

Trichostema austromontanum subsp. *compactum*
(Hidden Lake Bluecurls)

**5-Year Review:
Summary and Evaluation**



Trichostema austromontanum subsp. *compactum*
(Hidden Lake bluecurls) habitat near Hidden
Lake. Photo credit Jonathan Snapp-Cook,
(USFWS).



Trichostema austromontanum subsp.
compactum (Hidden Lake bluecurls).
Photo credit Jonathan Snapp-Cook,
(USFWS).

**U.S. Fish and Wildlife Service
Carlsbad Fish and Wildlife Office
Carlsbad, CA**

May 6, 2013

5-YEAR REVIEW
Trichostema austromontanum* subsp. *compactum
(Hidden Lake Bluecurls)

I. GENERAL INFORMATION

Purpose of 5-year Reviews:

The U.S. Fish and Wildlife Service (Service) is required by section 4(c)(2) of the Endangered Species Act (Act) to conduct a status review of each listed species at least once every 5 years. The purpose of a 5-year review is to evaluate whether or not the species' status has changed since it was listed (or since the most recent 5-year review). Based on the 5-year review, we recommend whether the species should be removed from the list of endangered and threatened species, be changed in status from endangered to threatened, or be changed in status from threatened to endangered. Our original listing of a species as endangered or threatened is based on the existence of threats attributable to one or more of the five threat factors described in section 4(a)(1) of the Act, and we must consider these same five factors in any subsequent consideration of reclassification or delisting of a species. In the 5-year review, we consider the best available scientific and commercial data on the species, and focus on new information available since the species was listed or last reviewed. If we recommend a change in listing status based on the results of the 5-year review, we must propose to do so through a separate rule-making process defined in the Act that includes public review and comment.

Species Overview:

Trichostema austromontanum subsp. *compactum* (Hidden Lake bluecurls), a member of the Lamiaceae (mint family), was described by F. Harlan Lewis in 1945. This annual plant is located along the margins of a montane vernal pool, Hidden Lake, in the San Jacinto Mountains of Riverside County, California. The single pool supports the entire range of *T. a.* subsp. *compactum*. Threats identified at the time of listing included trampling, limited numbers, and an extremely localized range.

Trichostema austromontanum subsp. *compactum* was listed as threatened under the Act on September 14, 1998, and is not listed by the State of California pursuant to the California Endangered Species Act.

Methodology Used to Complete This Review:

This review was prepared by Stacey Love at the Carlsbad Fish and Wildlife Office, following the Region 8 guidance issued in March 2008. We used survey information from experts who have been monitoring various known occurrences of *Trichostema austromontanum* subsp. *compactum* and the California Natural Diversity Database (CNDDDB) maintained by the California Department of Fish and Wildlife (CDFW). We received no information relative to *T. a.* subsp. *compactum* from the public in response to our Federal Notice initiating this 5-year review (USFWS 2010, p. 28636). This 5-year review contains updated information on the species' biology and threats, and an assessment of information compared to that known at the time of

listing or since the last 5-year review. We focus on current threats to the species pursuant to the Act's five listing factors. This review synthesizes this information to evaluate the listing status of the species and provide an indication of its progress towards recovery. Finally, based on this synthesis and the threats identified in performing the five-factor analysis, we herein recommend a prioritized list of conservation actions to be completed or initiated within the next 5 years.

Contact Information:

Lead Regional Office: Larry Rabin, Deputy Division Chief for Listing, Recovery, and Environmental Contaminants; Lisa Ellis, Fish and Wildlife Biologist, Region 8; 916-414-6464.

Lead Field Office: Stacey Love, Fish and Wildlife Biologist; Bradd Baskerville-Bridges, Recovery Branch Chief; Carlsbad Fish and Wildlife Office; 760-431-9440.

Federal Register Notice Citation Announcing Initiation of This Review:

A notice announcing initiation of the 5-year review of this taxon and the opening of a 60-day period to receive information from the public was published in the Federal Register on May 21, 2010 (USFWS 2010, p. 28636). No information or comment was received during the open period.

Listing History:

Federal Listing

FR Notice: 63 FR 49006

Date of Final Rule: September 14, 1998

Entity Listed: *Trichostema austromontanum* subsp. *compactum* (Hidden Lake bluecurls), a plant subspecies

Classification: Threatened

State Listing

Trichostema austromontanum subsp. *compactum* is not listed under the California Endangered Species Act but is ranked by the State of California as S1.1, indicating a "very threatened" species having fewer than six occurrences (CNDDB 2011, p. 1).

Associated Rulemakings:

On September 25, 2007, the Service reached a "not prudent" finding regarding the designation of critical habitat (USFWS 2007, pp. 54377-54384).

Review History:

A 5-year Review was completed by the Carlsbad Fish and Wildlife Office in 2006 (USFWS 2006, pp. 1-15) and recommended no change in status.

Species' Recovery Priority Number at Start of 5-year Review:

The recovery priority number for *Trichostema austroriparianum* subsp. *compactum* is 15 according to the Service's 2012 Recovery Data Call, based on a 1–18 ranking system where 1 is the highest-ranked recovery priority and 18 is the lowest (USFWS 1983, pp. 43098–43105). This number indicates the subspecies faces a low degree of threat and has a high potential for recovery.

Recovery Plan or Outline:

No recovery plan or outline has been prepared for *Trichostema austroriparianum* subsp. *compactum*.

