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| TITLE | NAME | DATE |
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5- Year Review Short Form

Species Reviewed: Kodachrome bladderpod (*Physaria tumulosa*)

Federal Register Notice Announcing Initiation of this Review: May 6, 2014. Endangered and threatened wildlife and plants; 5-year status reviews of nine species in the Mountain Prairie Region (79 FR 25883)

Current Classification: Endangered

Current Recovery Priority Number: 8

This recovery priority ranking is indicative of a full species with a moderate degree of threat and relatively high potential for recovery.

Methodology used to complete this review:

The Utah Ecological Services Field Office completed this review on August 17, 2021. The Utah Ecological Services Field Office used all pertinent literature and documents on file for this review, including new information obtained since the 2009 recovery outline (Service 2009). This includes the following new information: population monitoring data from 2011 to 2014 (Hughes 2011, 2012, 2013, and 2014), survey data (Billings and Wheeler 2019; UNHP 2021); new Bureau of Land Management (BLM) resource management plans for the Grand Staircase-Escalante National Monument (GSENM) (BLM 2020a) and the Kanab-Escalante Planning Area (KEPA) (BLM 2020b); a report detailing seed collection and propagation efforts (Cort 2015); a research proposal for planned research on the species' taxonomy and genetic fitness (Massatti and Winkler 2021); and reports from recent field visits (Switek et al. 2016; Billings and Wheeler 2019; Reisor 2021a, 2021b).

Review Summary:

Taxonomy and Life History

Kodachrome bladderpod (*Physaria tumulosa*) is an herbaceous perennial plant of the mustard family (Brassicaceae) endemic to Kane County, Utah that grows on white and brown-red, sparsely vegetated shale knolls derived from the Winsor member of the Carmel geologic formation (Welsh and Reveal 1977; Van Buren and Harper 2002, Welsh et al. 2008; Service 2009). It grows in dense cushion-like mounds of mainly basal leaves that are narrowly linear, 0.1 to 0.4 inches (in) (2 to 10 millimeters (mm)) long and about 0.05 in (1 mm) wide (Welsh and Reveal 1977). Flowers have spatulate (spoon-shaped), yellow petals that are 0.2 to 0.3 in (5 to 7 mm) long (Welsh and Reveal 1977). Fruits are egg-shaped and are about 0.1 in (3 mm) long and contain 2 to 4 seeds (Welsh and Reveal 1977). Plants flower from late April through May with seeds maturing in June (Welsh and Reveal 1977). The species was originally described as *Lesquerella tumulosa* but was revised to *Physaria* with the rest of the species in the *Lesquerella* genus in 2002 (Al-Shebaz and O'Kane 2002).

Kodachrome bladderpod reproduces sexually but we lack information on its pollinators and breeding system. Based on information for the other members of the *Physaria* genus, Kodachrome bladderpod

likely relies on pollinators for reproduction. Other species of *Physaria* are pollinated by small-to-medium bees, bee flies, and true flies (Edens-Meier et al. 2011; Tepedino et al. 2012; Clark 2013), and numerous pollinators have been observed visiting Kodachrome bladderpod during field visits (Spector 2013). Where it is present, Kodachrome bladderpod occurs in dense patches and is one of the dominant forbs (herbaceous, non-graminoid species) in the habitat. It typically occurs in open patches within the Pinyon pine (*Pinus edulis*) and Utah Juniper (*Juniperus osteosperma*) woodland community and is often associated with the shrub bitterbrush (*Purshia tridentata*) and the forbs yellow cryptantha (*Cryptantha flava*) and California buckwheat (*Eriogonum fasciculatum*) (Van Buren and Harper 2002).

Regulatory History: Listing, Threats, and Protections

We listed Kodachrome bladderpod as an endangered species under the Endangered Species Act, as amended, (Act) on October 6, 1993 (58 FR 52027). The total number of individuals at the time of listing was estimated at 20,000 plants within in a single population (Kodachrome Basin) on Federal, state, and private lands. The threats identified at that time were mineral exploration and development (including an active quarry, mining claims, and potential for oil and gas development), off-highway vehicle (OHV) use, and inadequate regulatory protections since most known individuals were located on non-Federal lands (58 FR 52027). The species' restricted habitat and single population were identified as vulnerabilities that could exacerbate the effects of identified threats and increase the risk of catastrophic loss. We did not designate critical habitat for Kodachrome bladderpod (58 FR 52027).

