Species Report for *Eriogonum corymbosum* var. *nilesii* (Las Vegas buckwheat)

Nevada Fish and Wildlife Office
5/23/2014

EXECUTIVE SUMMARY

Eriogonum corymbosum var. *nilesii* Reveal (Las Vegas buckwheat) is a member of the Polygonaceae (buckwheat family). It is an open to somewhat spreading perennial shrub with numerous yellow to pale yellow flowers. Flowering typically occurs between the months of August and November. *E. corymbosum* var. *nilesii* was elevated to candidate status under the Endangered Species Act on December 6, 2007. In this report, we recognize the geographic range of *Eriogonum corymbosum* var. *nilesii* as restricted to southern Nevada, in contrast to some prior accounts affirming a range extending into southern Utah and northern Arizona. In southern Nevada, *E. corymbosum* var. *nilesii* is found northwest of the Virgin River (in Lincoln County) and west of Lake Mead (in Clark County). Within this region, *Eriogonum corymbosum* var. *nilesii* currently occupies a total of approximately 792.1 ac (320.6 ha). The majority (over 80 percent) of this occupied acreage is federally owned, with 72 percent administered by the BLM, and another 8.15 percent by the Department of Defense (DOD, Nellis Air Force Base). Landownership for the remainder of occupied habitat is as follows: City of Las Vegas (0.13 percent), Clark County (0.80 percent), State of Nevada (0.001 percent), and private landowners (18.81 percent). We recognize 12 populations of the species, 3 of which have been extirpated, and 9 remain extant.

Expressed in terms of acreage, *Eriogonum corymbosum* var. *nilesii* has been extirpated from an additional 1,303.5 ac (527.5 ha) of formerly occupied habitat, corresponding to nearly 62 percent of its historic range. Most of the lands from which the species has been extirpated are in private ownership (94.9 percent); the remaining lands are owned or managed by the City of Las Vegas (1.95 percent), Clark County (2.24 percent), or the DOD (0.9 percent).

Development has resulted in the extirpation of two populations as well as subsets of two other populations, from which a combined total of six subpopulations have been extirpated. Other factors affecting the species evaluated in this document include off-highway vehicle (OHV) use and other road corridors, mineral exploration and development, nonnative, invasive plant species, modified fire regimes, and climate change.

Eriogonum corymbosum var. *nilesii* is not listed by the state of Nevada, and is not a permitted species or otherwise afforded protections by the Clark County Multi-Species Habitat Conservation Plan. It is listed as a sensitive species by the BLM. The species has been afforded some protection by conservation agreements, land use designations, and other actions undertaken by BLM, DOD (Nellis Air Force Base), and Clark County. The amount of conservation benefit afforded by these various mechanisms varies widely, as does the percentage of occupied habitat and number of plants potentially protected by each.

BIOLOGICAL INFORMATION

Legal or Formal Status

Endangered Species Act

Eriogonum corymbosum var. *nilesii* Reveal (Las Vegas buckwheat) was elevated to candidate status under the Endangered Species Act (ESA) on December 6, 2007, and it has been evaluated as a candidate in the Candidate Notice of Review (CNOR) each year since 2007. Candidate species are plants and animals for which the U.S. Fish and Wildlife Service (USFWS) has sufficient information on the biological status and threats to propose them as endangered or threatened under the ESA, but for which development of a proposed listing regulation has been precluded by other higher-priority listing activities.

State of Nevada

Eriogonum corymbosum var. *nilesii* is not listed by the State of Nevada (Nevada Administrative Code 527.010).

Bureau of Land Management

Eriogonum corymbosum var. *nilesii* is a Bureau of Land Management (BLM) sensitive species. Populations of *E. corymbosum* var. *nilesii* on BLM land are managed under BLM 6840 Manual, Release 6–125, revised as of December 12, 2008 (BLM 2008a, pp. 1–48). BLM policy is to manage candidate species (as designated under the ESA) as sensitive species, defined as "species that require special management or considerations to avoid potential future listing" (BLM 2008a, Glossary, p. 5). The stated objective for sensitive species is to initiate proactive conservation measures that reduce or eliminate threats to minimize the likelihood of and need for listing (BLM 2008a, 6840.02). Conservation, as it applies to BLM sensitive species, is defined as "the use of programs, plans, and management practices to reduce or eliminate threats affecting the status of the species, or improve the condition of the species' habitat on BLM-administered lands" (BLM 2008a, Glossary, p. 2).

Clark County

Eriogonum corymbosum var. *nilesii* is included as a high priority evaluation species under the Clark County Multiple Species Habitat Conservation Plan (MSHCP) (RECON Environmental, Inc. 2000, Table 2-6). The MSCHP defines an evaluation species as those for which additional information is required or for which sufficient management prescriptions are unlikely to be able to be defined and implemented sufficiently to support application for a 10(a) 1(A) Permit under the ESA (RECON Environmental, Inc. 2000, p. 2-61). A status as an evaluation species does not provide *E. corymbosum* var. *nilesii* with protections afforded by the MSHCP.

Species Description

Eriogonum corymbosum var. *nilesii* is a member of the Polygonaceae (buckwheat family). It is an open to somewhat spreading perennial shrub that is 1.3–7.5 feet (ft) (4–23 decimeters (dm)) across and 1–3.9 ft (3–12 dm) tall (Figure 1). The 0.3–1 inch (in) (0.8–2.5 centimeters (cm)) long, elliptic to oblong leaf blades are woolly to densely tomentose (i.e., covered with short, matted, or tangled, soft, wooly hairs) abaxially (on lower leaf surfaces) and silvery-floccose (i.e., bearing tufts of long, soft hairs) adaxially (on upper leaf surfaces). Cymose (flat- or round-topped determinate) inflorescences are tomentose to floccose and contain numerous flowers with yellow to pale yellow perianths (Holmgren *et al.* 2012, pp. 270–273). Flowering typically occurs between the months of August and November (Reveal, 2005; *http://www.efloras.org/florataxon.aspx?flora_id=1&taxon_id=250060233*, accessed online September 16, 2013).

FIGURE 1. — *Eriogonum corymbosum* var. *nilesii*, S. Kulpa, USFWS.

Taxonomy and Genetics

Before *Eriogonum corymbosum* var. *nilesii* was described as a taxonomically discrete variety in 2002 (Reveal 2002, p. 25), plants bearing the morphological attributes and geographic distribution attributed to this taxon were treated under the names *E. corymbosum* (Bentham

1856, pp. 17–18), *E. aureum* (Jones 1895, pp. 718–719), *E. corymbosum* var. *glutinosum* (Jones 1903, p.14), and *E. corymbosum* var. *aureum* (Reveal 1983, pp. 292–293). We review the progression of these taxonomic treatments here.

The species *Eriogonum corymbosum* was described in 1856 by George Bentham (Bentham 1856, pp. 17–18). In 1895, Marcus E. Jones proposed that specimens of *E. corymbosum* bearing yellow flowers be recognized under the specific epithet *Eriogonum aureum* and proposed two new varieties affiliated with this epithet, var. *ambiguum* and var. *glutinosum* (Jones 1895, pp. 718–719). However, in 1903, Jones subsequently demoted his species *E. aureum* and its varieties to varietal status under *E. corymbosum*, using the name *E. corymbosum* var. *glutinosum* (i.e., not *aureum*) to describe yellow-flowered plants found in southern Utah and adjacent northern Arizona (Jones 1903, p. 14; Reveal 1967, p. 184).

In 1967, Reveal (pp. 186–187) recognized the *E. corymbosum* complex as consisting of seven varieties (var. *albogilvum, corymbosum, davidsei, erectum, glutinosum, orbiculatum*, and *velutinum*). In this treatment, only varieties *corymbosum* and *glutinosum* were described as occurring in the geographic area from which the variety *E. corymbosum* var. *nilesii* would later be described (i.e., southern Utah and northern Arizona). In this 1967 publication, Reveal describes *E. corymbosum* var. *glutinosum* as yellow-flowered and *E. corymbosum* var. *corymbosum* as white-flowered (Reveal 1967, p. 213).

In 1983, in accordance with nomenclatural rule changes promulgated by the XIII International Botanical Congress in Sydney, the name *E. corymbosum* var. *glutinosum* was superseded by *E. corymbosum* var. *aureum* (Reveal 1983, p. 292-293). As a result, all specimens previously identified as *E. corymbosum* var. *glutinosum* became subsumed under the name *E. corymbosum* var. *aureum* (Reveal 1983, p. 293). In 1985, Reveal (p. 502) expanded the range of *E. corymbosum* var. *aureum* westward, including disjunct populations near Las Vegas in Clark County, Nevada, with material from southern Utah and northern Arizona (previously treated under the name *E. corymbosum* var. *glutinosum*) as members of variety *aureum* (Reveal 1967, p. 213).

In 2002, Reveal (entire) prepared an unpublished treatment of the *Eriogonum corymbosum* complex, in which he again recognized a total of seven varieties, while also incorporating nomenclatural and taxonomic revisions to his 1967 treatment (Reveal 1967, pp. 186–187). Thus, the names assigned to the seven varieties recognized in these two treatments are not identical. Among the taxonomic revisions included in Reveal's latter (2002) treatment is a preliminary description of *E. corymbosum* var. *nilesii*, which he distinguished from *E. corymbosum* var. *aureum* and *E. corymbosum* var. *glutinosum* based upon morphological, ecological, and geographical considerations (Reveal 2002, p. 26). Reveal describes *E. corymbosum* var. *nilesii* from Las Vegas, Nevada (Clark County), and adjacent areas in southern Utah (Kane and Washington Counties), consisting of plants with the following attributes: pale yellow to yellow flowers; an open, spreading habit; floccose (bearing tufts of long, soft, tangled hairs) inflorescence branches; and silvery-floccose upper leaf surfaces. Reveal acknowledges material from northwestern Arizona as possibly warranting inclusion in this variety, pending further study (Reveal 2002, p. 26). He also resurrects the name *E. corymbosum* var. *glutinosum* to describe material from southern Utah and northern Arizona that, like *E. corymbosum* var. *nilesii*,

possesses pale yellow to yellow flowers, but differs in overall habit (round as opposed to open and spreading), and characteristics of the inflorescence branches (tomentose to floccose, as opposed to strictly floccose) and upper leaf surfaces (densely tomentose or less so and greenish, as opposed to silvery-floccose) (Reveal 2002, pp. 25, 32). Last, Reveal describes a dramatically restricted range for *E. corymbosum* var. *aureum,* essentially restricting this taxon to the Shivwits Hill area of Washington County, Utah, and distinguishing it from var. *nilesii* and *glutinosum* by characteristics of the inflorescence branches (glabrous, as opposed to tomentose or floccose) (Reveal 2002, p. 32). In 2004, Reveal's description of *Eriogonum corymbosum* var. *nilesii* was published in the botanical literature; this description was consistent with his earlier, unpublished account (Reveal 2002, entire), with regard to morphological characters, but not geographic distribution, in that Washington County, Utah, is omitted without explanation (Reveal 2004, p. 128).

Reveal's 2002 treatment emphasizes flower (perianth) color as a distinguishing characteristic among the varieties within the *Eriogonum corymbosum* complex, while noting that the character is prone to fade in older herbarium specimens (Reveal 2002, p. 25) and vary within and among populations, including the yellow-flowered varieties of var. *glutinosum*, *aureum*, and *nilesii* (Reveal 2002, p. 37). Nonetheless, a distinction based on white versus yellow flower color is not unique to the *Eriogonum corymbosum* complex, and is used to differentiate between varieties of other *Eriogonum* taxa (Reveal 2002, p. 25).

In 2005, Reveal co-authored a description of the *Eriogonum corymbosum* complex for the publication *Flora of North America (FNA), volume* 5 (Reveal, 2005; *http://www.efloras.org/florataxon.aspx?flora_id=1&taxon_id=250060233*, accessed online September 16, 2013). The morphological characters in this description for *E. corymbosum* var. *nilesii* remain consistent with Reveal's earlier descriptions (2002, entire; 2004, p. 128). Consistent with his 2004 publication, Reveal again omits mention of Washington County, Utah in his description of the taxon's range:

> Variety *nilesii* is a plant of the Mojave Desert, known for certain only from the Las Vegas and Muddy Mountains region of Clark County, Nevada. A collection from the flood plain of the Paria River in Kane County, Utah, is tentatively assigned to this variety.

This FNA description also notes:

> *Eriogonum corymbosum* is a difficult complex of overlapping expressions, some of which are maintained here as taxonomically significant. Although perianth color is used to group the varieties, this feature is not consistent even in single populations. Therefore, population trends in perianth color must be noted in the field. Most of the varieties are then distinguished on the basis of leaf characters, and again, considerable variation can be seen in some populations. Still, the combination of flower color, leaf features, and geographic distribution should prove useful in distinguishing the varieties.
>
> S. L. Welsh *et al.* (2003) alluded to hybrid combinations involving *Eriogonum corymbosum* and other species. Aside from the instances involving *E. brevicaule*, discussed below, none has been confirmed. Most of the putative hybrids are misidentified specimens of *E. lonchophyllum* or collections of var. *corymbosum* in which

the leaf-margins are not decidedly crisped, a feature usually seen only in fully mature plants.

Reveal's published description of *Eriogonum corymbosum* var. *nilesii* was based on morphological, ecological, and biogeographical considerations. Subsequent genetic analyses conducted with material from Las Vegas Valley (Clark County, Nevada) and Lincoln County, Nevada, revealed patterns of genetic cohesion and divergence that the authors interpreted as supporting the taxonomic distinctiveness of *E. corymbosum* var. *nilesii* within the *E. corymbosum* complex (Ellis and Wolf 2007, entire; Ellis *et al*. 2009, entire). These genetic analyses also revealed *E. corymbosum* var. *aureum* to be the closest relative of *E. corymbosum* var. *nilesii,* and suggested var. *aureum* to be of hybrid origin, resulting from out-crossing between var. *nilesii* and *E. thompsoniae* (Ellis *et al.* 2009, p. 699). This illustrates that hybridization has and may still be occurring among members of the *Eriogonum corymbosum* complex, and with other members of this genus.

We conclude that *E. corymbosum* var. *nilesii* is a valid taxon. However, variation in the field expression of diagnostic morphological characters (acknowledged in the above taxonomic treatments) has contributed to uncertainty with regard to the geographic range of *E. corymbosum* var. *nilesii,* particularly in southern Utah and northern Arizona. We summarize our understanding of the range and distribution of this taxon in the next section.

Range and Distribution

As noted in the previous section, the first, unpublished description of *Eriogonum corymbosum* var. *nilesii* (Reveal 2002, entire) defines the taxon's range as Las Vegas, Nevada (Clark County) and adjacent areas in Utah (Kane and Washington Counties). However, Washington County, Utah, is omitted from subsequent, published descriptions of this variety (Reveal 2004, p. 128; Reveal 2005, entire). Thus, the range of this variety in southern Utah and northwestern Arizona has been at times difficult to ascertain, especially in light of the variation in floral and vegetative features used to distinguish members of the *E. corymbosum* complex.