II. REVIEW ANALYSIS

Application of the 1996 Distinct Population Segment (DPS) Policy:

The Act defines “species” as including any subspecies of fish, or wildlife, or plants, and any distinct population segment (DPS) of any species of vertebrate. This definition of species under the Act limits listing as DPSs to species of vertebrate fish or wildlife. Because the species under review is a plant, the DPS policy is not applicable, and the application of the DPS policy to the species' listing is not addressed further in this review.

Information on the Species and its Status:

Species Biology and Life History



Figure 1. *Trichostema austroriparianum* subsp. *compactum* (Hidden Lake bluecurls). Photo credit Ayoola Folarin (USFWS).

Trichostema austroriparianum subsp. *compactum* is a compact, soft-villous (with long, shaggy hairs) annual approximately 10 cm (4 in) tall with short internodes (stem segments between leaves) (Figure 1). The leaves are elliptic (oval but narrowed at both ends). The blue flowers with five-lobed corollas are less than 7 millimeters (0.3 in) long with four stamens (Lewis 1945, pp. 280–281, 284–285; Lewis 1993, p. 732). The species is self-compatible and can produce seeds in the absence of pollinators (Spira 1980, p. 280). The fruit consists of four smooth, basally-joined nutlets (nut-like seed) (Lewis 1945, pp. 281, 285; Lewis 1993, p. 732). *Trichostema austroriparianum* subsp. *compactum* has a vinegar-like smell, thus the common name “vinegar weed” is used for the more widely-spread *T. lanceolatum* (Bauder 1999, p. 1).

The taxon appears to germinate only in previously inundated open soil on the banks of Hidden Lake when

daily temperatures reach 25–30°C (77–86°F) in the summer (Bauder 1999, p. vi). *Trichostema austromontanum* subsp. *compactum* flowers from July to September (Bauder 1999, p. 1), but this taxon has been documented flowering as late as November (Fraga and Wall 2007, pp. 4–5). Fruits and seeds begin to develop in early August and continue to develop until November when plants complete their life cycles as temperatures drop to freezing (Fraga and Wall 2007, pp. 2–5).

Seeds of *Trichostema austromontanum* subsp. *compactum* seem to require at least one cycle from wet, cold conditions to dry, warm conditions in order to germinate (Bauder 1999, p. vi). The taxon may be restricted to the single occurrence due to precise germination conditions and very low rate of dispersal. Dormant seed presence in the soil seems likely given abundance fluctuations (see Abundance heading below) (Bauder 1999, p. 37).

Trichostema austromontanum subsp. *compactum* has no documented pollinators and is self-compatible (89.1 percent seed set with the exclusion of pollinators) (Spira 1980, p. 282). Spira also found that insects visiting the nominate taxon *T. a.* subsp. *austromontanum* lacked pollen grains on their ventral (underside) surface (which is needed for the transfer of pollen to stigma), and therefore were not acting as effective pollinators (Spira 1980, p. 280). This suggests that flowers of this species are not commonly pollinated by insects and are likely self-fertilized (Spira 1980, pp. 280–283).

Spatial Distribution

Trichostema austromontanum subsp. *compactum* has been found only on the margins of Hidden Lake, 4.0 kilometers (2.5 miles) east-southeast of San Jacinto Peak in the San Jacinto Mountains, Riverside County, California (Figure 2). This small montane vernal pool at an elevation of 2,650 meters (m) (8,700 feet (ft)) is Riverside County's only high elevation vernal pool (Bauder 1999, pp. 3–4), and is part of Mount San Jacinto State Park (Park). Hidden Lake encompasses an area of approximately 1 hectare (2 acres) and averages 1.3 m (4 ft) deep during the period of maximum inundation (November–April) (Bauder 1999, p. 13; CDPR 2002, pp. 62–63). The area within the Park where *T. a.* subsp. *compactum* grows is designated as Mount San Jacinto State Wilderness and the area immediately surrounding Hidden Lake is the Hidden Divide Natural Preserve (CDPR 2002, pp. 62–63).



Figure 2. *Trichostema austromontanum* subsp. *compactum* (Hidden Lake bluecurls) habitat at Hidden Lake. Photo credit Jonathan Snapp-Cook (USFWS).

Abundance

Surveys have shown that the population size of *Trichostema austromontanum* subsp. *compactum* differs greatly from year to year, as is typical of annual plants. This fluctuation may be due to the amount of precipitation or the amount of suitable habitat along the margins of the lake or a

2013 5-Year Review for *Trichostema austromontanum* subsp. *compactum*

combination of factors. The population has been documented to be as large as 27,000 individuals in 2008, to as few as 75 individuals in 2000 (CNDDDB 2011, p. 1; Fraga and Wall 2010, p. 6). Despite the annual differences in the population size, it is considered stable as the variation in population size is primarily due to natural factors that were present historically, and similar variations in population size were observed over a multi-year period.

Habitat or Ecosystem

Trichostema austromontanum subsp. *compactum* occurs around the margin of Hidden Lake as the ponded water evaporates (Bauder 1999, pp. 20–23). Over several years of observations, *T. a.* subsp. *compactum* was most abundant on the northern margin of the vernal pool (Fraga and Wall 2007, p. 4). However, the area with the highest density of plants is located in different portions of the vernal pool margin each year. A small subpopulation is located in a swale (a low area where runoff collects) approximately 300 ft (91 m) to the northeast, between the Desert View Overlook and Hidden Lake.

