

Swale Paintbrush

(Castilleja ornata)

Status Survey Report

2017



©Mark Egger

Daniela Roth
NM Energy, Minerals, & Natural Resources Department
Forestry Division
Santa Fe, NM

Prepared for the
U.S. Fish & Wildlife Service, Region 2
Albuquerque, NM

INTRODUCTION

In 2009, the USFWS issued a 90-day finding in response to a petition to list *Castilleja ornata* (swale paintbrush, glowing Indian paintbrush) as threatened or endangered under the federal Endangered Species Act (74 FR 66866). The USFWS determined that listing the species as threatened or endangered may be warranted due to the present or threatened destruction, modification, or curtailment of its habitat or range resulting from improper grazing, or conversion to cultivated cropland. In response to this finding the USFWS is required to review the status of the species based on best available scientific and commercial information available. Although *C. ornata* is considered a predominantly Mexican species, it is possibly extinct there (NMRPTC 1999). The status of this species in Mexico is poorly known, but searches of the few historical collection sites in Chihuahua have failed to locate a single extant population. The Mexican sites visited had all been fully converted to agriculture.

The primary goal of this status report is to provide information on the current status of this species in the United States. The objectives of the status survey were to

1. Locate the historic population
2. Determine the current status, abundance, and threats, and
3. Survey similar habitats in Hidalgo County for the presence of other, previously unknown populations.

Species Description



Castilleja ornata 2017

Castilleja ornata is an annual herb with 1 or few erect stems, 2-5 dm tall with long-villose, non-glandular hairs mixed with shorter gland-tipped hairs; leaves oblong to lanceolate, unlobed, 3-nerved, 2-4 cm long, with strongly wavy margins and bases clasping the stem; floral bracts are unlobed, broadly rounded, wider above than below, wavy-margined, ochroleucous to very pale yellow on the upper third, often fading to dull red with age, glandular-puberulent; primary clefts of calyx 1 cm deep, secondary clefts emarginate; hooded upper corolla lobe (galea) exerted, 5 mm long, green. *Castilleja ornata* flowers from July through September (NMRPTC 1999).

Castilleja ornata is not likely to be confused with any other *Castilleja* species in New Mexico and is distinguished by its pubescence, wavy-margined leaves, and unusual bract color. *Castilleja minor* and *C. exserta* are the only other annual paintbrushes in New Mexico. They are readily separated from *C. ornata* by the color of their floral bract tips, which are bright red in the former and pink to magenta in the latter.



Fitzpatrick Camp

Distribution and Habitat

Castilleja ornata grows in flat, seasonally wet areas in arid grasslands at elevations between 1,570-2,100 m (5,100-6,900 ft). *Castilleja ornata* occurs in southwestern Hidalgo County, New Mexico, which is the only known location in the United States (Figure 1). It is also documented from western Chihuahua and west-central Durango in Mexico. It was first documented by Laird McIntosh from the Diamond A Ranch (previously Gray Ranch) in 1993 (McIntosh 1994). A more detailed survey of the Diamond A Ranch site in 1994 found plants distributed in 3 small sites (sub populations), all within several hundred feet of the Fitzpatrick Camp (Egger 1994). Plants were described as locally common, ranging from 50 to 800 individuals per site (Figure 4). The last documented record from the Diamond A Ranch is from 1998 (K.D. Heil 12468, 8/13/1998; UNM 96508). No information was given on the abundance of plants at the collection site.

METHODS

Original location and descriptive data came from reports (Egger 1994, McIntosh 1994), the NM Natural Heritage Program, and SEINet. Plant locations and survey routes were mapped with a Garmin Monterra GPS. Surveys were performed by 2 people, during optimum flowering season to maximize detection of plants, during the last week of August 2017. The primary focus was to locate and assess the status of the known population in the vicinity of the Fitzpatrick Camp on the Diamond A Ranch in Hidalgo County. Additional targeted surveys on the Diamond A Ranch and surrounding areas were based on the presence of potential habitat, identified through field reconnaissance, aerial imagery, and proximity to the known population.

