2010

Biological Monitoring Status Report

Crestridge Ecological Reserve

Prepared for

Endangered Habitats Conservancy

Prepared by

Conservation Biology Institute

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Table of Contents

Executive Summary ES-1
Introduction 1
Sensitive Species Surveys 2
- Methodology 3
- Results 3
- Recommendations 7

Photomonitoring 8
- Methodology 8
- Results 10
- Recommendations 10

Seed Collection 10
- Methodology 11
- Results 12
- Recommendations 14

Grassland Monitoring 14
- Methodology 14
- Results 15
- Recommendations 18

Trail Erosion Monitoring 19
References 20

Figures

1	2010 Sensitive Plant Locations	5
2	Photomonitoring Locations	9
3	Seed Collection Areas	13
4	2010 Species Richness	16
5	Comparison of Species Richness between 2009 and 2010	16
6	2010 Species Cover	17
7	Percent Cover of Litter, Exotic Species, and Native Species	18

Tables

1	Sensitive Plant Species Monitoring Recommendations	2
2	Sensitive Plant Survey Schedule	4
3	Seed Collection Schedule	12

Appendices

A	GPS Locations
B	CNDDB Field Forms
C	Photomonitoring Logs
C	Seed Collection Forms
E	Rancho Santa Ana Botanic Garden Seed Collection Report
F	Grassland Data
G	Trail Erosion

Executive Summary

In 2010, the Conservation Biology Institute (CBI) conducted biological monitoring on the Crestridge Ecological Reserve (CER) in San Diego County, California. Survey efforts focused on detecting and assessing the status of six MSCP priority plant species. Additional sensitive or unique species were mapped or recorded where observed, and invasive species were mapped in selected areas. Additional monitoring activities included seed collection, grassland monitoring, and trail erosion monitoring.

Focused surveys were conducted for two MSCP covered species: San Diego thornmint (*Acanthomintha ilicifolia*), a federally threatened and state endangered species last detected onsite in 2003, and San Diego goldenstar (*Bloomeria clevelandii*), a CNPS List 1B species that had been detected just offsite in 2000, but had not been observed since that time. Both species were detected in 2010. A small population (17 plants) of San Diego thornmint was found on the slopes above Rios Canyon ('Thornmint Hill') and a large population of San Diego goldenstar (ca. 7,400 plants) was detected both on- and offsite in the easternmost portion of the reserve. Presence/absence monitoring for Palmer's grapplinghook indicated that species appears to be stable in clay soils on Thornmint Hill.

Thirteen permanent photomonitoring sites, or photopoints, were established for 4 plant species: San Diego thornmint (1 photopoint), San Diego sagewort (*Artemisia palmeri*, 3 photopoints), Lakeside ceanothus (*Ceanothus cyaneus,* 8 photopoints), and Ramona horkelia (*Horkelia truncata*, 1 photopoint). Baseline photodocumentation was collected at each photopoint as a cost-efficient manner of assessing and recording general habitat conditions and threats to population stability from natural or anthropogenic sources such as erosion, off-road vehicle activity, or equestrian uses. Photomonitoring will supplement more detailed population monitoring which is anticipated to occur every 3-5 years, and is intended to serve as both an 'early-warning' system and provide a long-term (photographic) record of change over time.

Seed collection was conducted for Lakeside ceanothus in the east-central portion of the reserve. Seed collection, a goal for this species in the HMMP, is intended as a 'hedge' against extinction or extirpation by preserving genetic diversity and providing a seed source in the event of catastrophic disturbance. Seed collection was considered a priority after the 2003 Cedar fire, which burned the majority of the Lakeside ceanothus population onsite. Collected seed was transported to Rancho Santa Ana Botanic Garden (RSA) for processing and long-term storage. A small portion of the seed was sent to the USDA National Center for Genetic Resource Preservation in Ft. Collins, Colorado as a backup collection. The collection effort yielded nearly 79,000 seeds with and estimated seed viability of >95%. The seed is currently in long-term storage at RSA and will be available for conservation/recovery purposes on the reserve.

Grassland monitoring was conducted in the native grassland restoration site as part of a long-term effort to assess habitat changes/improvements in this area due to specific management measures (i.e., herbicide treatment). This effort, which constituted the second year of monitoring, included a quantitative assessment of species richness and cover along four transects. Data indicated that herbicide treatment was most effective in reducing the cover of exotic grasses; exotic forbs dominated all areas, including those treated with herbicide, although an increase in native forb species was observed in 2010; exotic grasses appear to inhibit native species germination and establishment more than exotic forbs; and some native seed bank remains in the soil. Recommendations include continued herbicide application to control exotic grasses, subsequent monitoring to assess shifts in species richness and/or cover, and onsite seed collection of native forb species to augment the soil seed bank.

Trail erosion was documented in two areas of the reserve accessed for other monitoring purposes. Eroded areas with the potential to limit access or pose a safety risk were mapped and photographed; this mapping was not comprehensive.

Based on 2010 monitoring results, the following recommendations are provided for future monitoring or management of MSCP priority plant species:

Species	Status	Recommendations
San Diego Thornmint (*Acanthomintha ilicifolia*)	Detected in 2010; majority of habitat threatened by *Brachypodium distachyon*	• Continue annual presence/absence monitoring • Maintain/establish additional photoplots; monitor annually • Develop *Brachypodium* monitoring and management strategy
Lakeside Ceanothus (*Ceanothus cyaneus*)	Stable	• Conduct population monitoring every 3-5 years • Continue annual photoplot monitoring • Collect seed in eastern portion of CER
San Diego Sagewort (*Artemisia palmeri*)	Stable/Increasing	• Conduct presence/absence monitoring every 3 years • Continue annual photoplot monitoring

Species	Status	Recommendations
Palmer's Grapplinghook (*Harpagonella palmeri*)	Stable	• Conduct annual presence/absence monitoring • Control invasives (primarily, *Brachypodium distachyon*)
Ramona Horkelia (*Horkelia truncata*)	Stable	• Conduct population monitoring every 3 years • Continue annual photoplot monitoring
San Diego Goldenstar (*Bloomeria [=Muilla] clevelandii*)	Detected in 2010	• Conduct presence/absence surveys during optimal rainfall years • Establish photoplots; monitor annually • Map the extent of habitat • Map invasives in and adjacent to habitat: develop a weed control strategy

Introduction

This report summarizes 2010 biological monitoring activities conducted by the Conservation Biology Institute (CBI) on the Crestridge Ecological Reserve (CER) in San Diego County, California. Monitoring focused on detecting and assessing the status of two MSCP covered plants and one (non-covered) sensitive plant species, establishing photomonitoring points for three additional sensitive plant species, seed collection, and grassland monitoring. Although not included in the scope of services, severe trail erosion, as well as additional sensitive and invasive plant species, were mapped or recorded where observed.