Changes in Taxonomic Classification or Nomenclature

There have been no changes in the nomenclature or taxonomic classification of *Trichostema austromontanum* subsp. *compactum* since it was listed.

Genetics

No papers investigating the genetics of the species have been published since listing.

Species-specific Research and/or Grant-supported Activities

Funding was awarded to Rancho Santa Ana Botanic Garden (RSABG) and California Department of Parks and Recreation (CDPR) through the Service's Showing Success Grant Program in 2006. These funds were used to: (1) develop a Conservation Strategy for *Trichostema austromontanum* subsp. *compactum* (Fraga and Kietzer 2009) in coordination with the Service; (2) erect interpretive signs along the boundaries of the Hidden Divide Natural Preserve for educational purposes; (3) conduct census surveys, monitoring, and floristic research on *T. a.* subsp. *compactum*; (4) conduct seed banking and germination trials; (5) monitor unauthorized visitors; and (6) purchase an automated weather station (Fraga and Wall 2010, pp. 2–3; Kietzer 2011b, pp. 2–4). The weather station collects data on the microclimate of Hidden Lake including relative humidity, temperature, and precipitation (Kietzer 2011b, p. 4).

Fraga and Wall (2010, pp. 8–9) of RSABG conducted controlled germination trials. Their results of low germination success corroborated those of Bauder (1999).

Five-factor Analysis

The following five-factor analysis describes and evaluates the threats attributable to one or more of the five listing factors outlined in section 4(a)(1) of the Act.

Since the 1920s, Hidden Lake has been a popular destination for hikers and equestrians in the Park. In 1964, a tram was constructed that greatly increased the number of visitors to the Park. In the 1970s and 1980s, a movie was shown to tram-riders that included images of people swimming at Hidden Lake (Hamilton 1983, p. 96). The high number of visitors to Hidden Lake, combined with the lack of regulations on the use of Hidden Lake, threatened the rare and unique community of plants and animals found at this high montane vernal pool. There was special concern for the continued existence of *Trichostema austromontanum* subsp. *compactum* because Hidden Lake was the only location where this species occurred. Researchers found that in cases of heavy trampling, the number of *T. a.* subsp. *compactum* that survived to produce flower was greatly reduced (Hamilton 1991, p. 22). The Service and others were concerned that without the protections and implementation of proper management actions, this species could become endangered and possibly extinct. *Trichostema austromontanum* subsp. *compactum* was subsequently listed as threatened due to vulnerabilities associated with trampling and its limited numbers (USFWS 1998, p. 49016–49017).

FACTOR A: Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range

No threats to the habitat of *Trichostema austromontanum* subsp. *compactum* were identified in the final listing rule (63 FR 49006; September 14, 1998). Present or threatened destruction, modification, or curtailment of *T. a.* subsp. *compactum* habitat or range is not now a threat, nor do we expect it to be in the future. Surveys have been conducted at Hidden Lake in recent years and observers found that habitat disturbances have been minimized (Fraga and Wall 2010, p. 5). We anticipate that these conditions will remain essentially the same in the future due to the adequate regulatory mechanisms in place to protect suitable habitat for *T. a.* subsp. *compactum* (see discussion under Factor D—Inadequacy of Existing Regulatory Mechanisms, below).

FACTOR B: Overutilization for Commercial, Recreational, Scientific, or Educational Purposes

In the 1998 final listing rule, no threats to *Trichostema austromontanum* subsp. *compactum* were attributed to Factor B (63 FR 49006; September 14, 1998). Since listing, we are only aware of the collections of seed and plant material by Service-authorized permittees for the purpose of creating a conservation seed bank for this taxon at RSABG (USFWS permit #TE00918–3). These permitted collections were conducted by trained individuals, following Service guidelines to minimize effect on the population of *T. a.* subsp. *compactum*. In conclusion, we find that overutilization for commercial, recreational, scientific, or educational purposes is not now a threat to *T. a.* subsp. *compactum* throughout its range, nor likely to be a threat in the future.

FACTOR C: Disease or Predation

No threats to *Trichostema austromontanum* subsp. *compactum* were attributed to Factor C in the 1998 listing rule (63 FR 49006; September 14, 1998). We have no data to suggest that herbivory is a threat to *T. a.* subsp. *compactum* or that it will become a threat within the future. In conclusion, we find that neither disease nor predation is a threat to *T. a.* subsp. *compactum* throughout its range, both now and in the future.

FACTOR D: Inadequacy of Existing Regulatory Mechanisms

At the time of listing, regulatory mechanisms thought to have some potential to protect *Trichostema austromontanum* subsp. *compactum* included: 1) the California Environmental Quality Act (CEQA); 2) conservation provisions under section 404 of the Federal Clean Water Act (CWA); and 3) land management of CDPR at the Park. The final listing rule (USFWS 1998, pp. 49015–49018) provides an analysis of the level of protection that was anticipated from those regulatory mechanisms. In the 2006 5-year review, we updated the discussion of CDPR land management only. Below, we discuss all regulatory mechanisms discussed in the listing rule.

State Protections

California Environmental Quality Act (CEQA)

CEQA is the principal statute mandating environmental assessment of projects in California, and applies to projects proposed to be undertaken or requiring approval by State and local public agencies (http://www.ceres.ca.gov/topic/env_law/ceqa/summary.html). The purpose of CEQA is to evaluate whether a proposed project may have an adverse effect on the environment and, if so, to determine whether that effect can be reduced or eliminated by pursuing an alternative course of action or through mitigation.

