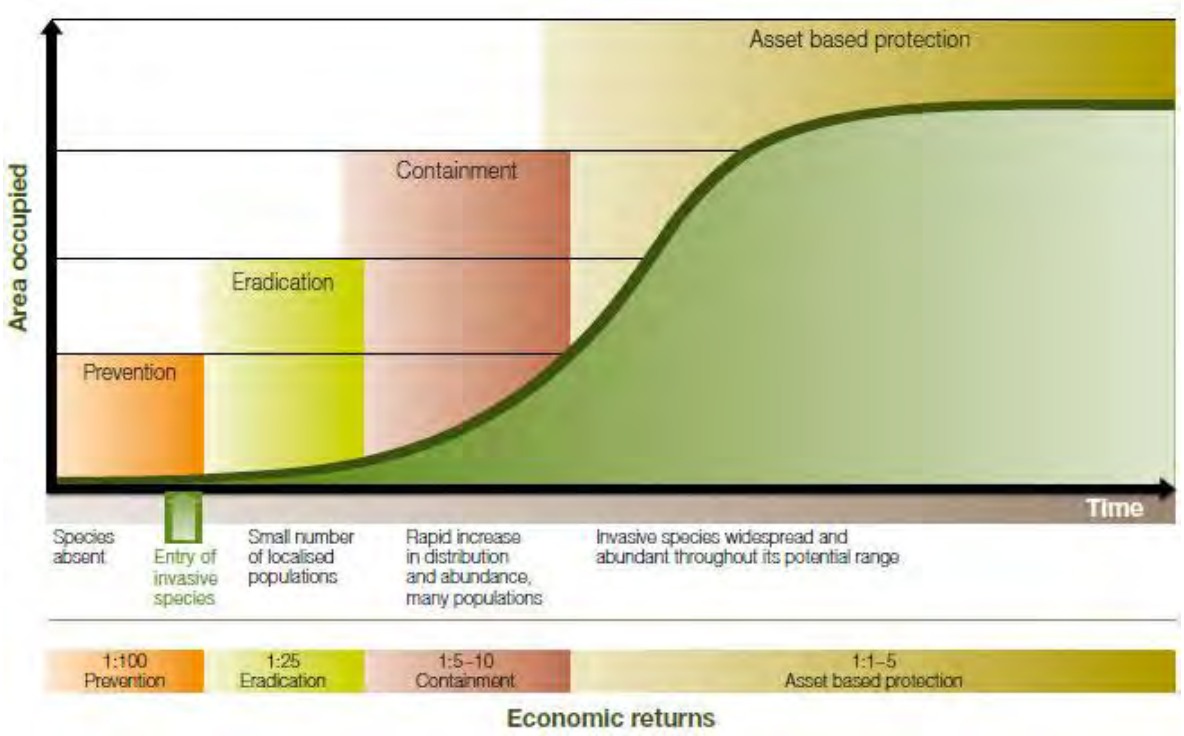


Figure 2: Phases of invasive species invasion and control (the S-curve) and associated management categories. Adapted from (Agriculture Victoria, 2002)

In 2014, the Dunes Collaborative set out to identify which areas in the GNDC would be the focus for this asset-based protection approach. What they came up with was a conservation strategy that identified a network of high priority conservation areas designed to preserve and promote native biodiversity; maximize resiliency to a changing climate; maintain ecological processes that promote the dynamic nature of the dunes; preserve and promote wetland and upland habitat quality and connectivity. They termed this conservation strategy the Dune Protected Areas, or DPA Network (The Land Conservancy of San Luis Obispo County, 2018). The DPA Network is based loosely on the "Green Infrastructure Network" concept (Figure 3) 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.

