San Diego Association of Governments
EMP Grant Program

Back Country Land Trust
San Diego Thornmint and Quino Checkerspot Butterfly Habitat Restoration
Project Final Report

Project Period: September 27, 2013 through September 27, 2016
SANDAG Contract Number: 5001764

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Executive Summary

The Back County Land Trust (BCLT), in partnership with AECOM, received grant funding from the San Diego Association of Governments under the *TransNet* Environmental Mitigation Program (EMP) Fiscal Year 2013 Funding for Land Management. BCLT and AECOM used the EMP funds for restoration of native grassland habitat at BCLT's property, Wright's Field, located in Alpine, California (the Project). Specifically, funds were utilized to restore and enhance the two remaining San Diego thornmint (*Acanthomintha ilicifolia*; thornmint) populations, as well as Quino checkerspot butterfly (*Euphydryas editha quino*; Quino) host plant (*Plantago erecta*; plantago) populations. Wright's Field populations of both species are facing extirpation due to nonnative plant invasion. Working in partnership with AECOM's highly skilled and qualified restoration team, BCLT implemented restoration and enhancement on two sites within native grassland habitat, both of which support thornmint and plantago. Restoration and management activities included removal of nonnatives; seed collection, bulking, and redispersal; monitoring (qualitative and quantitative) and reporting; resource agency coordination; volunteer training; and public outreach and education. After a 3-year period, the Project was successful and achieved its goals of reestablishing a viable thornmint population and enhancing native grassland habitat for Quino at Wright's Field.

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Overview

The Back County Land Trust (BCLT), in partnership with AECOM, received grant funding from the San Diego Association of Governments (SANDAG) under the *TransNet* Environmental Mitigation Program (EMP) Fiscal Year 2013 Funding for Land Management. BCLT and AECOM used the EMP funds for restoration of native grassland habitat at BCLT's property, Wright's Field, located in Alpine, California (the Project). Specifically, funds were utilized to restore and enhance the two remaining San Diego thornmint (*Acanthomintha ilicifolia*; thornmint) populations, as well as Quino checkerspot butterfly (*Euphydryas editha quino*; Quino) host plant (*Plantago erecta*; plantago) populations. Thornmint is listed as federally threatened and state endangered. Quino is listed as federally endangered. Both species are considered among the most imperiled sensitive species in Southern California and have suffered serious decline in the last 20 years; both species and the native grasslands that support them are priorities for the 2013 EMP program. Wright's Field populations of both species are under the threat of extirpation due to nonnative plant invasion. Working in partnership with AECOM's highly skilled and qualified restoration team, BCLT proposes to implement restoration and enhancement on two sites within native grassland habitat, both of which support San Diego thornmint and plantago. Restoration and management activities included removal of nonnatives; seed collection, bulking, and redispersal; monitoring (qualitative and quantitative) and reporting; volunteer training; and public outreach and education.

Project Location

Restoration and enhancement of the two existing San Diego thornmint and Quino host plant (plantago) populations were implemented within an approximately 22,000-square-foot (sq ft) area at Wright's Field (Figures 1 and 2). The restoration area encompassed two sites that include the two existing San Diego thornmint populations: Restoration Area 1 was approximately 5,500 sq ft and Restoration Area 2 was approximately 16,500 sq ft. Based on a survey conducted by California Department of Fish and Game (CDFG) in 1994, Restoration Area 1 had approximately 400 plants and Restoration Area 2 had approximately 50 plants (CDFG 1994). The thornmint populations had greatly diminished since that survey and were facing extirpation, with an estimated total of fewer than 50 plants between the two populations. Management actions were needed to remove nonnative plant species and enhance and restore populations of thornmint and plantago, and enhance the overall native grassland habitat.