Table 1 presents monitoring recommendations for sensitive plants on CER, based on monitoring guidelines in the Habitat Management and Monitoring Plan (CBI and EHC 2009) and results of 2009 monitoring efforts (CBI 2009). San Diego thornmint (*Acanthomintha ilicifolia*) and San Diego goldenstar (*Bloomeria clevelandii*) were not detected in 2009 surveys; thus, 2010 monitoring for these species focused on detection. Population monitoring was conducted in 2009 for Lakeside ceanothus (*Ceanothus cyaneus*), San Diego sagewort (*Artemisia palmeri*), and Ramona horkelia (*Horkelia truncata*), so the 2010 effort for these species focused on establishing photomonitoring plots. Presence/absence monitoring was conducted for Palmer's grapplinghook (*Harpagonella palmeri*), an annual species that occurs in large numbers onsite. Seed collection was initiated for Lakeside ceanothus, and monitoring of the grassland restoration site was continued in 2010. Because detailed mapping of Engelmann oaks was conducted in 2009, no focused surveys were conducted for this species in 2010.

Monitoring activities are discussed in the following sections with respect to methodology, results, and recommendations.

Sensitive Species Surveys

CBI conducted focused plant surveys for two MSCP covered species: San Diego thornmint and San Diego goldenstar. San Diego thornmint had not been detected onsite since 2003, and there was concern that it had been extirpated as a result of the 2003 Cedar fire and/or post-fire habitat degradation. San Diego goldenstar had been detected just offsite in 2000, but had not been observed in that location in subsequent surveys, nor had it ever been detected on the reserve.

Table 1

Sensitive Plant Species Monitoring Recommendations

Species	Status	Recommendations
San Diego Thornmint (*Acanthomintha ilicifolia*)	Unknown (not detected in 2009)	• Annual presence/absence monitoring • Annual population monitoring if species is detected • Control invasives • Document weed control effort
Lakeside Ceanothus (*Ceanothus cyaneus*)	Stable	• Population monitoring every 3-5 years • Annual photoplot monitoring • Seed collection
San Diego Sagewort (*Artemisia palmeri*)	Stable/Increasing	• Presence/absence monitoring every 3 years • Annual photoplot monitoring • Flag and avoid during management activities
Palmer's Grapplinghook (*Harpagonella palmeri*)	Stable	• Annual presence/absence monitoring • Collect stand-specific information • Control invasives
Ramona Horkelia (*Horkelia truncata*)	Stable	• Population monitoring every 3 years • Annual photoplot monitoring • Seed collection • Flag and avoid during management activities
San Diego Goldenstar (*Bloomeria [=Muilla] clevelandii*)	Unknown (not detected in 2009)	• Presence/absence surveys during optimal rainfall years

Methodology

Sensitive plant surveys were conducted by botanist Patricia Gordon-Reedy and field assistant Janet McDonald, according to the schedule in Table 2. Previously known sensitive plant populations were located using maps generated in 2000 and 2009 (McMillan and CBI 2002, CBI 2009). Survey methodology consisted of walking transects through suitable habitat; surveyors were generally spaced no more than 5-10 meters (m) apart. Habitat for each species was visited at least once to determine presence/absence and collect pertinent data. If the population was not detected during this initial visit, the location was re-visited during the field season to maximize the potential for detection. For San Diego thornmint, a total of six survey visits were made in 2010; the species was detected on the final visit.

Locations of sensitive plant populations were recorded using an Earthmate GPS PN-20; GPS locations for sensitive plants are listed in Appendix A.1. Because map quality made mapping areal extent of population boundaries difficult, point locations were recorded in 2010. Although focused surveys were conducted only for the two species mentioned above, new occurrences of additional sensitive species were recorded where encountered. These GPS locations are also included in Appendix A.1.

For San Diego thornmint and San Diego goldenstar, direct counts or size estimates of plant populations were recorded in field notes and California Native Species Field Survey Forms were completed (Appendix B). These forms will be submitted to the CNDDB as part of the 2010 reporting process.

For Palmer's grapplinghook, data points were recorded and habitat qualitatively assessed to ensure that this annual species was present in approximately the same locations and densities as previous years. Locality information is included in Appendix A.1.

Results

San Diego Thornmint

San Diego thornmint was first detected on CER in 2000, when two stands were mapped on slopes above Rios Canyon ('Thornmint Hill'). A small stand was detected in the same area in 2003 (D. Lawhead, pers. comm.). The species had not been seen in this location since 2003, despite numerous survey efforts. The 2009 monitoring report (CBI 2009) provides the survey history and known locations of San Diego thornmint on CER. In 2010, surveys for this species focused on relocating known populations on slopes above Rios Canyon and on lands to the east,

Table 2

Sensitive Plant Survey Schedule

Survey Personnel[1]	Survey Date	Survey Type	Survey Location
PGR/JM	4/7/10	Presence/absence; population estimates	Slopes above Rios Canyon
PGR/JM	4/14/10	Presence/absence; population estimates	Slopes above Rios Canyon
PGR/JM	5/5/10	Presence/absence; population estimates	Slopes above Rios Canyon
PGR/JM	5/12/10	Presence/absence; population estimates	Slopes above Rios Canyon
PGR/JM	5/21/10	Presence/absence; population estimates	East end of reserve
PGR/JM	6/2/10	Presence/absence; population estimates	Slopes above Rios Canyon
PGR/JM	6/7/10	Presence/absence; population estimates	Slopes above Rios Canyon

[1]PGR = Patricia Gordon-Reedy; JM = Janet McDonald.

north, and south. Thornmint surveys were conducted in April, May, and June. Surveys were conducted approximately one month later than 'normal,' due to late rains and below average spring temperatures that resulted in delayed phenology (i.e., germination, growth, flowering) for many plant species. On June 2, a small stand of thornmint (17 plants) was detected near one of the year 2000 locations (Figure 1). A photomonitoring point was also established for this occurrence; photographs of the species, habitat, and general location are included in Appendix C.1.

