Recovery Plan for the Swale Paintbrush
(*Castilleja ornata*)

[Photo Credit: Daniela Roth]

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PURPOSE AND DISCLAIMER

This document presents the U.S. Fish and Wildlife Service (USFWS) plan for the conservation of Swale Paintbrush. The recovery plan is the second part of the USFWS 3-part recovery planning framework and includes the statutorily required elements pursuant to section 4 of the Endangered Species Act (ESA). This recovery plan is informed by the first part of the framework, a Species Status Assessment (SSA). The SSA report delivers foundational science for informing decisions related to the ESA and includes an analysis of the best available scientific and commercial information regarding a species' life history, biology, and current and future conditions that characterize the species' viability (i.e., ability to sustain populations in the wild over time) and extinction risk. We will also prepare a Recovery Implementation Strategy (RIS), the third part of the framework. The RIS is an easily updateable operational plan that is separate and complimentary to the recovery plan and that details the on-the-ground recovery activities needed to complete the recovery actions contained in the recovery plan.

Recovery plans describe the envisioned recovered state for a listed species (when it should no longer meet the ESA definitions of a threatened species or endangered species) and include a recovery strategy, recovery criteria, recovery actions, and the estimates of time and cost needed to achieve it. Plans are published by USFWS and are often prepared with the assistance of recovery teams, contractors, State agencies, and others. Recovery plans do not necessarily represent the views, official positions, or approval of any individuals or agencies involved in plan formulation, other than USFWS. They represent the official position of the USFWS only after they have been signed by the Regional Director as approved. Recovery plans are guiding and planning documents only; identification of an action to be implemented by any public or private party does not create a legal obligation beyond existing legal requirements. Nothing in this plan should be construed as a commitment or requirement that any Federal agency obligate or pay funds in any one fiscal year in excess of appropriations made by Congress for that fiscal year in contravention of the Anti-Deficiency Act, 31 U.S.C. 1341, or any other law or regulation. Approved recovery plans are subject to modification as dictated by new findings, changes in species status, and completion of recovery actions.

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RECOMMENDED CITATION AND ELECTRONIC AVAILABILITY

U.S. Fish and Wildlife Service. 2026. Recovery plan for Swale Paintbrush (*Castilleja ornata*). U.S. Fish and Wildlife Service, Southwest Region, Albuquerque, New Mexico, USA. 30 pp.

An electronic copy of this Final Recovery Plan will be made available on the Swale Paintbrush ECOS webpage.

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1. INTRODUCTION

Swale Paintbrush (*Castilleja ornata*) is a rare annual flowering plant known from a single extant population system in Hidalgo County, New Mexico. On January 6, 2025, the U.S. Fish and Wildlife Service (USFWS or Service) listed the species as endangered under the Endangered Species Act (ESA) and found that designating critical habitat was not prudent (December 5, 2024; 89 FR 96602).

Swale Paintbrush is assigned a recovery priority number of 5C, indicating a species that faces a high degree of threat, has low recovery potential, and is in conflict with potential construction or other development projects or other forms of economic activity (48 FR 43098). Its degree of threat is high due to exposure to risks from stressors. Its recovery potential is low because of low control over, and high uncertainty about, threats. Risk exposure is high and our capacity to manage threats is low; too, the species may be at immediate risk from border wall construction activities. We finalized a recovery outline on December 11, 2024 to guide recovery efforts and inform consultation and permitting activities until a comprehensive recovery plan for the species is approved (Service 2024, entire).

This recovery plan describes criteria for determining when the Swale Paintbrush should be considered for downlisting or delisting, lists site-specific actions that will be necessary to meet those criteria, and estimates the time and cost to achieve recovery. Additionally, brief summaries of information on the species' life history, habitat, needs, status, and threats are included, along with a brief discussion of factors limiting its populations. A detailed discussion of these and other topics pertinent to the recovery of Swale Paintbrush can be found in the current Species Status Assessment (SSA). Detailed on-the-ground activities, implementing recovery actions, can be found in the Recovery Implementation Strategy. These supplemental documents are available at Swale Paintbrush's species profile. The Recovery Implementation Strategy (RIS) and SSA are finalized separately from the Recovery Plan and will be updated on a routine basis.