In 2009, botanical surveys along the corridor of a proposed water pipeline route extending through portions of southern Utah, northern Arizona and southern Nevada (known as the Lake Powell Pipeline) identified specimens of *Eriogonum corymbosum* var. *nilesii* in Coconino and Mohave Counties, Arizona; and Washington and Kane Counties, Utah (Utah Board of Water Resources 2010, p. 4-50). Key features used to differentiate *E. corymbosum* var. *nilesii* from other varieties during this survey effort included rounded inflorescence, yellow flowers, and hairy leaves, although two locations (the Divide in Washington County, Utah and Long Canyon in Kane County, Utah) displayed mixed white and yellow flowers (Utah Board of Water Resources 2010, p. 4-50; 4-54). Reveal later (in 2010) verified that herbarium specimens from the proposed pipeline route in Washington County, Utah, were *E. corymbosum* var. *nilesii* (G. Reese, Logan Simpson Design, pers. comm. 2011). Apparently Reveal did not examine specimens from the remainder of the pipeline route. That same year (2010), Reveal confirmed that specimens originally collected in 2005 (in surveys unassociated with the Lake Powell pipeline) from Lincoln County, Nevada were also *E. corymbosum* var. *nilesii* (A. Tiehm, University of Nevada, Reno, pers. comm. 2011).

With the publication of *Intermountain Flora* 2a (in Holmgren *et al.* 2012, pp. 270–273), Reveal expanded the range of *Eriogonum corymbosum* var. *nilesii* to include southern Lincoln County, Nevada and Mohave County, Arizona. Reveal's range description makes no mention of Washington County, Utah; while this is consistent with his earlier publications (2004 and 2005), it stands in seeming contradiction to his reported verification of *E. corymbosum* var. *nilesii* specimens collected from this county in 2010 (Reese, pers. comm. 2011). Coconino County, Arizona is also not mentioned in Reveal's 2012 description; however, we have no information to suggest that Reveal examined *E. corymbosum* var. *nilesii* specimens from this county (also from the pipeline route). Reveal's 2012 description (Reveal p. 272 in Holmgren *et al.* 2012), also notes that material along the Pariah River, in Kane County, Utah, which he previously attributed to *E. corymbosum* var. *nilesii* (Reveal, 2005), was more appropriately regarded as *E. corymbosum* var. *glutinosum*.

In order to gain clarification regarding the range of *Eriogonum corymbosum* var. *nilesii*, particularly in northwestern Arizona and southern Utah, the USFWS approached Drs. Ellis and Wolf, at Utah State University, authors of prior publications examining genetic relationships within the *E. corymbosum* complex, including *E. corymbosum* var. *nilesii* (Ellis and Wolf 2007, entire; Ellis *et al*. 2009, entire). In the spring of 2012, we collected leaf tissue samples from 14 putative *E. corymbosum* var. *nilesii* locations as well as 6 reference sites (var. *nilesii, aureum, glutinosum, corymbosum, orbiculatum*, and *E. thompsoniae*) (Figure 2). We returned to these same locations in the fall of that same year (2012) to collect representative herbarium specimens and record observations in the dominant patterns and range of variation expressed in key morphological traits. We collected genetic samples in the spring, and plant attribute data in the fall because leaf tissue is no longer optimal for genetic analysis when *E. corymbosum* var. *nilesii* plants are in flower (August – November). We collected multiple herbarium specimens from each location; upon returning from the field, we systematically examined each specimen in terms of the diagnostic morphological traits emphasized in each of Reveals' descriptions, namely: perianth (flower) color, habit (round or spreading), and leaf hair characteristics. We recorded the attributes of each specimen in a spreadsheet (Kulpa, *in litt.* 2012a). We first summarize our findings from inspection of morphological characters, followed by the results from genetic analyses. Our observations of morphological traits (floral and vegetative) revealed that plants from locations in southern Nevada (Clark and Lincoln Counties, except locations near Gold Butte, in far eastern Clark County) were rather consistent in expressing the suite of morphological traits attributed to *Eriogonum corymbosum* var. *nilesii*, namely: yellow-flowers, open and spreading habit, and appropriate leaf characteristics (Figure 3, solid yellow circles). By contrast, plants from other locations were more variable in these key features (Figure 3, remaining symbols).

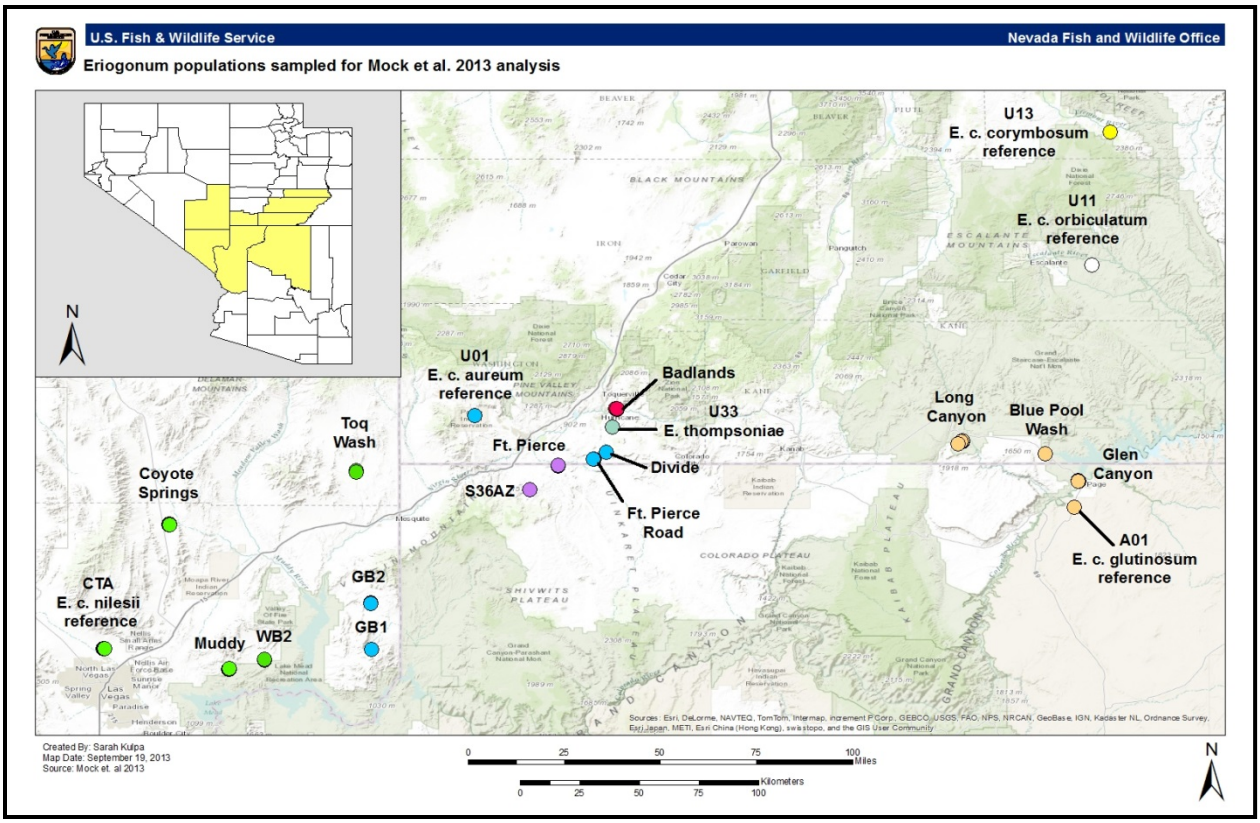

FIGURE 2—*Eriogonum* locations sampled for genetic analysis (Mock *et al*. 2013, entire). Sites are color-coded to match the genetic groupings and taxonomic affinities in Mock *et al*. 2013: green = *E. corymbosum* var. *nilesii*; blue = *E. corymbosum* var. *aureum*; orange = *E. corymbosum* var. *glutinosum*; white = *E. corymbosum* var. *orbiculatum*; light green = *E. thompsoniae*; purple = locations containing hybrids of varieties *aureum*+*nilesii*; and red = undetermined.

Results from genetic analyses by Mock et al. (2013, entire) are depicted in Figure 2 and summarized in Table 1. Although Ellis (2013) and Mock *et al*. (2013, entire) refer to these sampling locations as "populations", we refer to them merely as sampling "locations", because we herein define "populations" of this taxon based upon spatially explicit criteria (see *Distribution (within the range)*, described below). Of the 14 putative *E. corymbosum* var. *nilesii* locations sampled across Nevada, Utah, and Arizona, only four demonstrated strong genetic affinities to the reference location for *E. corymbosum* var. *nilesii* (CTA; Figure 2, green circles). All of these four locations occur in southern Nevada (Clark and Lincoln Counties). Eight of the remaining 10 locations sampled exhibited genetic affinities more consistent with taxa other than *E. corymbosum* var. *nilesii*, with 7 of these locations more closely affiliated with var. *glutinosum* (Figure 2, orange circles) or var. *aureum* (Figure 2, blue circles), and one demonstrating ambiguous genetic composition tentatively deemed most similar to *E. thompsoniae* (Figure 2, red circles). Two remaining locations were assessed to be hybrids of varieties *aureum* and *nilesii* (Figure 2, purple circles).

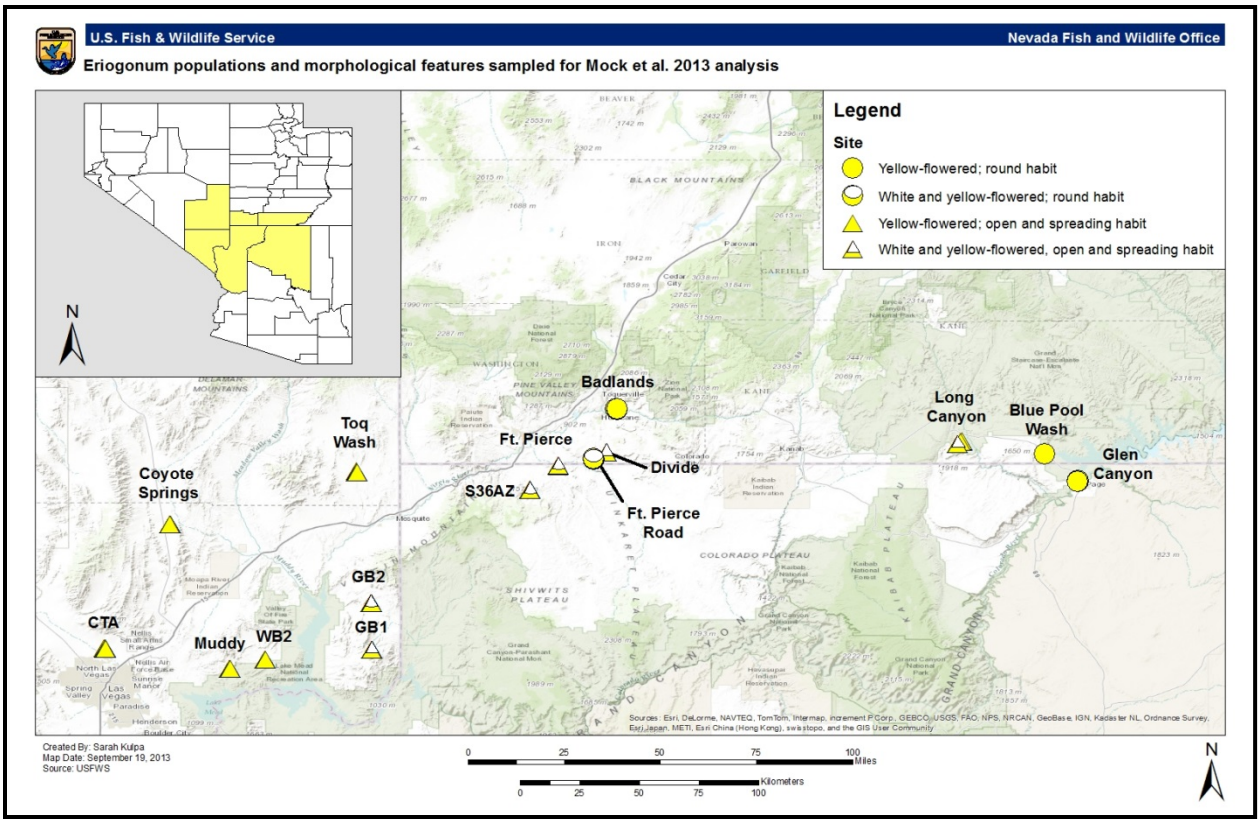

FIGURE 3—Morphological features of *Eriogonum* locations sampled for genetic analysis. Yellow circles = yellow-flowered plants with a predominantly round habit; white and yellow circles = white and yellow flowered plants with a predominantly round habit; yellow triangles = yellow-flowered plants with a predominantly open and spreading habit; and white and yellow triangles = white and yellow-flowered plants with a predominantly open and spreading habit. Additional morphologic traits measured can be found in (Kulpa, *in litt.* 2012a).

TABLE 1—Genetic analysis (of amplified fragment length polymorphisms, or AFLPs) of known and putative *Eriogonum corymbosum* var. *nilesii* locations across southern Nevada and Utah, and northern Arizona. Table reproduced in its entirety from Mock *et al.* 2013, p.7.

Pop #	Site Name	Taxon
E. c. nilesii group		
P14	CTA1	*E. c. nilesii*
P10	Muddy	Newly sampled
P11	Toq Wash	Newly sampled
P12	WB2	Newly sampled
P13	Coyote Springs	Newly sampled
E. c. aureum group		
P17	U01	*E. c. aureum*
P02	Divide	Newly sampled
P04	Ft. Pierce Road	Newly sampled
P09	GB1	Newly sampled
P15	GB2	Newly sampled
Admixed group: *aureum/nilesii*		
P03	Ft. Pierce	Newly sampled
P07	S36AZ	Newly sampled
E. c. glutinosum group		
P16	A01	*E. c. glutinosum*
P01	Glen Canyon	Newly sampled
P05	Long Canyon	Newly sampled
P06	Blue Pool Wash	Newly sampled
More distantly related reference taxa		
P20	U33	*E. thompsoniae*
P08	Badlands	Newly sampled
P18	U11	*E. c. orbiculatum*
P19	U13	*E. c. corymbosum*

We therefore conclude, on the basis of morphological and genetic data, that the range of *Eriogonum corymbosum* var. *nilesii* is restricted to southern Nevada. Material previously assessed as *E. corymbosum* var. *nilesii* on the basis of morphological traits acknowledged to be variable in the published literature (e.g., Reveal 2002; Reveal 2005), is both geographically and genetically discrete, as depicted in Figures 2 and 3, above. According to these datasets, *E. corymbosum* var. *nilesii* is found northwest of the Virgin River (in Lincoln County, Nevada) and west of Lake Mead (in Clark County, Nevada).

Distribution (within the range)

Across its range, *Eriogonum corymbosum* var. *nilesii* occupies a total of approximately 795.3 ac (321.85 ha). The majority of occupied habitat is federally owned, with 72 percent administered by the BLM, and another 8.15 percent by the Department of Defense (DOD). Landownership patterns for the remainder of occupied habitat are as follows: City of Las Vegas (0.13 percent),

Clark County (0.80 percent), State of Nevada (0.001 percent), and private landowners (18.81 percent). *E. corymbosum* var. *nilesii* has been extirpated from an additional 1,303.5 ac (527.5 ha) of formerly occupied habitat, corresponding to nearly 62 percent of its historic range. Most of the lands from which the species has been extirpated are in private ownership (94.9 percent); the remaining lands are owned or managed by the City of Las Vegas (1.95 percent), Clark County (2.24 percent), or the DOD (0.9 percent).

