

**A PETITION TO THE STATE OF CALIFORNIA
FISH AND GAME COMMISSION**

For action pursuant to Section 670.1, Title 14, California Code of Regulations (CCR) and Sections 2072 and 2073 of the Fish and Game Code relating to listing and delisting endangered and threatened species of plants and animals.

I. SPECIES BEING PETITIONED:

Common Name: Livermore tarplant

Scientific Name: *Deinandra bacigalupii*

II. RECOMMENDED ACTION:

(Check appropriate categories)

a. List X

b. Change Status

As Endangered X

from _____

As Threatened _____

to _____

Or Delist _____

III. AUTHOR OF PETITION:

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I hereby certify that, to the best of my knowledge, all statements made in this petition are true and complete.

Signature: 

Date: August 29, 2014

TABLE OF CONTENTS

EXECUTIVE SUMMARY	3
TAXONOMY AND DESCRIPTION	3
Taxonomic History	3
Description	4
Phenology	4
Similar Taxa	4
ECOLOGY	5
Habitat	5
Pollination	5
Associated Species.....	6
Distribution	6
Abundance	7
Trends	8
KNOWN OCCURRENCES	8
EO 1. Greenville Road	8
EO 2. Springtown	8
EO 4. East Valley	9
ATTEMPTS TO LOCATE ADDITIONAL POPULATIONS.....	9
THREATS	10
Degree and Immediacy	10
CURRENT MANAGEMENT ACTIVITIES.....	14
POTENTIAL MANAGEMENT ACTIVITIES.....	15
AVAILABILITY OF SOURCES OF INFORMATION	17
Bibliography	17

LIST OF TABLES

Table 1. DEBA Census Totals	7
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LIST OF FIGURES

Figure 1. Livermore tarplant (<i>Deinandra bacigalupii</i>). Photographed by H. Bartosh	4
Figure 2. Location of EO 2 Springtown	7
Figure 3. Locations of EO 1 Greenville and EO 4 East Valley	7
Figure 4. Soil deposition to the left and constructed road in the background at EO 1.	11
Figure 5. 2002 aerial photo of EO 1 without disturbance.....	11
Figure 6. 2012 aerial photo of EO 1 showing soils deposition and road.....	12
Figure 7. Off-road vehicle track at southern part of population (EO 2).	13

Executive Summary

Livermore tarplant (*Deinandra bacigalupii*) is an erect, aromatic, taprooted annual in the sunflower family (Asteraceae), which was described as new to science in 1999 (Baldwin 1999). *Deinandra bacigalupii* (DEBA) is currently known from only three occurrences limited to just 90 acres in the Livermore Valley, Alameda County, California. One occurrence is located on public and private lands, and the remaining two are on privately owned parcels. A total of 303,720 individuals have been estimated in a single year (2009) (Bartosh 2009).

One of the three occurrences has been steadily encroached upon since 2002 from soil deposition activity, excavation of the western portion of the property, and the construction of a roadway. All of these activities have, and continue to directly impact DEBA occupied habitat. Potential indirect impacts to DEBA from its proximity to these activities include establishment and expansion of non-native plants, changes in hydrologic conditions, soil compaction and disturbance, inadvertent or intentional application of herbicides, fertilizers, and pesticides near to colonies. Zoning within all or portions of the remaining occurrences is such that the parcels can be plowed for crops or developed into a horse boarding facility without CEQA review. Heavy, illegal off-road vehicle use is also affecting one of the occurrences.

Overall, the species is threatened by alteration of habitat due to industrial and agricultural uses and associated disturbances, displacement by non-native grasses and forbs that tolerate alkaline habitat, off-road vehicle use, and development potential based on zoning designations.

DEBA is not currently proposed for listing under the Federal Endangered Species Act as all occurrences are located on private land, which alone does not trigger a Federal nexus. Listing of Livermore tarplant under the California Endangered Species Act is necessary to provide critical legal protections and habitat designations to ensure survival of this highly endangered plant species.

TAXONOMY AND DESCRIPTION

TAXONOMIC HISTORY

Livermore tarplant (*Deinandra bacigalupii* B.G. Baldwin) is an endemic species from the Livermore Valley, Alameda County, California. Robert F. Hoover made the type collection (*R.F. Hoover 9954*, UC) on August 31, 1966 from the “junction of Ames St. and Raymond Road, north of Livermore, in “sandy alkaline soil.” Hoover only labeled his collection as *Hemizonia*, without identification to species. Less than a year later, on April 26, 1967 Rimo Bacigalupi annotated Hoover’s collection stating “Does not seem to match any thus far published species of *Hemizonia*.” Dale E. Johnson identified the collection to be *Hemizonia paniculata* [= *Deinandra paniculata*] in 1978. Barry Tanowitz (1983) included these plants within his circumscription of *Hemizonia increscens* subsp. *increscens* [= *Deinandra increscens* subsp. *increscens*], as reflected in David J. Keil’s (1993) treatment of *Hemizonia* in *The Jepson Manual*. Hoover’s specimen went unrecognized as a new species until freshly collected plants from the same population were brought to the Curator of the Jepson Herbarium, Bruce Baldwin, for identification by Dean K. Kelch and Rob Preston (Baldwin 1999). The original description was published by Bruce Baldwin in 1999 (Baldwin 1999). *Deinandra bacigalupii* was named in honor of Rimo Bacigalupi, first Curator of the Jepson Herbarium (Baldwin 1999).



