NORTH PARK PHACELIA

(*Phacelia formosula)*

5-Year Status Review:
Summary and Evaluation

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U.S. Fish and Wildlife Service
Upper Colorado Basin Region
Denver, Colorado

August 2021

U.S. FISH AND WILDLIFE SERVICE
5-YEAR STATUS REVIEW for
North Park Phacelia
(*Phacelia formosula*)

Species Reviewed: North Park Phacelia (*Phacelia formosula*)

Federal Register Notice of Listing Determination:

- September 1, 1982. Determination that *Phacelia formosula* is an Endangered Species, Final Rule (47 FR 38540).

Federal Register Notice Announcing Initiation of this Review:

- April 12, 2019. Initiation of 5-Year Status Review of 6 Species in the Mountain-Prairie Region; request for information (84 FR 14965).

Lead Region: Legacy Region 6, Interior Regions 5 and 7, Western Colorado Ecological Services Field Office, Ann Timberman, 970–819–0541; ann_timberman@fws.gov.

Classification: Endangered

Methodology used to complete this review: In accordance with section 4(c)(2) of the Endangered Species Act of 1973 (16 U.S.C Section 1531 *et seq.*), as amended (Act), the purpose of a 5-year status review is to assess each threatened and endangered species to determine whether its status has changed, and it should be classified differently or removed from the Lists of Threatened and Endangered Wildlife and Plants. Status reviews are to be completed in accordance with Sections 4(a) and 4(b) of the Act (16 U.S.C. Section 1533(c)). We solicited data for this 5-year status review, and the associated Species Status Assessment (SSA) report, from interested parties through an April 12, 2019, *Federal Register* notice announcing this review (84 FR 14965). We reviewed all information that we received and incorporated information relevant to our analysis in our SSA report (Service 2021, entire). Information that we received from this data call relevant to our analyses included: summaries of conservation actions by the U.S. Bureau of Land Management, and information from non-governmental organizations (NGOs) and other interested parties on potential threats.

REVIEW ANALYSIS

Overview of the Species Status Assessment Process

The SSA report provides the U.S. Fish and Wildlife Service's (Service's) comprehensive biological status review for the North Park Phacelia, including a thorough account of the species' current and future viability, or the ability of a species to sustain populations in the wild over time" (Service 2016, p. 21; Service 2021, entire). Scientific experts contributed to our analysis, and the draft SSA report was independently peer reviewed and reviewed by partners, including those from the Colorado Natural Heritage program, and the Bureau of Land Management (BLM). The results of the independent peer review of the draft SSA report are available online on the Service's Science Peer Review webpage (*https://www.fws.gov/mountain-*

prairie/science/peerreview.php). We incorporated the results of the peer and partner review into our SSA report. The SSA report is available online at *https://ecos.fws.gov/ecp/species/123*.

The SSA report provides the best available biological information to inform our recommendation on the status of the North Park Phacelia under this 5-year status review. This includes resource needs and current and future conditions, which we describe in terms of the conservation biology principles of resiliency, redundancy, and representation (Shaffer and Stein 2000, pp. 307–310; Wolf *et al.* 2015, entire; Smith *et al.* 2018, entire). The SSA therefore provides the scientific analysis for the 5-year status review. The following discussion presents a summary of the results and conclusions of the SSA report (Service 2021, entire).

For this SSA, we defined viability as the ability of the North Park Phacelia to sustain populations in natural ecosystems over a biologically meaningful timeframe, which, in this case, we defined as the next 30 years (2050) into the future. This timeframe is a period that captures approximately 15 generation intervals of this biennial species, and after which the effects of any stressors on the population would be detectable (Service 2021, p. 29). This timeframe is also a period that allows us to reasonably project conservation efforts, actions, and the potential effects of various stressors (Service 2021, p. 29).

To assess the viability of the North Park Phacelia, we used the three conservation biology principles of resiliency, redundancy, and representation, collectively known as the 3Rs (Shaffer and Stein 2000, pp. 307–310; Wolf *et al.* 2015, entire; Smith *et al.* 2018, entire). In short:

- Resiliency is the ability for populations to persist in the face of stochastic events, or for populations to recover from years with low reproduction or reduced survival, and is associated with population size, growth rate, and the quality and quantity of habitats;
- Redundancy is the ability for the species to withstand catastrophic events, for which adaptation is unlikely, and is associated with the number and distribution of populations; and
- Representation is the ability of a species to adapt to changes in the environment and is associated with its diversity, whether ecological, genetic, behavioral, or morphological.

For our analysis, we identified the North Park Phacelia's ecological requirements for survival and reproduction at the individual, population, and species levels, and described the factors, both positive and negative, that influence the viability of the North Park Phacelia, currently and into the future. We then evaluated the species' current levels of resiliency, redundancy, and representation, and projected plausible changes to these 3Rs into the future; considered together, the current and future levels of resiliency, redundancy, and representation characterize the viability of the North Park Phacelia (Service 2021, pp. 22–37).

Summary of Species Status Assessment for North Park Phacelia

Summary of Life History, Ecology, Range, and Distribution from the SSA

Our SSA report provides our full account of the life history, ecology, range, and historical and current distribution for the North Park Phacelia (Service 2021, pp. 11–15), which we summarize

here. North Park Phacelia is a narrow endemic, herbaceous biennial (rarely annual) (Ackerfield 2015, p. 503) up to 22 centimeters (8.7 inches) tall, much branched, erect to spreading. Flowers are purple (Spackman *et al.* 1997, unpaginated) or violet (Ackerfield 2015, p. 503). Plants appear somewhat grayish, glandular and hairy (Spackman *et al.* 1997, unpaginated). Seeds are dark brown, pitted, excavated on either side of the ventral ridge, the margins rounded and smooth (Ackerfield 2015, p. 503). Each seed capsule produces only four seeds (Osterhout 1919, p. 2). Seeds are small, about 2.5 to 3.1 millimeters (0.098 to 0.122 inch) long (Atwood 2010, p. 1).

North Park Phacelia occurs at elevations of approximately 7,840 to 8,260 feet above sea level (ASL) (2,420 to 2,517 meters ASL) in Jackson County and northwestern Larimer County, Colorado. In Jackson County, the species occurs on specific soil outcrops composed of barren, raw exposures of the sedimentary Coalmont formation, a coal-bearing sandstone substrate susceptible to erosion (Figure 1) (CNHP 2015, p. 1). Recent genetic analysis concluded that 3 populations of *Phacelia sp*. located in the Laramie River valley are the same species as those located in Jackson County, thus increasing the known range of the species (Riser *et al.* 2020, entire). The Laramie River valley populations occur on barren shale exposures identified as Niobrara Shale outcrops rather than the Coalmont formation. Both areas occupied by North Park Phacelia appear well drained and sparsely vegetated.

At the time of listing on October 1, 1982, there were only two known North Park Phacelia populations, both located in North Park, Colorado (47 FR 38540, September 1, 1982). In 1982, we estimated that the Michigan River population had a maximum of 200 plants during a favorable year (47 FR 38540; September 1, 1982). The second population, identified as the North Platte population, was located approximately 5 miles from the Michigan River population, with approximately 2,500 individuals (47 FR 38540; September 1, 1982). Records do not indicate the size of the occupied area of the Michigan River population. The initial Michigan River location was identified as a sandstone bluff near Walden, Colorado, and occupied about one quarter mile of the bluff. The North Platte population consisted of five sites along eight miles of the North Platte River, with no additional information provided. Colorado Natural Heritage Program (CNHP) data indicate two "historical" occurrences identified as California Gulch Northeast and Dodge Ranch. Both of these occurrences are in North Park, but there are no survey data for these occurrences, and one of the occurrences has never been verified. Because the status of these occurrences is unknown and we do not have demographic or other data for these two populations, we did not consider these two populations in our species status assessment.