Most written accounts of the geographic range and distribution of *E. corymbosum var. nilesii* use the terms "site," "location," "occurrence (often, but not always, in reference to Natural Heritage Program Element Occurrence (EO) records), "population," and "subpopulation" interchangeably. In most cases where the term "population" has been used, the criteria for aggregating smaller sites into populations are not explicitly defined. This generates discrepancies among sources with respect to reporting abundance and distribution of the species, with the net result being that different sources (and even different surveys by the same source) are usually not comparable. The tendency to treat each spatially discrete *E. corymbosum* var. *nilesii* location as a separate population can also suggest more populations than may actually exist. For the purpose of this document, the USFWS has applied spatial mapping standards devised by NatureServe and its network of Natural Heritage Programs (NatureServe 2004, entire) to organize known location data for E. corymbosum var. nilesii into spatially discrete mapping units which we herein treat as "populations" of the species. Because the population genetic structure and dispersal distances (of pollinators and seed) are not known for *E. corymbosum* var. *nilesii*, our delineation of presumed populations primarily reflects the degree of spatial separation among known locations, the existence of (or potential for) intervening patches of seemingly suitable habitat, and the presence of known or presumed barriers to dispersal. Based upon these factors, we have aggregated 26 known, spatially discrete locations of the species into 12 "populations" (Figure 4 and Table 2, column 1). This document uses the term "subpopulation" only when necessary to reference a portion of 1 or more of these 12 populations. For further ease of reference, our "populations" are cross-referenced to corresponding Nevada Natural Heritage Program (NNHP) EO numbers (Table 2, column 3).

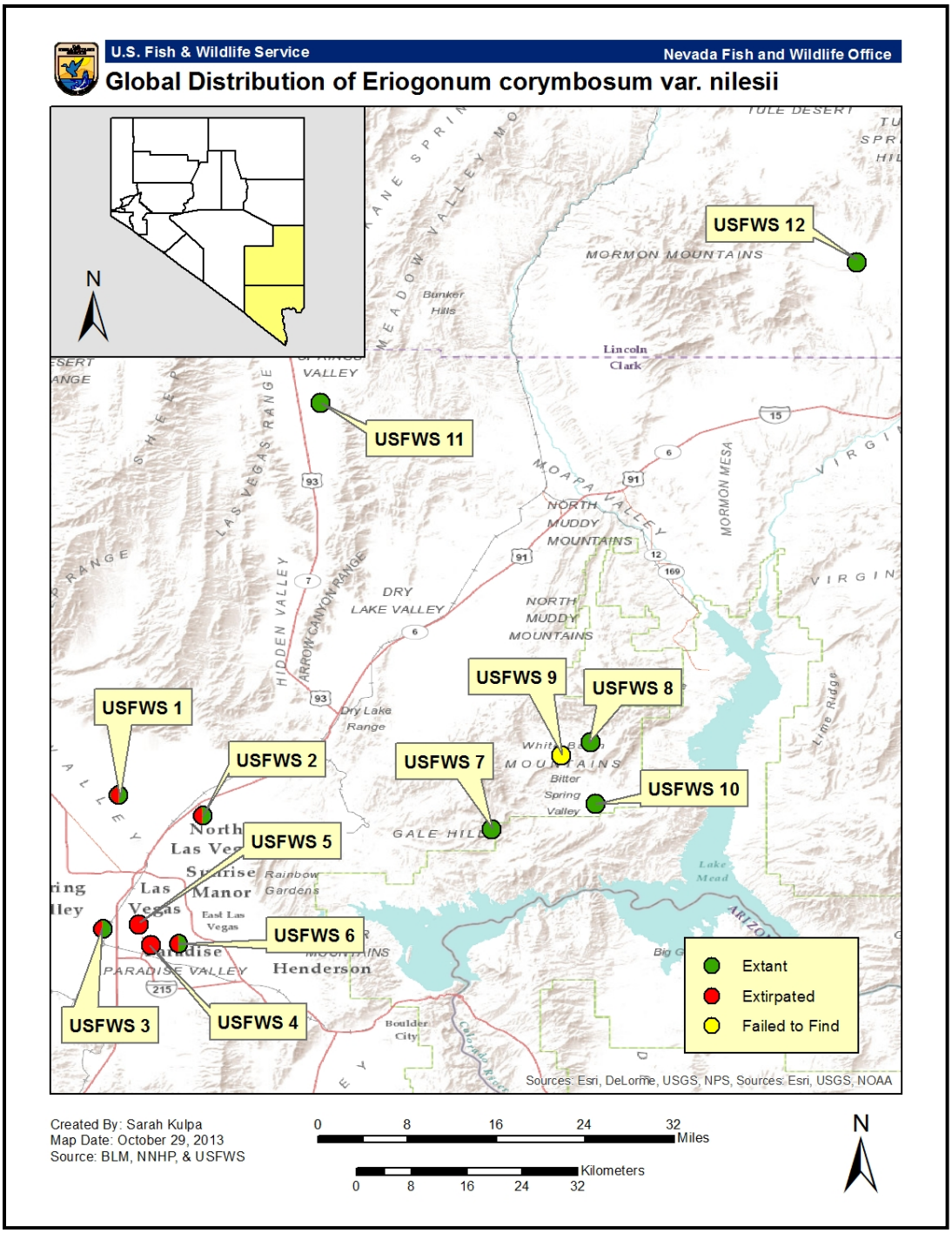

FIGURE 4—Global distribution of *Eriogonum corymbosum* var. *nilesii* in Clark and Lincoln Counties, Nevada. Green circles represent extant populations, red circles represent extirpated populations, circles that are half-green and half-red represent populations that are still extant, but have portions that have been lost, and yellow circles represent populations that were not able to be located during recent survey efforts. Populations and their subpopulations are further defined in Table 2.

Table 2.—Summary of *Eriogonum corymbosum* var. *nilesii* populations in Nevada. Bold lines separate populations and gray shading indicates a population or subpopulation that has been extirpated.

Eriogonum corymbosum var. *nilesii* population (USFWS)	Site Name	EO[1]	State	County	Population estimate range(s) remaining[2]	Estimated acres (hectares) remaining[3]	Population estimate range(s) lost	Estimated acres (hectares) lost[3]	Land Owner	Status
1	Centennial Pkwy N	14	NV	Clark	619–822+	69.97 (28.31)	1,000	13.94 (5.64)	City of Las Vegas, Private	Extant
	Elkhorn & Jones NE	15	NV	Clark			294–1288+	120.95 (48.95)	Private	Extirpated
	Upper Las Vegas Wash	17	NV	Clark	5,606	137.84 (55.78)			BLM, State, Private	Extant
	Ann & 5th NE	18	NV	Clark	25–50+	2.31 (0.93)	60	2.33 (0.94)	Private	Extant
	5th & Lone Mountain N	20	NV	Clark	25–50+	3.69 (1.49)	60	14.58 (5.9)	Private	Extant
	Ann Road Bluff	25	NV	Clark	25–50+	30.04 (12.16)[4]	1370+	499.34 (202.08)	City of North Las Vegas, Private	Extant
	Alexander & Revere NW	26	NV	Clark			50	6.46 (2.61)	Private	Extirpated
	Craig & Simmons	27	NV	Clark	4	2.07 (0.84)[5]	275+	37.68 (15.25)	Private	Extant
	Centennial & Decatur	35	NV	Clark			5	0.07 (0.03)	Clark County	Extirpated

Table 2, continued.

Eriogonum corymbosum var. *nilesii* population (USFWS)	Site Name	EO[1]	State	County	Population estimate range(s) remaining[2]	Estimated acres (hectares) remaining[3]	Population estimate range(s) lost	Estimated acres (hectares) lost[3]	Land Owner	Status
2	Nellis AFB	12	NV	Clark	895+	76.49 (30.95)[6]	311+	63.67 (25.77)	DOD, Private	Extant
3	Tropicana & Decatur	6	NV	Clark	30–40	6.38 (2.58)	326–336	13.45 (5.44)	Clark County	Extant
	Tropicana Wash A	7	NV	Clark			unknown	23.6 (9.55)	Clark County, Private	Extirpated
	Tropicana Wash B	8	NV	Clark			unknown	2.65 (1.07)	Clark County	Extirpated
	Tropicana Wash C	9	NV	Clark			unknown	2.98 (1.21)	Clark County, Private	Extirpated
4	Patrick & Maryland	39	NV	Clark			unknown	5.5 (2.23)	Clark County	Extirpated
5	UNLV	41	NV	Clark			unknown	4.51 (1.83)	Private	Extirpated
6	Patrick & Pecos	2	NV	Clark	300	8.73 (3.53)[7]	unknown	487.96 (197.47)	Private	Extant
7	Muddy Mountains	36	NV	Clark	296+	6.61 (2.67)			BLM	Extant
8	White Basin 1	3	NV	Clark	81–302+	175.41 (70.99)			BLM	Extant
9	White Basin 1 SW	38	NV	Clark				0.06 (0.02)[9]	BLM	Extirpated
10	White Basin 2	40	NV	Clark	227–248+	53.13 (21.5)			BLM	Extant

Table 2, continued.

Eriogonum corymbosum var. *nilesii* population (USFWS)	Site Name	EO[1]	State	County	Population estimate range(s) remaining[2]	Estimated acres (hectares) remaining[3]	Population estimate range(s) lost	Estimated acres (hectares) lost[3]	Land Owner	Status
11	Coyote Springs W	31	NV	Clark	700	3.39 (1.37)[8]	750	3.77 (1.53)	Private	Extant
	Coyote Springs E	32	NV	Clark	2,380+	18.17 (7.35)			Private	Extant
	Coyote Springs Valley N	33	NV	Clark	1,752–1,756+	5.38 (2.18)			BLM	Extant
	Coyote Springs Valley S	34	NV	Clark	8,211–8,274+	60.43 (24.46)			BLM	Extant
12	Toquop Wash	30	NV	Lincoln	10,000+	135.24 (54.73)			BLM	Extant
TOTAL					**31,176–31,773**	**795.3 (321.85)**	**4,501–5,505**	**1,303.5 (527.51)**		

[1]EO = Element occurrences mapped in the NNHP database.
[2]Population Estimate = Population estimate reported from the most recent and comprehensive survey. Estimates of areas where extirpation maybe imminent is included. For further discussion of this see *Current Status of Population and Habitat*, below.
[3] = Estimated acres (hectares) extant and extirpated were calculated using previous acreage estimates from Morefield 2007 (pp. 1–4), shapefiles in our records (NNHP, Geospatial Data 2007 and 2013; USFWS, Geospatial Data 2012a, 2012b, and 2012c; BLM, Geospatial Data 2013; and J. Harter, unpubl. survey 2013a, 2013b, 2013c, 2013d, and 2013e), and aerial imagery (ESRI ArcGIS Imagery Basemap satellite imagery).
[4] = Extirpation is imminent on 1.1 ac (0.45 ha) at the Ann Road Bluff subpopulation due to development.
[5] = Extirpation is imminent on 0.85 ac (0.34 ha) at the Craig & Simmons subpopulation due to development.
[6] = Extirpation is imminent on 18.09 ac (7.32 ha) at the Nellis AFB subpopulation due to development.
[7] = Extirpation is imminent on 8.73 ac (3.53 ha) at the Patrick & Pecos subpopulation due to development.
[8] = Extirpation is imminent on 3.39 ac (1.37 ha) at the Coyote Springs W subpopulation due to development.
[9] = 2013 surveys could not relocate the plant at the White Basin 1 SW subpopulation; therefore it is reported in this table as extirpated.

Phenology and Life History

Eriogonum corymbosum var. nilesii breaks dormancy in early spring and new leaves and flowering stems appear at the end of March or early April (Kulpa *in litt.* 2012b). Plants flower from August to November. Mature fruits or achenes are brown, 2–2.5 (–3) mm long and are glabrous except for an occasional papillate (i.e. a short, rounded nipple-like bump or protrusion) beak (Reveal, 2005; *http://www.efloras.org/florataxon.aspx?flora_id=1&taxon_id=250060233*, accessed online September 16, 2013).

At least twenty different species of floral visitors have been observed frequenting the flowers of *Eriogonum corymbosum* var. *nilesii*. These included at least five species of flies, five species of bees, two wasps, five different species of butterflies and a mayfly. A spider was also observed preying on the insects that frequent this plant (Glenne 1999, p. 12). These floral visitors can only represent presumed pollinators because they were not observed to be carrying pollen; however they represent the best available information regarding possible pollinators of *E. corymbosum* var. *nilesii*.

There is no data on germination events for *Eriogonum corymbosum* var. *nilesii*; therefore the conditions necessary for seed germination and seedling recruitment are unknown. Nothing is known about the longevity of *E. corymbosum* var. *nilesii* seeds; therefore it is not known whether the species forms a seedbank, nor is it known how long seeds may remain viable once shed from the parent plant. Germination trials demonstrated that seeds planted two weeks after collection had three times greater germination than seeds planted eight months after collection, suggesting that seeds of *E. corymbosum* var. *nilesii* may lose viability quickly (Winkel 2004, pp. 57–58). Transplantation and translocation studies found that *E. corymbosum* var. *nilesii* plants are easy to salvage at the end of their dormancy period (i.e. early March) as long as care is taken during salvaging and planting to keep the above-ground plant and rootball intact, and supplemental irrigation is provided during an establishment period of several months (Winkel 2004, p. 58).

Habitat

Eriogonum corymbosum var. *nilesii* occurs between 656 and 2,789 feet (ft) (200–850 meters (m)) in elevation on clayey, gravelly, or rarely sandy flats and slopes (0–3 percent) or gypsum flats and mounds (Drohan and Merkler 2009, p. 99; Reveal *in* Holmgren *et al.* 2012, pp. 270–273). Plants are often found growing in areas of Holocene or Pleistocene marsh stream channels (now filled with alluvial materials in some instances), but not necessarily in the bottom of channels (Drohan and Merkler 2009, p. 99). On the basis of Reveal's description of *Eriogonum corymbosum* var. *nilesii* as having a strong preference for gypsophilous soil (Reveal 2002, p. 26), botanists subsequently presumed the species to be a gypsophile, meaning a species that occurs solely on soils with gypsum, and never on soils without gypsum. However, results from soil and tissue analyses conducted by Drohan and Merkler (2009, entire) suggest that factors other than gypsum may also be contributing to the habitat preferences of *E. corymbosum* var. *nilesii* and the species should not be classified as strictly a gypsophile.

Eriogonum corymbosum var. *nilesii* is likely influenced by a combination of surface and subsurface soil characteristics that affect potential soil water content. *Eriogonum corymbosum* var. *nilesii* prefers silty, deep soils which can potentially have a higher available water capacity, benefiting the species over its life cycle (Drohan and Merkler 2009, p. 103). Additionally, the soils the species inhabits have low soil bulk densities, ranging from 0.81–1.79 mg kg^{-1}. Lower bulk density soils have greater aeration and allow for root and water penetration. Furthermore, petrocalcic (i.e., formed when secondary calcium carbonate accumulates in the subsoil to the extent that the soil becomes cemented into a hardpan) subsurface horizons are present, and are noted for perching water and storing soil moisture in arid environments (Drohan and Merkler 2009, p. 103).