Figure 1. Livermore tarplant (*Deinandra bacigalupii*). Photograph by Heath Bartosh

DESCRIPTION

Livermore tarplant (*Deinandra bacigalupii*, hereafter abbreviated DEBA) is an erect, aromatic, taprooted annual in the sunflower family (Asteraceae). It grows to a height of 10 to 40 cm, branched in the distal half or to near the base. When mature it produces flat-topped or panicle-like clusters of inflorescences (heads). The leaves are sessile, mostly cauline, entire or irregularly lobed, and are coarse-hairy and stalked-glandular. The radiate flowering heads consist of 8 (sometimes 6 or 9) deep yellow ray flowers and 15 to 18 (sometimes 10 or 21) disk flowers that are mostly staminate and have yellow to brown anthers. The disk pappus generally comprises 8 to 13 awl-shaped to square, fringed to deeply cut scales 0.1 to 0.8 mm.

PHENOLOGY

DEBA flowers from June to October (Baldwin in Baldwin et al. 2012; CNPS 2014). Seed production closely follows flowering during summer and fall months.

SIMILAR TAXA

DEBA is sympatric with Lobb's tarplant (*Deinandra lobbii*) and occurs in the same geographic region as Kellogg's tarplant (*Deinandra kelloggii*) but is not known to co-occur with *D. kelloggii*. Lobb's tarplant differs from DEBA primarily by having only 3 (sometimes 4) ray and disc flowers each (Baldwin in Baldwin et al. 2012). Kellogg's tarplant differs from DEBA mainly by having 5 ray flowers and six disk flowers (ibid.). *Deinandra lobbii* occurs at the type locality of DEBA.

Although, DEBA is morphologically similar to *D. increscens* and *D. paniculata*, which are not known to occur in the San Francisco Bay Area, it can be readily distinguished from those two species by its much shorter pappus and its yellow or brownish, as opposed to dark purple, anthers. In the East Bay, there are no other *Deinandra* species that can be easily mistaken for DEBA (Baldwin 1999).

ECOLOGY

HABITAT

DEBA is supported by poorly drained, seasonally dry, highly alkaline Pescadero and Solano series soils (Baldwin 1999) of sedimentary parent material. It occurs in alkaline meadows and grasslands in the vicinity of barren alkali scalds, alkali vernal pools, and playa-like pools.

The primary (largest) population of DEBA co-occurs with several California Rare Plant Rank (CRPR) and state and federally-listed species, including brittle scale (*Atriplex depressa* [CRPR 1B.2]), hispid bird's-beak (*Chloropyron molle* subsp. *hispidum* [CRPR 1B.1]), and palmate bracted bird's-beak (*Chloropyron palmatum* [state and federally endangered]). DEBA is supported by alkali meadow/grassland near the margins of alkali sink habitat, both considered sensitive natural communities by the California Department of Fish and Wildlife

In the Livermore Valley region, alkali grassland generally occurs on alkaline soils of the Clear Lake, Pescadero, San Ysidro, and Solano series. In some areas, these grasslands are dominated by saltgrass (*Distichlis spicata*), while other areas of alkali grassland resemble valley non-native grassland, though cover of non-native annual grasses and forbs supported by these soil types is low while native grass and forb cover is high. Of the vegetation communities described by Holland (1986), the most similar is alkali meadow. Alkali meadow is characterized by a sparse to densely vegetated plant community consisting of relatively few low growing plant species with a strong component of perennial species (Holland 1986). It is usually supported by fine-textured, seasonally or perennially moist alkaline soils. Features referred to as alkali scalds are frequently associated with alkali grassland. Alkali scalds exhibit saline or alkaline crusts on the soil surface, supporting little or no vegetation, due to elevated soil pH, which can be toxic to most plant species (Nomad 2009).