The 2010 thornmint occurrence has particular significance. First, the plants were growing in relatively undisturbed habitat, which was most notable for the absence of the nonnative, invasive grass, purple falsebrome (*Brachypodium distachyon*). Purple falsebrome has invaded much of the remaining thornmint habitat on CER. It likely out-competes thornmint for available

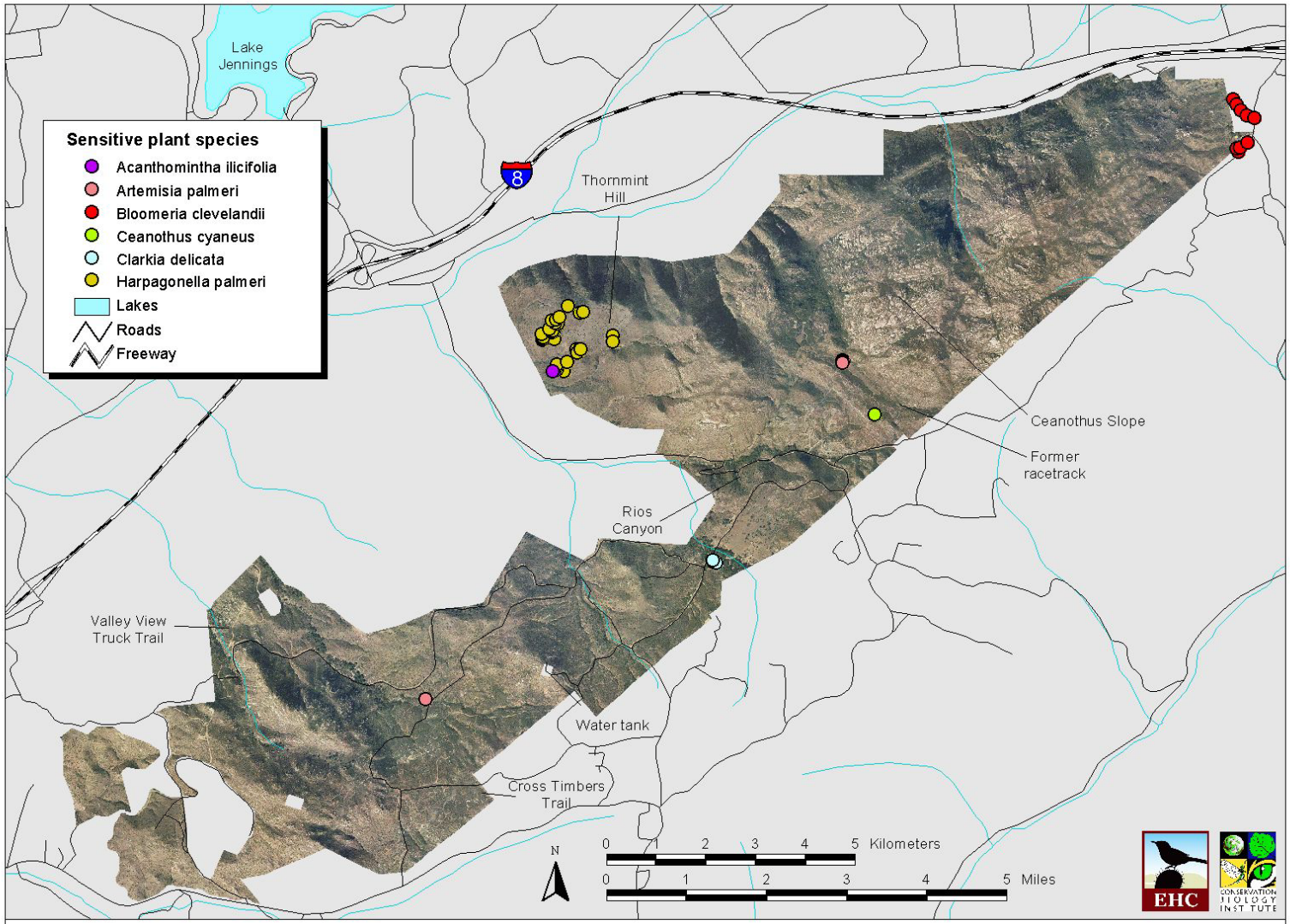


Figure 1. 2010 Sensitive Plant Locations

resources and thus, may be a primary contributor to the lack of thornmint elsewhere onsite. Second, this stand provides evidence of a persistent thornmint seed bank onsite, despite the 2003 Cedar fire. Last, plants were observed relatively late in the season, in a year in which temperatures and precipitation resulted in phenological delays for many plant species.

San Diego Goldenstar

A large population (ca. 7,400 individuals) of San Diego goldenstar was detected at the eastern end of CER, where it occurs both on- and offsite (Figure 1). This species was considered to have a high potential for occurrence in this area based on detection of a small population (offsite) in 2000 and the presence of suitable clay soils. The size of the 2010 population is most likely related to the optimal growth conditions, which included late rains and below average spring temperatures.

Although San Diego goldenstar was detected primarily in nonnative grassland, it is interesting to note that it was also found in or adjacent to mesic habitats in two locations: (1) vernal-like depressions (offsite) dominated by small-leaved bentgrass *(Agrostis microphylla)*, Kellogg's dwarf rush *(Juncus kelloggii)*, common toad rush *(Juncus bufonius* var. *occidentalis)*, navarretia *(Navarretia* sp.), loosestrife *(Lythrum hyssopifolia)*, nitgrass *(Gastridium ventricosum)*, and chaffweed *(Centunculus minimus)*, and (2) wet meadows dominated by Mexican rush *(Juncus mexicanus)*.

Much of the habitat onsite or just offsite is dominated by nonnative grassland. Of concern is the presence of several large stands of long-leaved veldt grass (*Erharta longiflora*) just north of occupied habitat in the northeast corner of CER.

Palmer's Grapplinghook

Presence/absence surveys were conducted for Palmer's grapplinghook in the vicinity of 'Thornmint Hill,' where this species has been observed in large numbers during past survey efforts. Palmer's grapplinghook appears to be stable with respect to general location and population size; however, there is concern that this mat-forming annual species, which occurs in open areas on clay soils, may be threatened by purple false-brome invasion.