At the time of listing, the recovery priority number for this species was 11 to indicate a moderate degree of threat and low recovery potential. In 2009, we changed the recovery priority number to 8 to indicate a moderate degree of threat and high recovery potential (Service 2009). The change reflected additional regulatory protections afforded to the species and its habitat from the transfer of non-Federal land ownership to the BLM within the GSENM (Service 2009, BLM 2020a). With the GSENM, new mineral leases or prospecting permits were no longer permissible, and this reduced the threat of mineral exploration and development (BLM 1999). The GSENM area was reduced by 47 percent in 2017 and the lands removed from the monument remain under Federal ownership within the KEPA (BLM 2020a; BLM2020b). All known Kodachrome bladderpod plants occur on Federal land within the boundaries of the GSENM or KEPA (Figure 1). The portion of the Kodachrome Basin population that are on KEPA lands are open to potential mineral development activities (BLM 2020b). All plants within the current GSENM boundaries remain protected from new mineral development activities (BLM 2020a).

Current Population Distribution and Trend

Two new populations (Deer Springs Point and No Man's Mesa) of Kodachrome bladderpod were found south of the original population in the Kodachrome Basin within the GSENM (Figure 1). Previously characterized as Navajo bladderpod (*P. navajoensis*) or varieties of *P. hitchcockii*, they were recently examined and determined to be *Physaria tumulosa* based on flower and seed characteristics (Billings and Wheeler 2019; Massatti and Winkler 2021). Herbarium specimens from No Man's Mesa were reclassified as *P. tumulosa* from *P. navajoensis* (Navajo bladderpod) by Walter Fertig in 2017 and surveys following this reclassification revealed a significant number of additional Kodachrome bladderpod individuals at that location (Billings and Wheeler 2019). Both populations are on slightly different soils characterized by higher red clay content with a darker brown to reddish color rather than the white shale knolls observed at the Kodachrome Basin population (Hughes 2014). A genetic evaluation to confirm the taxonomy of the two populations and evaluate genetic fitness and

genetic exchange between populations is planned for 2022 (Massatti and Winkler 2021). New genetic information about all three populations may allow us to reexamine the status of the species.