In our previous 5-year status review completed in 2012, we indicated that there were 8 known populations of North Park phacelia, all of which are located in Jackson County, Colorado. Currently, there are 11 populations of North Park phacelia compared to the 8 populations described in our previous 5-year status review. Figure 1 displays the spatial distribution of North Park phacelia in Jackson and Larimer Counties, Colorado.

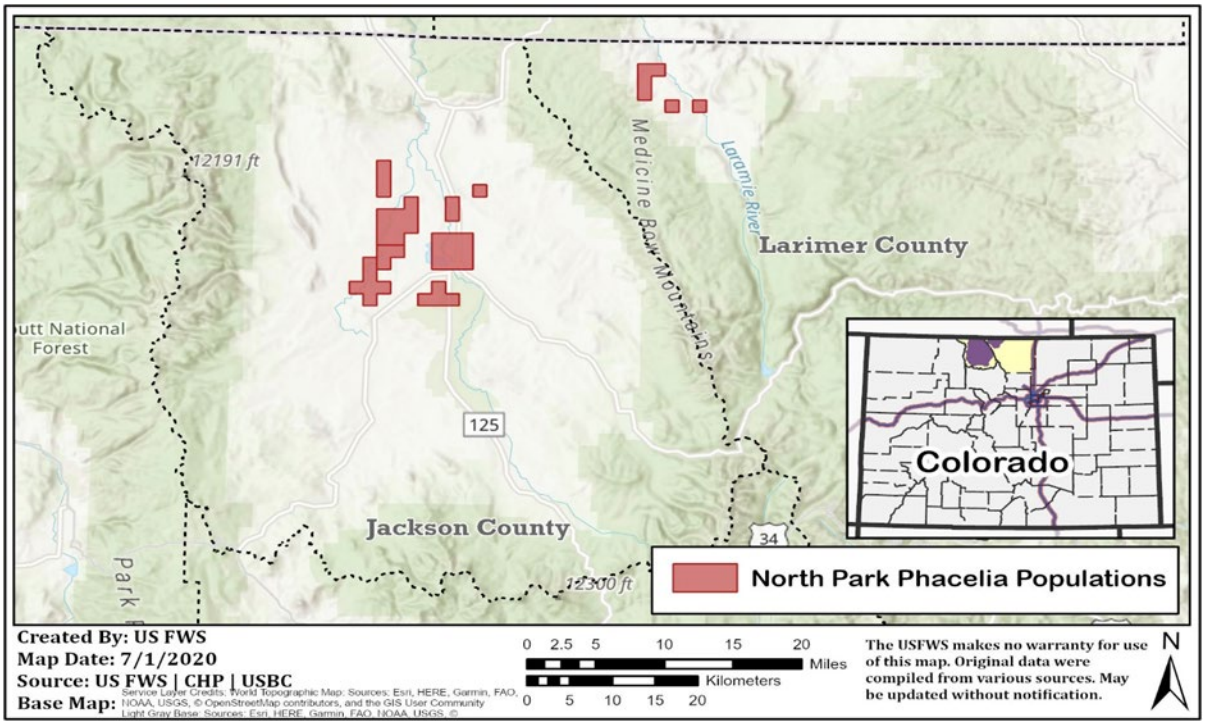

Figure 1. Current Range of North Park Phacelia. The size and shape of the populations are masked per a data use agreement with the Colorado Natural Heritage Program, due to the presence of private lands. The size of the polygons is not an indication of actual population size. In addition, all populations are separated by at least one mile.

For the purposes of our SSA, we refer to populations of the North Park Phacelia using the names used by the Colorado Natural Heritage Program's element occurrence records. The occupied area and abundance estimates for each population are displayed in Table 1.

Table 1. Occupied Area and Abundance Estimates of North Park Phacelia Populations (CNHP 2020)

Population Name	Area (acres)	Estimated Abundance (CNHP)
Jackson County		
Case Flats, Potter Creek, Rockwell	123.8	6,000
Diamond J Ranch	78.9	300
Verner & Brownlee	69.2	2,000
California Gulch	67.6	200-350
Airport	61.3	200
Diamond J State wildlife Area (SWA)	50.4	2,000
North Park Resource Natural Area ACEC	30.6	1,200-3,000
Battleship–Dwinell Ranch	7.3	50-400
Larimer County		
Laramie River Bull Mountain	0.48	300
Forrester Creek	5.9	2,000
Hohnholz North East	69.9	375-800
Total	565	17,350

In 2010, the BLM initiated an annual trend monitoring program for North Park Phacelia, pursuant to the FWS's 2012, 5-year status review, which identified the need for a range-wide trend monitoring study. The BLM implemented frequency monitoring, rather than density monitoring, to determine trend, because frequency is the preferred method for detecting changes in short-lived species and is much more sensitive in detecting changes in spatial arrangement (Elzinga et al., 1998, p. 175). The frequency variability observed in these surveys is an indication of resiliency within the monitored sites as they respond to stochastic climate variability. However, the trend line displayed on the graph indicates a decade long decline in average plant frequency in North Park. The apparent decline coincides with the combined spring and summer water deficit for the period 2011-2020, which was higher than the historic average. We employed statistical testing to the trend data and determined that with one exception, the monitored populations do not individually show a statistically significant decline. Because only one population showed a significant trend (decline) over the years, and because no frequency data has been collected at five of the 11 populations, we chose not to incorporate frequency trend data as a metric to assess overall population resiliency.

Summary of Species Needs from the SSA

Here we summarize what individual North Park Phacelia plants need to survive from seed to seed-producing adult. Our SSA report provides additional detail and information cited (Service 2021, entire)

In general, soil nutrients provided by the Coalmont and Niobrara formations, sunshine, and adequate soil moisture provided by precipitation, all influence the daily needs of individual plants. North Park Phacelia seeds likely require temperature stratification and adequate moisture to break seed dormancy and germinate (Service 2021, pp. 11–12). Adequate moisture during the growing season influences abundance in each population. The specific temperature variation and precipitation quantity influence the ability of individuals to grow and survive at different life stages (Service 2021, p. 12). The North Park Phacelia needs to occur in multiple, resilient populations distributed across its range in order to meet redundancy requirements and withstand catastrophic events (Service 2021, p. 15). Adequacy of precipitation may vary spatially across the species' range. Additionally, North Park Phacelia needs genetic and ecological diversity in order to preserve variation and the ability to adapt to changing conditions (Service 2021, p. 14). Although no species-specific seed bank persistence studies have been completed, two studies of other species within the genus *Phacelia* indicate persistence of seeds in the seed bank from 4 to 18 years (Langton 2015, p. 80; Meyer 2018, p. 1). Seed persistence over numerous reproductive years may allow a species to build an extensive reservoir of seeds in the seed bank (Kemp 1989, entire). We assume that North Park Phacelia has evolved a similar strategy whereby seeds may remain dormant in the seed bank during drier periods and germinate when conditions are favorable (Service 2021, p. 12).