Additional Species

During focused plant surveys, CBI also recorded new locality information for a number of sensitive (non-covered) species on the reserve, including Palmer's grapplinghook, Palmer's

sagewort, and delicate clarkia (*Clarkia delicata*) (Appendix A.1, Figure 1). In addition, invasive plant species detected during sensitive plant surveys were also recorded (Appendix A.2).

Recommendations

San Diego Thornmint

Based on results of the 2010 thornmint survey, we recommend the following:

1. Continue yearly presence/absence surveys in occupied and potential thornmint habitat to establish the boundary/extent of the population and assess population fluctuations. Results should be correlated to climatic variables.

2. Maintain and establish additional photomonitoring points within occupied thornmint habitat and monitor yearly to develop a photographic record of this species and its habitat onsite.

3. Develop a *Brachypodium* monitoring and management strategy to (1) protect San Diego thornmint habitat from further degradation, (2) rehabilitate degraded thornmint habitat, and (3) improve native species diversity in and adjacent to thornmint habitat. It is envisioned that this strategy will include an experimental component to determine effective treatment methods for *Brachypodium* and the effect of treatments on native species, including thornmint.

San Diego Goldenstar

Based on results of the 2010 goldenstar survey, we recommend the following:

1. Continue yearly presence/absence surveys in occupied and potential San Diego goldenstar habitat to establish the boundary/extent of the population and assess population fluctuations. Results should be correlated to climatic variables.

2. Establish photomonitoring points within occupied San Diego goldenstar habitat and monitor yearly to develop a photographic record of this species and its habitat onsite.

3. Map the extent of San Diego goldenstar habitat, as well as invasive species in and adjacent to occupied habitat, and develop a weed control strategy for this portion of the reserve.

Palmer's Grapplinghook

Based on results of the 2010 Palmer's grapplinghook survey, we recommend the following:

1. Continue yearly presence/absence surveys in occupied grapplinghook habitat to establish the boundary/extent of the population and assess population fluctuations.

2. This species would likely benefit from *Brachypodium* management, since it occupies similar habitat (typically adjacent to) as San Diego thornmint.

Photomonitoring

CBI established permanent photopoints to monitor selected populations of sensitive species from year to year through photodocumentation. The 2010 monitoring effort developed a baseline photographic record of habitat/site conditions for four sensitive plant species on the reserve: San Diego thornmint, Palmer's sagewort, Lakeside ceanothus, and Ramona horkelia. San Diego thornmint and Lakeside ceanothus are MSCP covered species; the other two species occur primarily along trails and thus, are subject to impacts from authorized/unauthorized land uses and invasive plant species.

For this program, photomonitoring is intended to provide a qualitative record of habitat conditions, including invasive species, successional changes, or disturbances that might warrant management considerations. This monitoring is not designed to provide estimates of population density or cover, nor is it not intended to replace more intensive species monitoring. Rather, it will supplement species monitoring and provide an 'early warning' system in interim years where more intensive monitoring is not conducted.

Methodology

A total of 13 photopoints were established on CER, as follows (Figure 2):

- San Diego thornmint – 1 photopoint
- San Diego sagewort – 3 photopoints
- Lakeside ceanothus – 8 photopoints
- Ramona horkelia – 1 photopoint

Photopoint location was sited to provide an advantageous view of the plant population or stand of interest. At each photopoint location, a permanent marker – or *monument marker* – was installed. We used 12" long galvanized nails that were sunk into the soil surface as monument markers. Each nail was surrounded by a washer for greater visibility during relocation. The decision to use this type of marker rather than rebar or another, upright structure was based largely on proximity of photopoints to use areas, i.e., a more visible marker might be more susceptible to vandalism.