Project Background and Need

Wright's Field is the largest open space area in Alpine and is located on a heavy clay bench that has an underlying basalt base. The erosion of the basalt base has created very deep clay lenses throughout the site that support a variety of vegetation types, including very high quality native grassland. Research conducted on the needlegrass (Nasella sp.) populations at Wright's Field suggest that the native grassland carries unique genetics compared to other native grasslands that still remain in Southern California (Rice and Knapp 1995). In addition to native grassland, Wright's Field also supports coastal

Figure 1

Figure 2

sage scrub, chaparral, and Engelmann oak woodlands. All of the habitats have suffered some past disturbances from grazing, off-road activity, and other factors, but the native vegetation remains intact throughout the entire site. Nonnative plant invasion is the primary threat to all vegetation types found on Wright's Field, particularly the native grassland. Sensitive plant species currently supported by the habitats at Wright's Field include San Diego thornmint, Palmer's grappling hook (Harpagonella palmeri), and Engelmann oak (Quercus engelmannii**)**; sensitive wildlife species include grasshopper sparrow (Ammodramus savannarum), ringtail (Bassariscus astutus**)**, granite night lizard (***Xantusia henshawi***)**, coast horned lizard (***Phrynosoma coronatum***)**, orange-throated whiptail (***Aspidoscelis hyperythra***)**, northern harrier (Circus cyaneus), burrowing owl (Athene cunicularia), western spadefoot (***Spea hammondii***)**, Quino, and Hermes copper butterfly (Lycaena ***hermes***)**.

Because Wright's Field is a fenced conservation area, the site is protected from development and other human disturbance (e.g., off-road vehicle use). Thus, the primary threats/stressors to the thornmint populations and Quino habitat are invasion of nonnative plant species. Studies conducted in the last 20 years as well as the listing rule for San Diego thornmint noted competition with nonnative species as a major threat to the species (Bauder et al. 1994). This threat is particularly concerning for San Diego thornmint because the species appears especially sensitive to nonnative competition. Some studies have shown that the most prominent nonnative species that threatens San Diego thornmint are wild oats (Avena spp.), purple false brome (Brachypodium distachyon), black mustard (Brassica nigra), yellow star thistle (Centaurea melitensis), artichoke thistle (Cynara cardunculus), and fennel (Foeniculum vulgare) (Bauder and Sakrison 1997, p. 40). These nonnatives would be specifically targeted in restoration and maintenance efforts. The listing rule also notes that smaller populations of San Diego thornmint are more vulnerable to extinction and that more management attention is needed for conserving smaller occurrences.

The native grasslands and the species supported by the grasslands are declining due to nonnative plant invasion. Specifically, the thornmint populations at Wright's Field are on the verge of extirpation due to the small numbers of individuals, from approximately 450 plants in the mid-1990s (CDFG 1994) to less than 50 individuals (as estimated by AECOM in 2013 upon Notice to Proceeed). The population is at the eastern extreme of the thornmint range and is likely to harbor unique genetic traits, which is important for long-term species survival. Only two locations have populations of San Diego thornmint that are farther east than the Wright's Field population: Viejas Mountain and Posser Mountain.

Plantago is also declining in the grasslands at Wright's Field due to nonnative plant invasion. The stability and survivability of Quino at Wright's Field is directly tied to the health of the native grasslands that support the host plants and nectar sources for the butterfly. If deterioration continues, the grasslands at Wright's Field may no longer support Quino in the near future.

Past management at Wright's Field has included installation of fencing from TransNet EMP funded grants, as well as erosion control, weed control, maintenance from volunteer groups, and monitoring of thornmint populations. Current management includes continual monitoring, as well as volunteer work for trail maintenance, trash removal, and nonnative plant control.

Project Goals and Objectives

The goals for restoration, maintenance, and management activities at Wright's Field were:

a. To restore the two existing populations of San Diego thornmint,
b. To enhance the host plant population (plantago) for Quino; and
c. To enhance the overall native grassland habitat.

The objectives that were implemented to achieve the project goals over the 3-year restoration, maintenance, and monitoring period were:

1. Reestablish the estimated population size from the mid-1990s (goal of approximately 450 plants total between the two restoration areas)

2. Double the size of the plantago population from the size of observed conditions prior to implementation of the grant program (Note: No individuals were observed between the two populations at Notice to Proceed)

3. Reduce nonnative cover of the native grassland habitat by 50% compared to observed conditions prior to implementation of the grant program

Summary of Project Budget

Table 1 provides a summary of the total Project cost, including EMP grant funds and total matching funds provided by BCLT.