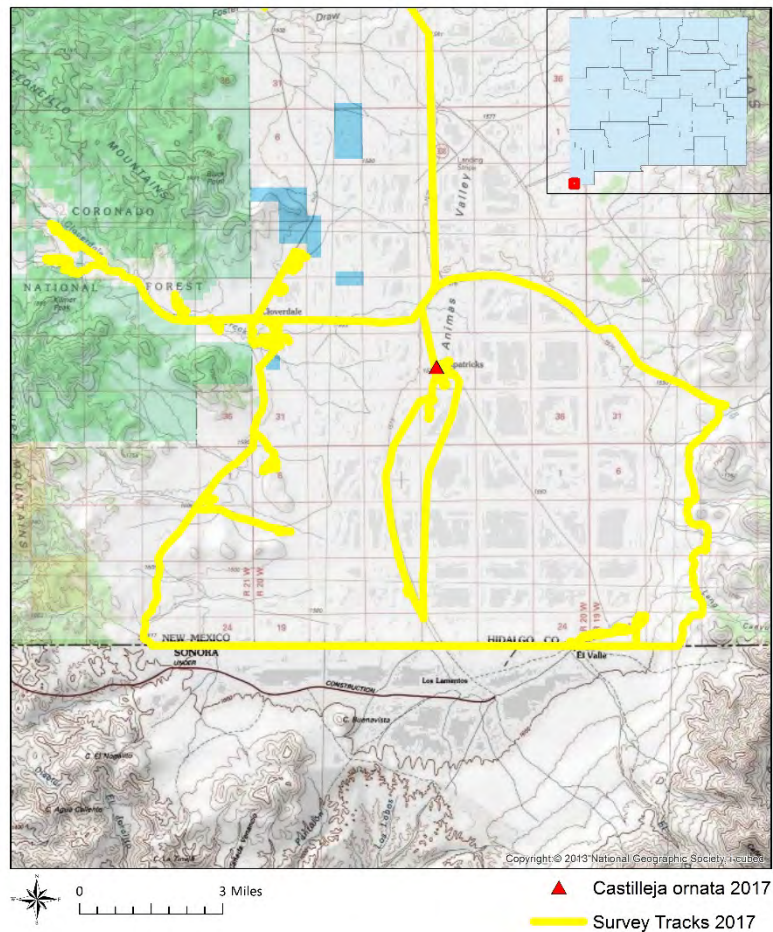


Figure 1. Survey routes and location of the 1994 and 2017 populations of *Castilleja ornata*, at the Fitzpatrick Camp, Diamond A Ranch, in Hidalgo County, NM.

RESULTS

After an initial failure to locate any plants in the vicinity of Fitzpatrick Camp, we intensified survey efforts into tightly spaced transects through the area estimated to contain plants in 1994 (Figure 2). A total of 2 plants were found in the vicinity of the Fitzpatrick Camp (Figure 3). No other plants were located anywhere on the Diamond A Ranch or surrounding areas, despite extensive searches in potential habitat, ranging from seasonal to permanent wetlands, including the Cloverdale and the Lang cienégas (Figure 1; Sivinski and Tonne 2011).