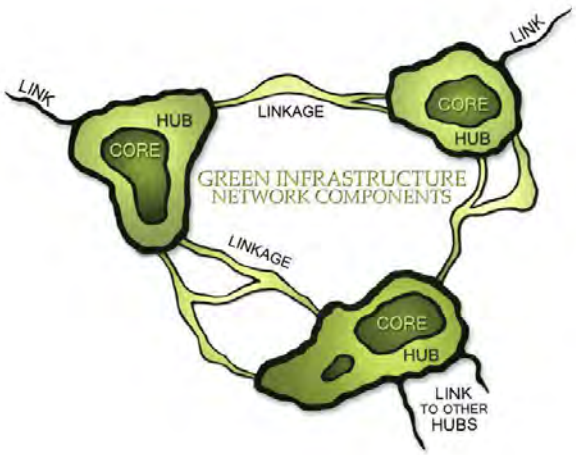


Figure 3: Green Infrastructure Network. The Dune Protected Areas Network is roughly based on the Green Infrastructure Network used to create wildlife pathways through urban areas.

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 the Dunes Collaborative Restoration Task Force, 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 area 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.

Figure 4 shows the location of these Dune Protected Areas.

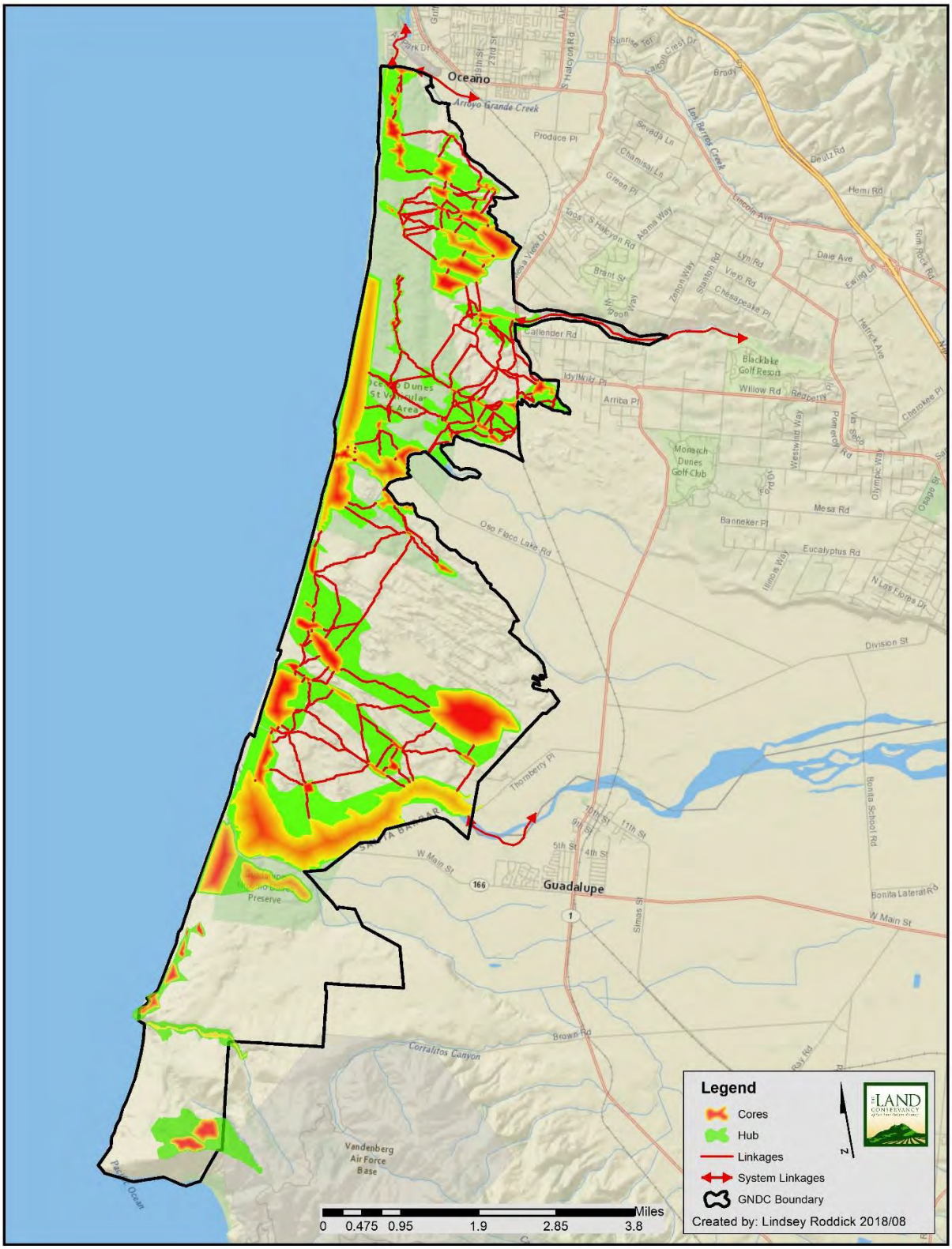


Figure 4: Dune Protected Areas Network in the Guadalupe Nipomo Dunes Complex.

Management Strategy

The Dunes Collaborative has been an important advocate for restoration and preservation of the GNDC's native ecosystem since it was created in 2001. A lot of that work has focused on developing partnerships to address restoration needs in the dunes following a 1998 settlement between various State of California agencies and Unocal for injuries from contamination at the Guadalupe Oil Field in the heart of the GNDC. This settlement was set aside in a trust overseen by CA Department of Fish and Wildlife's Office of Spill Prevention Response and the CA State Coastal Conservancy.

Armed with the Dune Protected Areas Network Conservation Plan, the Dunes Collaborative worked with the agencies that oversee the trust to identify a funding strategy to protect these critical resources. This involved a "knock down phase" where a significant investment was made to do initial treatments of target invasive species to get the population down to 1-5% cover and a "long-term