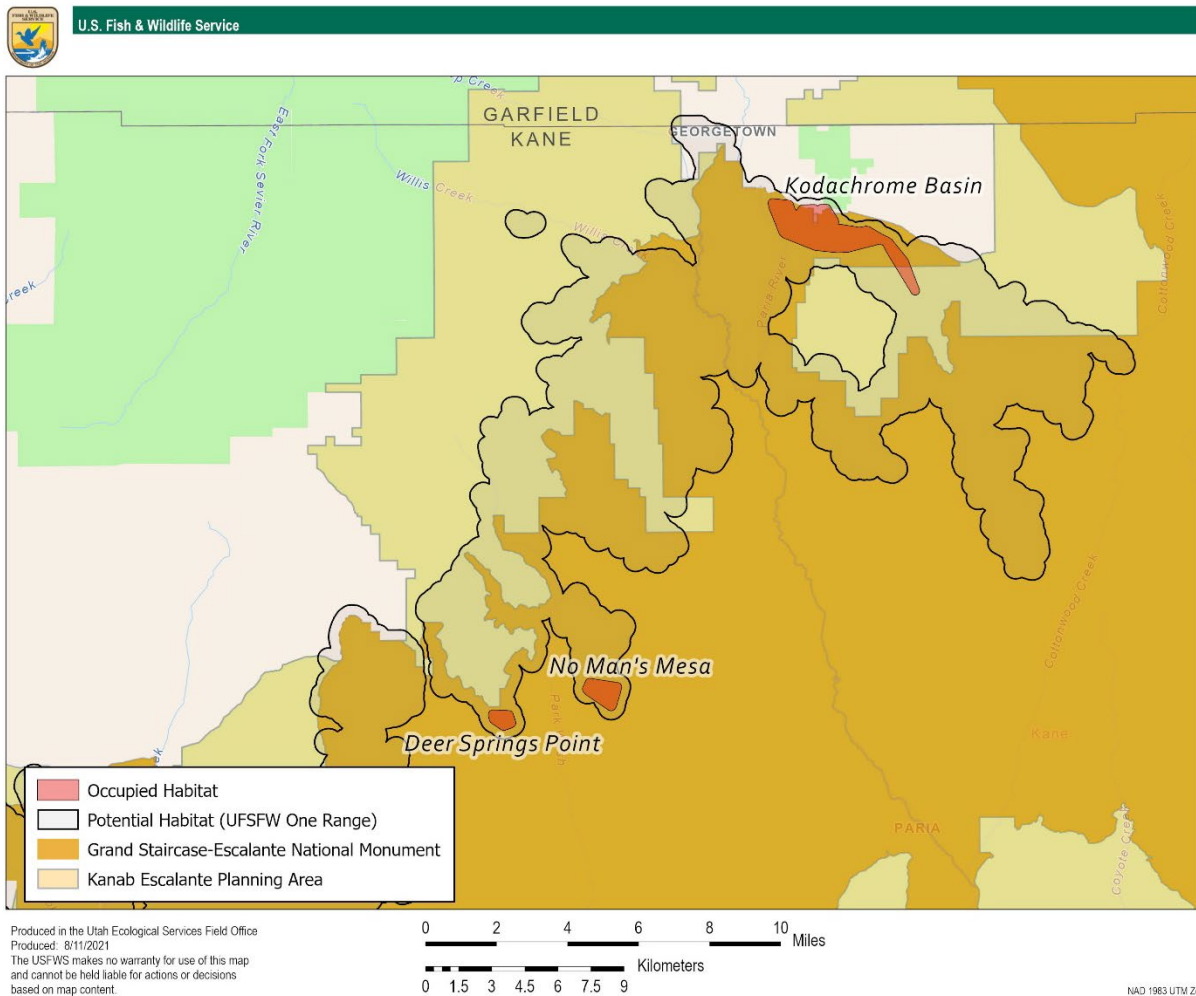


Figure 1. Map showing current GSENM boundaries (dark yellow), KEPA boundaries (light yellow), suitable Kodachrome bladderpod habitat (solid line), and known populations of Kodachrome bladderpod (red).

We estimate the total population comprising the three populations to be 45,000 individuals, approximately 25,000 more plants than we reported at the time of listing (Billings and Wheeler 2019; UNHP 2021). The Kodachrome Basin population is the largest of the three populations and contains approximately 75 percent of the total population (Table 1).

Table 1. Summary of known Kodachrome bladderpod populations.

| Population Name | Most recent survey | Estimated population size | Percent of total population |
|--------------------|--------------------|---------------------------|-----------------------------|
| Kodachrome Basin | 2017 | 30,000 – 40,000 | 75 |
| No Man's Mesa | 2017 | 10,000 | 16 |
| Deer Springs Point | 2016 | 5,000 | 9 |
| Total | | 45,000 – 55,000 | 100 |

A standardized monitoring protocol for Kodachrome bladderpod has not been developed and therefore long-term population trend information for these populations is not available. Monitoring efforts have been intermittent at the Kodachrome Basin population since listing and no monitoring has been performed at the two new populations after the initial censuses in 2016 and 2017. High adult mortality was observed between 1997 and 2001 at Kodachrome Basin, but it was unknown whether this reflected the species' natural lifespan or the effect of some external influence (Van Buren and Harper 2002). Population trends at the Kodachrome Basin population were somewhat stable between 2008 to 2013 (Hughes 2011; Hughes 2012; Hughes 2013; Hughes 2014). Monitoring of the Kodachrome Basin population is expected to resume in 2022 and no monitoring plans are in place for the other two populations (R. Brinkerhoff, pers. comm. 2021).

Seeds were collected from the Kodachrome Basin population in 2012, 2013, and 2014 for long-term *ex-situ* seed bank storage and propagation trials (Reisor 2012, 2013; Cort 2015). In preliminary propagation trials, an average 94 percent germination rate was achieved for seeds treated with a plant growth hormone (gibberellic acid) (Cort 2015). Propagated plants may require specialized care to successfully establish in wild populations. No further seed collections or propagation trials have been completed since 2015.