Soil and tissue chemistry suggest that *Eriogonum corymbosum* var. *nilesii* may experience reduced competition from other plant species by an ability to tolerate conditions that other species apparently cannot. Sites occupied by *E. corymbosum* var. *nilesii* were found to contain significantly higher boron, chlorine, magnesium, potassium, and sodium (in the upper 15.7 in (40 cm)) compared to otherwise similar habitats where the species is absent (Drohan and Merkler 2009, p. 101). Buck et al. (2011, p. 25) found that *E. corymbosum* var. *nilesii* tends to occupy soils with a relatively high arsenic level, which supports the findings of Drohan and Merkler (2009 p. 102) that found mean arsenic concentrations of 412 mg kg^{-1} in the species tissues. Correspondingly, mean phosphorus was low in leaf tissue and in soils at *E. corymbosum* var. *nilesii* sites (Drohan and Merkler 2009, p 102; Buck et al. 2011, p. 225). This suggests that *E. corymbosum* var. *nilesii* has either a greater tolerance to arsenic uptake or decreased phosphorus requirements relative to other native plants in the area, thus aiding in its ability to thrive in its habitat niche (Buck et al. 2011, p. 225).

Eriogonum corymbosum var. *nilesii* exists primarily in areas where there is little other vegetation. These areas are surrounded by areas of denser vegetation consisting of mostly perennial plants. Species most often associated with *E. corymbosum* var. *nilesii* include: *Acacia greggii* A. Gray (catclaw acacia), *Ambrosia dumosa* (A. Gray) Payne (white bursage or burrobush), *Arctomecon californica* Torr. & Frém (California bearpoppy or Las Vegas bearpoppy), *Atriplex canescens* (Pursh) Nutt. (fourwing saltbush), *Ephedra torreyana* S. Watson (Torrey's jointfir), *Petalonyx parryi* A. Gray (Parry sandpaper plant), *Psorothamnus fremontii* (Torr. ex A. Gray) Barneby (Fremont's indigo bush), and *Stanleya pinnata* (Pursh) Britton (desert princesplume) (USFWS 2000, p. 11; Morefield 2004, p. 1).

Abundance and Population Trend

Reliable estimation of population size or trends in *Eriogonum corymbosum* var. *nilesii* is complicated by many factors. Estimates of population size (in terms of abundance of individuals) have usually been obtained by different observers employing a variety of means and levels of survey effort. At one extreme, observations consist of coarse estimates (e.g. individuals ranging from 2 to 5, 25 to 50, > 50, 10,000^{+}, etc.); at the other extreme, they consist of meticulous counts of every plant present. Still other observers have estimated abundance by extrapolating from counts within a small portion of occupied habitat (delimited with or without the use of plots and/or transects). In addition, not all populations estimates reported are based on comprehensively surveyed areas, and as a result, some estimates of abundance do not reflect the

entire populations. Thus, because of the varied methods used in arriving at these estimates, they are not always directly comparable, and must be interpreted with some caution.

Differences in methods used to map populations create additional discrepancies, in that boundaries vary considerably in terms of the unoccupied (but presumed suitable) and/or buffer habitat included. We used polygon boundaries provided from NNHP as a base for our occupied area delineation, which are often buffered by GPS uncertainty values (i.e. anywhere from 0 to 800 m). Our base polygon boundaries were then expanded if our area of interest had supplemental point or polygon data not included in the NNHP database (i.e. data taken by us or provided to us, but not yet provided to NNHP for incorporation in their database) (USFWS, Geospatial Data 2012a, 2012b, and 2012c; BLM, Geospatial Data 2013; and J. Harter, unpubl. survey 2013a, 2013b, 2013c, 2013d, and 2013e).

Keeping all of these caveats in mind, the combined total of available estimates of plants at the 9 extant populations ranges between 31,176–31,773 individuals across a total of 795.3 ac (321.85 ha) (NNHP, Geospatial Data 2007 and 2013; Table 2, column 6 and 7). We have very little confidence in these estimates of abundance; we present them solely because they represent the only available estimates for *Eriogonum corymbosum* var. *nilesii*. Additionally, available data suggests approximately 4,501–5,505 plants have already been lost, across a total of 1,303.5 ac (527.51 ha) of habitat (Table 2, column 8 and 9). Future development has been assessed as imminent at two populations and four subpopulations (Morefield 2007, p. 1–4 and USFWS, 2013 Geospatial Data). If these anticipated impacts occur, one population (USFWS 6; 300 individuals on 8.73 ac (3.53ha)) and four subpopulations (3,107–3,132 individuals on 23.51ac (9.51 ha)) are expected to be lost entirely (extirpated) whereas partial impacts (loss of individuals and habitat) are anticipated at the remaining population (500 individuals 11.69 ac (4.73 ha)). We explain these patterns and the reasons for these anticipated future impacts in our descriptions of populations and subpopulations, below.

Current Status of Populations and Habitat

In this section, we summarize the 12 populations of *Eriogonum corymbosum* var. *nilesii* in terms of land ownership, estimated acreage, estimated number of plants, land use patterns (i.e. development, mining claims, and off road vehicle (OHV) trails), and other site-specific considerations such as the presence of non-native, invasive plant species.

Site Accounts

Population USFWS 1
Property owners within this population include the BLM (55.83 percent), City of Las Vegas (0.41 percent), State of Nevada (0.002 percent), and private landowners (43.76 percent). Population USFWS 1 consists of 6 extant subpopulations, collectively occupying 245.93 ac (99.52 ha) or 31 percent of the total amount of extant, occupied habitat mapped for *Eriogonum corymbosum* var. *nilesii* (Table 2). The 6 subpopulations have been previously estimated (by various sources) to contain between 6,304–6,582 plants (NNHP, Geospatial Data 2007 and 2013). An additional three subpopulations (not including the 6 extant subpopulations) have been extirpated within this larger population boundary and 5 of the 6 extant subpopulations have

incurred partial losses of plants and occupied habitat. In total, available data suggests approximately 3,114–4,108 plants have been lost, across 695.35 ac (281.40 ha) of habitat. Future development has been assessed as imminent at 2 of the 6 subpopulations (Morefield 2007, 1–4; USFWS, 2013 Geospatial Data ; if anticipated impacts occur, this could result in the loss (extirpation) of 2 subpopulations or approximately 27–52 plants and 1.95 ac (0.79 ha) of habitat.

The majority of lands in population USFWS 1 are administered by BLM. One of the six extant subpopulations, known as "Upper Las Vegas Wash", includes 137.3 ac (55.56 ha) of occupied habitat located on BLM lands that have been established as the Conservation Transfer Area (CTA) and Eglington Preserve (See below in *Factors Affecting the Species* and *Conservation Actions and Efforts*). However, *Eriogonum corymbosum* var. *nilesii* occurs in the most developed portion of the CTA, in an area that contains two existing power lines and a soon to be paved road (Grand Teton Road) along the southeastern portion of the CTA near the Eglington Preserve (BLM 2011, p. 70). The nonnative, invasive plant species *Halogeton glomeratus* (M. Bieb.) C.A. Mey. (saltlover) has also colonized disturbed soils in this area (Edwards 2007, pp. 1–21; Kulpa *in litt.* 2012b). The fence enclosing the CTA near Aliante Parkway and Horse Drive has been cut and trash is being dumped among *E. corymbosum* var. *nilesii* plants (Kulpa *in litt.* 2012b). Additionally, illegal OHV traffic, particularly dirt-bike riding, is common in the CTA and of concern for BLM (BLM 2011, p. 79, Kulpa *in litt.* 2012b).

Population USFWS 2

Property owners within this population include the DOD (85 percent) and private landowners (15 percent). Collectively, 76.49 ac (30.95 ha) or 10 percent of the total amount of extant occupied habitat mapped for *Eriogonum corymbosum* var. *nilesii* occurs within population USFWS 2 (Table 2). This population has been previously estimated (by various sources) to contain approximately 895 plants (NNHP, Geospatial Data 2007 and 2013). Available data suggests that 311 plants and 63.67 ac (25.77 ha) of habitat have been lost from this population. Future development has been assessed as imminent (Morefield 2007, 1–4 and Kulpa *in litt.* 2012b) and if anticipated impacts occur, this is likely to result in the loss of an additional 500 plants and 11.69 ac (4.73 ha) of habitat.

The DOD lands that encompass 85 percent of population USFWS 2 are managed as Nellis Air Force Base (AFB); the specific portion of the AFB where *E. corymbosum* var. *nilesii* occurs is referred to (by the AFB) as "Area III". A fence was constructed around Area III in 2000 to protect the area from illegal OHV activity and dumping of construction and household debris; the construction of this fence was apparently unassociated with the presence of *E. corymbosum* var. *nilesii*. However, a lot of trash still remains and nonnative, invasive plant species *Halogeton glomeratus*, *Salsola tragus* L. (prickly Russian thistle), and *Strigosella africana* (L.) Botsch (syn. *Malcolmia africana*; African mustard) are present within the population (Edwards 2007, pp. 1–21; Kulpa *in litt.* 2012b). Additionally, 233 ac (94 ha) of Area III has been set aside as a Conservation Area for the protection of *Eriogonum corymbosum* var. *nilesii* and *Arctomecon californica* (Las Vegas bearpoppy), another rare species also found on the AFB. Within this Conservation Area, 54.2 ac (21.93 ha) is occupied by *E. corymbosum* var. *nilesii*, corresponding to 71 percent of the total occupied acreage mapped within population USFWS 2 (Table 2). The Conservation Area is to remain undeveloped unless military mission requirements dictate otherwise (see below in *Factors Affecting the Species* and *Conservation Actions and Efforts*;

Nellis AFB 2010, pp. 168–171). Recreation trails for equestrian and hiking activities are defined and marked in this area (Nellis AFB 2010, p. 171).

Population USFWS 3
Population USFWS 3 consists of 1 extant subpopulation ("Tropicana and Decatur") on Clark County land. This population consists of 6.38 ac (2.58 ha) or 0.81 percent of the total amount of extant, occupied habitat mapped for *Eriogonum corymbosum* var. *nilesii*. The most recent abundance estimate at this location occurred in 2012, in which between 30 and 40 plants were estimated at this location (Kulpa *in litt.* 2012b). An additional three subpopulations have been extirpated within this larger population boundary and a portion (326–336 plants on 13.45 ac (5.44 ha)) of the single remaining extant subpopulation has incurred partial losses of plants and habitat. In total, approximately 326–336 plants and 42.68 ac (17.27 ha) of habitat has been lost from this population.

The remaining portion of subpopulation "Tropicana and Decatur" is within a 10 ac (4 ha) Buckwheat Conservation Area designated as part of the Lower Flamingo Wash Detention Basin (see *Factors Affecting the Species* and *Conservation Actions and Efforts* below; Clark County 2010, p.1; HDR Engineering 2010, entire). Prior to the development of the Lower Flamingo Wash Detention Basin, OHV activity was reported from this area (Hiatt 2007, p. 3). The nonnative, invasive plant species *Salsola tragus* has colonized disturbed soils within this subpopulation. The area has historically housed a large homeless population and continues to be covered in trash, discarded drug paraphernalia, and stray cat feeding stations (BLM 2007a, p. 3, 32–34; Kulpa *in litt.* 2012b).

Population USFWS 4
Population USFWS 4 has been extirpated due to development on Clark County lands. There are no available population estimates, however plants were once distributed across some 5.5 ac (2.23 ha) of habitat (NNHP, Geospatial Data 2007 and 2013)

Population USFWS 5
Population USFWS 5 has been extirpated due to development on private lands. There are no available population estimates, however plants were once distributed across some 4.51 ac (1.83 ha) of habitat (NNHP, Geospatial Data 2007 and 2013).

Population USFWS 6
Population USFWS 6 occurs on private land. This population consists of 8.73 ac (3.53 ha) or 1.1 percent of the total amount of extant, occupied habitat mapped for *Eriogonum corymbosum* var. *nilesii*. This population has been estimated (by various sources) to contain approximately 300 plants (NNHP, Geospatial Data 2007 and 2013). The majority of this population (487.96 ac (197.47 ha) of occupied habitat) has already been lost; the number of plants previously found on this formerly occupied habitat is unknown. Future development has been assessed as imminent for the extant portion of this population, and if anticipated impacts occur, this population will be extirpated (Morefield 2007, 1–4).

Population USFWS 7
Population USFWS 7 occurs on BLM land and occupies 6.61 ac (2.67 ha) or 0.83 percent of the

total amount of extant, occupied habitat mapped for *Eriogonum corymbosum* var. *nilesii*. The most recent abundance estimate at this location indicates 296 plants in 2013 (J. Harter, unpubl. survey 2013e). This population is within the Muddy Mountains Wilderness and is protected from mining, grazing, OHV use, and human development (see below in *Conservation Actions and Efforts*; BLM 2007b, p. 2, 4, 59). *Bromus rubens* is present in low quantities within this population (Kulpa *in litt.* 2012b).

Population USFWS 8
Population USFWS 8 occurs on BLM land and occupies 175.41 ac (70.99 ha) or 22.06 percent of the total amount of extant, occupied habitat mapped for *Eriogonum corymbosum* var. *nilesii*. This population has been previously estimated (by various sources) to contain approximately 81–302 plants (NNHP, Geospatial Data 2007 and 2013). Twenty-two closed mining claims occur within one of the legal sections (Section 21, Township 18 South, Range 66 East) in which this population occurs (BLM 2013a, Land and Mineral Legacy Rehost 2000 System – LR2000). OHV use is limited to existing roads, trails, and dry washes in this area and was observed along existing roads (BLM 1998a, p. 2–32; BLM 1998b, p. 24; Kulpa *in litt.* 2012b). Ongoing revisions to the Las Vegas BLM's RMP are expected to include a proposal to designate USFWS 8 and the surrounding area as the Bitter Spring Area of Critical Environmental Concern (ACEC), for the protection of *Eriogonum corymbosum var. nilesii* and two other special status plant species, which would also limit OHV activity in this area to designated roads and trails (F. Edwards, BLM, pers. comm., 2013).

Population USFWS 9
Population USFWS 9 was unable to be re-located in 2013 survey efforts, thus is considered extirpated for the purposes of this document (J. Harter, unpubl. survey 2013d). A population estimate is unknown and past surveys indicate plants were distributed across 0.06 ac (0.02 ha) (NNHP, Geospatial Data 2007 and 2013).

Population USFWS 10
Population USFWS 10 occurs on BLM land and occupies 53.13 ac (21.5 ha) or 6.68 percent of the total amount of extant, occupied habitat mapped for *Eriogonum corymbosum* var. *nilesii*. This population has been previously estimated (by various sources) to contain between 227–248 plants (USFWS, 2013 Geospatial Data). OHV use is limited to existing roads, trails and dry washes in the area and was observed along the wash bordering *E. corymbosum* var. *nilesii* habitat (BLM 1998a, p. 2–32; BLM 1998b, p. 24; Kulpa *in litt.* 2012b).