endowment phase" where treated areas are continually resurveyed and managed in perpetuity to ensure successes are sustained. This year (2022) marks the official end of the knockdown phase of this project. Some key results are highlighted below.

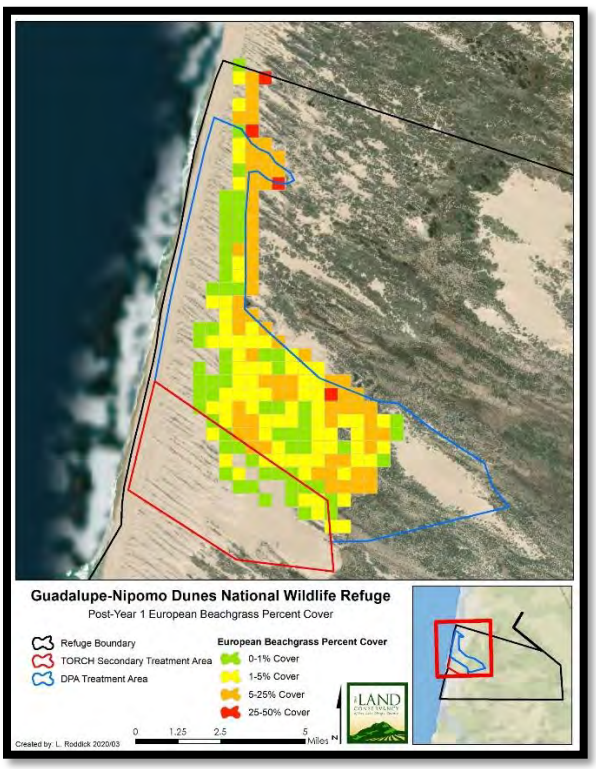
Guadalupe Nipomo Dunes National Wildlife Refuge

Within the Guadalupe Nipomo Dunes National Wildlife Refuge lies the Successional Dune DPA. The main goal in this DPA was to reduce percent cover of European beachgrass (*Amophila arenaria*) and iceplant (*Carpobrotus spp.*) to a 1-5% level by year 4. Treatments were all done on the ground using either truck mounted sprayers or backpacks. Glyphosate products were used on the iceplant while a mixture of glyphosate and imazapyr was used on the European beachgrass. Each treatment area only got one application per year between the months of November and February (outside of western snowy plover nesting season). This project was very successful at meeting its objectives and has also spring-boarded additional funding to expand treatments outside of the DPA. Although there is still propagule pressure on the edges of the DPA hubs, the buffer seems sufficient to protect core areas of the DPA and re-sprouting from previously treated areas is minimal to non-existent. The most difficult aspect to this project is the remoteness and inaccessibility of the property. This makes specialized equipment including tracked UTV's a necessity. When treating areas like this it is important to consider increased costs of mobilization and wear and tear on vehicles driving in sand and salt.