Life History

Swale Paintbrush individuals have one to several erect stems that stand 20–50 centimeters (7.9–19.7 inches) in height. Plants have oblong leaves with strongly wavy leaf margins, and floral bracts are typically off-white to very pale yellow (New Mexico Rare Plant Technical Council (NMRPTC) 1999, unpaginated), although orange and reddish phases of the plant have been observed. In some plants, the bracts turn dull reddish with age. Across the range, aspects of the Swale Paintbrush's life cycle seem timed to monsoon season precipitation patterns. Plants germinate between April and June, flower between late-May and late-August (coincident with monsoonal rainfall), and set seed in late August through October (NMRPTC 1999, unpaginated). The longevity of Swale Paintbrush in the seedbank is unknown; however, the longevity of surrogate *Castilleja* species is up to five years in storage and two years in the wild (Service 2023, pp. 22–24).

Species within the genus *Castilleja* are root hemiparasites, meaning that plant vigor depends on exploitation of host plants for carbon, nitrogen, and other nutrients (Heckard 1962, p. 29).

Castilleja plants begin to establish connections with host plant roots (via structures called haustoria) as juveniles (Heckard 1962, p. 28). For the Swale Paintbrush, alkali sacaton (*Sporobolus airoides*) and blue grama (*Bouteloua gracilis*) are thought to be the primary host plants within the Animas Valley populations.

Habitat

Swale Paintbrush is native to the grasslands of Hidalgo County, New Mexico in the United States and to the eastern Sierra Madre Occidental in Chihuahua and Durango, Mexico. Within these grasslands, Swale Paintbrush inhabits swales—seasonally moist, loamy depressions that receive runoff from nearby areas. While Swale Paintbrush is known from grassland communities, little is known about the range of vegetative communities in which it may occur. It has been recorded in grasslands and savannahs in high-elevation basins and valleys above 4,000 feet (1,500 meters). Swale Paintbrush is known from elevations ranging from approximately 4,920 to 7,550 feet (1,500 to 2,300 meters), and there is an unverified report of Swale Paintbrush from approximately 4,160 feet (1,270 meters).

Species Needs

The individual, population-level, and species-level needs of the Swale Paintbrush are summarized in tables 1-1 through 1-3, below. For additional information, please see the SSA report (Service 2023, chapter 2).

Table 1. Individual-level requisites for germination, establishment, growth, and reproductive success.

Life Stage	Requirements	Description
Seeds—germination	Suitable abiotic conditions	• Winter temperatures below 2 degrees Celsius (36 degrees Fahrenheit) for cold stratification. • Suitable warmth, light, and soil moisture for germination of seeds; cool season precipitation supports germination soil moisture. • Minimal to no nonnative vegetation that outcompetes Swale Paintbrush for soil nutrients, light, and water resources.
Seedlings and Vegetative Plants—establishment and growth	Suitable biotic and abiotic conditions	• Adequate monsoonal rainfall June through August, the critical rainfall period for Swale Paintbrush, for growth and establishment. • Proximity of surrounding plants, likely alkali sacaton (*Sporobolus airoides*) and/or blue grama (*Bouteloua gracilis*), for increased water and nutrient uptake via parasitic haustoria. • Lack of herbivory and trampling throughout germination, establishment, and growth periods. • Minimal to no nonnative vegetation that outcompetes Swale Paintbrush or its host species for soil nutrients, light, and water resources.
Flowering Plants—reproduction	Pollination	• Presence of suitable pollinators during the flowering season (June to September). • Lack of herbivory or trampling through flower production (June to September) and seed set (July to October). • Minimal to no nonnative vegetation that outcompetes Swale Paintbrush, its host species, or pollinator forage and pollinator host plants for soil nutrients, light, and water resources.

Table 2. Population-level requisites for resilient populations of Swale Paintbrush. λ = lambda, or population growth rate, and N = census population size.

Resiliency Type	Requirements	Detail
Demographic	Population growth rate (λ)	• The long-term λ needs to be high enough to rebound from periodic population crashes, i.e., on average λ > 1.0.
	Population size (N)	• Sufficiently large N to withstand periodic stochastic events and population crashes. • The N required may vary geographically across populations.
Habitat	Precipitation	• Adequate quantity and timing of cool season rainfall to allow for germination and establishment. • Adequate quantity and timing of monsoonal rainfall during the critical rainfall period of Swale Paintbrush (June through August) to allow for germination, establishment, growth, survival, and reproduction.
	Habitat	• Presence of host species, such as alkali sacaton, for hemiparasitic relationships and increased uptake of water and nutrients. • Minimal to no nonnative vegetation that outcompetes Swale Paintbrush, its host species, or pollinator forage and pollinator host plants for soil nutrients, light, and water resources. • Absence of persistent chemical contaminants that interfere with Swale Paintbrush's, host species', or pollinator species' physiological functionality. • Limited levels of herbivory across all life stages. • Natural processes, such as hydrological cycles and periodic disturbances, that maintain grassland integrity (such as natural fire return intervals of low intensity; seasonally appropriate fires that maintain canopy gaps, enhance grass and forb growth, and prevent colonization by woody species).
	Pollination	• Presence of suitable pollinator(s). • Sufficient soil moisture and nutrients for production of flowers and nectar resources. • An abundance and diversity of native flowering plants within the habitat to attract pollinators and maintain genetic connectivity between Swale Paintbrush patches.