CEQA requires disclosure of potential environmental impacts. A “significant effect on the environment” is defined as a substantial, or potentially substantial, adverse change in any of the physical conditions within the area affected by a project, including flora. A mandatory finding of significance must be made if a project has the potential to substantially reduce the number or restrict the range of a rare, threatened, or endangered species. Although *Trichostema austromontanum* subsp. *compactum* is not State-listed, it is identified by the California Native Plant Society as a California Rare Plant Rank 1B (formerly known as “List 1B”) plant (CNDDDB 2011, p. 1; <http://cnps.org/cnps/rareplants/ranking.php>). The CDFW recognizes that the majority of plants identified on California Rare Plant Ranks 1A, 1B, and 2 would normally qualify for State listing, and therefore, any impacts to these plants, including *T. a.* subsp. *compactum*, must be addressed under CEQA (Morey and Berg 1994, p. 23; M. Showers, CDFW, 2011, pers. comm.).

Projects may move forward if there is a statement of overriding consideration. If significant effects are identified, the lead agency has the option of requiring mitigation through changes in the project or to decide that overriding considerations make mitigation infeasible (CEQA section 21002). Protection of listed species through CEQA is, therefore, dependent upon the discretion

of the lead agency involved.

California Department of Parks and Recreation (CDPR)

As discussed above, the entire known distribution of *Trichostema austromontanum* subsp. *compactum* occurs at a single vernal pool known as Hidden Lake, owned by the State of California and managed by CDPR. The CDPR is able to effect significant protections for the species. Evidence of this control implemented both before and since listing can be seen today. Prior to listing, the protections included actions to reduce impacts from visitors by removing references to Hidden Lake from trail maps and signs. Since listing, the CDPR installed barriers in 2000 to exclude equestrian use of the area surrounding Hidden Lake (E. Guaracha, CDPR, 2006, pers. comm.).

In 2002, as a part of their general plan update, CDPR designated Hidden Lake and its associated watershed area as the Hidden Divide Natural Preserve (Preserve) (CDPR 2002, pp. 62–63). As a Preserve, the area is afforded regulatory protection that allows CDPR to manage Hidden Lake specifically for the conservation of *Trichostema austromontanum* subsp. *compactum* and other sensitive resources found in the area. This is in contrast to before the designation when recreational concerns also were given consideration. In 2006, CDPR surveyed, mapped, and established a legal description of the Preserve boundary to better facilitate their ability to patrol and enforce rules and regulations of the preserve (Kietzer 2011b, p. 1). Barring an unlikely major public infrastructure project (utilities, roads, etc.), the general plan covering the Park will remain stable until at least 2025 (R. Krueper, CDPR, 2012, pers. comm.).

In partnership with the Service and as part of the Service’s 2006 “Showing Success Grant Program,” CDPR erected interpretative signs for educational purposes along the official trail within the Preserve in 2009 informing visitors that off-trail hiking is prohibited (Kietzer 2011b, p. 2). Additionally, these funds were used to install an automated weather station, conduct monitoring of unauthorized visitors, and establish monitoring protocols for *Trichostema austromontanum* subsp. *compactum* in coordination with RSABG and the Service (Kietzer 2011b, pp. 2–4).

While facilitating limited visits to the Preserve, CDPR is currently constructing Hidden Divide Trail to minimize impacts to *Trichostema austromontanum* subsp. *compactum* from unauthorized access. An existing unauthorized trail to a nearby viewpoint is being moved approximately 20 to 40 feet upslope and away from the margin of Hidden Lake where the largest portion of *T. a.* subsp. *compactum* occurs. The trail bed will be incorporated into the existing slope where it should be easier to maintain natural drainage patterns, compared to the unauthorized trail that is currently present. Inspections of the completed trail will take place by trained CDPR staff during peak seasons and maintenance will occur as needed to prevent alteration of natural hydrology.

The new Hidden Divide Trail will not connect to other Park trails and will remain off maps and unadvertised by Park staff. Once completed, CDPR will allow access to the trail through a limited permit system or guided tour only for those visitors who inquire about the site. Horses will not be allowed. The trail will provide some viewing areas with interpretive signs to educate visitors about the unique ecosystem supporting *Trichostema austromontanum* subsp. *compactum*.

At the same time, it will restrict physical access to Hidden Lake, using signs and barriers to minimize off-trail use. Additionally, C DPR will increase visitor monitoring and begin a zero tolerance program citing visitors off-trail within the Preserve. Finally, adaptive management techniques will be applied. C DPR will close the trail or adjust the number of permits released per day accordingly should impacts to *T. a.* subsp. *compactum* or the surrounding ecosystem be observed.

These protections enacted by the C DPR associated with the Preserve are expected to remain should this species be delisted and we believe these protections are adequate to conserve *Trichostema austromontanum* subsp. *compactum* in the future.

Federal Protections

Section 404 of the Federal Clean Water Act (CWA)

Under section 404 of the CWA, the U.S. Army Corps of Engineers (Corps) regulates the discharge of fill material into waters of the United States, which include navigable and isolated waters, headwaters, and adjacent wetlands (33 U.S.C. 1344). In general, the term “wetland” refers to areas meeting the Corps’ criteria of hydric soils, hydrology (either sufficient annual flooding or water on the soil surface), and hydrophytic vegetation (plants specifically adapted for growing in wetlands). Any action with the potential to impact waters of the United States must be reviewed under the CWA, and the Act. These reviews require consideration of impacts to listed species and their habitats, and recommendations for mitigation of significant impacts.