Alkali sink vegetation occurs on poor soils with high alkalinity due to evaporation of water that accumulates in closed drainages. Of the vegetation communities described by Holland (1986), the most similar are valley sink scrub and alkali playa. Valley sink scrub is characterized by low, open to dense, succulent shrublands, dominated by alkali-tolerant Chenopodiaceae species, especially iodine bush (*Allenrolfea occidentalis*). A layer of understory plant species is usually lacking but in some areas may support perennial and annual vegetation. Similarly, alkali playa is characterized by low, grayish, microphyllous and succulent shrubs to about one meter tall. Total cover is usually low, due to wide spacing between shrubs and minimally developed understory. However, in some years, with adequate rainfall, there are spectacular wildflower displays between the shrubs (Coats et al. 1988). Valley sink scrub occurs on heavy, saline, or alkaline clays of lakebeds, basin rims or playas. High groundwater supplies provide capillary water for the perennial plant species. Soil surface is often bright white, salty crust over dark sticky clay. Similarly, alkali playa occurs on poor soils with high salinity and/or alkalinity due to evaporation of water that accumulates in closed drainages. These areas often have a high water table and with salt crust on the surface.

Elevation of DEBA occurrences ranges from 152 to 183 meters. Average mean temperature of Livermore Valley is 14 degrees Celsius, and the average annual rainfall is between 33 to 46 centimeters (USDA 1966).

POLLINATION

No pollination studies have been performed on DEBA to date and no anecdotal observation data on pollinators is available. In general, members of the Asteraceae are considered to be pollinated by wide diversity of insects, or more rarely birds or wind. Pollinators of this taxon likely include members of

Diptera, Hymenoptera, Lepidoptera, Hemiptera and Coleoptera, based on observations on other *Deinandra* and related taxa.

ASSOCIATED SPECIES

DEBA is often associated with a number of native and non-native species including iodine bush (*Allenrolfea occidentalis*), brittlescale (*Atriplex depressa*), soft chess (*Bromus hordeaceus**), pungent tarplant (*Centromadia pungens* subsp. *pungens*), salt dodder (*Cuscuta salina*), saltgrass (*Distichlis spicata*), annual hairgrass (*Deschampsia danthonioides*), alkali heath (*Frankenia salina*), narrow tarplant (*Holocarpha virgata* subsp. *virgata*), alkali barley (*Hordeum depressum*), Mediterranean barley (*Hordeum marinum* subsp. *gussoneanum**), toad rush (*Juncus bufonius* var. *bufonius*), California goldfields (*Lasthenia californica*), sickle grass (*Parapholis incurva**), narrowleaf flax flower (*Leptosiphon liniflorus*), long styled sand spurrey (*Spergularia macrotheca* var. *longistyla*), hairy clover (*Trifolium microcephalum*), brome fescue (*Festuca bromoides**), small six-weeks grass (*Festuca microstachys*), and rattail six weeks grass (*Festuca myuros**) (Baldwin 1999).

DISTRIBUTION

All known populations of DEBA are in the eastern portion of the Livermore Valley on both public and private land within the City of Livermore and unincorporated Alameda County, California. Populations are clustered in three occurrences, located within a three mile radius of each other in the Altamont Creek watershed that feeds Las Positas Creek (see Figure 2 and 3). These occurrences¹ are hereafter referred to as EO 1 (EO = Element Occurrence) Greenville Road, EO 2 Springtown², and EO 4 East Valley. The total areal extent of occupied habitat is approximately 90 acres. See *Known Occurrences* section below for additional details on occurrences.

* Denotes a species with an origin other than California (non-native).

¹ An occurrence (or element occurrence, “EO”) is defined by the DFG California Natural Diversity Database (CNDDDB) as a discrete plant population separated from other populations by at least ¼ mile.

² Includes the former EO #3

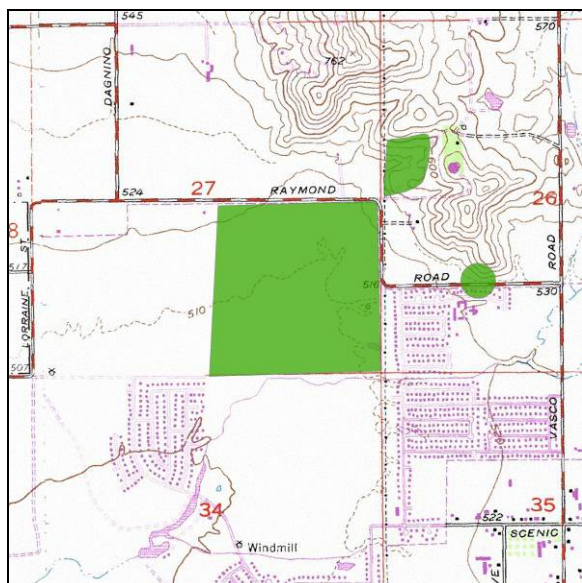


Figure 2. DEBA occurrence EO 2 Springtown (3 shaded polygons) as mapped by CNDDDB.