Table 1
Project Cost including Total Grant and Matching Funds

Total Grant Funds	$108,540.00	74%
Total Grantee Match	$38,243.49	26%
Total Project Cost	$146,783.49	100%

Work Performed by Task

Task 1 – Dethatch and Weed Control

Budget: $30,272.00
Spent: $30,272.00
Match for Task: $0

Task 1 included an initial round of dethatching and ongoing weed control to remove nonnatives within the restoration areas throughout the 3-year project. During fall 2013, following Notice to Proceed, removal of nonnative thatch was performed at both restoration areas. In addition, the two restoration areas were delineated with stake and rope to keep out foot traffic from the public using nearby trails.

During the 3-year grant period, between eight and 10 weed control visits were performed each year, as needed, to address nonnative plant growth. Nonnative growth was assessed during monitoring visits (see Task 2) to determine when and where weed control was needed. Weed control was performed by spraying of herbicide and/or by hand (specifically around thornmint individuals) to target nonnative species, primarily Russian thistle *(Salsola tragus),* natal grass (*Melinis repens*)*,* thistle *(Centaurea* sp.*)*, mustard *(Brassica* sp.*)*, filaree (*Erodium cicutarium*), and scarlet pimpernel (*Anagallis arvensis*). Details of weed control visits were documented in the quarterly status reports.

By the end of Year 3 (September 2016), the goal to achieve a 50% reduction of nonnative cover compared to initial conditions had been far exceeded, with estimated nonnative plant cover reduced from 60% in the southern restoration area and 90% in the northern restoration area to less than 5% nonnative cover in both areas.

Task 2 – Seed Collection, Bulking, and Dispersal

Budget: $22,503.00
Spent: $22,503.00
Match for Task: $0

Due to severe drought conditions in San Diego County (National Drought Mitigation Center 2016), thornmint and plantago seed was not available for collection during 2013 or 2014, as originally anticipated. Small numbers of thornmint and plantago did germinate on the site during 2015 and 2016, so seed was collected during spring/summer 2015 and 2016 for seed bulking in the greenhouse. Seed from bulking efforts in early 2015 was used to propagate thornmint and Plantago, and a second round of propagation occurred during winter 2015/2016.

Thornmint flats were sown with collected seed and approximately 600 seedlings germinated by January 2016. By the end of March 2016, AECOM had approximately 387 plants remaining in 1-, 5- and 15-gallon containers at the nursery for seed bulking. In addition, 10 flats of Plantago erecta were planted in 2016 for seed bulking. Seed propagated in the greenhouse was not redispersed on the site as sufficient rainfall did not occur. Instead, seed is being stored by BCLT for dispersal when adequate conditions occur (i.e., suitable rainfall).

Approximately 200 of the thornmint seedlings were outplanted at the northern thornmint restoration area in February and March 2016. The transplanted seedlings were flagged following installation, monitored periodically and watered, as necessary, to supplement natural precipitation.

No thornmint were transplanted at the southern restoration area, as this population is believed to have a different genetics than the northern population (based on studies conducted by the Center of Natural Lands Management [CNLM]). However, natural germination of thornmint in the southern restoration area was observed during winter 2015/2016. In the southern restoration area, clustered tarweed (Deinandra fasciculata) was observed during 2016 as becoming too dominant and outcompeting the

thornmint. Therefore, to reduce the population within the southern restoration area, seed was collected and spread around the buffer of the northern restoration area.

As part of this task, other native seed including purple needlegrass (Nassella pulchra), gumweed (Grindelia squarrosa), and California aster (Corethrogyne filaginifolia) was also collected from the restoration areas. Seed was dispersed into the buffers around the restoration areas and also stored to use for later dispersal by BCLT at the restoration areas to enhance native cover (pending sufficient site conditions).