Summary of Cause-and-Effects from SSA: Stressors and Conservation Efforts

As documented in our SSA report, we evaluated stressors that positively or negatively influence the North Park Phacelia at the individual, population, and species levels, either currently or into the future (Service 2021, pp. 15–37). Stressors may influence the resiliency of populations, either by directly affecting individuals or by fragmenting habitat. The stressors, or negative factors, we evaluated result from anthropogenic influences, or are environmental.

These stressors are interrelated to varying degrees; for example, infrastructure development may influence both habitat availability and human-caused mortality, such as by removal or crushing. Positive actions, in the form of conservation efforts such as land protections and regulations, have reduced sources of habitat degradation and human-caused losses. These efforts have improved resiliency from levels at the time of listing in one of the populations. Collectively, conservation measures are important to the viability of the North Park Phacelia in the future.

We assessed a number of stressors that have the potential to affect resiliency, including habitat disturbances and fragmentation, and climate factors. Disturbances include roads, livestock trampling, agricultural developments, and oil and gas infrastructure development. Agricultural infrastructure has the potential to cause habitat loss and fragmentation, and loss of individual plants during development and use. Fugitive dust may impart some indirect effects to populations in close proximity to these disturbances. Roads may cause increases in invasive species, which could influence resiliency of North Park Phacelia. Additionally, use of roads by ORVs or other vehicles to access utility corridors, non-renewable energy developments, or livestock operations may crush or trample individual plants and disturb habitat.

Currently, some of the stressors we evaluated affect the majority of North Park Phacelia populations, but the severity of these effects to resiliency of populations is unknown. We determined that the effects of climate change are likely the biggest influence on future resiliency of North Park Phacelia populations and the viability of the species into the future to year 2050.

There are several conservation efforts and mechanisms that reduce or ameliorate stressors for the species. Conservation efforts or regulatory mechanisms include: Federal land protections under the BLM's Resource Management Plan, including motorized off-highway vehicle restrictions, and establishment of Areas of Critical Environmental Concern; a private land conservation easement that provides long-term habitat protection for a portion of one of the populations; and placement of OHV use-deterrent devices to reduce or eliminate habitat impacts at one population site. Our SSA report provides our full analysis of stressors and conservation efforts (Service 2021, pp. 15–20).

Summary of Current Condition from the SSA

In our SSA report, we evaluate current condition by examining current levels of resiliency in the 11 North Park Phacelia populations and their contributions to redundancy and representation to species across its range. Below, we summarize our evaluation of current condition for each of the 3Rs, with additional detail regarding our analysis provided in the SSA report (Service 2021, pp. 15–28).

Summary of Current Resiliency

We describe the resiliency for each of the 11 populations in terms of the habitat, demographic, and climate factors needed by the North Park Phacelia (Service 2021, pp. 22–24). We developed a categorical model to calibrate resiliency based on a range of conditions for two habitat factors (occupied area and ecological setting) and one demographic factor (abundance measured by abundance estimates), and one climate variable (growing season water deficit) (Service 2021, pp. 23–24). We selected these factors based on their importance to resiliency and because we could evaluate them relatively consistently across all 11 populations. We then used a categorical model as a key to evaluate resiliency for each population by systematically evaluating the current condition of each factor. To calculate an overall score for resiliency, we assigned values to the resiliency categories and then calculated an average of the factor ranking (Table 8 in Service 2021, p. 24). Populations in higher resiliency categories are at less risk from potential stochastic events, such as extended drought conditions, than populations in lower resiliency categories (Service 2021, p. 25). Our SSA report provides additional detail regarding the methodology we used to evaluate resiliency for each of the 11 populations (Service 2021, pp. 22–24).

Current Condition – Resiliency, Redundancy, and Representation

To evaluate current condition of North Park Phacelia, we evaluated habitat in terms of the occupied area for each population and its ecological setting in terms of disturbance, abundance, and climate variables for the 11 populations. We relied upon data provided by the CNHP, the North Central Climate Adaptation Science Center and CIRES, University of Colorado, Boulder, and recent genetic information provided by the Denver Botanic Gardens, to inform our assessment. This information allowed us to consider the species' resiliency, redundancy, and representation.

Table 2 summarizes our evaluation of current resiliency for each population. Of the 11 populations, six populations currently have high resiliency, and five populations have a moderate resiliency. None of the populations has a low resiliency ranking.

Table 2. Summary of Current Condition of the 11 North Park Phacelia populations.

Population Name	Occupied Area	Ecological Setting - Percent Disturbance	Abundance (Population Estimate)	Growing Season Water Deficit	Overall Resiliency Score
North Park Resource Natural Area ACEC	Moderate	High	High	High	High (2.75)
California Gulch	Moderate	Moderate	Moderate	High	Moderate (2.25)
Airport	Moderate	Low	Low	High	Moderate (1.75)
Case Flats, Potter Creek, Rockwell	High	High	High	High	High (3)
Verner & Brownlee	Moderate	High	High	High	High (2.75)
Diamond J Ranch	High	High	High	High	High (3)
Hohnholz NE	Moderate	High	Moderate	High	High (2.5)

Laramie River-Bull Mountain	Low	Moderate	Moderate	High	Moderate (2)
Forrester Creek	Low	Moderate	High	High	Moderate (2.25)
Diamond J State Wildlife Area	Moderate	Moderate	High	High	High (2.5)
Battleship - Dwinell Ranch	Low	Moderate	Moderate	High	Moderate (2)