Figure 5: Specialized equipment necessary to transport people, supplies and herbicide to remote areas.

In addition, although we are seeing great native plant recruitment in treated areas, we are also seeing the invasive purple ragwort (*Senecio elegans*) spreading into areas previously occupied by European beachgrass. Secondary invasion often occurs with landscape level control efforts and it is important to anticipate those in advance. Efforts are underway to address the purple ragwort in the entire GNDC.

Figure 5: *Senecio elegans* (close up in picture on the right) growing in a patch of dead beachgrass. This is was common in the southern project area.



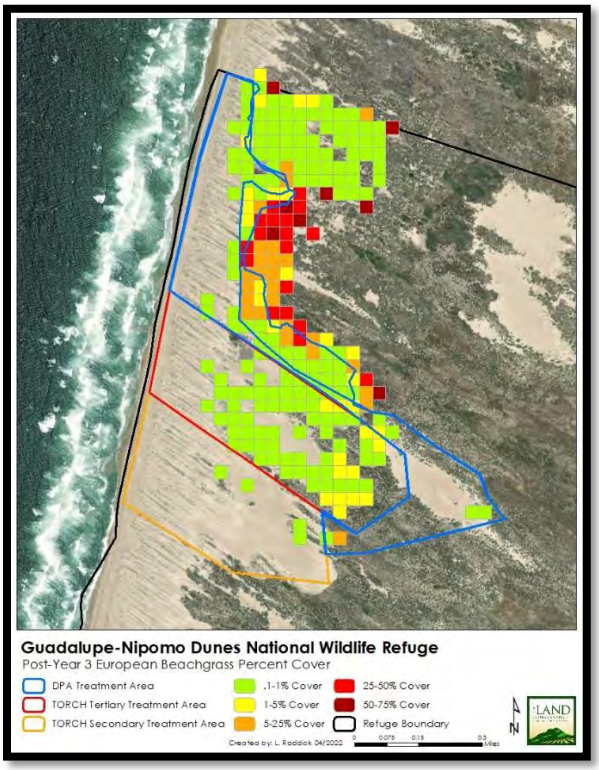


Figure 6: European beachgrass percent cover in the Successional Dune DPA in year 1 vs year 3.