Task 3 – Volunteer Training and Public Outreach

Budget: $4,117.00
Spent: $4,117.00
Expected Matching Funds: $11,625.00
Actual Match for Task: $16,830.68

As part of the Project, BCLT and AECOM engaged the public in the restoration of thornmint and enhancement of native grassland habitat at Wright's Field in several ways. First, BCLT and AECOM led numerous visits to educate local children from Joan McQueen Middle School and Alpine Academy High School about the importance of conserving Wright's Field and the many special plants and animals that live there (May 7, October 8, and October 15, 2014; March 2 and March 11, 2016). Approximately 200 students were trained to identify thornmint and search other areas of Wright's Field with suitable habitat to potentially identify new or undetected populations. BCLT and AECOM also worked with a local Girl Scout troop to enhance a portion of the native grassland habitat at Wright's Field and create more available habitat for species like thornmint and Quino. BCLT and AECOM led public nature walks to discuss the Project with members of the public and elicit volunteers (October 5, 2013; April 19, 2014). Throughout the 3-year Project period, BCLT developed and distributed public education and outreach materials to the BCLT media list and community members through newsletters, emails, and social media sites. Volunteer recruitment was also done through word-of-mouth and posted signs at Wright's Field.

Task 4 – Monitoring and Reporting

Budget: $26,214.00
Spent: $26,214.00
Expected Matching Funds: $18,000.00
Actual Match for Task: $21,412.81

During the 3 years of the Project, qualitative monitoring was performed generally monthly by AECOM to evaluate weed status at the restoration areas and determine maintenance needs. Qualitative monitoring was also performed to estimate population sizes for thornmint and plantago. The original

grant application envisioned matching funds from Michael Klein (KEPS Consulting) for pollinator monitoring. However, due to health issues, Michael Klein was unable to perform monitoring. Instead, BCLT and AECOM staff provided volunteer monitoring as part of matching funds. Monitoring observations and results were documented in AECOM's monthly status reports provided to BCLT, and in the quarterly reports provided to SANDAG.

Task 5 – Resource Agency Coordination

Budget: $7,708.00
Spent: $7,708.00
Actual Match for Task: $0

As part of this task, AECOM coordinated with the U.S. Fish and Wildlife Service, CDFG, and the County of San Diego to receive approval for collection and bulking of thornmint seed. The County permit was issued on December 11, 2013. In addition, throughout the Project period, AECOM coordinated with local non-profit groups, such as CNLM on the approach to thornmint enhancement and genetics, and the Conservation Biology Institute (CBI) regarding grassland management and the management of sensitive grassland plant and animal species. AECOM was invited to participate in San Diego Management and Monitoring Program thornmint working group as a result of coordination with CNLM and CBI. The presentation focused on the work with BCLT, including implications of the drought and planned work for the next 2 years of the grant. Presentations at the working group provided information with potential implications on thornmint restoration (e.g., genetic studies performed by CNLM). As part of volunteer efforts, AECOM also coordinated with Daniel Marschalek at San Diego State University about the use of the Wright's Field thornmint restoration sites for a pollinator study conducted by the university.

Task 6 – Administration

Budget: $17,726.00
Spent: $17,726.00
Actual Match for Task: $0

Task 6 involved BCLT contract administration, invoice preparation, coordination with SANDAG, and oversight of AECOM. All time for BCLT on the Project was included under this task.

Results and Next Steps

When the grant proposal was submitted for the Project, BCLT and AECOM anticipated three growing seasons to restore thornmint and Quino habitat. However, severe drought conditions in 2013 and 2014 resulted in no germination of thornmint or plantago at the restoration areas, delaying Project progress in these years. However, due to AECOM's seed collection and propagation efforts in 2015 and 2016 (as

described above), the Project was not only able to achieve, but actually exceeded, Project goals. By the end of Year 3, the project had generated approximately 587 San Diego thornmint individuals, beyond the population of 450 observed during the CDFG survey in 1994. In addition, it is estimated that over 10,000 thornmint seeds were produced during the 2016 seed bulking effort. There were no plantago populations within the restoration areas at the start of the Project, but, by the end of Year 3, approximately 500 individuals were present in the southern population and 250 in the northern population, for a total of approximately 750 plantago (compared to no individuals within the restoration areas prior to the start of the project). In addition, nonnative cover was reduced from 60% in the southern restoration area and 90% in the northern restoration area to less than 5% in both restoration areas, which is well over the goal of a 50% reduction in nonnative cover. Overall, the Project was a great success, reestablishing thornmint populations and enhancing native grassland habitat for Quino at Wright's Field.