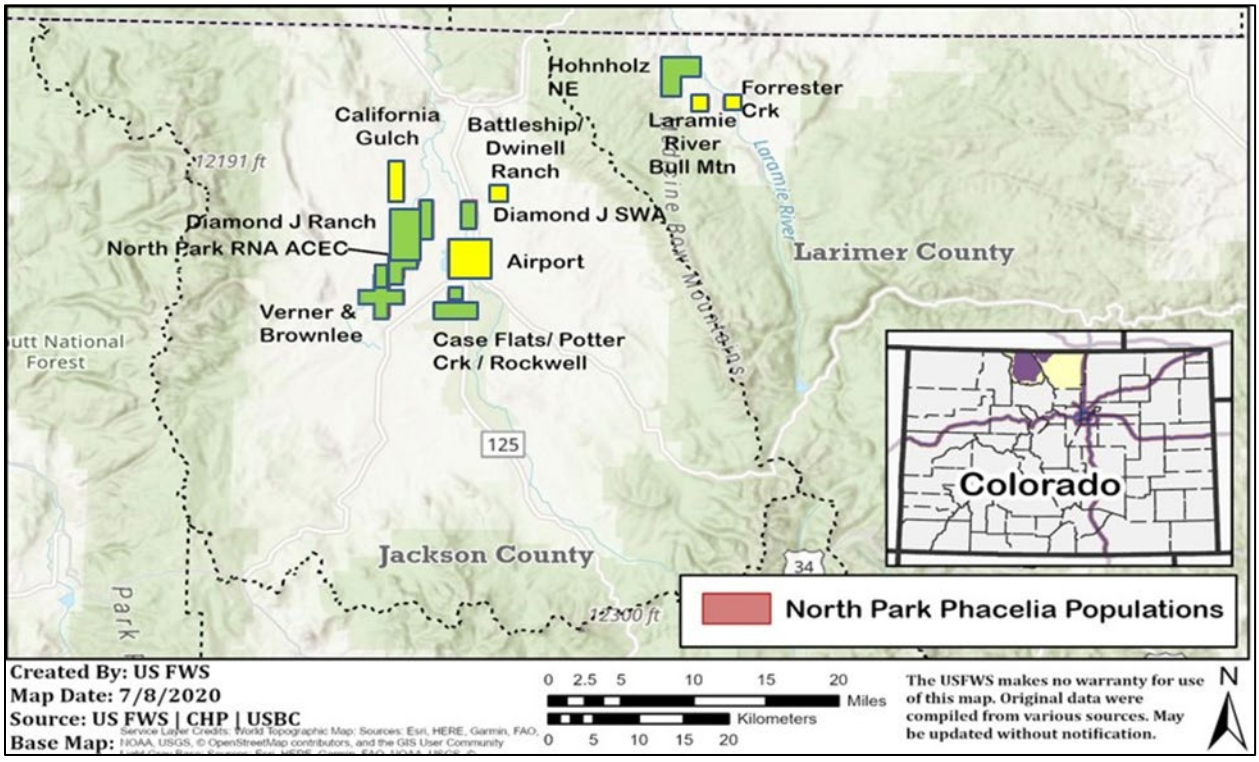

Figure 2. Map of the current condition for the 11 North Park Phacelia populations, in terms of resiliency, redundancy, and representation. Colors represent the current resiliency for each population, based on the current condition of habitat, demographic, and climatic factors for each population. Populations with higher levels of resiliency are at less risk from environmental and demographic stochasticity. Currently, six populations have high resiliency, and five have moderate resiliency.

Summary of Current Resiliency, Redundancy, and Representation

Resiliency

Based on our analysis and our ranking methodology, six North Park Phacelia populations are in a "high" resiliency condition category and the remaining five populations are in a "moderate" resiliency category. Three populations have smaller occupied areas, thus reducing their resiliency ranking. Although still within the range of moderate resiliency, the Airport population was the least resilient population, due to higher historical disturbance in the ecological setting and low abundance. The most resilient populations have moderate to larger occupied area, are rated higher for ecological setting (e.g. less disturbance), and generally have higher abundance.

These populations include the Case Flats, Potter Creek, Rockwell; North Park Resource Natural Area ACEC; Verner & Brownlee; and Diamond J Ranch. Current condition average growing season water deficit (GSWD) was within one-half standard deviation of the historical average, putting all populations in a "high" resiliency condition for this metric. Historically, the North Park Phacelia periodically experienced individual years with GSWD above (and below) one standard deviation of the historical average (Service 2021, Appendix C), which provides a range of GSWD variation experienced and tolerated by the species. We believe the assumed persistence of the seed bank will allow the species to withstand environmental and demographic stochasticity by bridging the gap between favorable years for at least the next 30 years.

Redundancy

Like many narrow endemic species, the redundancy of North Park Phacelia is, and has likely always been, relatively low because of its limited geographic range and habitat specificity. However, North Park Phacelia consists of 11 populations, separated by at least 1 mile. Three populations occur approximately 20 mi (30 km) from the other 8 populations, and are separated by the Medicine Bow Mountain Range, which helps spread catastrophic risk over a larger geographic area. We are not aware of any populations that have been lost to the species. Under the current circumstances, redundancy is higher with 11 known populations compared to the 2 known populations at listing (1982). There may be additional undiscovered populations within the range of the species. We believe that redundancy is likely stable under current conditions.

Representation

Riser *et al.* (2020, entire), through genetic analysis, reported the breadth of genetic variability of the species both within and between populations of North Park Phacelia. In addition, Atwood (2010, p. 1–3) concluded that North Park Phacelia in the Laramie River valley show a number of measurable differences in growth forms of flowers, leaves, and seeds from those in North Park. Based on this information, we believe the species displays a relatively high degree of genetic diversity, which may confer some type of adaptability to environmental change. The role of pollinators is unclear since the species can self-pollinate, and we assume that some genetic exchange occurs between populations periodically. We consider ecological representation low as there is little variation in soil type and conditions at population sites. The different soil types between populations in Jackson County and those in the Laramie River valley represent what little ecological variability exists.

Our SSA report provides a full account of our evaluation of resiliency, redundancy, and representation for each population, including the assessment of each habitat and demographic factor for each population. Please see the SSA report for our full analysis of current resiliency (Service 2021, pp. 23–29).

Summary of Future Conditions from the SSA

We evaluated future conditions for North Park Phacelia using projections for the stressors, habitat factors, and demographic factors that influence resiliency, redundancy, and representation. To evaluate future conditions, we used the same methodology that we used to

evaluate current condition. Below we summarize the future scenarios and our evaluation of future condition under each scenario, with our full analysis in the SSA report (Service 2021, pp. 29–36).

Summary of Future Scenarios

We used scenario planning to describe plausible futures for the North Park Phacelia and to capture uncertainty associated with our future projections. Future scenarios allowed us to explore possible future conditions for the North Park Phacelia, given the uncertainties of annual abundance variability and seed persistence in the seed bank. Due to the lack of annual census data, we were unable to assess future changes in occupied area or abundance, although warmer drier conditions may lead to lower annual abundance. In addition, we lacked evidence indicating whether future human development will significantly increase within the range of the species (Service 2021, pp. 17–18). We were also unable to model future disturbance within North Park Phacelia habitat (conservation measures are also in place to prevent habitat loss and fragmentation in a number of the populations).

Given our understanding of the needs of North Park Phacelia in regards to climate variables, we evaluated future viability of North Park Phacelia under four plausible climate scenarios, which capture the range of possible water deficit. As described in more detail in our SSA report (Service 2021, pp. 29–30), we developed four future scenarios based on future changes in GSWD compared to historical conditions. We used a web-based tool to help select climate models that capture the range of variability of climate model projections within the range of North Park Phacelia. We selected four climate models for our projection of future climate conditions relative to the baseline period 1979−2000. The North Central Climate Adaptation Science Center and CIRES, University of Colorado, Boulder provided climate metric projections for years 2021-2050. We used 2050 as our biologically meaningful timeframe for our analysis of future condition, because it represents the best available projection for the factors most influential to North Park Phacelia resiliency. We based our condition criteria on the standard deviation of GSWD from the historical mean. Based on climate modeling, any of our future scenarios has the same probability of occurrence:

- **Future Scenario 1 (Warm - Wet) –** Under this scenario, growing season water deficit increases 0.2 inches above the historical average;
- **Future Scenario 2 (Hot - Wet)** – Under this scenario, growing season water deficit increases by 1.12 inches above the historical average;
- **Future Scenario 3 (Very Hot - Very Wet) –** Under this scenario, growing season water deficit increases by 0.25 inches above the historical average;
- **Future Scenario 4 (Very Hot - Dry) –** Under this scenario, growing season water deficit increases by 1.69 inches above the historical average.

We considered all four scenarios to be equally plausible for the purposes of our SSA analysis. We used the same methodology that we used to evaluate current condition to project the resiliency for the 11 population 30 years into the future. After evaluating resiliency, we then evaluated redundancy and representation for each future scenario.

Summary of Future Conditions by Scenario

Table 3, below, summarizes our evaluation of future resiliency for each ecosystem with the inclusion of current conditions for comparison; the SSA provides additional detail on this analysis (Service 2021, pp. 30–38).

Table 3. Current and future conditions in terms of overall resiliency for 11 populations for the North Park Phacelia.