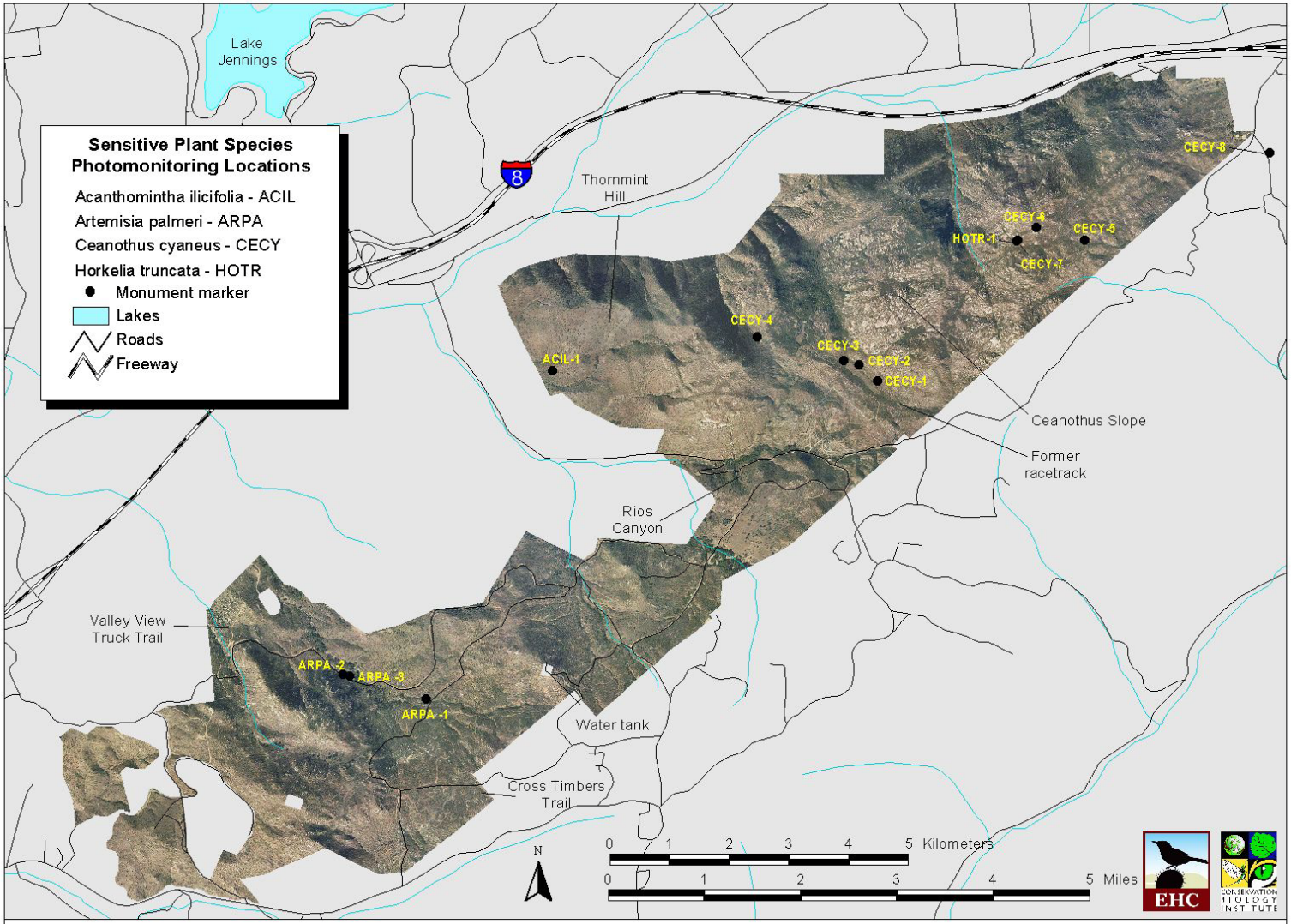


Figure 2. Photomonitoring Locations

The GPS

location of each monument marker was recorded on photograph logs (Appendix C), along with a narrative of the marker location; Appendix A.3 includes a list of all photopoint locations. In addition, landmark points, or supplemental locations used to relocate the monumentmarker or reestablish it in the event of loss, were also identified, described, and recorded via GPS. Permanent features (e.g., rocks) were used as landmarks where available. Both monument markers and landmark points were documented photographically and are included in the permanent record for each photopoint.

Once photopoints were established, photographs were taken from that point or in reference to that point to document the species of concern. Although photographs were taken in a 360º radius, photo direction was contingent upon presence of the monitored species and thus, did not necessarily correspond to 90º increments (e.g., 0º, 90º, 180º). Attributes that accompany each photograph include compass direction, deviations from monument marker (if any), and a brief description of the photograph.

Results

The photodocumentation record for 2011 is included in Appendix C, as follows:

- San Diego thornmint – Appendix C.1
- San Diego sagewort – Appendix C.2
- Lakeside ceanothus - Appendix C.3
- Ramona horkelia – Appendix C.4

Recommendations

Photopoint monitoring provides a relatively efficient and cost-effective method for monitoring changes in habitat and population conditions. Set-up of photomonitoring points is the most time-intensive phase of this monitoring activity. Now that points have been established, photographic documentation should be conducted at these points regularly (e.g., yearly) to allow for a 'rapid response' to impacts or changing habitat conditions. Photopoint monitoring should be supplemented by more detailed species monitoring at less frequent intervals (e.g., every 3-5 years; last conducted in 2009). In 2011, additional monitoring points should be established for San Diego goldenstar.

Seed Collection

CBI initiated conservation seed collection for two 'populations' of Lakeside ceanothus on the reserve. Seed collection is identified as a goal in the HMMP, and was considered particularly

important for this species because of impacts from the 2003 Cedar fire. Seed collection was established to act as a 'hedge' against extinction or extirpation by preserving genetic diversity and providing a seed source in the event of catastrophic disturbance. In addition, the collection provides information on seed viability and may function as a source of material for researchers. The 2010 seed collection effort focused on plants in the east-central portion of CER.

Collected seed was delivered to Rancho Santa Ana Botanic Garden (RSA) for processing, testing, and long-term storage. RSA's tasks were conducted under an existing Memorandum of Understanding (MOU) with the California Department of Fish and Game (CDFG) (authorized by Mary Ann Showers). RSA has submitted a report documenting the collections to CDFG in Sacramento; this report is included as Attachment E.

Methodology

Seed collection was conducted by Patricia Gordon-Reedy and Janet McDonald according to the schedule in Table 3. Due to 2010 climatic conditions, seed development and thus, seed collection, was delayed by over a month from the projected timeline. The seed collection effort included a number of 'scouting' trips to assess seed ripeness. CER reserve manager Cathy Chadwick and volunteer Andrea Johnson assisted in the scouting effort (Table 3).

Seed was collected according to standard seed collection protocols (e.g., CDFG Guidelines; General Seed Collection Guidelines for California Native Plant Species, Rancho Santa Ana Botanic Garden). In general, no more than 5% of seed was collected on a population or per plant basis; sampling was done randomly and evenly through the population (subject to topographic constraints); and plants were sampled in a variety of habitat conditions to maximize genetic diversity. For conservation collections, a minimum of 2,500 seeds per collection is typically used as a baseline target; the seed collection strategy onsite used this number as a minimum goal.

Two separate collections were made, which represented geographically separate areas on the reserve. Collections were maintained as maternal line samples (e.g., seed from each plant was maintained in separate bags). The first collection (CECY-1) included 50 plants, and was made on August 16, 2010. The second collection (CECY-2) included 30 plants and was made on August 24, 2010. General seed collection locations are presented in Figure 3. Collected seed was packaged and sent to RSA for processing, viability testing, and long-term storage. Seed collection forms are included in Appendix D.

Table 3

Seed Collection Schedule

Date	Activity	Personnel
7/5/10	Assess seed status	Patricia Gordon-Reedy Janet McDonald
7/21/10	Assess seed status	Patricia Gordon-Reedy Cathy Chadwick
8/13/10	Assess seed status	Cathy Chadwick Andrea Johnson
8/16/10	Seed collection, cleaning	Patricia Gordon-Reedy Janet McDonald
8/24/10	Seed collection, cleaning	Patricia Gordon-Reedy Janet McDonald
8/25/10	Documentation, packaging	Patricia Gordon-Reedy

Results

The collections yielded nearly 79,000 seeds and estimated seed viability was > 95%. A small portion of the collection (8,000 seeds) has been sent to the USDA National Center for Genetic Resource Preservation in Ft. Collins, Colorado as a backup collection; additional seeds (ca. 6,220) will be used for testing and propagation at RSA. The remainder of the collection (ca. 65,000 seeds) has been placed in long-term storage at RSA and will be available for conservation/recovery purposes on the reserve, if needed. Minimum recommended conservation seed collections are typically on the order of 500-2,000 seeds.

