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Mr. Michael Beck
Endangered Habitats Conservancy
P.O. Box 22438
San Diego, CA 92192-2438

Dear Michael:

This letter report summarizes results of 2015 biological monitoring and management on the Crestridge Ecological Reserve (CER), and provides recommendations for future actions. Biologists from the Conservation Biology Institute (CBI) and EHC and volunteers with the Earth Discovery Institute (EDI) participated in the 2015 effort. Tasks included:

- Monitoring and management of two MSP¹ priority plant species
- Invasive plant management and monitoring
- Photomonitoring

Our primary focus was on two plant species identified as priorities for monitoring in 2015 (SDMMP 2013): San Diego thornmint (*Acanthomintha ilicifolia*) and San Diego goldenstar (*Bloomeria clevelandii*). We also continued management and monitoring of the invasive grass, purple falsebrome (*Brachypodium distachyon*), to maintain treatment progress made over the last several years, and worked with the Earth Discovery Institute (EDI) to continue long-term photomonitoring for Lakeside ceanothus (*Ceanothus cyaneus*), which is a covered species under the San Diego Multiple Species Conservation Plan (MSCP). Each task is summarized below with respect to methods, results, and recommendations.

Task 1. MSP Rare Plant Monitoring

In 2015, rare plant monitoring focused on San Diego thornmint and San Diego goldenstar. Both species are priority MSP species, are covered under the MSCP, and have been monitored previously on CER.

¹ MSP = Management Strategic Plan. The MSP for western San Diego County was developed by the San Diego Management and Monitoring Program (SDMMP 2013) and identifies regional priorities for monitoring and management.



CBI biologist Jessie Vinje and EHC biologist Jonathan Appelbaum monitored these species using the SDMMP rare plant monitoring protocol (SDMMP 2014). This protocol was developed to ensure consistency in data collection in support of regional monitoring per the SDMMP's MSP (SDMMP 2013). Table 1 summarizes survey results, identifies threats, and provides management recommendations. Neither species was detected in 2015. Lack of detection may be due to extended drought conditions and invasive species. Refer to Table 2 for invasive and competitive native plants identified as potential threats to these species. One of these invasive species, long-leaved veldt grass (*Ehrharta longiflora*), has been identified as a medium priority invasive species for management in the Invasive Species Strategic Plan (CBI et al. 2012). Invasives control should focus on species that (individually or in combination) may result in detrimental impacts to covered species (e.g., altered resource allocation, vegetation structure, recruitment, or competitive exclusion) (CBI et al. 2012).

Per MSP monitoring protocols, monitoring forms were completed for both species. CBI will submit monitoring forms to SDMMP.

Task 2. MSP Rare Plant Management

Based on recommendations from 2014 monitoring, we conducted targeted invasive plant management (clipping per Best Management Practices, CBI 2014) at the occupied San Diego thornmint location on CER. This task required knowledge of all species within the treatment area to ensure that only invasive species were removed. Figure 1 shows the site after clipping.

Although San Diego thornmint was not detected at this location in 2015, we recommend continued management to control invasive species and enhance thornmint habitat. Long-term monitoring that encompasses a range of climatic conditions will determine whether or not San Diego thornmint persists at this location.

Task 3. Invasive Plant Management

This task included management of the invasive grass, purple falsebrome (*Brachypodium distachyon*), in experimental treatment areas to maintain progress made over the last several years. An estimated 10 acres of previously-treated *Brachypodium*-infested habitat were treated in 2015 to continue *Brachypodium* control efforts and promote germination and growth of native species. Treatments included line-trimming, herbicide (Fusilade II and glyphosate) application, and hand-pulling. Treatments were conducted primarily by Recon Environmental, Inc. to ensure consistent and rapid treatment per techniques developed in 2013 and refined in 2014. EHC biologist Jonathan Appelbaum conducted mechanical treatments (line-trimming) in selected locations. Due to budget constraints, treatments were prioritized where invasive plant cover was highest. Refer to Table 3 for treatment applications and schedule. Differences in *Brachypodium* cover between years are depicted in Figures 2 and 3.