Population	Current Condition	Scenario 1	Scenario 2	Scenario 3	Scenario 4
North Park Resource Natural Area ACEC	High	High	High	High	High
California Gulch	Moderate	Moderate	Moderate	Moderate	Moderate
Airport	Moderate	Moderate	Moderate	Moderate	Low
Case Flats, Potter Creek, Rockwell	High	High	High	High	High
Verner & Brownlee	High	High	High	High	High
Diamond J Ranch	High	High	High	High	High
Hohnholz NE	High	High	High	High	Moderate
Laramie River-Bull Mountain	Moderate	Moderate	Moderate	Moderate	Moderate
Forrester Creek	Moderate	Moderate	Moderate	Moderate	Moderate
Diamond J State Wildlife Area	High	High	High	High	High
Battleship - Dwinell Ranch	Moderate	Moderate	Moderate	Moderate	Moderate

Summary of Future Resiliency

Future Scenario 1: Under scenario 1, we anticipate a slight increase in GSWD above the historical average, but within one-half of the standard deviation of the historical mean. The projected increase in GSWD could negatively influence abundance compared to historical conditions, although not enough to result in a change in the overall resiliency score for any population. In general, we believe that the species will respond to variations in GSWD in a manner similar to historical and current conditions by displaying both increases and decreases in annual plant abundance. Figure 2 above displays current conditions, and also displays future conditions for scenario 1 (no change from current conditions).

Future Scenario 2: Under scenario 2, the climate models predicted mean GSWD will increase by 1.12 in., but it remains within one-half standard deviation above the historical mean. Based on our criteria, this scenario results in conditions similar to current conditions. In this scenario, resiliency remains similar to historical and current conditions with six populations in the high resiliency category, and five populations in the moderate resiliency category. Figure 2, above displays current conditions, and also displays future conditions for scenario 2 (no change from current conditions).

Future Scenario 3: Under scenario 3, the climate models predicted an increase in GSWD of 0.25 in., which is slightly higher than historical conditions but within one-half of the standard deviation of the historical mean, and slightly higher than scenario 1. We anticipate similar species resiliency predicted for scenario 1 with six populations in a high resiliency category and five in a moderate resiliency category. Figure 2 above displays current conditions, and also displays future conditions for scenario 3 (no change from current conditions).

Future Scenario 4: Under scenario 4, we anticipate GSWD to be 1.69 in. higher than the historical mean, which is more than one half of a standard deviation above the historical average but is still within one standard deviation of the historical average. This higher increase in GSWD resulted in this metric falling into our moderate resiliency category. Overall, one population dropped from the moderate resiliency category to the low resiliency category, and one fell from the high resiliency category to moderate resiliency. Five populations remain in the high resiliency category, and five populations remain in the moderate category, with one population falling into the low resiliency category. We believe the assumed persistence of the seed bank allows the species to withstand environmental and demographic stochasticity, by bridging the gap between favorable years. Figure 3, below displays conditions of scenario 4, with one population going from high resiliency to moderate resiliency, and one population going from moderate resiliency to low resiliency. As stated previously, the species has experienced years of GSWD above the historical average, and above one standard deviation above the historical average, including during the historical period (SSA, Appendix C).

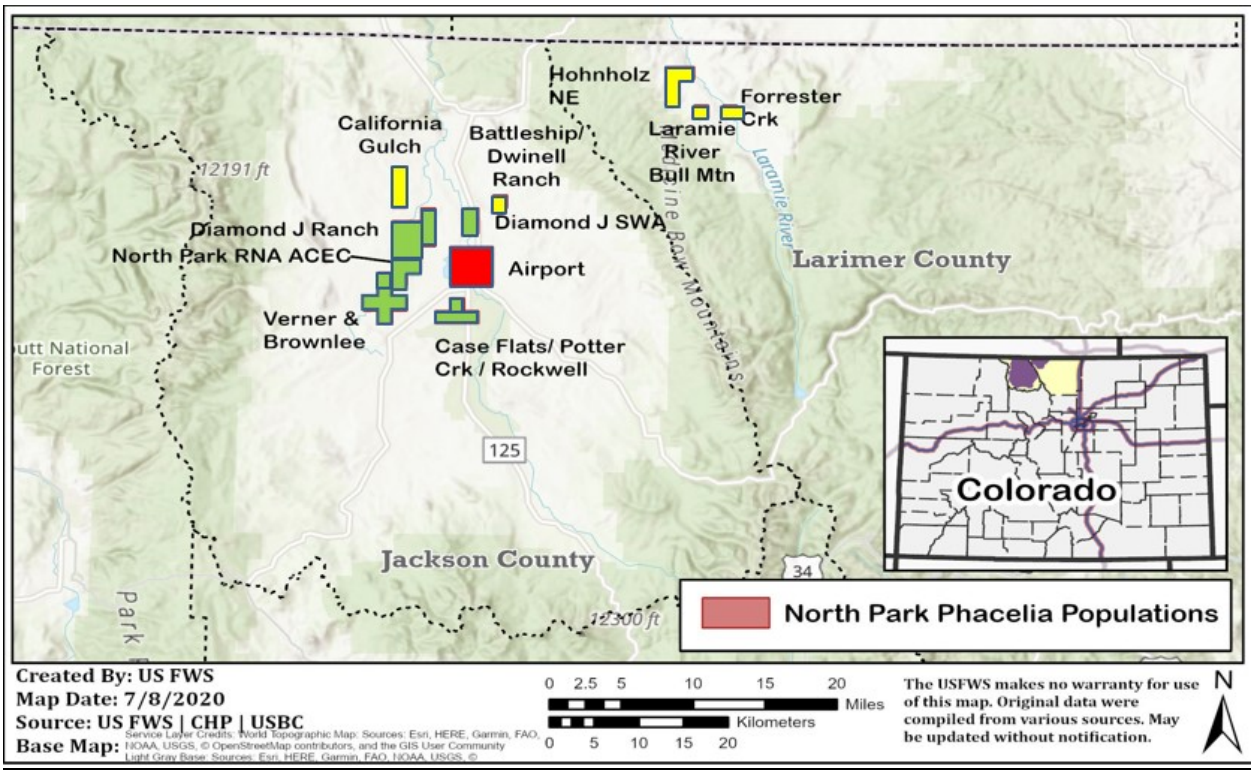

Figure 3. Map of resiliency for future scenario 4. Five populations have high resiliency, five have moderate resiliency, and one has low resiliency. The 11 populations distributed as illustrated on the map, contribute to redundancy, but the distribution offers only moderate ecological diversity for representation.

Summary of Future Redundancy and Representation

Given our analysis, only one population fell into our low resiliency category, but is still likely to remain extant. Therefore, we do not anticipate changes to redundancy or representation in the future (Service 2021, p. 36). We were unable to predict possible reductions in annual abundance and occupied area caused by increased GSWD. However, we believe it likely that annual abundance will continue to fluctuate annually, and long-term occupied area may decrease to some extent.