At the time of listing, the Corps Los Angeles District took jurisdiction over all vernal pool habitat, regardless of whether it consisted of road pools (ephemeral pools inhabited by vernal pool flora and fauna, formed inadvertently by human activities such as vehicle use) or other unvegetated pools that were found within historical vernal pool habitat. However, Supreme Court rulings have called into question the Corps’ regulation of vernal pools based on the definition of “waters of the United States” in the CWA: *Solid Waste Agency of Northern Cook County v. U.S. Army Corps of Engineers* (531 U.S. 159) (2001) (*SWANCC*) and *Rapanos v. United States*, 126 S. Ct 2208, U.S. (2006)). In these cases, the Court adopted a more restrictive view of “waters of the United States.” Following these rulings, Corps regulatory oversight of vernal pools is in doubt because of their “isolated” nature, and the Corps has made determinations regarding regulation of such wetland areas (including vernal pools) on a case-by-case basis. In response to the Supreme Court decisions, the Corps and the U.S. Environmental Protection Agency released a memorandum providing guidelines for determining jurisdiction under the CWA. Corps guidance indicates that wetlands adjacent to navigable-in-fact waters of the United States are subject to regulation under the CWA, as are non-adjacent wetlands that are shown to have a significant nexus to navigable waters. The guidelines provide for a case-by-case determination of a “significant nexus” standard that may protect some, but not all, vernal pools.

At listing, we did not expect section 404 of the Federal CWA to provide conservation benefits to *Trichostema austromontanum* subsp. *compactum* because we did not believe the subspecies location would meet the “significant nexus” standard. Since the only known occurrence of this subspecies is on State-owned land designated as a wilderness area inside a State Park, we

believed it was unlikely that protections associated with section 404 of the Federal CWA would be triggered.

Summary of Factor D

We believe that, in absence of the Act, the other existing regulatory mechanisms will continue to provide adequate protections to ensure that *Trichostema austromontanum* subsp. *compactum* is not likely to become endangered throughout its range. Listing under the Act provided support for the Service and CDPR to establish management and monitoring programs to ensure that *T. a.* subsp. *compactum* would not become endangered. If this subspecies were to be removed from the Federal list of endangered and threatened plants, the primary protections for *T. a.* subsp. *compactum* would be provided through CEQA and CDPR's management of the Preserve. Protections for this species pursuant to CEQA would be at the discretion of the lead agency. However, since CDPR would be the lead agency for the CEQA process, and given CDPR's commitment to conservation of *T. a.* subsp. *compactum*, we believe CEQA would confer some protection to this species. These regulatory protections should remain unchanged through 2025. In conclusion, we find that the currently existing regulatory mechanisms described above are adequate, and they would remain adequate to protect *T. a.* subsp. *compactum* and its habitat across its range now and within the future were the protections of the Act to be removed.

FACTOR E: Other Natural or Manmade Factors Affecting Its Continued Existence

The final listing rule identified other threats to *Trichostema austromontanum* subsp. *compactum* including trampling and low numbers of *T. a.* subsp. *compactum* individuals. In the 2006 5-year review, we updated the discussion of these threats. Since 2006, climate change has been identified as a new threat under Factor E.

Updated information regarding the magnitude of these threats to *Trichostema austromontanum* subsp. *compactum* is discussed below.

Trampling

At listing, the trampling threat to *Trichostema austromontanum* subsp. *compactum* was due to its extremely narrow endemic habitat and easy accessibility to Hidden Lake from the trail, just over a mile from the Palm Springs tramway (63 FR 49006; September 14, 1998). This site became increasingly popular with the development of the tramway in 1964 and the Desert Divide Trail in 1979. Measures such as removing references to Hidden Lake from State Park interpretive materials and eliminating existing trails helped to ameliorate impacts from visitors, but did not prevent all trampling impacts. The 1998 listing rule indicated the species continued to experience ongoing impacts from trampling by hikers and horses at that time.

Since listing, CDPR completed several actions to minimize the threat of trampling to the only known occurrence of *Trichostema austromontanum* subsp. *compactum*, including: (1) Installing a wooden barrier fence at historical access points to exclude equestrian use; (2) designating Hidden Lake and its associated watershed area as Hidden Divide Natural Preserve; (3) erecting signs informing visitors that off-trail hiking is prohibited within the Preserve; (4) conducting

monitoring of unauthorized visitors; and (5) educating unauthorized visitors with an interpretive message while informing them that they were in a closed area (CDPR 2002, pp. 62–63; Kietzer 2011b, pp. 2–3). Although a low number of hikers currently access the Hidden Lake area despite efforts to exclude visitors from the area, trampling by humans appears to have been minimized (Fraga and Wall 2010, p. 5; Kietzer 2011b, pp. 4–5). Furthermore, there is no evidence that horses have had access to the area around Hidden Lake since the exclusionary fences were installed in 2000. Because trespass by hikers and horses has largely been eliminated, there is no indication that trampling will threaten the subspecies in the future.