Table 1. 2015 Survey Results, Threats, and Management Recommendations.

Species	Population Size ¹	Occupied Habitat (acres) ²	Threats	Management Recommendations
San Diego thornmint (<i>Acanthomintha ilicifolia</i>)	0	0.001 ³	<ul style="list-style-type: none"> - Invasive Plants - Competitive Native Plants - Thatch - Small Population 	<p><u>Weed control.</u> Hand weed annually unless monitoring indicates less frequent weeding is appropriate.⁴</p> <p><u>Monitoring.</u> Monitor annually to assess population status and treatment success. Implement additional management, as needed (e.g., dethatching, seed augmentation).</p>
San Diego goldenstar (<i>Bloomeria crocea</i>)	0	NA ⁵	<ul style="list-style-type: none"> - Invasive Plants - OHVs - Trails (unauthorized) 	<p><u>Weed control.</u> Weed veldt grass and monitor for germinating individuals and treatment success.</p> <p><u>Access control.</u> Install fencing and/or signage to prevent trespass from adjacent homeowner, OHVs, horses, and hikers.</p> <p><u>Monitoring.</u> Monitor annually to assess population status and threats. Refine treatment frequency and method, and implement additional management, as needed (e.g., repair fencing, replace signage). Map occupied acreage using a hand-held global position system when the plants are detectable.</p>

¹ Refers to population size in 2015.

² Refers to habitat occupied in 2015 (acres) or, if species was not present in 2015, habitat occupied during the last survey period.

³ Occupied acreage refers only to 'small' location on west-facing slope just east of Rios Canyon Road.

⁴ See CBI 2014 for Best Management Practices for hand weeding within *Acanthomintha ilicifolia* populations.

⁵ NA = not applicable. No plants were detected in 2015, and previous data include point data only, so previous occupied acreage cannot be calculated.

**Table 2.** Invasive Plants and Competitive Native Plants.

Covered Species	Site	Invasive Plants	Competitive Native Plants
San Diego thornmint (<i>Acanthomintha ilicifolia</i>)	Crestridge	<i>Anagallis arvensis</i> <i>Bromus madritensis</i> <i>Bromus hordeaceus</i> <i>Brassica nigra</i> <i>Centaurea melitensis</i> <i>Erodium cicutarium</i> <i>Hirschfeldia incana</i> <i>Sonchus asper</i>	<i>Deinandra fasciculata</i>
San Diego goldenstar (<i>Bloomeria clevelandii</i>)		<i>Anagallis arvensis</i> <i>Bromus hordeaceus</i> <i>Bromus diandrus</i> <i>Bromus madritensis</i> <i>Centaurea melitensis</i> <i>Ehrharta longiflora</i> <i>Erodium botrys</i> <i>Festuca myuros</i> <i>Hirschfeldia incana</i> <i>Hypochaeris glabra</i> <i>Logfia gallica</i> <i>Sonchus oleraceus</i> .	None

Figure 1. San Diego Thornmint Treatment Plot after Clipping (note bare ground).

**Table 3.** Invasive Plant Treatment.

Treatment Area	Treatment Date	Treatment Type	Applicator ¹	Target Species
Polygon 3 ² Polygon 5	2/27/15	Fusilade II	Recon	<i>Brachypodium distachyon</i>
Polygon 3 ³	3/23/15	Fusilade II	Recon	<i>Brachypodium distachyon</i>
All treatment plots Polygon 1	3/24/15	Glyphosate	Recon	Nonnative forbs
Polygon 1	3/24/15	Hand-pulling	Recon	Brassica sp., nonnative grass seed heads
Polygon 1 (treatment plots)	3/31/15	Line-trimming	EHC	<i>Brachypodium distachyon</i>

¹ Recon = Recon Environmental, Inc.; EHC = Endangered Habitats Conservancy (Jonathan Appelbaum).