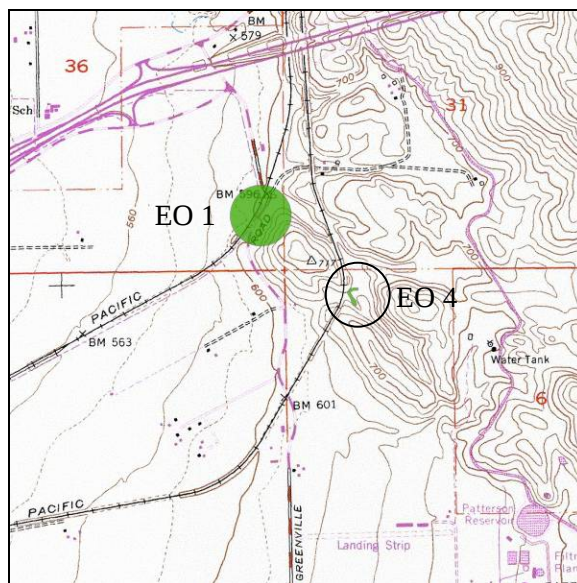


Figure 3. DEBA occurrence EO 1 Greenville Road, is the circle on the left and EO 4 East Valley is the small polygon east of the railroad tracks.

ABUNDANCE

As an annual plant, DEBA's population numbers can be expected to fluctuate dramatically from year to year depending on climatic conditions and other factors (see *Trends* section below). Very little population data has been collected on DEBA over the years based on CNDDDB occurrence data. Of the three occurrences only EO 2 at Springtown has census information associated with it. The highest number of individuals observed there, according to the CNDDDB, is 100 individuals at one of the colonies at this location. In August 2009, a census conducted of EO 1 (Bartosh 2009) estimated a total of 301,620 individuals.

Table 1. DEBA Census Totals

ELEMENT OCCURRENCE	2000	2004	2009
EO 1 – Greenville Road	n/a	n/a	1,600
EO 2 - Springtown	100 (est. from one colony ³)	unknown	302,120
EO 4 – East Valley	n/a	n/a	n/a

Source: CNDDDB December 2013; Bartosh 2009.

Historically, DEBA may have been more abundant when the Springtown Alkali Sink and adjacent alkali habitats were still intact prior to the development of a residential subdivision, golf course, and former dump site north of Interstate 580 and east of North Livermore Avenue. Based on an evaluation of U.S. Department of Agriculture soils and California's Farmland Mapping and Monitoring datasets (Cal. Dept. of Conservation FMMP 2009) it is estimated that 28 percent (648 acres) of the same soil series known to support DEBA have been lost in the Springtown area (Bartosh et al. 2010). Commercial and industrial development along the Greenville Road corridor may have also replaced DEBA occupied habitat.

³ A colony is defined as a discontinuous cluster of plants within a "population" defined in the above footnote.

TRENDS

Little is known about the long-term population trends of DEBA. Over the few years that observations have been made on DEBA, the largest number of individuals that have been counted in one year (2009) was 303,720. However, as discussed above, this species is an annual, and thus population numbers can fluctuate dramatically from year to year. For such annual species, habitat quantity and quality, and the degree and nature of the direct and indirect threats, are also critical and accurate indicators of the status of the species. These factors are discussed under *Known Occurrences and Threats* sections below.

KNOWN OCCURRENCES

As outlined above, DEBA is known from only three occurrences in and near the city of Livermore, Alameda County, California. It occupies approximately 90 of the 2,313 acres of potentially suitable alkaline habitat in the Springtown watershed based on Bartosh et al. 2010. Although this acreage of potentially suitable habitat is identified, it is possible that this entire habitat (identified by soil series) is not necessarily suitable and habitat requirements may be more specialized than currently understood as there is no current evidence it can survive outside its current distribution. One of these occurrences is on land owned by the City of Livermore, however a small discontinuous colony of this population lies on a private parcel. The other two occurrences are located on private land.

EO 1. GREENVILLE ROAD

This occurrence is located within unincorporated Alameda County, south of Interstate 580 and immediately east of Greenville Road south its intersection with Las Positas Road. This small occurrence is approximately 0.5 acres located on private land (APN 99B-5700-2-9) and currently operated as a soils disposal site. Soil disposal activities are encroaching on DEBA occupied habitat (see *Threats* section for additional detail). This 0.5-acre site is triangular in shape and DEBA occupies an alkaline swale/scald and the uplands surrounding it, including the Greenville Road shoulder. No population information has been systematically collected at this site, however approximately 1,600 individuals were estimated at this location in 2009.

EO 2. SPRINGTOWN

This occurrence is the type locality (first collected in 1966) and is located north of Interstate 580 between North Livermore Avenue and Vasco Road (Figure 2). Based on the most recent surveys there are two colonies, although CNDDDB shows three. One colony, north and east of Raymond Road is not considered extant, therefore only two colonies are discussed. Based on CNDDDB methodology these colonies are treated as one occurrence.