Low Number of Individuals

In the final listing rule, we described the vulnerabilities associated with low numbers, stating, “[t]he limited numbers and extremely localized range of *Trichostema austromontanum* subsp. *compactum* make this taxon more susceptible to single disturbance events such as trampling during the flowering season or alteration of the local water table from soil compression (63 FR 49006; September 14, 1998).” The conservation biology literature commonly notes the vulnerability of taxa known from one or very few locations and when only small populations exist (such as, Shaffer 1981, pp. 131–134; 1987, pp. 69–86; Primack 1998, pp. 301–308; Leppig and White 2006, pp. 264–274). Extrapolating from information provided in the final listing rule, we believe that the threat associated with low numbers of individuals was based on the idea that in years when there were fewer than 100 individual plants, very little seed was produced resulting in a species that may not persist on its own.

It is likely *Trichostema austromontanum* subsp. *compactum* is able to survive years with poor conditions and very few flowering plants because of the existing seed bank in the soil (Bauder 1999, p. 37). The majority of seeds of *T. a.* subsp. *compactum* produced each year are likely deposited in the soils of the basin of Hidden Lake because there are no known means of seed dispersal. We have also found through germination experiments that only a small percentage of seeds germinate, even when conditions are appropriate (Bauder 1999, p. 28; Fraga and Wall 2009, p. 5). This suggests that some proportion of *T. a.* subsp. *compactum* seeds likely remain dormant in the soil and survive through years lacking adequate conditions for plants to germinate, reach maturity, and reproduce. Data collected since 1980 on this taxon show that the population size fluctuates from fewer than 100 to greater than 10,000 plants, but the presence of a soil seed bank has allowed the species to persist. The differences in population size of *T. a.* subsp. *compactum*, especially absent evidence of trampling, may still be best characterized as natural variation or fluctuation of an annual plant, which is tied to the annual water level of Hidden Lake (Bauder and McMillan 1998, pp. 63–66; Bauder 1999, pp. 13–17). In this manner, we believe that the low numbers of individuals in some years is a temporary phenomenon and does not pose a long-term threat to this plant. Nevertheless, a seed-bank at RSABG has been established as a safeguard against extinction (Fraga and Wall 2010, p. 7).

Stochastic events (random punctuated events) can exacerbate other threats, especially to plants known from one or only a few populations or that exist in populations with low numbers of individuals. For example, the vulnerability of a population to other threats increases with incidence of disease outbreak or pest infestation spreading through a small population of plants (Primack 1998, p. 304). A fire, flood, or drought could also be more devastating to a small,

localized population. If this occurs, there is a diminished likelihood of the survival of a viable secondary population to sustain recolonization of the primary habitat site. These susceptibilities to small populations have not been documented as affecting *Trichostema austromontanum* subsp. *compactum* in the past nor were specific concerns discussed in detail in the final listing rule (63 FR 49006; September 14, 1998). Still, the existing natural seed bank and maintenance of the *ex situ* seed bank provide some flexibility to respond to stochastic events, should one occur. It is possible that stochastic events could impact this species in the future, but we do not believe that this potential threat alone is a significant threat to this species.

Climate Change

Our analyses under the Endangered Species Act include consideration of ongoing and projected changes in climate. The terms “climate” and “climate change” are defined by the Intergovernmental Panel on Climate Change (IPCC). “Climate” refers to the mean and variability of different types of weather conditions over time, with 30 years being a typical period for such measurements, although shorter or longer periods also may be used (IPCC 2007, p. 78). The term “climate change” thus refers to a change in the mean or variability of one or more measures of climate (e.g., temperature or precipitation) that persists for an extended period, typically decades or longer, whether the change is due to natural variability, human activity, or both (IPCC 2007, p. 78). Various types of changes in climate can have direct or indirect effects on species. These effects may be positive, neutral, or negative and they may change over time, depending on the species and other relevant considerations, such as the effects of interactions of climate with other variables (e.g., habitat fragmentation) (IPCC 2007, pp. 8–14, 18–19).

The 1998 listing rule did not discuss the potential impacts of climate change on *Trichostema austromontanum* subsp. *compactum* (63 FR 49006; September 14, 1998). Since listing, it has become apparent that potential threats exist to biota of the United States from ongoing, accelerated climate change (IPCC 2007, p. 1–17). Current climate change predictions for terrestrial areas in the Northern Hemisphere indicate warmer air temperatures, more intense precipitation events, and increased summer continental drying for the foreseeable future (Field *et al.* 1999, pp. 1–63; Cayan *et al.* 2006, pp. 1–47; IPCC 2007).

A trend of warming in the mountains of western North America is expected to decrease snowpack, hasten spring runoff, and reduce summer stream flows. Increased summer heat may also increase the frequency and intensity of wildfires (IPCC 2007). Climate modeling for California indicates similar outcomes in temperature and precipitation. Assessments have been carried out running low and medium emission scenarios through the six models used in the 2007 IPCC assessment. The results predict a 1 to 3 degrees Celsius (1.8 to 5.4 degrees Fahrenheit) increase in average temperature by the year 2050 (Cayan *et al.* 2009, p. 16). Over the same period, a 12 to 35 percent decrease in precipitation is predicted (Cayan *et al.* 2009, p. 17).