BCLT plans to store the remaining collected seed of thornmint, plantago, and other native species (as described under Task 2) for future dispersal pending sufficient rainfall. Based on the amount of seed produced in 2016 (estimated to be over 10,000 seeds), BCLT plans to hand seed the existing thornmint populations for another 3 years without any additional seed collection or seed bulking. In addition, BCLT will continue to engage the public and volunteers to continue with enhancement and protection of the thornmint populations at Wright's Field.

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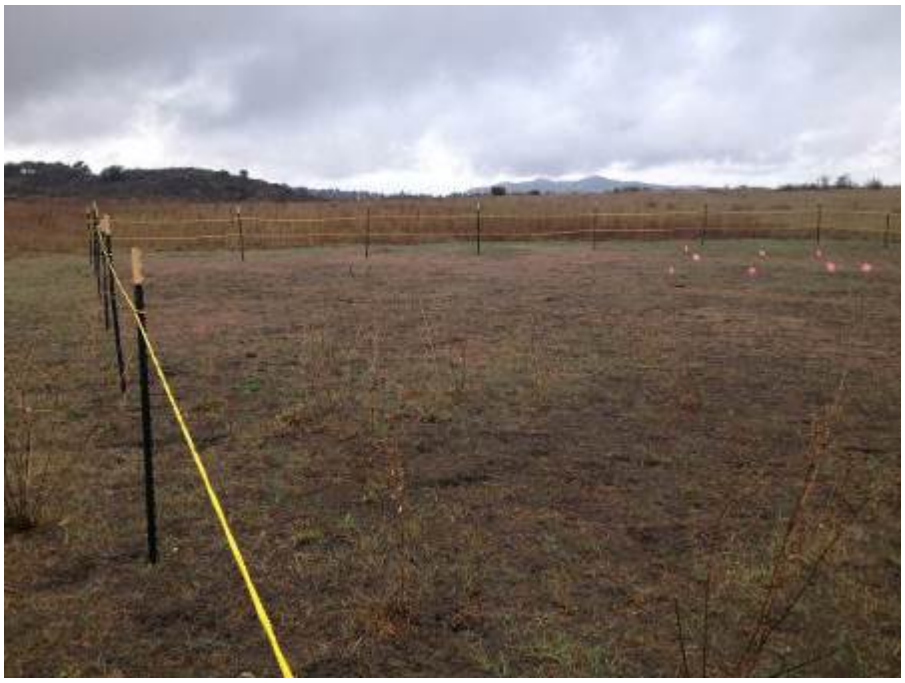
Photographs



October 2013: Initial flagging of thornmint at southern restoration area

October 2013: Initial monitoring of thornmint at northern site

October 2013: Thornmint individual

January 2014: Southern site following weed control visit

January 2014: Northern site following weed control visit (pin flags identify thornmint to be avoided during weed control)

April 2014: Educational tour for the public led by BCLT and AECOM staff

May 2014: Field trip for local students led by BCLT and AECOM staff

September 2014: Southern restoration area

September 2014: Northern restoration area following a weed control visit

October 2014: Dethatching in the buffer areas at Wright's Field

November 2014: Alpine Girl Scouts taking a tour of restoration project sites

January 2015: Northern restoration area during monitoring visit

January 2015: Northern restoration area during monitoring visit

February 2015: Southern restoration area following weed control

February 2015: Northern restoration area following weed control

April 2015: Thornmint individual observed during monitoring visit

April 2015: Northern site during monitoring visit

June 2015: Flowering thornmint observed during monitoring visit

June 2015: Flowering thornmint observed during monitoring visit

August 2015: Southern restoration area after weed control

December 2015: Photograph of thornmint propagation for seed bulking

January 2016: Photograph of thornmint propagation for seed bulking

January 2016: Pin flags indicating where propagated thornmint individuals were planted

February 2016: Site visit to observe planted thornmint individuals

March 2016: Germinated thornmint individual at the southern site

March 2016: AECOM and BCLT leading a field trip for local students to observe thornmint restoration

April 2016: Flowering thornmint (seed was collected for a second round of seed bulking)

April 2016: Flowering thornmint (seed was collected for a second round of seed bulking)

July 2016: Dried thornmint plant following harvest of seed for propagation

July 2016: Collected seed for propagation efforts