The largest colony is located on land owned by the City of Livermore that is currently zoned as open space designated for the Springtown Wetlands Preserve. It is also partially grazed by cattle. This colony, comprising approximately 75 acres, is located south of Raymond Road and west of Ames Street. In 2009 population sampling was conducted on the City of Livermore's Springtown Wetlands Preserve Property. The goal of the sampling was to estimate the number of Livermore tarplant individuals present in the Springtown Wetlands Preserve owned by the City of Livermore. Because counting each individual plant within this population was infeasible due to high overall abundance, the total number of individuals was estimated by extrapolation from a sampled portion of the population. Sampling methodology followed a two-stage sampling design with ten 60 meter x 60 meter macroplots randomly placed throughout the sampling area. Twenty 1 meter x 2 meter rectangular quadrats were placed randomly within each macroplot. All Livermore tarplant individuals were counted within each quadrat and recorded on data

sheets. Based on statistical analysis, the population size of Livermore tarplant individuals in the Springtown Wetlands Preserve was estimated to be approximately $301,620 \pm 63,931$ individuals, with a 95% confidence interval. This results in an estimate of a population ranging from 237,690 to 365,552 and is likely around 300,000 (Bartosh 2009). A majority of these individuals were characterized as small plants less than ten centimeters tall. The generally small plant size was likely due to unseasonably high temperatures in the Livermore Valley that stressed young plants before they reached maturity. Many of these diminutive individuals were observed in flower or to have developed fruit.

The other colony, which comprises approximately 0.5-acre, is separated by city streets and a residential subdivision and occupies privately owned land (APN 99B-5300-5-5). This parcel is located immediately west of Vasco Road and north of Dalton Avenue (opposite Pasatiempo Street). A visual estimate of this population was made in 2009 at roughly 500 individuals. These two colonies may have been essentially continuous and part of a much larger colony prior to residential development on the west side of Vasco Road.

EO 4. EAST VALLEY

This occurrence is approximately 0.35-mile southeast, on the other side of a low prominence (717 feet in elevation) from EO 1. It is also located in a drainage swale that ultimately drains into EO 1. This occurrence is also 0.5-acre in size and is privately owned (APN 99B-5600-4-24) as of 2011. The habitat that supports this occurrence is mostly intact except for the western edge, which has been historically impacted by a Western Pacific Rail line. No population information is available for this occurrence.

ATTEMPTS TO LOCATE ADDITIONAL POPULATIONS

The available data indicate that DEBA has likely always been limited in distribution. As early as the 1860s, when William Brewer came through the Livermore Valley during the original California Geological Survey, botanists have spent time collecting specimens in alkaline areas of east Alameda and Contra Costa counties. Since then, many of California's most renowned botanists have spent time documenting the plants of this area, such as:

- Edward Lee Greene in the 1880s and 1890s
- Willis Linn Jepson in the 1890s
- Alice Eastwood in the 1920s
- John Thomas Howell in the 1930s
- Robert F. Hoover in the 1930s and 1960s
- Peter Raven in the 1950s
- Helen Sharsmith in the 1960s
- Larry Heckard in the 1970s
- Roger Raiche in the 1980s
- James Jokerst in the 1980s
- Dean Wm. Taylor in the 1990s
- Barbara Ertter in the 1990s

- Sue Bainbridge in the 1990s and 2000s

In all of these years no other populations within Livermore Valley have been found. Although approximately 2,313 acres of potentially suitable habitat (Bartosh et al. 2010) are present within nearby Contra Costa County, DEBA does not occur there. Heath Bartosh⁴ has spent over 300 hours throughout 2007, 2011, and 2012 conducting predictive field searches for DEBA in Contra Costa County with a particular focus on the high quality alkaline habitat in the Vasco and Byron areas. During these searches DEBA was not observed.

THREATS

DEGREE AND IMMEDIACY

The threats to all three occurrences of DEBA are potentially significant and immediate. The primary risk factors are habitat destruction through development (potential and on-going) and other human-related activities, and competition from non-native plants.

1. Habitat Modification or Destruction

DEBA is threatened both directly and indirectly by development at all three sites. Direct threats include development activities that may destroy both plants and occupied and unoccupied habitat. Indirect threats include changes in hydrologic regime and water quality, invasion and habitat alteration by non-native plants, and soil disturbance and compaction.

The Greenville Road occurrence (EO 1) is zoned as rural property used for agriculture. This occurrence has been steadily encroached upon since 2002 based on aerial photo evaluation (Figures 4, 5, and 6). Habitat loss and degradation has resulted from soil deposition activity, excavation of the western portion of the property, and the construction of a roadway. The new roadway was accompanied by grading and gravelling of natural habitat. All of these activities have directly impacted DEBA occupied habitat. Potential and likely indirect impacts to DEBA from its proximity to this use include establishment and expansion of non-native plants, changes in hydrologic conditions, soil compaction and disturbance, inadvertent or intentional application or runoff of herbicides, fertilizers, and pesticides near to colonies, and continued soils deposition. The runoff from deposited soils adjacent to occupied habitat has altered site hydrology and has the potential to change soil chemistry of alkaline habitat.