RSA processed, tested, and stored seed as maternal line samples from 80 plants in two populations on CER. They determined that the fruits were collected at an optimal period and there was a very high percentage of filled, sound, ripe seed that was extracted from the material received. A total of 78,913 seeds were collected, including 52,387 seeds from CECY-1 and 26,526 seeds from CECY-2, which far surpassed the collecting strategy objective. Quantity of

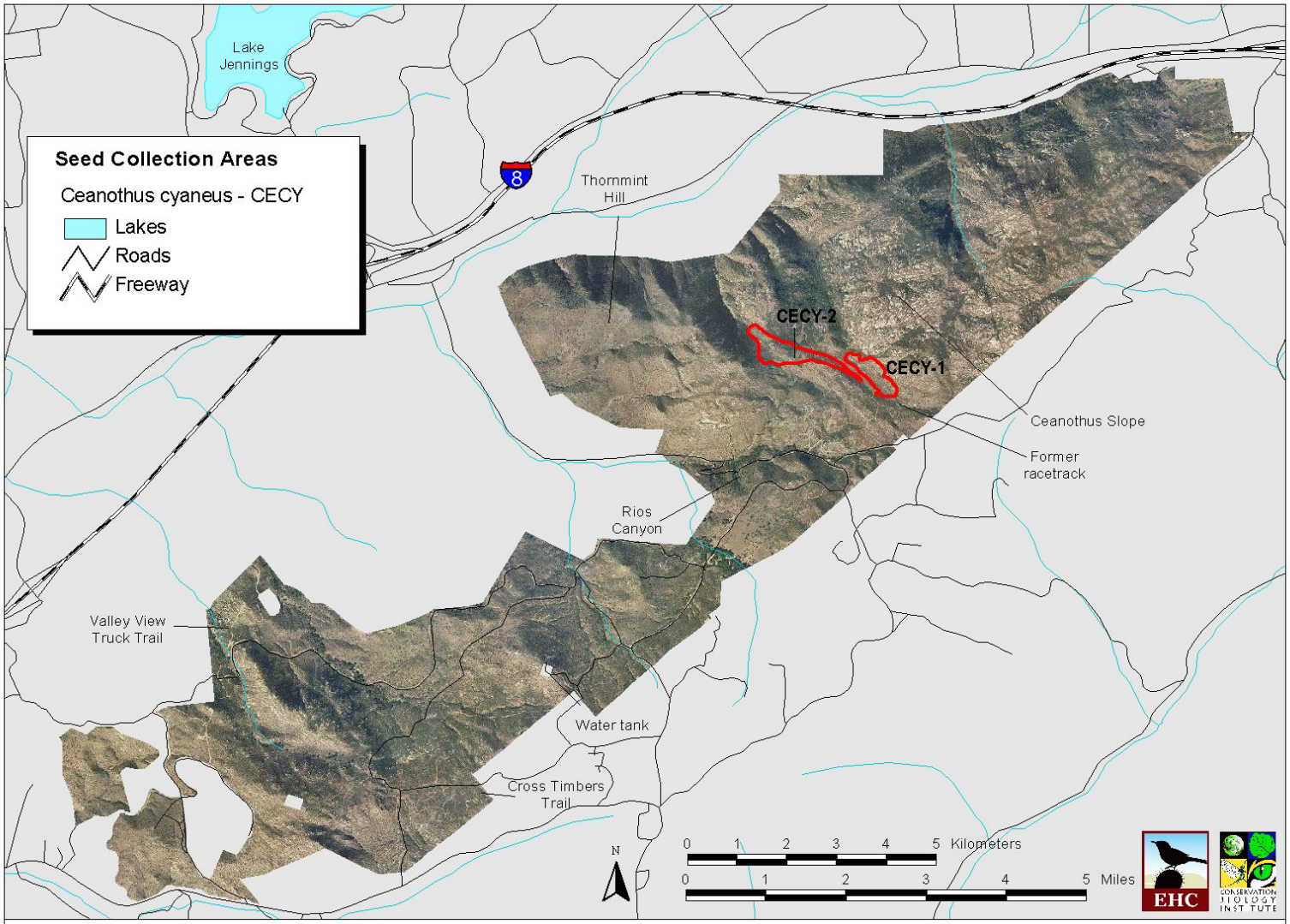


Figure 3. Seed Collection Areas

seed is related to prolific seed production and does not represent collections beyond the 5% threshold.

The estimated viability (% live seed) of each sample was greater than 95%. Test results indicated that there is physical dormancy in a high percentage of fresh seed which inhibits germination. RSA's final report (Appendix E) concluded that this material represents an excellent collection.

Recommendations

In addition to the collected seeds, this effort yielded valuable information on seed production, viability, and dormancy. We recommend collecting seed from the other two major populations on the reserve, which are at a distance from the collected populations and occur in different habitat conditions. Because CDFG's MOU with RSA expires in 2010, continued seed processing/storage at RSA would require funding.

Grassland Monitoring

CBI conducted quantitative grassland monitoring within the native grassland restoration site in the center of the reserve. Habitat is primarily nonnative grassland and disturbed coastal sage scrub. Baseline monitoring was conducted in 2009 by Patrick McConnell (McConnell 2009); 2010 monitoring constituted the second year of this monitoring effort.

Methodology

The grassland monitoring effort utilized methodology and transect locations established in 2009 (McConnell 2009). Refer to that document for a detailed discussion on methodology and for specific transect locations. Monitoring consisted of linear point-intercept transects with richness subplots to determine cover and species richness; this monitoring is part of a long-term effort to assess habitat changes/improvements in this area due to specific management measures.

Monitoring took place on May 14, 2010, and was conducted by Patricia Gordon-Reedy and Janet McDonald. We utilized the same four transects established in 2009 (McConnell 2009). Due to the timing of these surveys relative to the 2009 effort, species identification was less problematic than in 2009.

Results

Species Richness

In 2010, 33 species were present within richness plots. This included 20 exotic species, including 5 grasses. Three species were present along all transects: red brome (*Bromus madritensis* ssp. *rubens*), long beak filaree (*Erodium botrys*), and rat-tail fescue (*Vulpia myuros* var. *hirsuta*). Red brome had the highest frequency of occurrence in subplots (72%), followed by long beak filaree (69%) and rat-tail fescue (58%). Doveweed (*Croton setigerus*), a native annual species which was not detected in 2009, occurred along 3 of the 4 transects in 2010, and in 47% of subplots. Refer to Appendix F.1 for the distribution and frequency of all species encountered in richness subplots.