² Incomplete coverage.

³ Treated most, but not all, of Polygon 3.

Figure 2. *Brachypodium* Treatment Plot, Polygon 1 (2013). Note relatively high cover of *Brachypodium*, lack of bare ground, and lack of native species.



Figure 3. *Brachypodium* Treatment Plot, Polygon 1 (2015). Note lack of *Brachypodium*, increase in bare ground, and presence of native annual species, fascicled tarplant (*Deinandra fasciculata*).





Task 4. Invasive Plant Monitoring

CBI biologists Patricia Gordon-Reedy and Jessie Vinje collected cover and species richness data in *Brachypodium* treatment plots established in 2013 as part of a SANDAG Environmental Mitigation Program grant. Monitoring included quantitative data collection in 12 treatment plots. 2015 represented a gap year in funding; additional funding for *Brachypodium* monitoring will be available in 2016 and 2017 through a second EMP grant. Data collected in 2015 have been submitted to the SDMMP for analysis; however, data analysis will likely occur in 2016.

Task 5. Lakeside Ceanothus Photomonitoring

CBI worked with EDI to continue long-term photomonitoring of Lakeside ceanothus (*Ceanothus cyaneus*), which is a covered plant species under the MSCP. Photomonitoring was conducted by volunteers under the direction of Cathy Chadwick of EDI, according to protocols established by CBI and used for 2010-2015 photomonitoring for this species. CBI labeled, organized, and formatted photographs taken by EDI staff/volunteers, reviewed and analyzed 2015 photodocumentation, and assessed changes between years. This effort is described below; refer to Appendix A for photodocumentation.

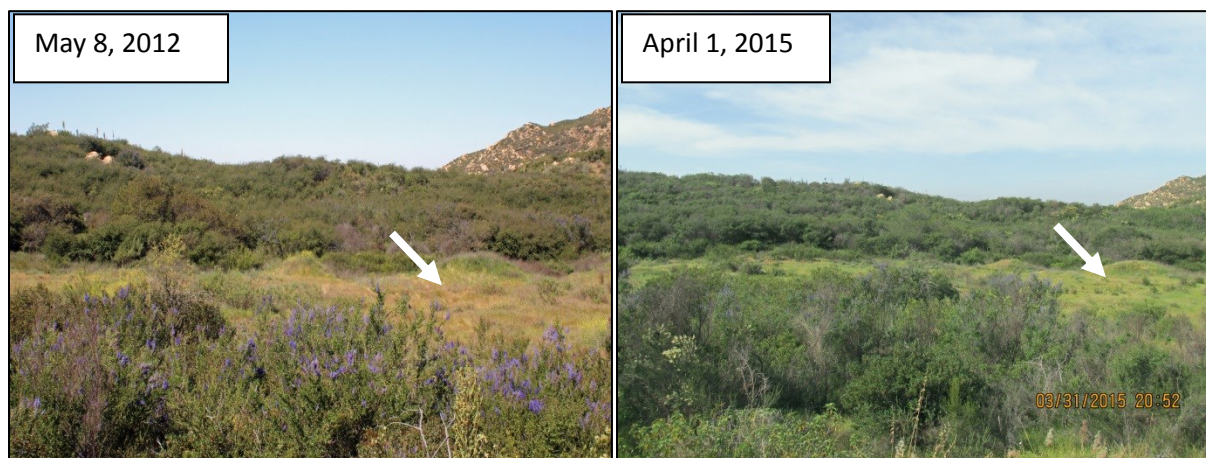
Methods. Lakeside ceanothus occurs in the eastern half of Crestridge. Eight photopoints were established in 2010 within Lakeside ceanothus stands; each photopoint and related stand have a unique identifier (e.g., CECY-1, CECY-2) (CBI 2011). In 2015, photomonitoring was conducted at all points except CECY-8 due to access constraints, and only one photograph was taken at photopoint CECY-7. Photopoints were originally sited to provide an advantageous view of the plant population or stand of interest. Each photopoint is marked with a permanent marker.