⁴ Senior Botanist at Nomad Ecology and Research Associate at the University and Jepson Herbaria at the University of California Berkeley



Figure 4. Soil deposition to the left and constructed road in the background at EO 1.



Figure 5. 2002 aerial photo of EO 1 without disturbance.



Figure 6. 2012 aerial photo of EO 1 showing soils deposition and road.

The Springtown occurrence (EO 2), existing as two colonies, has two different zoning designations. The colony within the Springtown Wetlands Preserve (despite the “Preserve” moniker) has no permanent protection. However, it is currently zoned as open space and the City of Livermore General Plan’s Open Space and Conservation Element has objectives related to DEBA protection. The City of Livermore is currently in the process of developing a conservation/mitigation bank that may include wetland construction within the Springtown Wetlands Preserve (S. Stewart pers. comm. 2014). If approved wetland creation has the potential to directly impact DEBA and its habitat through construction and indirectly through alteration in surface hydrology and additional introductions of noxious weeds.

Setting land use objectives is important as this location represents the largest population of DEBA but it is without permanent protection, such as a conservation easement, and a management plan. This area is also currently subject to heavy, illegal off-road vehicle use that is concentrated in the southern portion of the population (Figure 4). The main portion of this colony is directly threatened by expansion of an existing stand of perennial pepperweed (*Lepidium latifolium*) from the east side of Ames Street into the preserve. Perennial pepperweed⁵ typically forms monocultures and has the potential to displace all native vegetation including DEBA. Perennial pepperweed is highly competitive and forms dense colonies that displace native vegetation and wildlife and dense populations are difficult to control (DiTomaso and Healy 2007).

⁵ Perennial pepperweed is currently on the California Department of Food and Agriculture’s B List of Noxious weeds (CDFA 2013) and has a California Invasive Plant Council rating of High (Cal-IPC 2013).

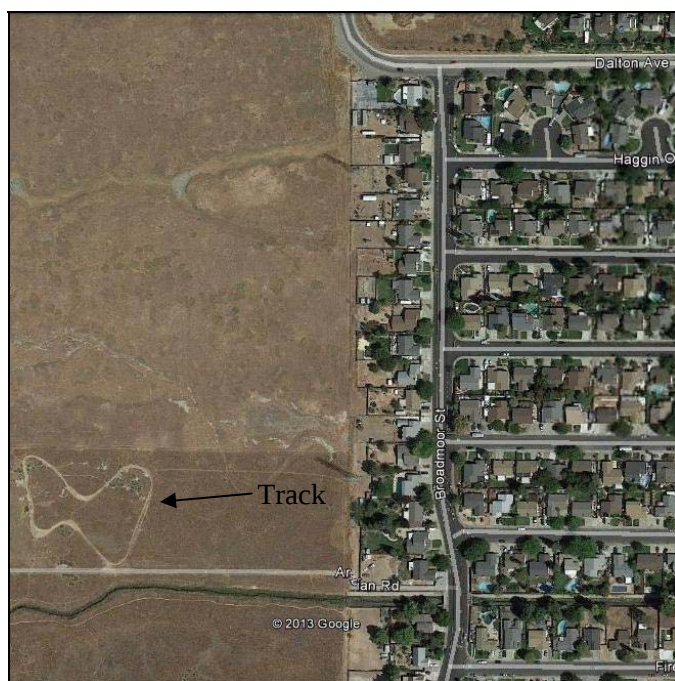


Figure 7. Off-road vehicle track at southern part of population (EO 2).

The second colony of EO 2, near the intersection of Vasco Road and Dalton Avenue, is significantly threatened due to its location within unincorporated Alameda County where it is zoned as a rural property used for agriculture, 10+ acres. With this zoning designation, this land could be plowed for crops or developed into a horse boarding facility without CEQA review.

The East Valley occurrence (EO 4) has a similar threat level as the second colony of EO 2, but this zoning designation also allows for higher use. The zoning is “rural property in transition to a higher use” City of Livermore Development Code (2010). With this zoning designation not only is agriculture a threat but there is potential for actual development into industrial, commercial, or residential property. Any habitat alteration at this occurrence has the potential to directly impact DEBA or indirectly impact it through changes in surface hydrology; changes in water quality and/or chemistry due to the application of herbicides or pesticides; increase in soil siltation or compaction from agricultural uses; and increase in non-native plants, which may invade from disturbed areas.

2. Overexploitation

Overexploitation is not known to be a significant threat.

3. Predation

Predation is not known to be a significant threat at this time.

4. Competition

All habitat for DEBA is threatened by invasion of non-native grasses and forbs from surrounding areas, and can be exacerbated by disturbance in these areas. A lack or absence of appropriate disturbance such as some changes in hydrology or appropriate grazing may also be a catalyst for detrimental competition of DEBA. Non-native grasses such as ripgut brome (*Bromus diandrus**) and Italian ryegrass (*Festuca perennis**) pose a threat through thatch accumulation in ungrazed areas of occupied DEBA habitat.