Population USFWS 11
Property owners within this population include the BLM (75 percent) and private landowners (25 percent). Population USFWS 11 consists of 4 extant subpopulations, collectively occupying 87.37 ac (35.36 ha) or 10.99 percent of the total amount of extant, occupied habitat mapped for *Eriogonum corymbosum* var. *nilesii*. These 4 subpopulations have been previously estimated (by various sources) to contain between 13,043–13,110 plants (NNHP, Geospatial Data 2007 and 2013). However, a portion of one subpopulation ("Coyote Springs W") has been lost from this population due to construction of the Coyote Springs Golf Club, totaling 750 plants and 3.77 ac (1.53 ha) of habitat. Future development at Coyote Springs has been assessed as imminent at two of the four subpopulations (Morefield 2007, 1–4; USFWS, 2013 Geospatial Data); if

anticipated impacts occur, this is likely to result in the total loss (extirpation) of these two subpopulations which is approximately 3,080 plants and 21.56 ac (8.73 ha) of habitat.

OHV use is limited to existing roads and trails in the area and was observed along roads bordering population USFWS 11 (BLM 1998a, p. 2–32; BLM 1998b, p. 24; Kulpa *in litt.* 2012b). Twenty-seven closed mining claims occur within three of the legal sections (Sections 22, 23, and 27, Township 13 South, Range 63 East) in which USFWS 11 occurs (BLM 2013a, Land and Mineral Legacy Rehost 2000 System – LR2000). However, an Area of Critical Environmental Concern (ACEC) was established for the desert tortoise (*Gopherus agassizii* – Mojave population) which overlaps with population USFWS 11 and in November 2009, mineral entry, was withdrawn in the ACEC until 2029 (BLM 2009, pp. 56657–56661).

Populations USFWS 12

Population USFWS 12 occurs on BLM land and is the only population of *Eriogonum corymbosum* var. *nilesii* that occurs outside of Clark County, Nevada. 135.24 ac (54.73 ha) or 17.01 percent of the total amount of extant, occupied habitat mapped for *E. corymbosum* var. *nilesii* occurs within population USFWS 12. This population has been estimated (by various sources) to contain approximately 10,000 plants (NNHP, Geospatial Data 2007 and 2013; S. Kulpa, J. Harter, and S. Cooper, unpubl. survey 2014).

Two development projects, Toquop Energy Project and TransWest Express Transmission Line (discussed below in *Factors Affecting the Species*), have the potential to indirectly impact population USFWS 12 (see below in *Factors Affecting the Species*). OHV use is limited to designated roads and trails and dirt bike trails were observed along washes within population USFWS 12 (BLM 2008b, p. 78, Map 16; Kulpa *in litt.* 2012b). Earth moving activity was observed along the road bordering the east side of the population as evidenced by piles of soil along the road (Kulpa *in litt.* 2012b). Twenty-five closed mining claims occur within five of the legal sections (Sections 13, 24, and 25, Township 11 South, Range 69 East and Sections 18 and 19, Township 11 South, Range 70 East) in which USFWS 11 occurs (BLM 2013a, Land and Mineral Legacy Rehost 2000 System – LR2000). *Bromus rubens* is present in low quantities within this population (Kulpa *in litt.* 2012b table).

TABLE 3—Scope, severity, and timing of each of the factors affecting *Eriogonum corymbosum* var. *nilesii*.

Threats	Scope	Severity	Timing (Immediacy)
Development (past)	67%	62%	Past/historical
Development (ongoing)	56%	5.5%	Ongoing
OHV Use and Road Development	67%	Unknown	Ongoing
Mineral Exploration and Development	0	Low to non-existent	Past/historical
Nonnative, Invasive Plant Species	56%	Unknown	Ongoing

Modified Wildfire Regime	0	Low to non-existent	Past/historical
Climate Change	100%	Unknown	Ongoing

FACTORS AFFECTING THE SPECIES

Eriogonum corymbosum var. *nilesii* has specialized habitat requirements, as described above, that restrict its distribution to a relatively narrow area in southern Nevada within the Mojave Desert (Figure 4). Within this landscape, several factors are currently altering habitat structure and composition to the general detriment of *E. corymbosum* var. *nilesii*. Specific examples of such factors include: development, OHV use and road development, mineral exploration and development, nonnative, invasive plant species, and modified wildfire regime. Climate change may influence the degree to which many of these threats, individually or collectively, affect *E. corymbosum* var. *nilesii*. We discuss the manner in which these factors are affecting *E. corymbosum* var. *nilesii* in the following paragraphs (see Table 3).

In the following discussion of the factors affecting the species, at the conclusion of each section, we indicate the timing, scope, and severity of each factor. *Timing* refers to the immediacy of the factor, and is categorized as ongoing, near-term future, long-term future, or past/historical. *Scope* is the percentage of the species' distribution (i.e., the percentage of the total range-wide population) that is expected to be affected by the factor within a specified, foreseeable amount of time, given continuation of current circumstances and trends. Because the lifespan and generation time of *Eriogonum corymbosum* var. *nilesii* is not known, we define the timeframe for our analysis in terms of that length of time over which we are reasonably confident in assumptions of anticipated future trends in factors identified as affecting this species. Our ability to project future trends in the various factors identified as relevant to *Eriogonum corymbosum* differs for each factor, with some factors (such as development) better assessed in terms of relatively short time periods (such as the 1–10 years future development is anticipated), whereas others (such as climate change) are more appropriately assessed in terms of longer time horizons (such as 50 years for most climate models).

Our evaluation of factors includes both existing and potential new factors affecting the species. Within the scope of each factor, *severity* is the level of damage to the species population that can reasonably be expected to be affected by the factor, given our assessment of timing and scope, assuming the continuation of current circumstances and trends. In the paragraphs below, we describe each of these potential factors in detail and explain our rationale for each of the scope and severity conclusions.

Development

Development for residential, commercial, or other purposes can affect *Eriogonum corymbosum* var. *nilesii* though various forms of habitat loss, degradation, or fragmentation. Impacts can be direct, through permanent conversion of habitat to non-suitable conditions, or indirect, through increased nonnative plant invasions, and/or OHV use. Development has resulted in the extirpation of two *E. corymbosum* var. *nilesii* populations (USFWS 4 and 5) and portions of two others (USFWS 1–subpopulations "Elkhorn & Jones NE", "Alexander and Revere NW", and "Centennial & Decatur"; USFWS 3–subpopulations "Tropicana Wash A", "Tropicana Wash B",

and “Tropicana Wash C”; Table 1). We review the various forms of past, ongoing, and planned development activities at *E. corymbosum* var. *nilesii* populations below.

Las Vegas Valley

The total, extant distribution of *Eriogonum corymbosum* var. *nilesii* in Las Vegas Valley consists of approximately 6,702–6,965 plants on 337.5 ac (136.58 ha) in 4 populations (USFWS 1, 2, 3, and 6) (Table 1). However, as a result of development, approximately 3,751–4,755 *E. corymbosum* var. *nilesii* plants on 1,300 ac (526.09 ha) have been lost within the Las Vegas Valley, including the extirpation of two populations (USFWS 4 and 5) (Morefield 2007, p. 1–4; NNHP, Geospatial Data 2007 and 2013; USFWS, 2013 Geospatial Data; and ESRI ArcGIS Imagery Basemap satellite imagery). 95 percent of *E. corymbosum* var. *nilesii* habitat has been lost on private lands, with the remaining losses on City of Las Vegas (2 percent), Clark County (2 percent), and Department of Defense (1 percent) lands. Additionally, future development in the Las Vegas Valley is most likely imminent and future losses of 22 ac (8.9 ha) of *E. corymbosum* var. *nilesii* habitat and approximately 827–852 plants is anticipated (USFWS, 2013 Geospatial Data). Some of this development resulted in the establishment of conservation areas intended to minimize or off-set losses (of plants and habitat) from development. We explain these sites in the context of the development projects that led to their creation below; in the next section (*Conservation Actions and Efforts*) we elaborate upon the protection that each site affords to the species.

Conservation Transfer Area (CTA) and Eglington Preserve

Through the 1990s, more than 9 of every 10 acres in Clark County, Nevada, were under Federal management. From 1997 to 2007, Clark County became one of the fastest growing counties in the United States, with the population increasing annually by an average of 5.6 percent and the population in Las Vegas Valley increasing from less than 800,000 to nearly 2 million people (BLM 2008c, p. 7). In October 1998, the United States Congress passed the Southern Nevada Public Land Management Act (SNPLMA, P.L. 105–263) which made possible the disposal of approximately 52,000 ac (21,044 ha) of Federal lands in areas of urban development in exchange for lands elsewhere in the State that possess higher natural resource values (BLM 2008c, pp. 7–10). In November 2002, SNPLMA was amended by enacting the Clark County Conservation of Public Land and Natural Resources Act (P.L. 107–282), which added an additional 22,000 ac (8,903 ha) to the disposal boundary. Together with the lands covered under SNPLMA, approximately 74,000 ac (29,947 ha) of the public domain in the greater Las Vegas Valley became eligible for disposal (BLM 2008c, p. 10).

The BLM Las Vegas Field Office prepared the *Las Vegas Valley Disposal Boundary Final Environmental Impact Statement* (LVVDB FEIS) in 2004 to identify the environmental consequences that could result from the disposal of BLM managed lands (approximately 46,700 ac (18,899 ha)) within the disposal boundary (BLM 2004a, p. 1-4; BLM 2011a, p. 1). During preparation of the LVVDB FEIS, sensitive biological, cultural, paleontological, and hydrological resources, including *Eriogonum corymbosum* var. *nilesii*, were identified along the Upper Las Vegas Wash in the northern part of the Las Vegas Valley. The LVVDB Record of Decision (ROD) was issued in December 2004 and selected the Conservation Transfer Alternative which

allowed BLM to dispose of approximately 46,700 ac (18, 899 ha) of lands in the Las Vegas Valley for future growth, while requiring approximately 5,000 ac (2023 ha) to be withheld from sale, pending further analysis, due to the presence of sensitive resources, including *Eriogonum corymbosum* var. *nilesii* (BLM 2011a, pp. 1–2). The area withheld was referred to as the Conservation Transfer Area (CTA) ; the LVVDB ROD indicated that the CTA boundary should be adaptable, meaning that it could be increased or decreased in size to meet the needs and concerns of interested parties that participate in the development of its conservation (BLM 2004b, p. 2).

Sometime between 2002 and 2004, the City of North Las Vegas nominated 3,000 ac (1,214 ha) for disposal in the Upper Las Vegas Wash area (BLM, USFWS, Nevada Division of Forestry (NDF), and City of North Las Vegas 2005, p. 1). In accordance with the LVVDB FEIS and ROD, a Conservation Agreement (CA) was created among BLM, USFWS, NDF, and City of North Las Vegas, calling for 300 ac (121 ha) of this 3,000 ac (1,214 ha) to be retained in BLM ownership, and established as the Eglington Preserve. The Eglington Preserve encompasses a portion of population USFWS 1, specifically subpopulation "Upper Las Vegas Wash" (BLM, USFWS, NDF, and City of North Las Vegas, entire).

In May 2007, the BLM prepared a *Fee- Based Compensatory Mitigation Plan for Eglington Preserve* with the objective of preserving, enhancing, and restoring riparian areas and uplands, thereby improving the ecological function of active wash drainages, sensitive plant and wildlife habitat, and natural hydrologic function (BLM 2007c, p. 1). In September 2007, the BLM established a Cooperative Management Agreement (CMA) with the Nature Conservancy (TNC) to further aid in the protection, restoration, and enhancement of resources, including *E. corymbosum* var. *nilesii*, on 143 ac (58 ha) within the Eglington Preserve (BLM and TNC 2007, entire). Per stipulations in the CMA, in October 2007, TNC entered a Memorandum of Agreement (MOA) with the U.S. Army Corps of Engineers (Corps) to initiate the fee-based compensatory mitigation program at the Eglington Preserve (Corps and TNC 2007, entire).

In October 2011, the BLM issued the *Upper Las Vegas Wash Conservation Transfer Area Final Supplemental Environmental Impact Statement* (Final SEIS) and ROD (BLM 2011a, entire). As a result of the LVVDB FEIS and ROD, recommendations from cooperating agencies and stakeholders, and internal BLM discussions, the CTA study area size was expanded from 5,000 ac (2,023 ha) to 10,669 ac (4,318 ha) which encompasses the 300 ac (121 ha) Eglington Preserve (BLM 2011a, p. 1–3, 8).

Nellis Air Force Base (AFB) Area III

The DOD, with assistance from the USFWS, is responsible under the Sikes Act (16 USC 670a-670f, as amended) for implementing programs and management strategies to conserve and protect biological resources. The Sikes Act was amended in 1997 to include the development of mutually agreed upon Integrated Natural Resource Management Plans (INRMP) through voluntary cooperative agreements among the DOD installation, the USFWS, and respective state wildlife agency. These documents are used to guide landscape-level planning and management on DOD lands

In 2000, threats to the Nellis Air Force Base (AFB) Area III prompted the construction of a fence to protect the area from illegal OHV activity and dumping of construction and household debris, which also indirectly protected a portion of population USFWS 2. In 2006, Nellis AFB proposed to develop 370 ac (150 ha) for military housing and a detention basin in an area occupied by *Eriogonum corymbosum* var. *nilesii* and another sensitive plant species, *Arctomecon californica* (USFWS 2006, p. 1). This development would have resulted in the loss of 76.6 ac (31 ha) of *E. corymbosum* var. *nilesii* habitat within population USFWS population 2. Through subsequent discussions between DOD, Nevada Division of Forestry (NDF), and USFWS, Nellis AFB agreed to set aside a 233 ac (94 ha) portion of Area III, including 54.2 ac (21.9 ha) of *E. corymbosum* var. *nilesii* habitat. The establishment of the Conservation Area allowed for the development of approximately 137 ac (55 ha) of Area III for military family housing and detention basins (NDF 2007, entire). Unfortunately, attempts to negotiate a formal conservation agreement between Nellis AFB, NDF, and USFWS were abandoned (USFWS 2007, entire), but the 233 ac (94 ha) in Area III was officially established as a Conservation Area by Nellis AFB per the 2010 INRMP (INRMP; Nellis AFB 2010, p. 170). The INRMP for Nellis AFB states that areas containing *E. corymbosum* var. *nilesii* will remain undeveloped unless military mission requirements dictate otherwise, and the DOD will not allow further development for activities that are purely recreational (Nellis AFB 2010, pp. 168–171). A remainder of 10.6 ac (4.3 ha) of *E. corymbosum* var. *nilesii* habitat on Nellis AFB is outside of this Conservation Area, bordering military housing and the detention basin. This occupied habitat remains vulnerable to future development, although the INRMP for Nellis AFB states that all activities that impact *E. corymbosum* var. *nilesii* require consultation with NDF and USFWS (Nellis AFB 2010, p. 170).

Tropicana and Decatur

A portion of population USFWS 3 (subpopulation "Tropicana and Decatur", Table 2) was designated as a conservation area in 2009 in association with the Lower Flamingo Wash Detention Basin project (HDR Engineering, Inc. 2010, entire). Clark County, Nevada, in cooperation with BLM, developed a conservation and mitigation plan for *Eriogonum corymbosum* var. *nilesii*, which was present within project footprint. The plan conserved 10 ac (4 ha) within the larger project footprint as the Buckwheat Conservation Area; some 277 *E. corymbosum* var. *nilesii* plants displaced during the project's construction activities were translocated into this area in March 2009 (Clark County 2010, p. 1). However, only 10–15 percent of the translocated plants appeared to be alive in December 2009, and new growth was limited (HDR Engineering, Inc. 2010, pp. 1–4). According to this 2010 report, follow-up surveys to assess the survival of translocated plants were to occur in 2–3 years; however, we are unaware of any follow-up surveys having been conducted. Fencing was also installed prior to the start of construction work in order to exclude construction equipment and activities; this fencing was to remain after construction to exclude motorized and non-motorized vehicles from this area (Clark County 2010, p. 1). Restrictive and educational signage was also pledged for the property, in order to protect *E. corymbosum* var. *nilesii* and inform the public of its unique properties (Clark County 2010, p. 1). We have no information on the current status of fencing or signage on this site.