Summary of Viability from SSA

Viability is the "ability of a species to sustain populations in the wild over time" (Service 2016, p. 21). Taken together, current and future levels of resiliency, redundancy, and representation characterize the viability of the North Park Phacelia. Currently, there are six populations with high resiliency, and five populations with moderate resiliency (Table 2, above). Within 30 years in the future, there are few changes or reductions in resiliency across the populations, depending on the scenario. Under Scenarios 1-3, there are no reductions in resiliency despite relatively small increases in GSWD. Under Scenario 4, we anticipated declines in resiliency where GSWD is more than one-half standard deviation above the historical mean. To summarize changes in resiliency from current to future conditions, there is low risk from stochastic events if GSWD does not exceed one standard deviation of the historical mean too frequently, but there is greater

risk from stochastic events if GSWD is above one standard deviation of the historical mean for more than 4-5 consecutive years. The North Park Phacelia has experienced years of high GSWD, and we believe the assumed persistence of the seed bank allows the species to withstand environmental and demographic stochasticity, by bridging the gap between favorable years.

Eleven populations characterize current redundancy for the North Park Phacelia with at least one mile between populations, and three populations are 20 miles from the North Park populations and separated by the Medicine Bow Mountains to the east. Catastrophic risk is spread across these 11 populations, but ecological diversity is somewhat limited. In 30 years, if GSWD increases above one-half standard deviation of the historical mean, as in scenario 4, resiliency decreases in two populations, and one of the populations is at greater risk from stochastic events. To summarize redundancy across the future scenarios: catastrophic risk to the North Park Phacelia stays the same if GSWD does not increase above one standard deviation of the historical average, as in three of the four future scenarios. Catastrophic risk to the species increases slightly in the most extreme climate scenario, although even in this scenario, we do not anticipate any of the populations to become extirpated and redundancy would remain unchanged. Representation remains unchanged into the future in all scenarios as well.

Our SSA characterizes the viability for the North Park Phacelia, or its ability to sustain populations in the wild over time, based on the best scientific understanding of its current and future abundance, distribution, and diversity (Service 2021, entire). Based on our assessment of the 3Rs, currently and 30 years into the future, viability for the North Park Phacelia should remain similar to current conditions.

STATUS RECOMMENDATION

Standard for Review

Section 4 of the Act (16 U.S.C. Section 1533) and its implementing regulations (50 CFR part 424) set forth the procedures for determining whether a species meets the definition of "endangered species" or "threatened species." The Act defines an "endangered species" as a species that is "in danger of extinction throughout all or a significant portion of its range," and a "threatened species" as a species that is "likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range." The Act requires that we determine whether a species meets the definition of an "endangered species" or a "threatened species" because of any of the following factors:

(A) The present or threatened destruction, modification, or curtailment of its habitat or range;
(B) Overutilization for commercial, recreational, scientific, or educational purposes;
(C) Disease or predation;
(D) The inadequacy of existing regulatory mechanisms; or
(E) Other natural or manmade factors affecting its continued existence.

These factors represent broad categories of natural or human-caused actions or conditions that could have an effect on a species' continued existence. In evaluating these actions and

conditions, we look for those that may have a negative effect on North Park Phacelia, as well as other actions or conditions that may ameliorate any negative effects or may have positive effects.

We use the term "threat" to refer in general to actions or conditions that are known to or are reasonably likely to negatively affect individuals of a species. The term "threat" includes actions or conditions that have a direct impact on individuals, as well as those that affect individuals through alteration of their habitat or required resources. The term "threat" may encompass—either together or separately—the source of the action or condition, or the action or condition itself.

However, the mere identification of any threat(s) does not necessarily mean that the species meets the Act's definition of an "endangered species" or a "threatened species." In assessing whether a species meets either definition, we must evaluate all identified threats by considering the effects of the threats and the expected response of the species—in light of those actions and conditions that will ameliorate the threats—on an individual, population, and species level. We evaluate each threat and its expected effects on the species, then analyze the cumulative effect of all of the threats on the species as a whole. We also consider the cumulative effect of the threats in light of those actions and conditions that will have positive effects on the species—such as any existing regulatory mechanisms or conservation efforts. The Service recommends whether the species meets the definition of an "endangered species" or a "threatened species" only after conducting this cumulative analysis and describing the expected effect on the species now and in the foreseeable future.

In our status recommendation, we correlate the threats acting on the North Park Phacelia to the factors in section 4(a)(1) of the Act. We summarize our 5-year status review for the North Park Phacelia below.

Summary of Analysis

The biological information we reviewed and analyzed as the basis for our findings is documented in the SSA report (Service 2021, entire), a summary of which is provided above. We based the projections for the future condition of the North Park Phacelia on our expectations of the potential stressors that may affect the species. When we listed the North Park Phacelia as an endangered species on September 1, 1982 (47 FR 38540), we identified only two populations, one of which experienced severe habitat degradation caused by motorcycle use within the population, low population size, and potential impacts from coal, and oil and gas extraction (Factor A), impacts from livestock trampling (Factor A), inadequacy of existing regulatory mechanisms (Factor D), and additional human threats (Factor E) as the primary threats (47 FR 38541–38542).

In our SSA report, we reevaluated these stressors and additional stressors that fall broadly into three categories: those with habitat-related effects (Factor A); sources of human-caused mortality (Factors B and C), and other stressors (Factor E) (Service 2021, pp. 15–19). These stressors are interrelated to varying degrees; for example, motorized access is related to both habitat impacts and human-caused mortality. Specifically, stressors with potential habitat-related effects (Factor A) include, motorized access and management, developed sites, livestock

allotments, mineral and energy development, recreation, habitat fragmentation, development on private lands, and activities that may disturb habitat. Sources of human-caused mortality (Factors B and C) that we evaluated include removal of plants, trampling by livestock, residential development, and off highway vehicle use (OHV). We considered the effects of other stressors (Factor E) including connectivity and genetic health,; effects of climate change,; and catastrophic events, such as wildfires and climate change (Service 2021, pp. 15–19, 42–51). Lastly, we evaluated potential cumulative effects of these stressors (Service 2021, pp. 15-19). Our SSA report provides our full analysis of stressors on North Park Phacelia (Service 2021, pp. 15–19, 42–51).

We also evaluated a variety of conservation efforts and mechanisms across the 11 populations that either reduce or ameliorate stressors or improve the condition of habitats or demographics (Service 2021, pp. 19–20). These conservation efforts or mechanisms include: Federal land protections through no surface occupancy stipulations; a conservation easement on private lands (approximately 22 acres within one population), and placement of deterrent devices, such as large rocks, to prevent habitat impacts in the one population that was historically impacted by OHV use. The BLM has implemented regulatory mechanisms that help address the stressors we identified under Factors A, B, C, and E.

We note that by using the SSA framework to guide our analysis of the scientific information documented in the SSA report, we have analyzed individual effects of stressors on individuals, ecosystems, and the North Park Phacelia, as well as their potential cumulative effects (Service 2021 pp. 15–19). We incorporate the cumulative effects into our analysis when we characterize the current and future condition of the North Park Phacelia. Our current and future condition assessment is iterative because it accumulates and evaluates the effects of all the factors that may be influencing the North Park Phacelia, including negative influences from stressors and positive influences from conservation efforts. We evaluate potential effects from these influences consistently across the same subset of habitat and demographic needs for the North Park Phacelia, both currently and into the future. Because the SSA framework considers not just the presence of the factors, but also the degree to which they collectively influence risk to the entire species, our assessment integrates the cumulative effects of the five factors and replaces a standalone cumulative effects analysis.