However, the most significant immediate threat to all DEBA occurrences is the non-native invasive broadleaf pepperweed (*Lepidium latifolium**)⁶ and stinkwort (*Dittrichia graveolens**)⁷. These species are aggressive invaders and are well adapted to alkaline habitat. Broadleaf pepperweed is a perennial that spreads by rhizomes, which makes removal difficult. Stinkwort is a prolific seeder. Its seeds are wind dispersed, which allows isolated populations to spread easily. Based on their life histories these species have the potential to aggressively outcompete DEBA in its natural habitat, particularly broadleaf pepperweed, which can form a monoculture if left unabated (DiTomaso and Healy 2007)..

5. Disease

Disease is not known to be a significant threat at this time.

6. Other Natural Events or Human-related Activities

Since ca. 2002 the Greenville Road occurrence (EO 1) has been impacted by road building and soils deposition activities, as described above.

Habitat destruction and off-road vehicle use threaten the continued existence of DEBA. The Springtown occurrence (EO 2) is routinely used, illegally, by off-road vehicle enthusiasts and bmx bicycle riders. As shown in Figure 7 above, a “figure 8” shaped off-road vehicle track has been created by local residents. This track is within the southern portion of the population and, through its creation and use, has directly impacted DEBA individuals and serves as a vector for non-native plant invasions.

CURRENT MANAGEMENT ACTIVITIES

The only DEBA occurrence that has associated conservation management activities is the Springtown Wetlands Preserve colony of EO 2. It is currently zoned as open space and the City of Livermore General Plan’s Open Space and Conservation Element has objectives related to DEBA protection including:

- Objective OSC-1.1 (Policy 6): The City shall preserve and maintain Frick Lake and the Springtown Alkali Sink area as important wildlife and plant habitats through preservation of open space in and around these areas.
- Objective OSC-1.4 (Policy 3): The City shall encourage and cooperate with the County, EBRPD, LARPD, and other agencies and organizations to establish a program to preserve representative examples of natural and near-natural landscape communities, such as the Springtown Alkali Sink, Brushy Peak, Corral Hollow, Cedar Mountain and Sycamore Grove.

Though these objectives have resulted in some baseline studies conducted by Susan Bainbridge⁸, such as vegetation classification, mapping, and change detection for vegetation and palmate-bracted bird’s beak, floristic inventory, and rare plant and weed mapping, these studies have not yet resulted in any active, on-the-ground, management activities. However, a Springtown Alkali Sink Working group has been convened by the City of Livermore Planning Department. This working group includes representatives from the Friends of Springtown, the University and Jepson Herbaria, Alameda County Resource Conservation District, East Bay Chapter of the California Native Plant Society, and Tri-Valley Conservancy. While not working directly on DEBA protection, their objectives related to protection of the alkali sink include signage, fundraising, outreach, weed control, and additional fencing, as well as

⁶ Cal-IPC Rating of High

⁷ Cal-IPC Rating of Moderate

⁸ Research Associate at the University and Jepson Herbaria at the University of California Berkeley

enhancing long-term protection and management. As mentioned above, the Springtown Wetlands Preserve is subject to heavy off-road vehicle impacts due to a lack of sufficient fencing, although there is posting of “no trespassing” signs. Law enforcement patrols appear to be too infrequent to minimize or prevent these impacts.

The other two occurrences, EO 1 and EO 4, have no existing management.

POTENTIAL MANAGEMENT ACTIVITIES

To assure adequate management and recovery of DEBA, the species must be listed pursuant to the California Endangered Species Act (CESA) by the State of California and the remaining colonies must be set aside in preserve areas that provide sufficient ecosystem function, adequate buffering from disturbance, appropriate ecological management, and inclusion of areas of potential, unoccupied habitat.

1. Listing the Species Under CESA

Given the extreme rarity of the species and its current threats, listing under the CESA is an appropriate action to be undertaken by the State of California. This plant is not currently proposed for listing under the Federal Endangered Species Act as all occurrences are located on private and other non-federal lands, where DEBA solely occurs, which does not trigger a Federal nexus and therefore provides little or no protection. Thus, DEBA requires the take prohibitions of CESA to assist in its protection. State listing will also make it possible to procure private and public funding to initiate some of the protective and research needs of the species.

2. Adequate Buffering

For development projects that have the potential to occur at any of the occurrences, buffering for sensitive species is typically set at a minimum buffer of 100 feet. Buffering of sensitive species is theorized to provide protection from edge effects, which include invasion of non-native species, microclimate changes, and changes in hydrology.

The Greenville Road occurrence (EO 1) is insufficiently buffered from impacts related to the soils deposition and road construction. Close monitoring of this site could yield information about the changes in hydrology and other environmental factors. There should also be monitoring of the impacts from non-native plant introductions from deposition of these soils. Similar concerns may require the establishment of a buffer at the colony of EO 2, west of Vasco Road, and EO 4 should developments be approved on these parcels to protect DEBA from direct and indirect impacts.