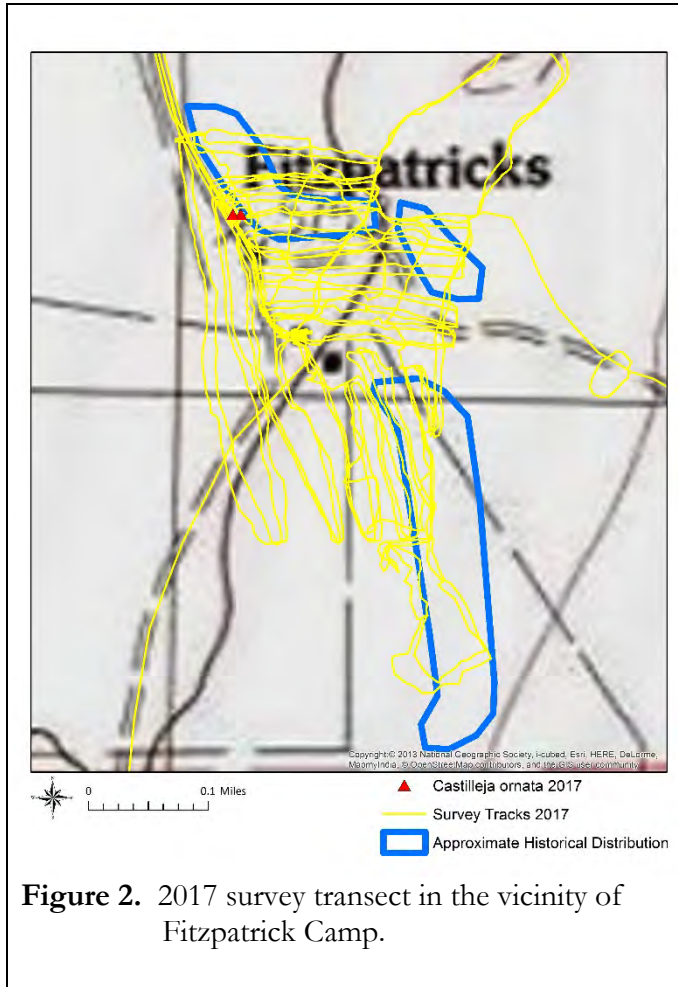


Figure 3. 2017 location and habitat of *Castilleja ornata* (Fitzpatrick Camp in background).

In 2017 the plant community surrounding the Fitzpatrick Camp was composed primarily of alkali sacaton (*Sporobolus airoides*) mixed with western ragweed (*Ambrosia psilostachya*). Other associated species included Baltic rush (*Juncus arcticus*), buffalo gourd (*Cucurbita foetidissima*), common kochia (*Kochia scoparia*), and Powell's amaranth (*Amaranthus powellii*). The associated plant community is similar to the that described by McIntosh and Egger in 1994 (Figures 4 & 5).



©Mark Egger

Figure 4. *Castilleja ornata* in the immediate vicinity of the Fitzpatrick Camp on the Diamond A Ranch in 1994, looking south.



Figure 5. Vicinity of the Fitzpatrick Camp on the Diamond A Ranch in 2017, looking north.

DISCUSSION

Extensive surveys in 2017 found only 2 individuals of *Castilleja ornata* in one location. These plants were located in the vicinity of previously documented sites. Based on current knowledge, *C. ornata* is the rarest native plant in the state of New Mexico and might be functionally extinct.

Precipitation amounts drive the variability in the abundance of annual plants. In arid systems, water availability and timing are known to be limiting factors influencing germination and establishment of annual plants. *Castilleja ornata* is an annual plant, likely germinating with the onset of the summer monsoon rains (typically in early July), flowering in August and September. Although we have no specific historical rainfall record for the Diamond A Ranch, the average annual precipitation in nearby Animas is 11.15 inches, ranging from 4.73 inches in 1956 to 19.67 inches in 1991, over a 74-year period (WRCC 2018). Rainfall totals were within or above that average in 2015, 2016, and 2017. The majority of rainfall is received during the summer monsoons, between late June and early October. The critical rainfall period for *C. ornata* is presumed to be from June through August, when plants germinate, establish, and flower. In 1993 and 1994, when hundreds of plants were documented from the Diamond A Ranch population during August, total rainfall amounts between June and August were 3.35 and 1.93 inches, respectively (in Animas). In 2017, the total rainfall amount between June and August was 4.48 inches, over half of which came during the month of July. Plant abundance was apparently not correlated to rainfall amounts in 2017, either due to the lack of a seed bank or another unknown variable preventing plants from germination and establishment.