Figure 4 presents the relative proportion of native forbs, exotic forbs, and exotic grasses along each transect in 2010. Transects 1 and 2 received some herbicide treatment (Fusilade II) to control nonnative species; a portion of Transect 3 received herbicide treatment; and Transect 4 did not receive any herbicide treatment. Transects 1 and 2 support the greatest number of species (18 and 17, respectively), and greatest number of native species (6 and 7, respectively).

In comparison, 2009 monitoring results detected 27 species, including 17 exotics, of which 5 were grasses (McConnell 2009). A number of species detected in low numbers in 2009 were not observed in 2010. Likewise, 11 new species were detected in 2010, all in low numbers expect doveweed. Doveweed was dominant in Transect 1 and occurred in nearly half of the richness plots, overall.

Figure 5 provides a comparison of species richness along transects in 2009 versus 2010. Overall, species richness increased slightly in Transects 1 and 4 and decreased slightly in Transects 2 and 3. These differences may be attributable to climatic conditions rather than specific management actions. Within-transect trends for native forbs are similar from year-to year, with only minor shifts in species richness. The greatest shift in species richness among functional plant groups occurred along Transect 1, where the number of exotic forbs increased by 150% and the number of exotic grasses decreased by 60%; this transect received the most intensive herbicide treatment.

Figure 4
2010 Species Richness

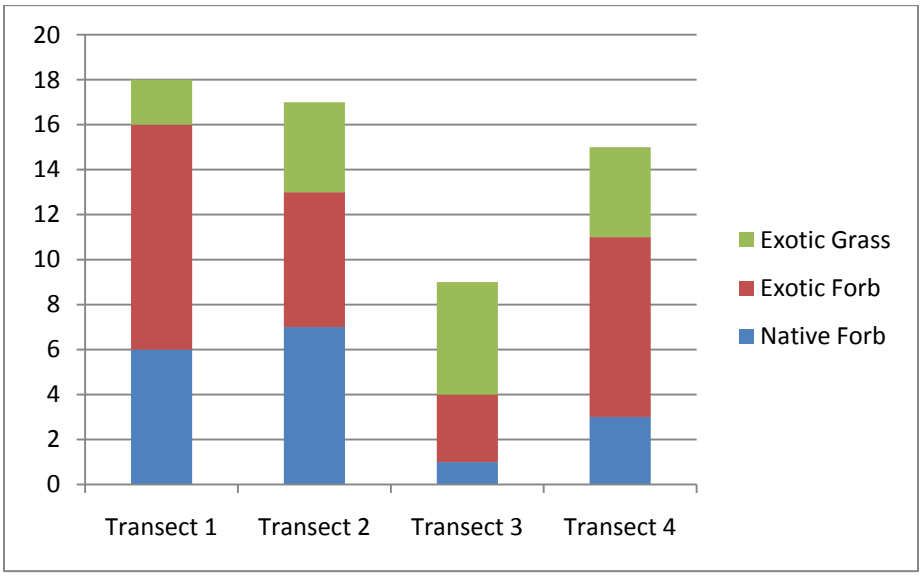
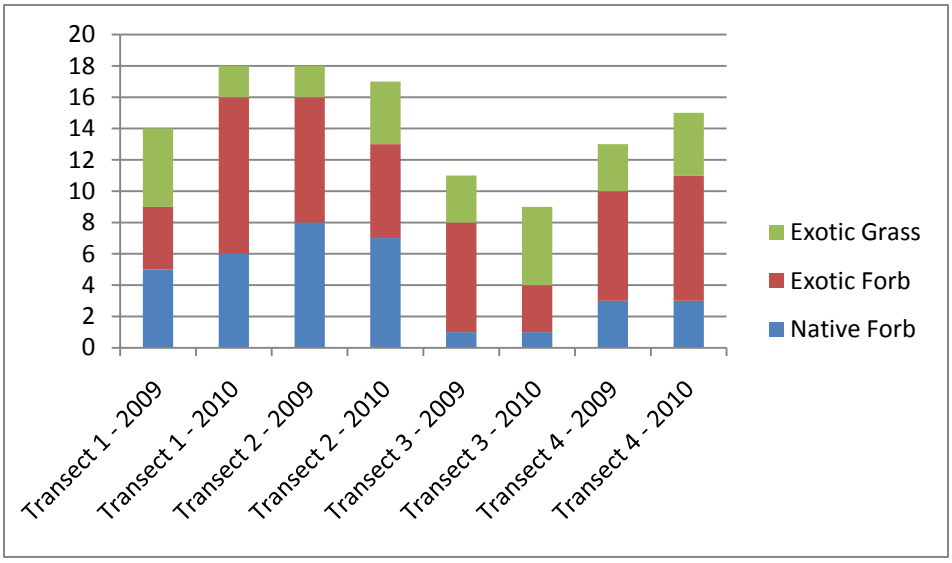


Figure 5
Comparison of Species Richness between 2009 and 2010



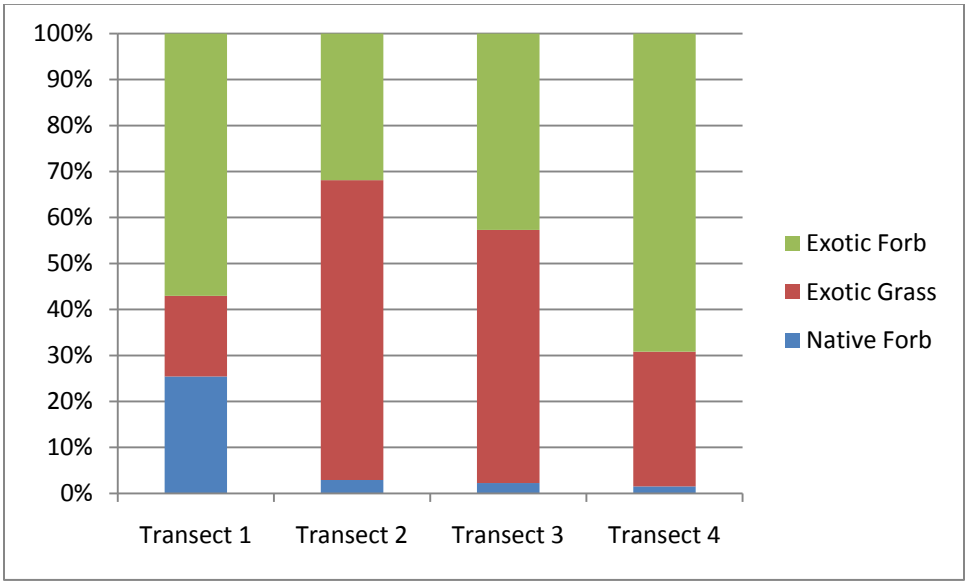
In all other transects, the number of exotic grass species increased in 2010, while exotic forbs either decreased (Transects 2 and 3) or increased slightly (Transect 4).