Coyote Springs Development

In 2008, Coyote Springs Investment (CSI) proposed to build a master-planned town on 21,454 ac (8,682 ha), in an area bordering Lincoln and Clark Counties along U.S. Highway 93 (Entrix, Inc., Huffman-Broadway Group, and Resource Concepts, Inc 2008, p. 3-4; USFWS 2008, p. 2). This proposed development encompasses two subpopulations ("Coyote Springs W" and "Coyote Springs E") of population USFWS 11; these subpopulations collectively contain approximately 3,830 individuals and 25.9 ac (10.5 ha) of occupied habitat. The "Coyote Springs W" subpopulation has already been impacted by development, with some 750 individuals and 3.77 ac (1.53 ha) of occupied habitat having been lost to the construction of Coyote Springs Golf Club (Table 2). Since 2008, the remainder of the project has been stalled due to the recession, but CSI has recently initiated discussions with two solar companies, signaling their plans to resume development. CSI is unsure when residential development will begin, but expects they are still a few years away from initiation (Las Vegas Sun 2012, entire; S. Cooper, USFWS, pers. comm. 2013).

Toquop Energy Project

In 2013, Toquop Energy Inc. submitted a Plan of Development (POD) for the Toquop Energy Project to the BLM Caliente Field Office and Ely District Office (Toquop Energy Inc. 2013, pp. 6–14). This project proposal consists of plans to build a 1,100 megawatt natural-gas fired power generation plant and ancillary facilities on 210 ac (85 ha) in Lincoln County, Nevada. Toquop Energy Inc. originally proposed this facility in 2002 and was granted rights-of-way from BLM in 2003. However, prior to initiating construction, Toquop Energy Inc. reevaluated the energy market and instead proposed to convert the planned development to a coal-fired power generation facility. An updated Draft Environmental Impact Statement was drafted, but a Final Environmental Impact Statement was not completed because the application was withdrawn. Toquop Energy Inc. is now moving forward with its original proposal as reflected in the updated POD submitted in 2013 (Toquop Energy Inc. 2013, pp. 6–14).

The proposed power generation plant is located approximately 1 mile (1.6 kilometer) southwest of population USFWS 12, which (as stated above) is the only population of *Eriogonum corymbosum* var. *nilesii* outside of Clark County (Table 2). Additionally, a transmission pipeline, buried electric distribution powerline, and paved access road will be located approximately 1 mi (1.6 km) west of the same population, while an unpaved, existing road that borders the population to the east will be used to access the water well field from the power generation plant (Toquop Energy Inc. 2013, p. 12). These ground disturbing activities (see *OHV activity and road development*, below), degrade and fragment habitat by creating pathways for nonnative, invasive plant species and facilitating OHV activity, which serves as another source of direct plant mortality (through trampling or crushing established individuals).

TransWest Express Transmission Line Project

The BLM and U.S. Department of Energy (DOE) have proposed the TransWest Express Transmission Project. This project is an extra high voltage, direct current transmission system that would extend over 725 mi (1,167 km) from south-central Wyoming to southern Nevada

(BLM 2013b, p. 2-1). Construction impacts would occur within the 250-ft-wide (76.2 m wide) transmission line right-of-way, the 2 mile (3.2 km) wide transmission line corridor, and the ancillary facility footprints. Within the right-of-way, surface disturbances would consist of clearing in preparation of transmission line structure installation and vegetation removal and blading to facilitate the construction of temporary and permanent above and below ground ancillary facilities. Within the transmission line corridor, surface-disturbing activities would be limited to development and maintenance of temporary and permanent access roads (BLM 2013b, pp. 3.6-21–3.6-22). Three transmission line corridors have been proposed, all of which impact *Eriogonum corymbosum* var. *nilesii*. Population USFWS 12 is currently within the corridor for the agency-preferred alternative for this project (BLM 2013b, p. 2-24, 3.6-3, 3.6-64, 3.6-69, and 3.6-71).

Eriogonum corymbosum var. *nilesii* is included in the BLM's proposed list of species to address in a Biological Assessment (BA) to be submitted for purposes of ESA section 7 consultation and technical assistance (for candidate species) on the proposed project (C. Pontarolo, BLM, pers. comm. 2014). We anticipate receiving a draft BA for review late-May or June, with the final BA being completed by mid-July. The BLM and DOE anticipate the completion of the Final Environmental Impact Statement in September 2014 followed by a Record of Decision in late December 2014 (S. Cooper, pers. comm. 2014).

On January 30, 2014, the USFWS received shapefiles depicting a refined agency-preferred corridor, reduced from a 2-mi (3.2 km) wide planning corridor to a narrower, 525 ft (160 m) corridor depicting the actual, anticipated alignment for the transmission line right-of-way (A. Grow, AECOM Environment, pers. comm. 2014). Whereas the original, wider planning corridor implied an opportunity for the transmission line to be routed on either side (east or west) of *Eriogonum corymbosum* var. *nilesii* population USFWS 12, the narrower, refined alignment directly bisects population USFWS 12. Upon receiving this updated information, we discussed our concerns with the BLM (the acting Field Manager of the Caliente Field Office and the Energy Project Manager of the Ely District Office). On May 15, 2014, the BLM Cheyenne State Office Project Manager informed the USFWS that BLM has asked the applicant to move the alignment outside of occupied and suitable habitat for the species, along the eastern edge of population USFWS 12, thereby avoiding direct impacts to *E. corymbosum* var. *nilesii* and its habitat. In this communication, BLM clarified that although this revised alignment will not be reflected in the Administrative Final EIS to be distributed in June of this year; it will be included in the adopted alternative in the Final EIS for the project (S. Knowlton, BLM, pers. comm. 2014).

USFWS 12 is the only population of *Eriogonum corymbosum* var. *nilesii* outside of Clark County. Although the population will not be directly impacted from transmission line construction, it may incur indirect impacts from construction dust and nonnative, invasive plant species due to the construction and maintenance of the transmission line corridor. The proposed transmission line corridor also includes the development and maintenance of temporary and permanent access roads, which as described below (see *OHV activity and road development*), have the potential to degrade and fragment habitat by creating pathways for nonnative, invasive plant species while facilitating OHV activity, which may serve as a source of direct plant mortality (through trampling or crushing established individuals). The USFWS remains

concerned about the potential for these indirect effects to the population, and will continue to work with BLM and the TransWest Express project proponent to ensure that they are adequately minimized during construction and maintenance of this transmission line corridor. However, we do not currently regard it as likely for indirect effects from this transmission line to result in the extirpation of this population.

Summary of Development

Development has impacted *Eriogonum corymbosum* var. *nilesii* habitat and resulted in the extirpation of two populations (USFWS 4 and 5) and portions of two others (USFWS 1– subpopulations "Elkhorn & Jones NE", "Alexander and Revere NW", and "Centennial & Decatur"; USFWS 3–subpopulations "Tropicana Wash A", "Tropicana Wash B", and "Tropicana Wash C"; Table 1). Future development in the Las Vegas Valley is most likely imminent and future losses of 22 ac (8.9 ha) of *E. corymbosum* var. *nilesii* habitat and approximately 827–852 plants is anticipated (USFWS, 2013 Geospatial Data). Outside of the Las Vegas Valley, one population (USFWS 12) is located immediately outside of the perimeter of the agency-preferred corridor for the TransWest Express Transmission Line Project, although indirect impacts (from dust, nonnative invasive species, and potentially, altered fire regimes) may still occur from this project. Portions of population USFWS 11 have already been lost (subpopulation– Coyote Springs W) and others (subpopulations – Coyote Springs W and Coyote Springs E) will be lost due to development at Coyote Springs and the TransWest Express Transmission Line Project.

The timing of threats related to development is ongoing, because this factor is currently operating in Las Vegas Valley, with portions of population USFWS 1 being impacted. As noted above, additional populations have been extirpated by this factor in the past. With regard to scope, 5 of the 9 extant populations are currently being impacted, or are expected to be impacted in the future; therefore over 50 percent of extant populations are being affected by this factor. With regard to severity, 1,303.5 ac (527.51 ha) have already been lost due to development; only 792.1 ac (320.55 ha) of occupied habitat remains. Of the remaining occupied habitat, 43.93 ac (17.78 ha) could be lost if anticipated development occurs.

Off Highway Vehicle (OHV) Use and Road Development

Demand for recreational opportunities is increasing with Clark County's population growth. Off-highway vehicle (OHV) activity accounts for the single greatest recreational use of public lands within Clark County (Clark County 2000, p. 4-70). A 2007 Conservation Management Strategy (CMS) for some rare plants in Clark County describes casual OHV use and the creation of new trails as significant threats for all rare plant species on BLM managed lands (TNC 2007, pp. 44, 62, 80, 91, 103, 120, 132, 145, 157). Although this CMS does not address *Eriogonum corymbosum* var. *nilesii*, observations by the USFWS have revealed that populations USFWS 1, 3, 8, 10, 11, and 12 are affected to some degree by OHV use and road development (Edwards 2007, pp. 1–21; Kulpa *in litt.* 2012b). Authorized and unauthorized roads can cause loss, degradation, and fragmentation of *E. corymbosum* var. *nilesii* habitat. Additionally, OHV use and road development can destroy cryptobiotic soil crusts, compact soil, reduce rates of water infiltration, increase wind and water erosion, and destroy other native vegetation (Lovich and Bainbridge 1999, pp. 315–316). Furthermore, vehicles often leave the road, compacting soils,

crushing plants, and providing a means for nonnative plant species to invade otherwise remote, intact habitats. Brooks and Lair (2005, p. 8) and others (Brooks and Pyke 2001, p. 4; Gelbard and Belnap 2003, entire) found that vehicular pathways are the primary pathways for nonnative, invasive species into arid and semi-arid systems because vehicles serve as the dispersal vector for nonnative, invasive propagules and disturbance within vehicle routes facilitate the establishment of invading plant species.

OHV activity on BLM lands is regulated under the Federal Land Policy Management Act (FLPMA P.L. 94-579, 43 U.S.C. 1701) which is a multiple-use mandate that allows for various activities such as OHV activity, recreation, grazing, mining, etc., as well as resource conservation actions. The 1998 BLM Las Vegas District Resource Management Plan (RMP) includes provisions limiting OHV activity to designated roads, trails, and/or dry washes in all ACECs and Wilderness Study Areas (BLM 1998b, p. 24). The Coyote Springs ACEC, set aside for desert tortoise, encompasses portions of USFWS 11 on BLM land; therefore OHV activity in this area is limited to designated roads and trails (BLM 1998b, p. 24). Ongoing revisions to the Las Vegas BLM's RMP are expected to include a proposal to designate population USFWS 8 and the surrounding area as the Bitter Spring ACEC, for the protection of *Eriogonum corymbosum var. nilesii* and two other special status plant species, which would also limit OHV activity in this area to designated roads and trails (F. Edwards, pers. comm., 2013).

Regardless of these anticipated future ACEC designations, the CMS for rare plants in Clark County identifies actions such as closing illegal roads and trails and enforcement of OHV regulations as means to improve rare plant conservation on public lands (TNC 2007, p. 241–235). Nationwide, enforcement of OHV restrictions on Federal land is limited with only a few resource law enforcement officers (Gregory 2008, pp. 1–12). On BLM-managed lands under the jurisdiction of the Southern Nevada District Office, there is roughly 1 officer for every 370,200 ac (149,815 ha) (F. Edwards, pers. comm. 2007); therefore, BLM's ability to regulate OHV activity in southern Nevada is not expected to improve in the near future. For example, within the CTA (portion of USFWS 1, subpopulation "Upper Las Vegas Wash"), OHV use is limited to existing or designated trails on lands, but illegal OHV use, particularly dirt-bike riding, is common and I of concern for BLM managers (BLM 2011a, p. 79).

The timing of OHV activity and road development is ongoing. OHV activity and road development is affecting 6 of the 9 (i.e., 67 percent of) extant populations. With regard to severity, we are not currently aware of individuals or habitat having been lost as a result of these activities; however OHV activity is authorized and currently occurring within occupied habitat. Therefore, we expect that these impacts are occurring, and have either not yet resulted in overt losses of plants or habitat, or that these impacts have gone undetected.

Mineral Exploration and Development

In the United States, mining activity is authorized under an array of statutes primarily administered by the BLM, both on federally-managed lands as well as other lands where mineral rights have been reserved to the U.S. (so-called split-estate lands). Statutory authority for mining essentially originates with The General Mining Law of 1872, as amended (30 USC 22-54 and 43 CFR 3809); subsequent statutes have provided additional standards and processes for administrative (Federal) oversight for specific classes of mineral deposits. In 1976, the Federal

Land Policy and Management Act (FLPMA), as amended (43 USC 1701–1784) authorized the promulgation of regulations for the administration of applicable mining statutes, in order to ensure that mining operators and claimants prevent the "unnecessary or undue degradation of public lands", by adherence to performance standards, reclamation of disturbed areas, and complying with all applicable Federal and state laws related to environmental protection and the protection of cultural resources.

The BLM published implementing regulations for the various mining statutes in 1981. The BLM's statutory and regulatory authority thus depends upon the nature of the mineral deposit, which can be thought of in terms of three categories – leasable, salable or locatable. *Leasable* deposits refer to substances such as coal (43 CFR 3400), oil and gas (43 CFR 3100), and other leasable materials such as potassium and potash (43 CFR 3500); these are administered under the Mineral Leasing Act of 1920 (30 USC 181 et seq.). *Salable* deposits include common-variety substances such as sand, gravel, pumice, stone, soil and clay; these are regulated under the Materials Act of 1947, as amended (30 USC 601 et seq. and 43 CFR 3600). *Locatable* refers to metallic (e.g., gold, silver, lead) and nonmetallic minerals (e.g., gypsum, mica, gemstones, etc.) and uncommon varieties of clays and building stone; these continue to be regulated under the General Mining Law of 1872, as amended (cited above, see also the regulations at 43 CFR 3809).

The General Mining Law of 1872 calls for "all valuable mineral deposits in lands belonging to the United States… to be free and open to exploration and purchase". Accordingly, this statute allows citizens of the United Sates the opportunity to explore for, discover, and purchase certain valuable mineral deposits on Federal lands that are open for mining claim location and patent (i.e., open to mineral entry) (BLM 2011b, p.1–7). Only areas that have been "withdrawn" to mineral entry by a special act of Congress, regulation, or public land order are truly closed to mineral entry. Mineral location and entry was withdrawn in 2009 (for 20 years) at population USFWS 11 (BLM 2009, pp. 56658–56659). Population USFWS 7 is withdrawn from mineral entry by congressional action concurrent with wilderness designation in 2002 (P.L. 107–282).