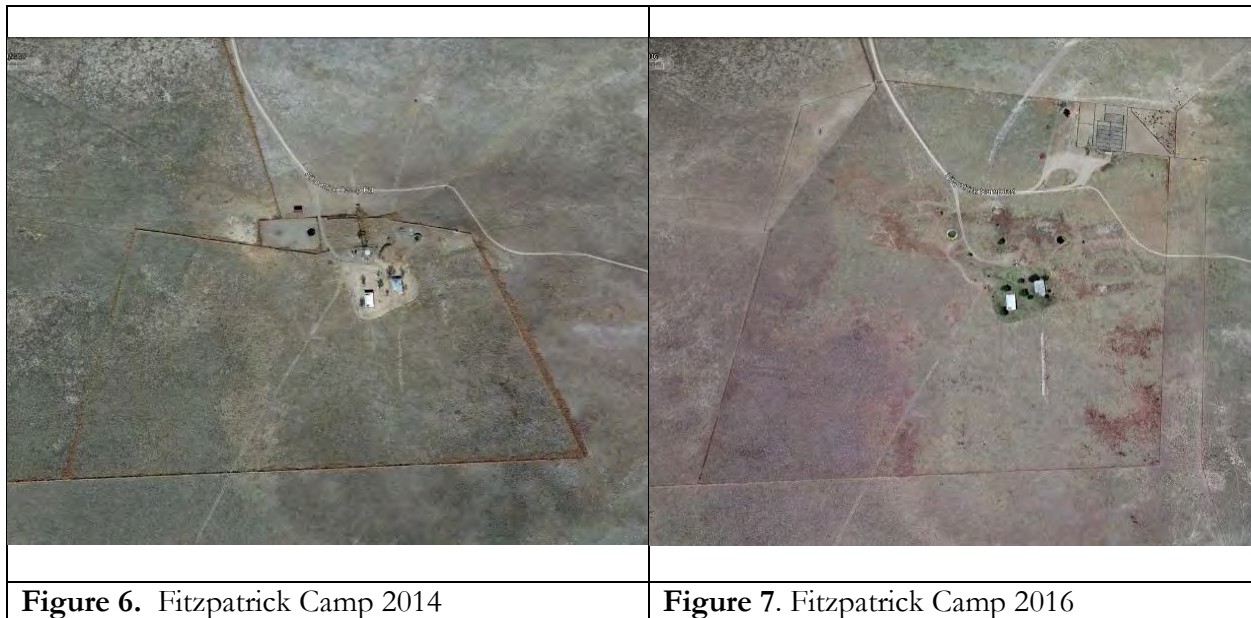
Between 2014 and 2016 a variety of improvements to the land were implemented surrounding the Fitzpatrick Camp (Figures 6 & 7). These included the removal of livestock from the vicinity of the facilities and housing, the removal of the original corral and the relocation of the corral to the NE of the ranch house, on-site burial of the original corral, trenching to divert water flow away from the ranch house and new corral, and expansion of the fenced area to the north, northwest and the east. The improvements took place in the immediate vicinity of the two historic population sites north of the ranch house (Figure 2). Improvements near the southernmost population were significantly fewer, consisting primarily of the outward relocation of the eastern fence boundary. We have no information about the timing or extent of the trenching and other ground disturbances, which may have significantly impacted plant abundance and reproduction.

It is possible that these ground disturbing activities altered local hydrology to a degree that the habitat is longer conducive to the germination and establishment of the species. Some annual species require a degree of disturbance to remove competition for resources with other, more aggressive perennial species, such as bunch grasses. The removal of livestock may have increased the competition with perennial bunchgrasses. However, based on previous surveys and photo documentation, *C. ornata* can be abundant even in the presence of dense stands of perennial grasses (Figure 4). *Castilleja* species have a hemiparasitic relationship with surrounding plants and depend on these plants for nutrients and water through a root connection (Meyer and Carlson 2004). It is likely that *C. ornata* has a hemiparasitic relationship with alkali sacaton (*Sporobolus airoides*), the dominant bunch grass in the habitat surrounding the Fitzpatrick Camp. *Castillejas* are generally not palatable to livestock and some species are known to be toxic to livestock.