Species Cover

In 2010, the only transect not completely dominated by nonnative species was Transect 1, which received the most intensive herbicide treatment. Transect 1 had the highest percent cover of native species and the lowest percent cover of nonnative grasses (Figure 6).

Figure 6

2010 Species Cover

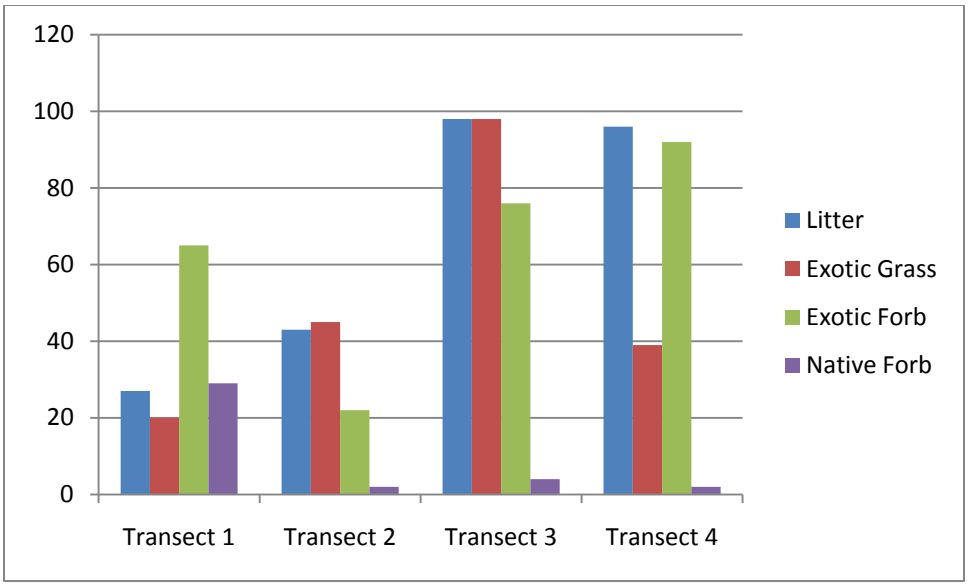


Refer to Appendix F.2 for the absolute cover of all species along transects. Red brome and long beak filaree had the highest percent cover overall, followed by rat-tail fescue and ripgut grass. Doveweed, which ranked 4th in species richness, ranked 6th overall in species cover along transects. Red brome, long beak filaree, and rat-tail fescue were the only species found along all transects. Red brome, which accounted for 18% total cover, comprised only 2% cover along Transect 1. Rat-tail fescue, which comprised 17% total cover, comprised 16% cover along Transect 1; this species is known to be resistant to Fusilade II treatment (Brown and Bettink 2011).

Figure 7 presents the percent cover of litter and exotic and native species along each transect. Litter increased with an overall increase in percent cover along transects. Although there does not appear to be a clear relationship between litter and exotic cover, there may be a relationship between litter and native species, with a higher percent cover of natives occurring under low litter conditions.

Figure 7

Percent Cover of Litter, Exotic Species, and Native Species



In 2009, the highest percent cover of native species occurred along Transect 2, and was due primarily to the presence of a native shrub. Excluding shrubs, the highest percent cover of native forbs was found along Transects 3, 2, and 4, respectively, in 2009; no native forbs were recorded along Transect 1. In 2010, following herbicide treatments, the highest percent cover of native forbs occurred along Transect 1, where 6 species were recorded. One native forb was detected along each of the other transects. In addition to receiving herbicide treatments, Transect 1 occupies a low-lying position relative to the other transects and is characterized by moister soils.

Recommendations

Herbicide treatment was most effective in reducing the cover of exotic grasses. Exotic forbs continue to dominate transects, including those treated with herbicide. Based on limited data, exotic grasses appear to inhibit native species germination and establishment more than exotic forbs. The appearance of six native species in an area (Transect 1) that had no native forbs in 2009 attests to the presence of some native soil seed bank.

The following management and monitoring measures are recommended for 2011:

1. Treat all portions of the grassland restoration area with herbicide; depending on precipitation patterns and germination of native and nonnative species, more than one application may be necessary.

2. Monitor the grassland area after herbicide application(s) to assess shifts in species richness and/or cover. Use these results to modify the management treatment, including additional herbicide treatments and/or augmentation of the soil seed bank.

3. Initiate onsite seed collection of native forb species to augment the soil seed bank. This may be particularly important in the drier, upland portions of the grassland restoration area.

Trail Erosion Monitoring

Trail erosion was documented in areas of the reserve accessed for other monitoring purposes. Severe erosion that has the potential to limit access and/or pose a safety risk was photographed and the location documented in a photolog. Areas of concern occur (1) along the La Cresta Heights Trail and (2) along the trail to the 'racetrack.' Appendix G provides location information (including GPS points) and photodocumentation of erosion at these sites. It should be noted that this documentation does *not* represent a comprehensive record of trail erosion on CER.

References

Brown, K. and K. Bettink. Management notes: *Vulpia myuros* (L.) C.C. Gmel. FloraBase: the Western Australia flora. http://florabase.calm.wa.gov.au/browse/profile/724

Conservation Biology Institute (CBI). 2009. 2009 biological monitoring report for the Crestridge Ecological Reserve. Prepared for Endangered Habitats Conservancy. 27 pp.

Conservation Biology Institute (CBI) and Endangered Habitats Conservancy (EHC). 2009. Habitat management and monitoring plan for the Crestridge Ecological Reserve – final administrative draft. Prepared for the California Department of Fish and Game. February.

Lawhead, D. 2010. Personal communication with P. Gordon-Reedy. April.

McConnell, P. 2009. Crestridge Ecological Reserve enhancement and restoration area: baseline plant cover and diversity conditions. 8 pp.