Photomonitoring was conducted on April 1, 2015 for photopoints CECY-1-3 and on April 8, 2015 for CECY-4-7. These dates were over a month earlier than previous photomonitoring periods due to reports of early flowering. Photomonitoring was conducted by Cathy Chadwick and EDI volunteer Mary Duffy using a Canon Powershot SX170-IS camera.

Results. The 2015 photomonitoring results, when viewed in time-series, are similar to 2014 results in demonstrating phenological differences between years and the effects of low rainfall (Appendix A). Phenological differences in 2015 may be attributed, in part, simply to differences in photomonitoring dates. Very little flowering is apparent in 2015 photos, despite reports of early flowering. Because photomonitoring did not occur at the same time as previous years, it is unclear whether lack of flowering reflects seasonal or climatic conditions (Figure 4).



Figure 4. Differences in vegetation and flowering between years (CECY-2); white arrow indicates band of herbaceous vegetation. Note flowering CECY in foreground in 2012 and lack of flowering CECY in same area in 2015.



Observations in 2015 (not apparent in the photo record) indicate greater Lakeside ceanothus flowering than in 2014, but less compared with other photomonitoring years. Many Lakeside ceanothus individuals were in full flower in late May and June and still flowering into July 2015.

Dieback or sparse foliage production was first observed in 2014 for Lakeside ceanothus and other shrub species (e.g., *Sambucus nigra* ssp. *caerulea*), and was attributed to low rainfall conditions (e.g., drought). This dieback appears to have intensified in some areas in 2015. Figure 5 depicts the dieback progression for CECY-6.

In 2014, we observed reduced herbaceous growth in many areas compared to previous years due to drought conditions. In 2015, we saw a resurgence of nonnative annual species in some areas where they had been absent in 2014; however, growth was generally comparable to or only slightly above levels seen in other (non-drought) years (Figure 6).

Table 4 provides a summary of conditions at each Lakeside ceanothus stand.



Figure 5. Lakeside ceanothus flowering (2010-2011) and die-back (2014-2015) across years (CECY-6); white arrows indicate Lakeside ceanothus shrubs.