Gypsum, which sometimes is a component of the soil where *Eriogonum corymbosum* var. *nilesii* is found, is a locatable mineral. Gypsum is primarily used to manufacture wallboards and plaster for construction purposes. It is also used in agriculture to neutralize acidic soils, improve soil permeability, add nutrients, stabilize slopes, and provide catalytic support for fertilizer benefits (Crangle 2013, pp. 33.1–33.2). Although locatable mineral claimants and operators are subject to the FLPMA standard of preventing "unnecessary or undue degradation", the BLM generally does not have the discretion to deny mining operations for locatable mineral resources (this contrasts with salable or leasable mineral activities, which BLM has the discretion to deny). These regulations recognize three levels of operation, with increasing requirements:

1. Casual use by an operator who does negligible disturbance and does not use mechanized earth-moving equipment (43 CFR 3809.5 and 3809.10). These activities may be conducted without notifying the administering agency.
2. Notice-level operations, involving surface alteration of 5 ac (1.67 ha) or fewer during any calendar year (43 CFR 3809.10, 3809.21, and 3809.301). These operations require a written notice to be filed with the administering agency within 15 days prior

to conducting work; if BLM does not respond within this time period, activities may commence.

Plan-level operations, involving surface disturbance of more than 5 ac (1.67 ha), bulk sampling of 1,000 tons of material or more, or operations proposed in special category lands, such as Areas of Critical Environmental Concern (ACECs), areas designated as "closed" to off road vehicle use, or lands containing federally proposed or listed threatened or endangered species or their proposed or designated critical habitat (43 CFR 3809.11). These operations require a Plan of Operations to be filed with the administering agency, and approved by that agency before work begins.

When *Eriogonum corymbosum* var. *nilesii* became a candidate for Federal listing in 2007, mining activities were identified as having the potential to impact two of the twelve populations recognized in this document (populations USFWS 8 and USFWS 12) (USFWS 2007, p. 11). In 2013, we reviewed the status of all locatable mining claims within the legal sections containing the species (BLM 2013a, Land and Mineral Legacy Rehost 2000 System - LR2000). According to this review, there are 74 "closed" (an administrative term that indicates a prior claim that is no longer current) and no "active" (meaning paperwork and fees filed with the BLM in support of the claim are current) locatable mineral claims within the sections occupied by this species (BLM 2013a, Land and Mineral Legacy Rehost 2000 System - LR2000).

With regard to the timing of mining-related impacts, although this activity has been previously identified as having the potential to affect *Eriogonum corymbosum* var. *nilesii*, we are unaware of mining having directly affected this species in the form of losses of individuals or habitat. With regard to scope, to be best of our knowledge, historically no populations have been affected by this activity, and no open locatable mineral claims currently exist within occupied habitat. In light of the above information, severity is low to non-existent.

Nonnative, Invasive Plant Species

Nonnative, invasive plant species, such as *Bromus rubens*, *Halogeton glomeratus* (M. Bieb.) C.A. Mey. (saltlover), *Salsola tragus* L. (prickly Russian thistle), and *Strigosella africana* (L.) Botsch (syn. *Malcolmia africana*; African mustard), have become established and are part of the associated plant community within 5 of the 9 extant populations (USFWS 1, 2, 3, 7, and 12) (Edwards 2007, pp. 1–21; Kulpa *in litt.* 2012b). Nonnative, invasive plant species can negatively affect *Eriogonum corymbosum* var. *nilesii* due to increased wildfire frequency (see Modified Wildfire Regime, below), alter ecological function, competition with and displacement of native plant species, and degradation of the quality and composition of *E. corymbosum* var. *nilesii* habitat (D'Antonio and Vitousek 1992, pp. 68–72; Gonzalez *et al*. 2008, entire; Mazzola *et al*. 2011, pp. 514–515; Pierson *et al*. 2011, entire). In addition, most climate change models project conditions conducive to the further spread of nonnative, invasive annual grasses (like *B. rubens*, see *Climate Change* below; Brooks and Esque 2002, pp. 336–338; Abatzoglou and Kolden 2011, entire;)

Bromus rubens produces persistent fine fuels that are linked to increased frequency, extent, and intensity of wildfire in these invaded communities due to the altered structure of plant communities as fire-intolerant native species are killed (Brooks and Pyke 2001, p. entire;, p. Salo

2004, p. 292; Salo 2005, p. 166). *Bromus rubens* can reach densities of over 6,000 plants m^2 and competes with and reduces the density of native, winter annuals (Brooks 2000, pp. 103–105; Salo 2004, p. 292). However, the species does not produce dormant seed or maintain a soil seed bank, but instead exhibits uniform germination under appropriate climatic conditions (i.e. cool, moist winters) (Salo 2004, p. 293). This trait of uniform germination can lead to population crashes when winter drought precludes seed production of this species (Salo 2004, p. 294). *Bromus rubens* is present in low quantities at two populations of *Eriogonum corymbosum* var. *nilesii*, USFWS 7 and 12 (Kulpa *in litt.* 2012b).

Halogeton glomeratus is not an extremely competitive plant and does not become dominant in undisturbed areas or areas with competing vegetation. However, disturbances such as overgrazing, mechanical soil disturbance and wildfire reduce desirable vegetation and increase bare soil which encourages the invasion and establishment of this species (DiTomaso *et al*. 2013, p. 200). *Halogeton glomeratus* has colonized disturbed soils at one *Eriogonum corymbosum* var. *nilesii* population, USFWS 2, and one subpopulation of population USFWS 1 ("Upper Las Vegas Wash;" Edwards 2007, pp. 1–21; Kulpa *in litt.* 2012b).

Salsola tragus is a nonnative, invasive plant species common in disturbed areas, waste places, and roadsides. It is tolerant of both arid and alkaline soils and is competitive in areas where moisture limits the growth of other species (DiTomaso *et al.* 2013, p. 353). Salsola tragus has colonized disturbed soils at one population, USFWS 2, and one subpopulation of population 3 — "Tropicana and Decatur" (Kulpa *in litt.* 2012b).

Strigosella africana is a nonnative, invasive plant species common in disturbed areas of the Mojave Desert (Al-Shehbaz in *http://www.efloras.org/florataxon.aspx?flora_id=1&taxon_id=242350689*, accessed online November 20, 2013). During a weed detection inventory of Clark County, Nevada, *S. africana* was detected significantly more on gypsum soils than other soils types although gypsum soil was considered not to be prone to invasion (Abella *et al*. 2009, p. 226). At USFWS 2 (within Nellis AFB Area III), *Strigosella africana* is common along the southern boundary of the site (Edwards 2007, pp. 1–21).

The majority of *Eriogonum corymbosum* var. *nilesii* habitat is not affected by nonnative, invasive plant species likely because the specialized habitat of the species has not experienced high levels of soil disturbances conducive to their spread. However, in areas where soils disturbances have occurred, nonnative, invasive plant species pose a threat to *E. corymbosum* var. *nilesii* due to their ability to potentially compete with and displace the species and other native species from its habitat. Additionally, if nonnative, invasive plant species (like *Bromus rubens*) heavily invade *E. corymbosum* var. *nilesii* habitat, the flammability of the surrounding plant community will increase in turn encouraging the likelihood of a wildfire.

The timing of nonnative, invasive plant species is ongoing. Nonnative, invasive plant species are present within 5 of the 9 (over 50 percent) extant populations. Within the scope, the severity of nonnative, invasive plant species is unknown because the best available scientific information does not provide any indication of the level of which nonnative, invasive plant species affect *Eriogonum corymbosum* var. *nilesii*.

Modified Wildfire Regime

Historically, wildfire has been infrequent in the Mojave Desert due to limited fuels created by sparse vegetation (Brooks 2002, p. 1088; Brooks and Matchett 2006, pp. 148–150). However, since the 1970s fires have become more frequent due to recent invasions by annual grasses, specifically *Bromus rubens* L. (red brome), *Bromus tectorum* L. (cheatgrass), *Schismus arabicus* Nees (Arabian schismus), and *Schismus barbatus* (Loefl. Ex L.) Thell. (common Mediterranean grass) (Brooks 2000, entire; Brooks and Matchett 2006, p. 149). Increasing invasion by nonnative, annual grasses coupled with wildfire is now considered one of the primary threats to the conservation of native plants and animals and the maintenance of ecosystem integrity in the Mojave Desert (Brooks and Esque 2002, entire; Lovich and Brainbridge 1999, p. 318).

Regardless of an overall increase of wildfire in the Mojave Desert, there are no reported accounts of wildfire within *Eriogonum corymbosum* var. *nilesii* habitat (BLM, Geospatial Data 2012). During 2005 and 2006, when over 1,000,000 ac (404,686 ha) burned in the Mojave Desert, a wildfire came within 1.3 mi (2.1 km) of population USFWS 12 (USFWS 2011, p. 30; BLM, Geospatial Data 2012). Although population USFWS 12 was not impacted directly (i.e., by burning), indirect effects such as increased invasion and propagule dispersion of nonnative plant species (such as *Bromus rubens*) into *E. corymbosum* var. *nilesii* could occur as a result of wildfires and Mojave ecosystem disruption.

With regard to the timing of wildfire-related impacts, although this activity has been previously identified as having the potential to affect *Eriogonum corymbosum* var. *nilesii*, we are unaware of wildfire having directly affected this species in the form of losses of individuals or habitat. With regard to scope, to the best of our knowledge, there are no reported accounts of *E. corymbosum* var. *nilesii* habitat burning nor are we able to project how this species would respond to wildfire. Therefore, in light of the above information, severity is low to non-existent.

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).

Scientific measurements spanning several decades demonstrate that changes in climate are occurring, and that the rate of change has been faster since the 1950s. Examples include warming of the global climate system, and substantial increases in precipitation in some regions of the world and decreases in other regions (For these and other examples, see IPCC 2007, p. 30; and Solomon *et al*. 2007, pp. 35–54, 82–85). Results of scientific analyses presented by the IPCC show that most of the observed increase in global average temperature since the mid-20th

century cannot be explained by natural variability in climate, and is "very likely" (defined by the IPCC as 90 percent or higher probability) due to the observed increase in greenhouse gas (GHG) concentrations in the atmosphere as a result of human activities, particularly carbon dioxide emissions from use of fossil fuels (IPCC 2007, pp. 5–6 and figures SPM.3 and SPM.4; Solomon *et al*. 2007, pp. 21–35). Further confirmation of the role of GHGs comes from analyses by Huber and Knutti (2011, p. 4), who concluded it is extremely likely that approximately 75 percent of global warming since 1950 has been caused by human activities.

Global climate projections are informative, and, in some cases, the only or the best scientific information available for us to use. However, projected changes in climate and related impacts can vary substantially across and within different regions of the world (e.g., IPCC 2007, pp. 8–12). Therefore, we use "downscaled" regional projections when they are available and have been developed through appropriate scientific procedures, because such projections provide higher resolution information that is more relevant to spatial scales used for analyses of a given species (see Glick *et al*. 2011, pp. 58–61, for a discussion of downscaling).

Warming in the Mojave Desert, where *Eriogonum corymbosum* var. *nilesii* occurs, began approximately in the late 1970s, and recent average temperatures have climbed well above prior values (Redmond 2009, pp. 23–24). For example, since 1970, minimum temperature (i.e. nighttime temperature) has increased by as much as 5.4°F (3°C) in the Las Vegas Valley (Miller 2011, p. 38). Generally, predictions for the geographic range of *E. corymbosum* var. *nilesii* suggest there will be more frequent and/or prolonged drought (Hereford *et al.* 2004, entire; Comer et al. 2013, p. 137; Guida *et al.* 2013, p. 3). Seager *et al.* (2007) ran a series of climate models and simulations on precipitation history and future of the southwestern United States and parts of northern Mexico that consistently showed a severe drying trend in this region throughout the 21st century, especially in areas where evapotranspiration exceeds precipitation (such as most desert regions). However, the Mojave Basin and Range Rapid Ecoregional Assessment climate model suggests localized increasing August precipitation, although increasing temperatures can easily cancel out effects of increased precipitation due to increased surface evaporation and evapotranspiration of plants especially during warmer summer months (Comer et al. 2013, pp. 133–134). Furthermore, winter precipitation has historically dominated the Mojave Desert and periodic declines in this type of precipitation are most strongly linked to drought stress in plants because groundwater recharge is generally more efficient during the cool portion of the year (Redmond 2009, p. 17; Guida *et al*. 2013, p. 3). Finally, these projections when coupled with increases of atmospheric carbon dioxide may also encourage the invasion of nonnative annual grass species (i.e. *Bromus* species) which could contribute to increased frequency and severity of wildfire (Brooks and Esque 2002, p. 337; Abatzoglou and Kolden 2011, pp. 475–476).

Plant species, such as *Eriogonum corymbosum* var. *nilesii*, that have narrow ranges and specialized habitat requirements have a higher risk of extinction due to demographic uncertainty and random environmental events (Shaffer 1987, pp. 69–75; Lande 1993, pp. 911–927; Hawkins *et al*. 2008, pp. 41–42). The potential for a population to adapt in a changing climate will be in part determined by the lifespan of the species and the age at which it reaches maturity, which are not known for *E. corymbosum* var. *nilesii* (Jump and Peñuelas 2005, p. 1013). Increasing temperatures and drought frequency could adversely affect *E. corymbosum* var. *nilesii* by causing physiological stress, altering phenology, and reducing recruitment events and/or seedling

establishment (Parmesan 2006, pp. 642–644; Hawkins *et al.* 2008, pp. 16–32). Some plants may lack sufficient environmental tolerance in the face of these altered conditions (Jump and Peñuelas 2005, p. 1016); likewise, populations may lack sufficient genetic diversity to adapt or persist, resulting in localized extirpations of currently occupied habitats (Haskins and Keel 2012, p. 230).

The direct, long term impact from climate change to *Eriogonum corymbosum* var. *nilesii* is yet to be determined. Under climate change projections, we anticipate further alteration of precipitation and temperature patterns. This may result in decreased survivorship of E. corymbosum var. nilesii by causing physiological stress, altered phenology, and reduced recruitment events and/or seedling establishment. Additionally, future climatic conditions may favor invasion by nonnative, invasive species and promote wildfire in *E. corymbosum* var. *nilesii* habitat which does not have a history of wildfire. Therefore, climate change may exacerbate impacts from other factors currently affecting this species and its habitat.

The timing of climate change is ongoing. The scope of climate change is 100 percent because all areas of all populations are impacted by climate change. Within the scope, the severity of climate change is unknown because even though climate projections exist for the Mojave Desert ecoregion, we do not know how *Eriogonum corymbosum* var. *nilesii* is likely to respond to these changing climatic regimes.