Current Threats

Since listing, the threats of mineral development and inadequate regulatory protections have been reduced under Federal ownership, though there is some potential for future mineral development in the Kodachrome Basin population on KEPA lands (BLM 2020b). Unauthorized OHV use remains a persistent threat to the Kodachrome Basin population. Damage to plants in visible vehicle tracks and damage to the biotic crusts and delicate soils in the habitat from unauthorized OHV use have been observed regularly for many years in the Kodachrome Basin population (Hughes 2012, 2013, 2014, 2016; Reisor 2021b). A frequent access area at the Kodachrome Basin population was partially fenced to prevent OHV use in 2000 and the fence was successful in reducing OHV access. Another portion of the Kodachrome Basin population is adjacent to a BLM-managed campsite and a cattle corral. There is no fencing and vehicle tracks and campfire rings have been observed beyond the signage installed to discourage vehicle use and camping in the habitat (Hughes 2011, 2012, 2013, 2014; Switek 2016; Reisor 2021b). We lack monitoring information on the effects of livestock use and recreation at this location. For both locations, additional fencing, maintaining existing fencing, or installing more substantial barriers (i.e., large boulders) may help deter unauthorized OHV use and other unintentional habitat damage. The populations at Deer Springs Point and No Man's Mesa are more difficult to access and closer to the edge of a cliff, and therefore are not currently as affected by recreational uses as the Kodachrome Basin population.

Climate change and drought were not identified as threats to the species at the time of listing. As a desert-adapted species in an environment characterized by drought cycles, we expect the species is well adapted to naturally occurring droughts. However, an increase in periodic prolonged droughts due to climate change beyond the naturally occurring drought cycles may reduce the resilience and redundancy of Kodachrome bladderpod (Gonzalez et al. 2018). While the potential effects of these changes to the species could be serious, they have not been evaluated. We recommend an evaluation of potential effects from climate change and drought on the species.

Recommendations on species status:

After reviewing the best available scientific information and recovery status, we conclude that Kodachrome bladderpod remains an endangered species. OHV use and recreation activities remain a persistent threat to this species, particularly at the Kodachrome Basin population. These threats have not been explicitly evaluated at the populations at Deer Springs Point and No Man’s Mesa. The current GSENM boundary may allow for mineral exploration and development within a portion of the Kodachrome Basin population. We will review the effect to the species of any future changes to the GSENM boundary. Baseline information regarding the species’ biology, including its life history, reproductive strategies, genetic stability, and long-term population trends are still unknown. Evaluation of climate change and drought on the persistence of the species has not been evaluated and remains unknown. Recovery planning, including the creation of recovery criteria for downlisting and delisting, is in progress. Therefore, we recommend no change in status for Kodachrome bladderpod at this time. If genetic information confirms the identification of the two new populations of Kodachrome bladderpod, we recommend re-evaluating the species to determine if a status change is warranted.

Recommended future actions:

Based on recent discussions with Federal agencies and conservation partners, we recommend the following future actions to support the recovery of the species: (1) use genetic information to confirm the identification of the two new populations as Kodachrome bladderpod and evaluate the species’ genetic fitness; (2) complete a final recovery plan for the species; (3) protect recovery populations and suitable habitat on Federal lands and, to the extent possible, on non-Federal lands; (4) continue systematic surveys of potential habitat for additional populations; (5) improve the protections for the Kodachrome Basin population against the effects of the nearby corral, campsite, and OHV use; (6) develop and implement standardized range-wide, long-term monitoring procedures for the species with special procedures for monitoring the species’ response to severe and prolonged droughts; (7) evaluate the effect of climate change and drought on the species, including a resurvey of the known populations in 2022 after the severe drought in 2021; (8) establish a set of need-based research priorities into the species’ biology and life history aimed at minimizing threats and supporting recovery; (9) implement *ex-situ* seed collection and preservation according to established protocols developed by the Center for Plant Conservation; (10) communicate with partners, stakeholders, and recreationists regarding the species’ recovery needs and progress; and (11) develop strong habitat protections for energy and/or mineral development on KEPA lands.

Approve: _____

Date: _____

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