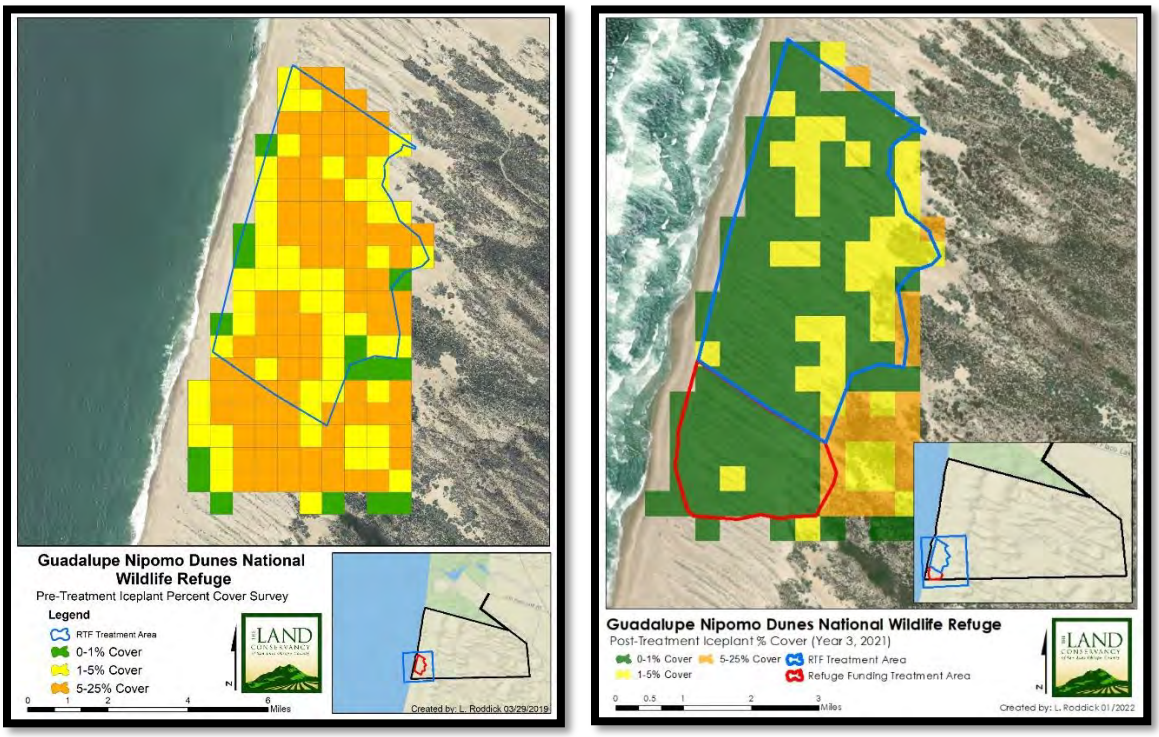


Figure 7: Iceplant percent cover in the Successional Dune DPA in year 1 vs year 3.

Black Lake Ecological Area

The main goal in the Black Lake Ecological Area DPA was to reduce perennial veldtgrass and European beachgrass cover to 1-5% by year 4. Treatment strategies for European beachgrass consisted of an herbicide mixture of glyphosate and imazapyr applied once a year. This tank mix works great and provides outstanding control.

Perennial veldtgrass on the other hand required an entirely different approach. It has a prolific seedbank which can germinate following any decent rain event and established plants can flower and set seed year round. Treatment for veldtgrass involved helicopter applications of a grass specific herbicide with the active ingredient clethodim. Treatments were made two times a year, typically in December and then in March. Follow-up ground treatments were made around sensitive resources. Typically a month after the clethodim treatment another round of control was performed by spot treating with glyphosate or hand removal to ensure nothing went to seed and that no herbicide resistance was developing.

Figure 8: Aerial application of perennial veldtgrass with grass specific herbicide.

Overall, this project has been very successful. The European beachgrass was an easy target and likely will not re-invade the area if we can push the neighboring population back. Perennial veldtgrass on the other hand has a significant seedbank which greatly increases the cost of yearly control and long term maintenance. Helicopter applications have proven very effect. Grasses seem to hide well and ground applicators often will miss about 5% of the plants when they go through an area. By year 4 we are seeing a significant reduction in above ground biomass but it will require at least another year of helicopter treatments before switching to all ground applications. There is a minimal amount of effort required to search an area for veldtgrass. After the initial “knock down phase”, the base level of effort to monitor and treat is significantly higher than in areas that were treated for European beachgrass and iceplant. But, perhaps the greatest lesson for plants like veldtgrass with windborn seed is to create your defensible spaces utilizing topography and wind direction to minimize the chance of reintroduction from neighboring populations. Ultimately, it comes down to weed seedbank dynamics. Plants that don’t reproduce by seed are much easier to eradicate than ones that produce seedbanks. Seedbanks can be long lived and germinate over long time frames. Diligence is required and continuous funding is essential. If you miss one year, the seedbank gets replenished and you are basically starting the clock over.

Figure 9: Veldtgrass treatment are in foreground April 2021. Live veldtgrass can be seen in the distance outside the DPA.