Significant temperature increases create a stressor especially for endemic species. This stressor enhances pressures from competitors, nonnative species, habitat change, low water supply, and disease. Species must possess adaptations to survive these pressures *in situ* (in place), they must be able to shift their geographic, ecological, or temporal range, or they may face decline (Cayan *et al.* 2009, p. 45). Higher temperatures might also be coupled with a drop in precipitation,

making adaptation for the *Trichostema austromontanum* subsp. *compactum* less probable. A geographic shift in range for this highly localized taxon that relies on Hidden Lake, the only water body in the high San Jacinto Mountains, is unlikely. Although we remain unsure how climate changes will ultimately manifest in high mountain forests of southern California, we do recognize some of the challenges to the adaptive ability of *T. a.* subsp. *compactum*, and climate change thus poses a potentially significant rangewide threat to the subspecies. However, we do not have specific information at this time to conclude that climate change is a threat to this species.

We are concerned that changes in the amount, timing, and type (rain or snow) of precipitation could alter the unique environment of Hidden Lake and potentially impact this taxon. To this end, an automated weather station was installed at Hidden Lake in 2010 to provide baseline data on climatic conditions (Kietzer 2011a, pp. 2–3). Additionally, a motion-activated wildlife camera was installed at the edge of the lake and programmed to take photographs at the same time every day to document changes in the water level along with other seasonal changes at the lake (Kietzer 2011b, p. 4). Finally, we believe that the maintenance of the *ex situ* seed bank provides some flexibility to respond to stochastic events including those associated with a changing climate. Should the Service propose to delist this subspecies, post-delisting monitoring for this taxon would allow the Service to continually assess any climate-change related impacts to allow for additional management responses to be undertaken, should they be necessary.

Summary of Factor E

Management actions taken at Hidden Lake by CDPR have reduced the threat of trampling to a minimal level in recent years. At listing, we were concerned that low numbers of individuals in some years threatened the existence of *Trichostema austromontanum* subsp. *compactum*. Since listing, we collected data suggesting this subspecies has a soil seed bank and germination mechanisms that have allowed the taxon to persist even in years when very few plants germinate, flower, and set seed. Low numbers of individuals in certain years suggests this is a natural and historical phenomenon for this taxon. Though it is possible that a stochastic event or factors associated with climate change could impact *T. a.* subsp. *compactum* or alter its habitat, we do not consider this to be a significant threat at this time. In conclusion, we find that other natural or manmade factors are not significant threats to *T. a.* subsp. *compactum* throughout its range and are not likely to become so within the future.

III. RECOVERY CRITERIA

Although a Recovery Plan for *Trichostema austromontanum* subsp. *compactum* has not been prepared and therefore specific delisting criteria have not been developed, the Service concluded in the 2006 5-year review for the taxon that delisting may be appropriate if it can be demonstrated that:

- (1) Management by CDPR has been effective;
- (2) Stochastic threats are not significant; and

2013 5-Year Review for *Trichostema austromontanum* subsp. *compactum*

(3) Sufficient seed is banked for reintroduction after an adverse stochastic event (USFWS 2006, pp. 11–12).

We further identified in the 2009 Spotlight Species Action Plan (USFWS 2009, pp. 2–4, 6) specific recovery actions that would promote recovery and move the taxon closer to delisting. We are using these actions in part to evaluate the progress towards recovery of this taxon:

- (1) Continue work with CDPR as partners to monitor visitor use at Hidden Lake;
- (2) Monitor population and habitat of *Trichostema austromontanum* subsp. *compactum*;
- (3) Complete collections for a seed bank;
- (4) Devise long-term protocol for seed banking and use of seeds in recovery; and
- (5) Finalize the Conservation Strategy and a long-term management plan for the species, and a long-term agreement with CDPR that will include established monitoring and the implementation of an adaptive management plan.

Existing conservation efforts for each of these actions are discussed below.

(1) Continue work with CDPR as partners to monitor visitor use at Hidden Lake

Monitoring of visitor use at Hidden Lake was conducted by CDPR from 2007 to 2010 (Kietzer 2011a, pp. 4–5). Although unauthorized access to the area appears to have been minimized (Fraga and Wall 2010, p. 5; Kietzer 2011a, pp. 4–5), CDPR will continue to monitor visitor use, which will be described in a future long-term management plan.

(2) Monitor population and habitat of Trichostema austromontanum subsp. compactum

In coordination with the Service, CDPR and RSABG developed a monitoring protocol for *Trichostema austromontanum* subsp. *compactum* resulting from several years of investigation (2006 to 2009 and 2012), which included mapping the area of occupancy of *T. a.* subsp. *compactum* around Hidden Lake and conducting census counts to estimate population size (Fraga and Wall 2010, pp. 4–6; K. Kietzer, CDPR, 2012, pers. comm.). Additionally, equipment for monitoring Hidden Lake's microclimate and its effects on the lake level was installed by CDPR in 2010 (Kietzer 2011a, pp. 2–3; Kietzer 2011b, p. 4). Monitoring of this taxon and its habitat will continue as described in a future long-term management plan.

(3) Complete collections for a seed bank

Collection of *Trichostema austromontanum* subsp. *compactum* seeds and establishment of an *ex situ* (off-site) conservation seed bank at RSABG occurred over 3 years (2006, 2008 and 2009). As a back-up, samples from each year's collections will be stored at the U.S. Department of Agriculture National Center for Genetic Resource Preservation in Fort Collins, Colorado (Fraga and Wall 2010, p. 7). This provides insurance that the subspecies will not go extinct if the natural occurrence were extirpated due to an adverse stochastic event or other circumstances (such as disease or prolonged drought). Completion of seed collection efforts fulfills the requirement of this recovery action.