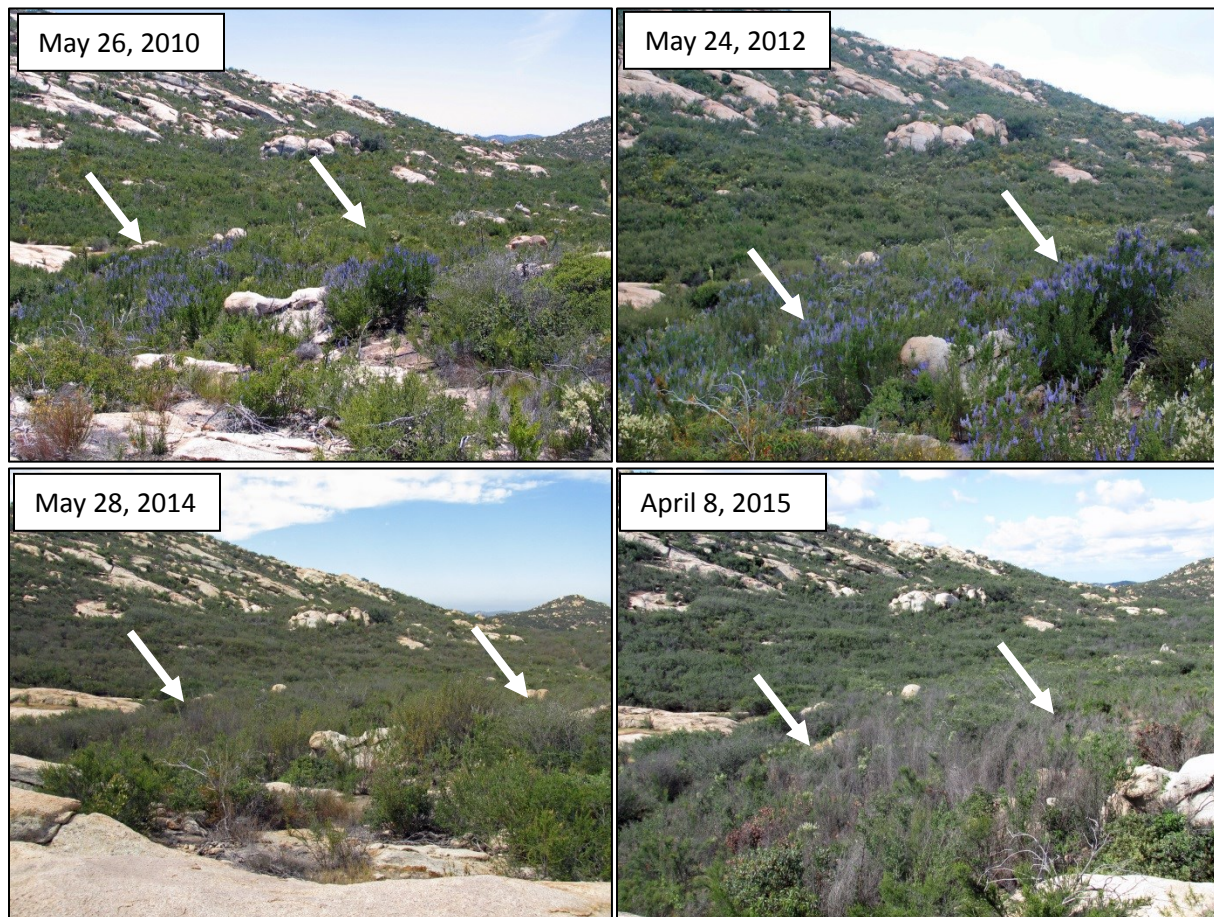
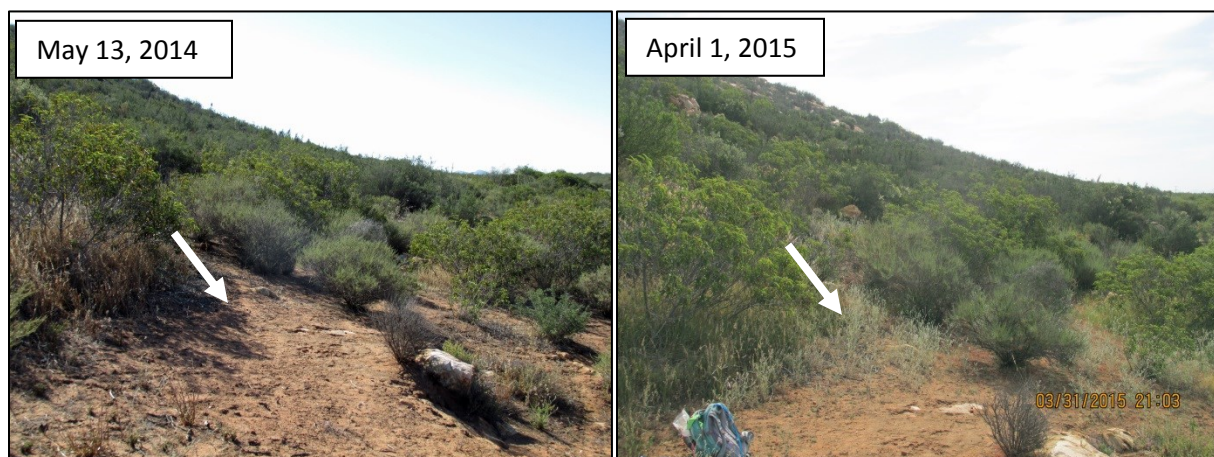


Figure 6. Differences in nonnative weedy species between years (CECY-2.7). Note the presence of nonnative annual species in open areas in 2015 and absence of nonnative annual species in 2014 (white arrows).