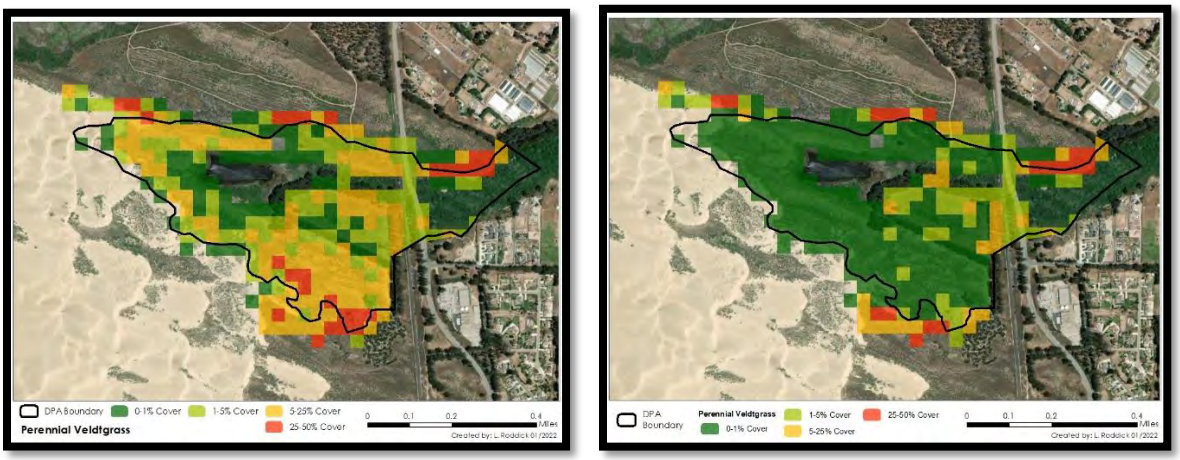


Figure 10: Veldtgrass percent cover comparison after year 1 and year 3 at the Black Lake Ecological Area DPA.

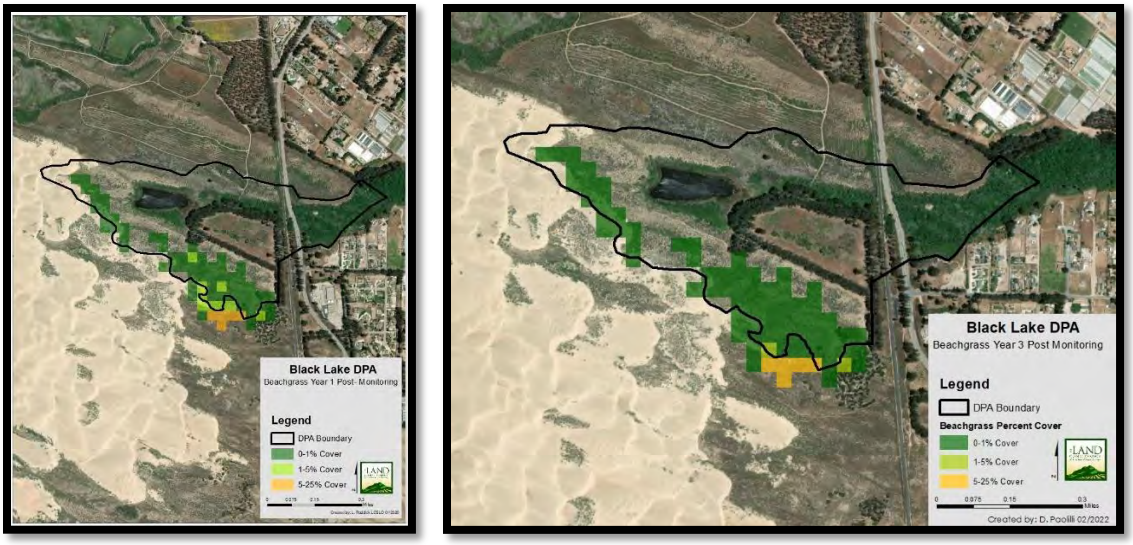


Figure 11: European beachgrass percent cover at the Black Lake Ecological Area DPA comparison of Year 1 and Year 3.

References

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