Application of Analysis to the Status Recommendation

The SSA describes the current and future viability of the North Park Phacelia in terms of the 3Rs, which characterize risk to the North Park Phacelia in the context of stochasticity (resiliency), catastrophes (redundancy), and long-term environmental change (representation) (Service 2021, entire). This analysis forms the basis for our recommendation under the Act. Because of uncertainties regarding the future, we evaluated future condition for four plausible future scenarios designed to capture the relevant uncertainties regarding future stressors. The fundamental question before the Service is whether the projections of extinction risk, described in the SSA report in terms of the resiliency, redundancy, and representation of the North Park Phacelia, under a range of future scenarios, indicate that the species meets the definition of an endangered or threatened species under the Act. Theoretically, if the abundance (resiliency), distribution (redundancy), and diversity (representation) of the North Park Phacelia decreases,

thereby decreasing overall viability, the extinction risk of the North Park Phacelia would correspondingly increase.

As described below, we first evaluate whether the North Park Phacelia is in danger of extinction throughout its range now. We then evaluate whether the North Park Phacelia is likely to become in danger of extinction throughout its range in the foreseeable future. We finally consider whether the North Park Phacelia is in danger of extinction in a significant portion of its range (SPR).

When we listed the species, there were two known populations of North Park Phacelia, both located within Jackson County, Colorado. Stressors on the species at that time indicated that the species was "in danger of extinction throughout all or a significant portion of its range." The narrow endemism of the species made the effects caused by stochastic events more detrimental to the species as a whole. Since 1982, nine additional populations were discovered for a total of 11 populations, thus increasing species viability. In our SSA report, we documented that some of the same stressors known at the time of listing still act upon North Park Phacelia populations, and may result in periodically lower abundance within populations. However, those stressors do not appear to cause significantly reduced resiliency within the populations. There are a number of potential stressors that could cause loss and degradation of North Park Phacelia habitat, such as livestock or oil and gas infrastructure development. If they occurred, livestock and infrastructure development would likely occur on private lands where there are few if any regulatory mechanisms to protect the species. Private lands consist of approximately 23 percent of the species known range.

Although there are stressors that act upon the species, none appear to cause significant impacts to population resiliency. Although not well understood, climatic factors appear to most heavily influence annual abundance within North Park Phacelia populations. Drier years, especially during the growing season of spring and summer, result in lower annual abundance of the species. However, the species has evolved mechanisms to responds to harsh conditions. Although a source of uncertainty, we believe that the North Park Phacelia seeds can persist in the seed bank for at least one year, and may persist for longer periods of time. Two other species within the *Phacelia* genus can persist in the seedbank from approximately 5 to 18 years. In addition, seeds will not germinate unless there is an appropriate amount of soil moisture, and temperature stratification occurs. These strategies likely allow the species to germinate, grow, and produce seeds during times when climatic conditions are more favorable, but remain dormant when conditions are not favorable. Persistence of seeds in the seedbank allows the species to bridge gaps between drier climatic conditions and more favorable conditions.

Evaluation of Status: In Danger of Extinction Throughout its Range

Under the Act, an endangered species is any species that is "in danger of extinction throughout all or a significant portion of its range" (16 U.S.C. Section 1532(6)). For this 5-year status review, we evaluate the best available scientific information about the species' current levels of demographic and habitat factors (these are described in the SSA report in terms of resiliency, redundancy, and representation) to describe the viability of the North Park Phacelia (Service

2021, entire). We compare our evaluation of the species' current risk of extinction against the definition of an endangered species.

Currently, there are 11 known populations of the North Park Phacelia (Service 2021, p. 3) compared to 2 populations at the time of listing. Six of these populations have high resiliency, and five have moderate resiliency, and none of the populations has low resiliency (Service 2021, p. 31–32). These levels of resiliency indicate a low risk from stochastic events for the North Park Phacelia. Catastrophic risk to North Park Phacelia is associated with prolonged drought over a period of several years, but the North Park Phacelia has adapted to periodic drought conditions through persistence of the seedbank and has endured numerous years of drier than normal conditions. Precipitation events within the range of the species do not always provide moisture to all populations at the same time. However, the number and spatial distribution of the populations of North Park Phacelia reduce the potential for prolonged drought to impact all population at once, because precipitation events are likely to provide moisture to some populations over the life-cycle the species. Based on genetic analysis, we believe the species displays a relatively high degree of genetic diversity, allowing it to adapt to ecological change. However, ecological representation is low as there is little variation is soil type and conditions at population sites. The different soil types between populations in Jackson County and those in the Laramie River valley, where the soil type is slightly different, represents what little ecological variability that does exist (Service 2021, p. 32).

The current condition of the North Park Phacelia represents a marked improvement from the known conditions at the time of listing. The threats to the North Park Phacelia identified at listing 39 years ago appear to have little influence over current populations, and therefore species viability. Additionally, the BLM has adopted a resource management plan that contains legally binding and enforceable science- and research-based measures and management practices designed specifically to conserve the North Park Phacelia. These regulatory mechanisms also help reduce threats associated with habitat loss and fragmentation on Federal lands, and lands overlaying Federal mineral estate, where they apply (Service 2021, pp. 19–20). North Park Phacelia populations have likely remained stable due to conservation actions and protective measures.

Given the current levels of resiliency in 6 out of 11 populations, and the lack of significant, imminent stressors, and seedbank persistence, we believe that the North Park Phacelia currently has sufficient ability to withstand stochastic and catastrophic events, and to adapt to environmental changes. Therefore, we conclude that the current risk of extinction is low, such that the North Park Phacelia is not currently in danger of extinction throughout all of its range.

Having found that the North Park Phacelia is not in danger of extinction throughout its range, we next evaluated whether the species is likely to become an endangered species within the foreseeable future throughout all of its range.

Evaluation of Status: Likely to Become Endangered Throughout its Range

Under the Act, a threatened species is any species that is "likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range" (16

U.S.C. Section 1532(20)). The term foreseeable future extends only so far into the future as the Service can reasonably determine that both the future threats and the species' responses to those threats are likely (50 C.F.R. 424.11(d)). The Service describes the foreseeable future on a case-by-case basis, using the best available data and taking into account parameters? Such as the species' life history characteristics, threat-projection timeframes, and environmental variability (50 C.F.R. 424.11(d)). The key statutory difference between a threatened species and an endangered species is the timing of when a species may be in danger of extinction, either now (endangered species) or in the foreseeable future (threatened species).

For the purposes of our analysis, we defined the foreseeable future for North Park Phacelia as 30 years into the future. We chose this timeframe because it is biologically meaningful by accounting for multiple generations, and the portrayal of divergent future climatic conditions forecast by various climate models. This timeframe also considers the possibility of changes to conservation measures that reduce and regulate potential stressors, such as revision of land management plans, which could occur at least once by any applicable land management agencies during this time frame. Moreover, it is a timeframe during which we can reasonably project both future threats and the North Park Phacelia's potential response.

To assist us in evaluating the status of the North Park Phacelia in the foreseeable future over the next 30 years, we evaluated future conditions for the 11 North Park Phacelia populations under four plausible future climate scenarios (Service 2021, pp. 29–36), as described above. Over the next 30 years, we anticipate a relatively narrow range of future conditions for the North Park Phacelia, with nearly the same level of the 3Rs as current condition under all future scenarios, (Service 2021, pp. 29–36). In three out of four future scenarios, six populations remain in high resiliency, while in future scenario 4, one population goes from high resiliency to moderate resiliency, and one population falls from moderate resiliency to low resiliency.