**Table 4.** Summary of Lakeside Ceanothus Stands in 2015.

Ceanothus (CECY) Stand Number	Minimal flowering	Die-back or Sparse Foliage	Soil Disturbance/Trail Use	Increase in Nonnative weeds
CECY-1	X	X	---	---
CECY-2	X	X	---	X
CECY-3	X	X	---	---
CECY-4	X	X	---	---
CECY-5	X	X	---	X
CECY-6	X	X	---	---
CECY-7	X	X	---	---

Photomonitoring provides a relatively efficient and cost-effective method for monitoring changes in habitat and population conditions. The major observations from the 2015 photomonitoring effort were minimal flowering throughout the population and continued die-back of Lakeside ceanothus in some areas. Because of the change in timing of 2015 monitoring, we were not able to discern whether sparse flowering was due to climatic conditions or monitoring period. For this reason, we recommend monitoring at the same time each year (± 7 -10 days). Recommended baseline monitoring periods are May 1-10 for CECY-1-3, and May 24-June 2 for CECY 4-7. If monitoring in multiple years of average or above-average rainfall shows low or no flowering during the baseline monitoring period, then *additional* photomonitoring earlier in the year may be warranted to determine if these changes are due to shifts in phenology. Note that we are not recommending additional monitoring at this time.

Because of the level of shrub die-off observed in 2015, we recommend continued photomonitoring in 2016. Current climate predictions suggest increased rainfall (El Niño conditions) during the winter months of 2015-2016. Under this scenario, photomonitoring in 2016 would provide insights on shrub recovery (if any) from drought over the short-term.

Nonnative, invasive species (particularly, nonnative grasses) have been documented previously at a number of Lakeside ceanothus stands. While cover of nonnative species was generally similar to other (non-drought) years, there are some stands where selective weed control should be implemented during normal (or above-normal) rainfall years to ensure that invasive species do not increase in extent. These stands include CECY-2, 3, 5, and 6. Invasives control may include hand-clearing (CECY-2) or herbicide control (nonnative grasses and forbs). In all cases, care should be taken to avoid native species.

In reviewing the 5-year time series, it is also apparent that it would be helpful to standardize photomonitoring protocols with respect to height, angle, and focal depth of photos. Refer to Appendix B for photomonitoring protocols for future photomonitoring.



Please do not hesitate to contact me at (858) 254-9199 or pgordonreedy@consbio.org if I can provide further information.

Sincerely,

Patricia Gordon-Reedy
Biologist/Vegetation Ecologist
Conservation Biology Institute

References

- Conservation Biology Institute (CBI). 2011. Biological monitoring status report, Crestridge Ecological Reserve. Prepared for Endangered Habitats Conservancy. December. 20 pp.
- Conservation Biology Institute (CBI). 2014. Adaptive management framework for the endangered San Diego thornmint, *Acanthomintha ilicifolia*, San Diego County, California. Prepared for California Department of Fish and Wildlife, local assistance grant P1182113. March. 27 pp. + appendices.
- Conservation Biology Institute (CBI), Dendra, Inc., and California Invasive Plant Council (Cal-IPC). 2012. Management priorities for invasive non-native plants: a strategy for regional implementation, San Diego County, California. Prepared for San Diego Association of Governments (SANDAG), contract no. 5001322. 83 pp.
- San Diego Management and Monitoring Program (SDMMP). 2013. Management Strategic Plan for Conserved Lands in Western San Diego County, v. 08.27.2013.
- San Diego Management and Monitoring Program (SDMMP). 2014. Rare plant monitoring protocol and field form. Updated 3/5/15.

Appendices

- Appendix A – Photomonitoring Record (2010-2012, 2014-2015)
Appendix B – Photomonitoring Protocols