(4) *Devise long-term protocol for seed banking and use of seeds in recovery*

Trichostema austromontanum subsp. *compactum* seeds collected at Hidden Lake are being stored at RSABG. Germination trials will be conducted at regular intervals to determine a long-term protocol for seed banking and use of seeds in recovery. This project is ongoing and will be discussed in further detail in a future long-term management plan.

(5) *Finalize the Conservation Strategy and a long-term management plan for the species, and a long-term agreement with C DPR that will include established monitoring and the implementation of an adaptive management plan*

A Conservation Strategy was completed that outlined conservation actions for this taxon (Fraga and Kietzer 2009, pp. 1–29), and will serve as a foundation for a long-term management plan. This plan and a long-term agreement with C DPR should be finalized before the taxon is delisted.

IV. SYNTHESIS

At listing, *Trichostema austromontanum* subsp. *compactum* was threatened by trampling and low number of individuals. C DPR has made several changes since listing to the management of Hidden Lake, including installation of fencing to exclude equestrian use and designating the area as Hidden Divide Natural Preserve. Since our 2006 5-year review, C DPR erected interpretive signs to educate visitors that off-trail hiking is prohibited within the Preserve and informed unauthorized visitors that they were in a closed area. These efforts also helped to inform recreationists about the fragility and uniqueness of the Hidden Lake habitat. These changes in management within the Preserve have been successful in minimizing trampling as a threat to *T. a.* subsp. *compactum*. The susceptibility of a population with a low number of individuals to stochastic events is buffered by the plant's reproductive strategies. Results from monitoring of the taxon since our 2006 5-year review support prior observations of annual variations in individual plants, which indicates a significant natural seed bank. Seed has also been collected in the field since 2006 and stored in a seed storage lab as another method to ensure survival in the case of an adverse stochastic event. This conservation measure, along with continued monitoring of the species' abundance and its environmental conditions, reduces the threat posed by the relatively low number of individuals to a level that is not significant. Since listing, we have become aware of the potential for climate change to affect all biota, including *T. a.* subsp. *compactum*; however, conditions associated with climate change have not yet had a noticeable impact on *T. a.* subsp. *compactum* or its habitat. Nevertheless, seed storage provides some flexibility to respond to stochastic events including those associated with a changing climate. Additionally, long-term monitoring would allow the Service to continually assess any climate-change related impacts to allow for additional management responses to be undertaken, should they be necessary. Therefore, we do not conclude that climate change is or will become a significant threat to the subspecies in the foreseeable future, given available information and current protective measures.

After reviewing available scientific information on the recovery of *Trichostema austromontanum* subsp. *compactum*, we believe that the threats to *T. a.* subsp. *compactum* have been reduced to a

level that they no longer pose a risk to this subspecies. *Trichostema austromontanum* subsp. *compactum* is not likely to become endangered within the foreseeable future throughout all or a significant portion of its range. Therefore, we find that *T. a.* subsp. *compactum* no longer requires the protection of the Act and we recommend removing the subspecies from the List of Endangered and Threatened Plants.

V. RESULTS

Recommended Listing Action:

- Downlist to Threatened
 Uplist to Endangered
 Delist (indicate reason for delisting according to 50 CFR 424.11):
 Extinction
 Recovery
 Original data for classification in error
 No Change

New Recovery Priority Number and Brief Rationale:

We recommend no change in the recovery priority number of 15 at this time. The taxon is a subspecies that faces a low degree of threat and a high recovery potential.

VI. RECOMMENDATIONS FOR ACTIONS OVER THE NEXT 5 YEARS

The actions listed below are recommendations to be completed over the next 5 years. These will further benefit *Trichostema austromontanum* subsp. *compactum* by providing information to better manage the population. Conservation of *T. a.* subsp. *compactum* is dependent on continued cooperation with our partners (i.e. C DPR and RSABG) to continue to minimize impacts from current threats and aid future restoration.

- 1) Continue to work towards goals established in the Spotlight Species Action Plan and Conservation Strategy for *Trichostema austromontanum* subsp. *compactum*.
- 2) Work with partners at RSABG and C DPR to establish monitoring protocols for *Trichostema austromontanum* subsp. *compactum* and its habitat to be used for Conservation Strategy goals and ultimately, in the case of delisting, a long-term agreement and Post-Delisting Monitoring Plan.
- 3) Research *Trichostema austromontanum* subsp. *compactum* reproductive strategies and pollinator requirements.

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2013 5-Year Review for *Trichostema austromontanum* subsp. *compactum*

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**U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW**

***Trichostema austromontanum* subsp. *compactum*
(Hidden Lake Bluecurls)**

Current Classification: Threatened

Recommendation Resulting from the 5-year Review:

- Downlist to Threatened
- Uplist to Endangered
- Delist
- No change needed

Review Conducted By: Carlsbad Fish and Wildlife Office

FIELD OFFICE APPROVAL:

Lead Field Supervisor, U.S. Fish and Wildlife Service

ACTING

Approve  **Scott A. Sobiech** Date MAY 06 2013

REGIONAL OFFICE APPROVAL:

**Lead Assistant Regional Director, Ecological Services, U.S. Fish and Wildlife Service,
Region 8**

Approve  Date 31 MAY 2013