SUMMARY OF FACTORS AFFECTING THE SPECIES

Development has impacted and is still impacting *Eriogonum corymbosum* var. *nilesii* through various forms of habitat loss, degradation, and fragmentation. Development impacts to *E. corymbosum* var. *nilesii* range from direct mortality (from uprooting, burying, or killing individuals) to the facilitation of nonnative, invasive plant species infestations. At one time, 2,095.6 ac (848.1 ha) were occupied by *E. corymbosum* var. *nilesii*, however direct impacts due to the permanent conversion of habitat to non-suitable conditions has resulted in the loss of 1,305.5 ac (527.51 ha) or 62 percent of this species' habitat. Included in this loss is the extirpation of two populations (USFWS 4 and 5) and six additional subpopulations within two other populations (USFWS 1 "Elkhorn & Jones NE", "Alexander and Revere NW", and "Centennial & Decatur"; USFWS 3 "Tropicana Wash A", "Tropicana Wash B", and "Tropicana Wash C"; Table 1). In addition to these losses, development is anticipated on 43.93 (17.78 ha) of remaining habitat and would result in the loss (extirpation) of another population (USFWS 6) and two additional subpopulations (USFWS 11 "Coyote Springs W" and "Coyote Springs E"). The agency preferred TransWest Express Transmission Project corridor has been relocated to avoid direct impacts to population USFWS 12, the only population of *E. corymbosum* var. *nilesii* found outside of Clark County. Indirect impacts may still occur from project construction and maintenance. Therefore, we regard development as likely to continue to impact this species and its habitat.

Off-highway vehicle (OHV) activity accounts for the single greatest recreational use of public lands within Clark County. OHV use is authorized on BLM lands and established OHV corridors are present within 6 of the 9 extant populations of *Eriogonum corymbosum* var. *nilesii*. OHV activities can kill or damage individual plants, and modify habitat by compacting soils, and

fragmenting both occupied and potential habitat, which in turn precludes or reduces potential recruitment and population expansion of *E. corymbosum var. nilesii*. OHV and other road corridors also create vectors for nonnative, invasive plant species to invade otherwise remote, intact habitats. OHV activity is expected to continue to represent a high percentage of recreational use of public lands. Unless actions are taken to manage this activity, we expect the threat from OHVs and road corridors to continue within the range of the *E. corymbosum* var. *nilesii*. We expect that these impacts are occurring, but have either not yet resulted in overt losses of plants or habitat, or that these impacts have gone undetected.

When *Eriogonum corymbosum* var. *nilesii* became a candidate for Federal listing in 2007, mining activities were identified as having the potential to impact two of the twelve populations (USFWS 8 and USFWS 12). However, mining claims in these areas have been closed and two other populations (USFWS 7 and 11) occur in areas that have been withdrawn from mineral entry. We are unaware of mining having directly affected the species in the forms of losses of individuals or habitat; therefore we consider the probability of this threat impacting *E. corymbosum* var. *nilesii* to be low or non-existent.

Nonnative, invasive plant species can negatively affect *Eriogonum corymbosum* var. *nilesii* through increased wildfire frequency, altered ecological function, competition with and displacement of native plant species, and degradation of habitat. Nonnative, invasive plant species can also be spread through OHV activity and other road corridors. Five of the nine extant populations are invaded by nonnative, invasive plant species. Therefore, we expect impacts from nonnative, invasive plant species to continue, however, the degree to which they affect *E. corymbosum* var. *nilesii* is still unknown.

Increased invasion by nonnative, annual grasses coupled by wildfire is considered one of the primary threats to the Mojave Desert. However, even with increases of wildfire in the Mojave Desert, there are no reported accounts of wildfire within *Eriogonum corymbosum* var. *nilesii* habitat. Because we are unaware of wildfire having directly affected the species in the form of losses of individuals or habitat, nor are we able to predict how this species would respond to wildfire, we consider the probability of this threat impacting *E. corymbosum* var. *nilesii* to be low or non-existent.

Given current climate change projections, we anticipate that the alteration of precipitation and temperature patterns may result in decreased survivorship of *Eriogonum corymbosum* var. *nilesii* due to physiological stress of individual plants, altered phenology, and reduced seedling establishment and plant recruitment. These alterations in climatic conditions are likely to exacerbate other factors currently affecting *E. corymbosum* var. *nilesii*, such as nonnative, invasive plant species or increasing likelihood of wildfire within its habitat.

Interactions Among Factors

Development results in the loss of habitat; depending upon the nature of development activities these impacts can be permanent and irreversible (conversion to land uses unsuitable to the species) or less so (ground disturbance and loss of established plants, without permanent conversion of habitat to non-suitable conditions). When development occurs in between (but not

within) populations, this can eliminate corridors for pollinator movement, seed dispersal, and population expansion. OHV and other road corridors can exacerbate habitat loss and fragmentation, and tend to be associated with (accompanying or following) development activities. Development and OHV/road corridors tend to create conditions that favor the establishment of nonnative, invasive plant species; once established these species tend to spread well beyond the footprint of development actions or OHV/road corridors, further deteriorating otherwise intact habitat and native vegetation, including *Eriogonum corymbosum* var. *nilesii*. Some nonnative invasive plant species, particularly annual grasses, then increase the frequency of wildfire, leading to modified wildfire regimes. Climate change has the potential to alter many patterns of land use, including development and associated infrastructure, but also the precipitation and temperature regimes that in turn influence the establishment and persistence of vegetation, both native (like *E. corymbosum* var. *nilesii*) and nonnative (like invasive, annual grasses) alike.

CONSERVATION ACTIONS AND EFFORTS

Bureau of Land Management

Eglington Preserve

In 2005, BLM, USFWS, NDF, and the City of North Las Vegas entered a Conservation Agreement (CA) to retain 300 ac (121 ha) of the Upper Las Vegas Wash area in Federal ownership to establish it as the Eglington Preserve (as described above in *Factors Affecting the Species*; BLM, USFWS, NDF, and the City of North Las Vegas 2005, entire). The Eglington Preserve encompasses a portion of population USFWS 1, specifically a portion of subpopulation "Upper Las Vegas Wash." The CA identifies goals and objectives to manage resources within Eglington Preserve, including goals and objectives specific to *Eriogonum corymbosum* var. *nilesii*. Specific goals and objectives include:

- To the greatest extent possible, provide for *in situ* preservation of *E. corymbosum* var. *nilesii* and *Arctomecon californica*, protect existing occurrences, and minimize habitat fragmentation;
- Provide for continuation of ecological processes as defined by the species-specific biology (e.g., pollination ecology) of *E. corymbosum* var. *nilesii* and *A. californica*;
- Provide ecological connectivity to the CTA (see below) to increase the effective ecological context of the plant populations within the Preserve;
- Develop opportunities for habitat restoration and mitigation of *E. corymbosum* var. *nilesii* and *A. californica* plants to enhance the long-term viability of plant populations within the Las Vegas Valley;
- Maximize opportunities for scientific research on *E. corymbosum* var. *nilesii* and *A. californica* ecology, natural history, and restoration techniques;
- Provide adequate protection, management, and mitigation actions for *E. corymbosum* var. *nilesii* within the Preserve so as not to contribute to the need for listing under the ESA;
- Provide opportunities for public education and outreach concerning the conservation of

E. corymbosum var. nilesii and *A. californica*;

- Implement short-term conservation actions (e.g. fencing) to stabilize *E. corymbosum* var. *nilesii* and *A. californica* populations and protect habitat by reducing immediate threats that inhibit growth, reproduction, and seedling establishment, and contribute to mortality;
- Implement a long-term plant conservation program while allowing for compatible residential and commercial development and recreational activities (BLM, USFWS, NDF, and the City of North Las Vegas 2005, pp. 7–8).

In May 2007, BLM prepared a *Fee-Based Compensatory Mitigation Plan for Eglington Preserve*. The objective of this mitigation plan is to preserve, enhance, and restore riparian areas and their associated uplands within the Eglington Preserve. Restoration, preservation, and enhancement activities will provide benefits of improved ecological function, sensitive plant and wildlife habitat, and natural hydrologic function (BLM 2007c, p. 1). This objective will be achieved cooperatively through a Cooperative Management Agreement (CMA) between BLM and TNC (BLM and TNC 2007, entire) and a MOA between TNC and the U.S. Army Corps of Engineers (Corps and TNC MOA 2007, entire). Objectives in the mitigation plan specific to *Eriogonum corymbosum* var. *nilesii* include: propagating the species from seed, transplanting 1,000 propagated plants (grown from seed collected from the area previously by BLM) into disturbed or degraded upland areas, protecting plants from herbivory via tree protectors, watering plants, and monitoring plants 4 full years to ensure at least 80 percent survival (BLM 2007c, p. 8).

Conservation Transfer Area (CTA)

In 2011, the BLM established the 10,669 ac (4,318 ha) CTA, which contains the 300 ac (121 ha) Eglington Preserve, and encompasses *Eriogonum corymbosum* var. *nilesii* subpopulation "Upper Las Vegas Wash" of population USFWS 1 (BLM 2011a, pp. 1–3). The BLM's vision for the CTA is "*To preserve the natural functioning of the Upper Wash, protect the sensitive resources within, and support education, research, and low-impact recreational use. The CTA is ecologically functional to the maximum extent possible and managed to ensure the long-term integrity of the Las Vegas Formation and associated fossil beds, the rare plant habitat for Arctomecon californica, Arctomecon merriamii, and Eriogonum corymbosum var. nilesii, as well as natural flood water capacity for present and future generations*" (BLM 2011a, p. 4). The BLM will require mitigation and monitoring measures to minimize impacts to resources caused by future allowable uses in the CTA as determined on a case-by-case basis and through revisions to their RMP. Additionally, a CA for the CTA will be established and will include the following measures that will benefit *E. corymbosum* var. *nilesii*:

- Avoid soil disturbance in *E. corymbosum* var. *nilesii*, *Arctomecon california*, and *Arctomecon merriamii* habitat in order to manage for sustainable natural populations;
- Develop procedures to reduce or eliminate impacts to special-status plant species. Measures could include relocating project facilities outside plant habitat, collecting seed, salvaging topsoil, and propagating and planting native material;
- Identify areas that should be avoided for activities or land uses to protect sensitive plant resources;
- Restore disturbed habitat;
- Control noxious weeds and invasive species;

- Protect natural ecological process, such as pollinator movement, natural wind flow patterns, surface water flows, etc., that maintain sustainable populations by providing connectivity between populations in evaluating land uses;
- Maintain open spaces and corridors between populations when considering land uses;
- Establish long-term monitoring studies for *A. californica*, *A. merriamii*, and *E. corymbosum* var. *nilesii* to track recruitment, population viability, and life history;
- Ensure that developments and land uses are compatible with the long-term protection of the sensitive plant species, including avoidance of habitat or application of meaningful mitigation;
- Restore existing and new land disturbances in sensitive plant habitat through use of stockpiled native soils, salvaged plant materials, and native plant species;
- Provide protection to sensitive plant habitat from activities such as illegal motorized use, dumping, trespassing, and other invasive uses through fencing, cleanup, or education;
- Provide ecological connectivity between the Eglington Preserve and CTA to the extent possible;
- Develop ongoing public information and interpretation of *A. californica*, *A. merriamii*, *E. corymbosum* var. *nilesii*, cultural, and paleontological resources;
- Establish a non-motorized trail system, compatible with the protection of sensitive resources, for the enjoyment of the public (BLM 2011a, pp. 5–8).

Designation of the Muddy Mountains Wilderness

The Muddy Mountains Wilderness, which supports populations USFWS 7, was added to the National Wilderness Preservation System by the Clark County Conservation of Public Land and Natural Resources Act of 2002 (P.L. 107–282; BLM 2007b, p. 3). This designation protects population USFWS 7 from mining, grazing, OHV use, and human development (BLM 2007b, p. 2, 4, 59).

Purchase of the White Basin

On August 29, 2007, BLM re-purchased approximately 1,103 ac (446 ha) of land owned by U.S. Borax which supports population USFWS 8 (BLM 2013c, *www.blm.gov/nv/st/en/snplma/snplma_prephase_1.html*, accessed November 4, 2013). Ongoing revisions to the Las Vegas BLM's Resource Management Plan are expected to include a proposal to designate the property and the surrounding area as the Bitter Spring ACEC, for the protection of *Eriogonum corymbosum var. nilesii* and two other special status plant species (F. Edwards, pers. comm., 2013).

Withdrawal of Minerals Claims

Two populations are in areas withdrawn from mineral entry. Population USFWS 7 is withdrawn from mineral entry by congressional action concurrent with the Muddy Mountains Wilderness designation in 2002 (P.L. 107–282). Population USFWS 11 is within an ACEC established for the desert tortoise (*Gopherus agassizii* – Mojave population). In November 2009, mineral entry, although subject to existing rights, was withdrawn in the ACEC until 2029 (BLM 2009, pp. 56657–56661). This withdrawal protects the ACEC from new mineral entry and location for 20

years.

Clark County

Establishment of Tropicana and Decatur Buckwheat Conservation Area

A portion of population USFWS 3 (subpopulation "Tropicana and Decatur", Table 2) was designated as a "Buckwheat Conservation Area" in association with the Lower Flamingo Wash Detention Basin project (Clark County 2010, p. 1; HDR Engineering, Inc. 2010, entire). 10 ac (4 ha) of 76.5 ac (31 ha) of *Eriogonum corymbosum* var. *nilesii* habitat impacted by the project comprise the "Buckwheat Conservation Area" (see above under *Factors Affecting the Species*). In March 2009, 277 *E. corymbosum* var. *nilesii* plants displaced by the project's construction activities were translocated to the "Buckwheat Conservation Area;" however, only 10–15 percent of the translocated plants appeared to be alive in December 2009 and evidence of new growth was limited (HDR Engineering, Inc. 2010, pp. 1–4).

According to this 2010 report, follow-up surveys to assess the survival of translocated plants were to occur in 2–3 years; however, we are unaware of any follow-up surveys having been conducted. Fencing was also installed prior to the start of construction work in order to exclude construction equipment and activities; this fencing was to remain after construction to exclude motorized and non-motorized vehicles from this area (Clark County 2010, p. 1). However, during December 2009 surveys, several small *Eriogonum corymbosum* var. *nilesii* plants were destroyed by dirt bikes that had established new trails in the area despite the fencing (HDR Engineering, Inc. 2010, p. 4). Restrictive and educational signage was also pledged for the property, in order to protect *E. corymbosum* var. *nilesii* and inform the public of its unique properties (Clark County 2010, p. 1). We have no information on the current status of fencing or signage on this site.

Department of Defense

Nellis Air Force Base (AFB) Area III

In 2000, threats to the Nellis AFB Area III prompted the construction of a fence to protect the area from illegal OHV activity and dumping of construction and household debris, which also indirectly protected portions of USFWS population 2. Under a permit for *Arctomecon californica*, a state-listed species in Nevada, Nellis AFB agreed to set aside a 233 ac (94 ha) portion of Area III under a conservation agreement so they could develop approximately 137 ac (55 ha) of Area III for military family housing and detention basins (NDF 2007, entire; see above in *Factors Affecting the Species*). Because habitat for *A. californica* overlaps with occupied *Eriogonum corymbosum* var. *nilesii* the conservation agreement would protect both plants. Unfortunately, attempts to negotiate a formal conservation agreement between Nellis AFB, NDF, and USFWS were abandoned (USFWS 2007, entire), but the 233 ac (94 ha) in Area III was established as a Conservation Area by Nellis AFB per the 2010 INRMP (INRMP; Nellis AFB 2010, p. 170). The INRMP for Nellis AFB states that areas containing *E. corymbosum* var. *nilesii* would remain undeveloped unless military mission requirements dictate otherwise and the DOD would not allow further development for activities that are purely recreational (Nellis AFB

2010, pp. 168–171). Nellis AFB will also consult with NDF and USFWS to incorporate conservation measures for the plant if development was to occur within occupied habitat (USAF 2010, pp. 168-171).

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