A long term monitoring program to inform an adaptive management program requires adequate buffering of the colonies/occurrences. Currently, little information exists regarding an accurate minimum buffering requirement of DEBA. With little known about reproductive biology of species, buffers need to be set at conservative distances until we understand what is allowable minimum. Vegetation monitoring transects set to specifically analyze the changes from the edge of adjacent roads or developments to the center of existing populations would help inform managers and agency personnel about the needs of the present and potential DEBA preserves and help to further designs for future reserves for other alkaline grassland species.

3. Preservation of Potential Habitat.

Principles of conservation biology include an emphasis on the need for the preservation of both occupied and unoccupied, potential habitat of a given species. The matrix of contiguous occupied and potential habitat allows species to expand and migrate through time and space in response to varying changes in climate and disturbance regimes. This matrix also allows species to survive stochastic events that may destroy individual populations. Currently very little alkali habitat is preserved in the Livermore Valley and lands further east in Alameda County. The following recommendations could be implemented to the long-term benefit of DEBA. It should be noted that although protecting adjacent similar habitat for long-term viability is a viable concept, however all areas mapped as the same soil series may not be suitable in the near term as there is no current evidence it can survive outside its current distribution. Therefore population expansion or translocation for preservation or mitigation purposes may not be viable.

Within northern Livermore Valley hundreds of acres of potentially suitable alkaline habitat exist in the vicinity of the Springtown occurrence (EO 2), particularly between Frick Lake and Vasco Road and south of Hartford Avenue east of North Livermore Avenue. Alkali habitat found in Doolan Canyon to the east may also be suitable for DEBA (Nomad 2009). East of the Greenville (EO 1) and East Valley (EO 4) occurrences there are small amounts of habitat that is potentially suitable, specifically in alkali areas north of Patterson Pass Road. However, the long term viability of this smaller amount of potential habitat surrounding fragmented occupied habitat of EO 1 and EO 4 has less probability of long term survival in this part of the Livermore Valley even if preserves are established there. If research through experimental reintroduction of DEBA into these areas is successful, the prospects of long term survival of the species could plausibly be improved, especially within the northern Livermore Valley, north of Interstate 580. The large and near pristine alkali habitat here would, if preserved, create large areas of core habitat although some is surrounded by roads and subdivisions.

4. Ecological Management

A program of ecological management, including the principles of adaptive management, is required to ensure the long term viability of DEBA. Given the fact that the desired preserves, yet to be protected, are fragmented by roads and subdivisions, management is expected to be more costly and intensive than for larger preserves.

As stated above there is currently no management plan for any of the occurrences nor is there adequate funding for management of DEBA occurrences. Without the establishment of conservation easements the private ownership of the land could also impede independent monitoring and management measures for the species. Any ecological management should be conducted in a manner consistent with research needs and goals listed below.

5. Research Needs

Priorities for ecological research include pollination biology, seed dispersal, seed herbivory, plant demographics, breeding system, germination studies, distribution of genetic diversity within and between occurrences and soil and other habitat requirements. This information could be used to build population models that could assist with the design of reserves.

Priorities for management research include ways to reduce the spread of broadleafed pepperweed, and stinkwort, particularly in alkali habitat. Burning, mowing, grazing, and appropriate herbicide use should be explored as well as the timing, frequency, and intensity of these disturbances. Researching the disturbance regimes and hydrology of alkali habitat is also needed to assist recovery of other rare alkali species such as the Federally and State Endangered palmate-bracted bird's-beak (*Chloropyron palmatum*).

6. Monitoring

Monitoring of extant populations of DEBA should be undertaken yearly using standardized protocols, especially in the smaller populations, which are at greater risk. Data obtained should be submitted to the California Department of Fish and Wildlife Natural Diversity Database. Surveys of any additional suitable habitat should also be regularly performed.

7. Agencies and Organizations to be Involved

City of Livermore

City of Livermore Community Development

Alameda County Board of Supervisors

Alameda County Planning Department

Zone 7 Water Agency

California Department of Fish and Wildlife

Department of Interior – U.S. Fish and Wildlife Service

California Native Plant Society – East Bay Chapter

Tri-Valley Conservancy

Friends of Springtown Preserve

University and Jepson Herbaria at the University of California, Berkeley

Alameda County Resource Conservation District

Availability of Sources of Information

- “north of Livermore, junction of Ames Street and Raymond Road, in sandy alkaline soil, Alameda County, California.” August 31, 1966. R. F. Hoover 9954 (holotype, UC; isotypes, CAD OBI, UC)

CAS California Academy of Sciences

OBI Robert F. Hoover Herbarium at Cal Poly San Luis Obispo

UC University Herbarium, University of California, Berkeley

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