As indicated in our SSA report, our 30-year future projections of resiliency for the North Park Phacelia remain relatively unchanged. Future GSWD increases under all projections but remain within 1 standard deviation of the historic mean. From an annual perspective, GSWD varies from year to year and can be above or below the historical mean (SSA 2021, Appendix C, pp. 58–62). Annual abundance is likely higher when GSWD is near the historical mean, and lower when GSWD is above the historical mean. As stated above, persistence of the North Park Phacelia seedbank can bridge the gap between favorable years and unfavorable years, including consecutive years of less than favorable conditions. Although scenario 4 indicates lower resiliency in 2 of the populations, only one population falls to a low resiliency category. Given our 30-year future projections of the 3Rs, the North Park Phacelia does not appear to experience increased risk of extinction under the four future scenarios. Therefore, the North Park Phacelia is unlikely to become in danger of extinction within the foreseeable future throughout all of its range.

To summarize, the North Park Phacelia as a species would be likely to withstand plausible stochastic events, catastrophic events, and retain sufficient adaptive capacity to withstand environmental change 30 years into the future. Therefore, after assessing the best available

information, we conclude that the North Park phacelia is not currently in danger of extinction throughout all of its range and is not likely to become so in the foreseeable future.

Evaluation of Status Throughout a Significant Portion of its Range

Having determined that the North Park Phacelia is not in danger of extinction, and is unlikely to become so in the foreseeable future throughout all of its range, we now consider whether the species may be in danger of extinction or likely to become so in the foreseeable future in a significant portion of its range—that is, whether there is any portion of the species' range for which it is true that both (1) the portion is significant; and, (2) the species is in danger of extinction now or likely to become so in the foreseeable future in that portion. We can choose to address either question first; if we reach a negative answer with respect to the first question that we address, we do not need to evaluate the other question for that portion of the species' range.

In undertaking this analysis for the North Park Phacelia, we choose to address the status question first—we consider information pertaining to the geographic distribution of both the species and the threats that the species faces to identify any portions of the range where the North Park Phacelia may be endangered or threatened.

For the North Park Phacelia, we considered whether threats are geographically concentrated in any portion of the species' range at a biologically meaningful scale. As summarized above and documented in our SSA report (Service 2021, pp. 15–20), we evaluated a variety of stressors associated with habitat destruction and modification, human-caused mortality, natural mortality, effects due to genetic health, effects due to climate change, and cumulative effects (Service 2021, pp. 15–20). Overall, we did not identify any concentration of threats across the 11 populations.

We first examined whether there might be a geographic concentration of threats in the California Gulch, Airport, Laramie River-Bull Mountain, Forrester Creek and Battleship-Dwinell Ranch populations, given their lower levels of current resiliency documented in the SSA report. However, we did not detect any specific geographic concentration of threats, since these populations are not geographically concentrated as two of the populations occur in the Laramie River Valley, and the other three occur in Jackson County, Colorado. We also could not identify substantial threats to the species that are concentrated either within North Park or within the Laramie River Valley.

Based on this analysis, we found no concentration of threats in any portion of the North Park Phacelia's range at a biologically meaningful scale. Therefore, no portion of North Park Phacelia can provide a basis for determining that the species is in danger of extinction now or likely to become so in the foreseeable future in a significant portion of its range, and we find that the North Park Phacelia is not in danger of extinction now or likely to become so in the foreseeable future in any significant portion of its range. This is consistent with the courts' holdings in *Desert Survivors v. Department of the Interior*, 336 F.Supp.3d 1131 (N.D. Cal. Aug. 24, 2018) and *Center for Biological Diversity v. Jewell*, 248 F. Supp. 3d 946 (D. Ariz. 2017).

Summary of Evaluation and Recommendation

Our review of the best available scientific and commercial information indicates that the North Park Phacelia does not meet the definition of an endangered species and does not meet the definition of a threatened species in accordance with Section 3(6) and 3(20) of the Act. Therefore, with this 5-year status review, we recommend that the North Park Phacelia be delisted under the Act.

U.S. FISH AND WILDLIFE SERVICE
5-YEAR STATUS REVIEW FOR
North Park phacelia
(*Phacelia formosula*)

CURRENT CLASSIFICATION: Endangered

RECOMMENDATION RESULTING FROM THIS 5-YEAR STATUS REVIEW:

____ Downlist to Threatened
____ Uplist to Endangered
__X_ Delist:
____ Extinction
_X__ Recovery
____ Original data for classification in error
__ No change is needed

REGIONAL OFFICE APPROVAL:

Approved by: ANNA MUNOZ Digitally signed by ANNA MUNOZ Date: 2021.08.30 15:29:43 -06'00' _____ Date: _____

Matthew Hogan
U.S. Fish and Wildlife Service
Acting Regional Director
Interior Regions 5 and 7

Acting

REFERENCES CITED

Ackerfield, J. 2015. Flora of Colorado. PRIT Press. 818 pp.

Atwood, N.D. 2010. Unpublished Progress Report on *Phacelia formosula* in North Park, Jackson County, Colorado and the Scully *Phacelia* in Larimer County, Colorado. Prepared for U.S. Fish and Wildlife Service, Grand Junction, CO. 3 pp.

Colorado Natural Heritage Program. 2015. Element Global Rank Report for Phacelia formosula. 4pp.

Elzinga C. L., D. W. Salzer, and J. W. Willoughby. 1998. Measuring & Monitoring Plant Populations. U.S Bureau of Land Management Papers. 17. 497 pp.

Kemp P. R. (1989). Seed banks and vegetation processes in deserts. In: Leck M. A. (ed). *Ecology of Soil Seed Banks*. Academic Press, San Diego, pp. 257–280.

Osterhout, G. E. 1919. Additions to the Flora of Colorado. Bulletin of the Torrey Botanical Club, Vol. 46, No 2: 53-56.

Riser J. P. III, J. Ramp Neale, M. Deprenger-Levin, J.B. Islam, A.L. Schwabe. 2020 (in prep) Executive Summary of Research Conducted by Denver Botanic Gardens. 11 pp.

Shaffer, M. L., and M. A. Stein. 2000. Safeguarding our precious heritage. Pages 301–321 *in* B. A. Stein, L. S. Kutner, and J. S. Adams, editors. Precious heritage: the status of biodiversity in the United States. Oxford University Press, New York, New York, USA.

Smith, D. R., N. L. Allan, C. P. McGowan, J. A. Szymanski, S. R. Oetker, and H. M. Bell. 2018. Development of a species status assessment process for decisions under the U.S. Endangered Species Act. Journal of Fish and Wildlife Management 9:302–320.

Spackman, S., B. Jennings, J. Coles, C. Dawson, M. Minton, A. Kratz, and C. Spurrier. 1997. Colorado Rare Plant Field Guide. Prepared for the Bureau of Land Management, the U.S. Forest Service, and the U.S. Fish and Wildlife Service by the Colorado Natural Heritage Program.

U.S. Fish and Wildlife Service. 2016. USFWS species status assessment framework. Version 3.4.

U.S. Fish and Wildlife Service. 2021. Species status assessment for the North Park Phacelia (*Phacelia formosula*): A biological report. U.S. Fish and Wildlife Service, Western Colorado Field Office, Grand Junction, CO.

Wolf, S., B. Hartl, C. Carroll, M. C. Neel, and D. N. Greenwald. 2015. Beyond PVA: why recovery under the Endangered Species Act is more than population viability. BioScience 65:200–207.