Our knowledge of the ecological and biological requirements of *C. ornata* are limited at best, but in the absence of species specific knowledge, we can infer certain traits from other, better known *Castillejas*, such as the hemiparasitic habit of most *Castillejas*, small seed size, and palatability to livestock.

We have no knowledge of the seed bank dynamics and viability of *Castilleja ornata*. Seeds of *Castilleja* species tend to be very small. Although it is presumed that a proportion of seeds produced by annual desert plants remain dormant after a germination event, small seeds are associated with greater variance in reproductive success and may not persist for very long in the seed bank (Pake and Venable 1996; Skogen et al. 2010). It is possible that prolonged drought conditions after 1994 have gradually reduced the seed input into the seed bank and that drought in combination with ground disturbing activities and habitat alterations have contributed to the overall decline of the species.

Other possible causes or contributors to the observed decline may be pollinator limitations and pollination success, and unknown pathogens or predators impacting plants through time.



RECOMMENDATIONS

Castilleja ornata is an annual species possibly exhibiting wide fluctuations in plant numbers from year to year. We know very little about the seed bank dynamics of the species. There is the potential that the species may reappear when conditions are conducive to germination and establishment of these plants. Known historic sites surrounding the Fitzpatrick Camp should be monitored annually for several years to document a possible return of this species to previously occupied sites. If plants return to known sites, monitoring plots should be established to document between year variation in germination and establishment, as well as reproductive success. Studies should be conducted to identify pollinators and pollination success. Seeds should be collected and stored for ex-situ conservation and propagation purposes and should be used to grow out plants for seed production,

increasing stored seeds available for future population augmentation and introduction purposes. Although habitat is limited, additional habitats in Hidalgo County should be surveyed for possible new or unreported populations.

ACKNOWLEDGEMENTS

Funding for this project has been provided by the U.S. Fish and Wildlife Service, Region 2, Albuquerque, NM, through a Section 6 Endangered Species grant. Habitat analysis, data collection and field surveys were greatly helped by Ed Conrad. Site access was granted by the Animas Foundation. Sam Smith helped with site access and potential habitat locations, as well as transportation to otherwise inaccessible sites.

LITERATURE CITED

- Egger, Mark. 1994. Report on the status and distribution of *Castilleja ornata* on the Gray Ranch. Letter to the Animas Foundation.
- McIntosh, L. 1994. First report of *Castilleja ornata* (Scrophulariaceae) from the United States. *Phytologia* 76 (4): 329-332.
- Meyer, S.E, and S.L. Carlson. Comparative seed germination biology and seed propagation of eight Intermountain paintbrush species of Indian paintbrush. USDA Forest Service Proceedings RMRS-P-31.
- New Mexico Rare Plant Technical Council. 1999. New Mexico Rare Plants. Albuquerque, NM: New Mexico Rare Plants Home Page. <http://nmrareplants.unm.edu> (Latest update: 25 July 2017).
- Pake, C.E., and D. L. Venable. 1996. Seed banks in desert annuals: implications for persistence and coexistence in variable environments. *Ecology* 77(5):1427-1435.
- SEINet. 2017. <http://swbiodiversity.org/seinet/index.php>
- Sivinski, R. and P. Tonne. 2011. Survey and assessment of aridland spring cienégas in the southwest region. Unpublished report prepared by EMNRD – Forestry Division, Santa Fe, NM, for the USFWS Region 2, Albuquerque, NM.
- Skogen, K.A., L. Senack, and K. Holsinger. Dormancy, small seed size, and low germination rates contribute to low recruitment in *Desmodium cuspidatum* (Fabaceae). *The Journal of the Torrey Botanical Society* 137(4):355-365
- Western Regional Climate Center. 2018. Accessed via <https://wrcc.dri.edu/summary/Climsmnm.html> on March 12, 2018.