Table 1. Species-level requisites for long-term viability (ability to maintain self-sustaining populations in the wild over a biologically meaningful timeline).

3 Rs	Species-Level Requisites	Description
Resiliency	Self-sustaining populations across the species' range	Self-sustaining populations are demographically, genetically, and physiologically robust; have sufficient quantity of high-quality habitat; and are free of, or have manageable, threats.
Redundancy	Sufficient distribution of populations to spread risk	Sufficient distribution to guard against catastrophic events wiping out portions of the species' adaptive diversity and the species as a whole (i.e., to reduce covariance among populations); populations spread out geographically but also ecologically (different ecological settings).
	Potential for demographic and/or genetic rescue	Adequate connectivity to conserve the potential for genetic and/or demographic rescue in the event of local declines or extirpations.
Representation	Maintain adaptive diversity of the species	Populations maintained across spatial and environmental gradients to maintain ecological and genetic diversity.
	Maintain evolutionary processes	Maintain the evolutionary drivers of adaptation (gene flow, natural selection, genetic drift).

Current Condition

Swale Paintbrush's distribution has declined from historical conditions. Swale Paintbrush was historically documented from 13 sites: 2 sites in the Animas Valley of Hidalgo County, New Mexico, and 11 sites in the eastern Sierra Madre Occidental of Chihuahua and northern Durango in Mexico (Figure 1-1). The Swale Paintbrush was first observed from a site in Chihuahua, Mexico, in 1887, and was discovered in New Mexico in 1993 (Service 2023, pp. 6–11). The Swale Paintbrush was last observed in Mexico in 1985, and in New Mexico in 2021.

Of the 13 historical sites, only 1 site—the Gray Ranch site within the Animas Valley of Hidalgo County, New Mexico—is recently confirmed as extant. Swale Paintbrush plants were last observed at the Gray Ranch site in September of 2021, with a minimum abundance of 6,000 plants distributed across 11 hectares (28 acres) of habitat. 2021 was the last year that the Gray Ranch site was accessible for surveys, so the current status of the site is unknown. The Gray Ranch site was considered to have moderate to high resiliency in 2023—based on the most recent abundance estimate exceeding the minimum viable population size and habitat conditions of the Animas Valley being generally favorable. However, habitat resiliency and, hence, population abundance is temporary in the absence of natural processes and/or management activities that conserve grassland integrity. Further, the small area that the species is known to occupy puts it at high risk of extirpation due to catastrophic events.

The current status of Swale Paintbrush at the 12 other historical sites is unknown. Based on the presence of potentially suitable habitat in the vicinity of historical collection sites, we ranked four of those sites as “possibly extant,” six of those sites as “possibly extirpated,” and the remaining two sites as “presumed extirpated” (Service 2023, p. 38). Although potentially suitable habitat may remain at some of the historical sites, the size and abundance (i.e., resiliency) of the historical sites is unknown, and we do not have information that these sites are extant, resilient, stable, or otherwise able to contribute to the viability of the species.

In addition to historically documented sites, a potential new site in Parque Nacional Cumbres de Majalca (Cumbres de Majalca National Park) near Chihuahua, Chihuahua was observed, via iNaturalist, in September 2022 (iNaturalist Contributors and iNaturalist 2026, observation 133626987). The observation consists of a single image of a single plant. No voucher specimen, by which to confirm identification, has been collected, but experts are reasonably confident that the plant is an orange color morph of Swale Paintbrush. No further information about this Cumbres de Majalca National Park occurrence has become available, despite inquiries, so the status of this site is also unknown. Because there is no voucher specimen for this site, we ranked this site as “unverified.”

Overall, the Swale Paintbrush has limited viability due to its limited resiliency, lack of (or limited, depending on the identity and status of the Cumbres de Majalca occurrence) redundancy, and limited representation at the species level. The species is currently known to occur at a single site at the northern periphery of its known historical range and is vulnerable to the impacts of catastrophic events. Given its limited distribution, the species likely reflects only a small portion of its historical genetic and ecological diversity; thus, the Swale Paintbrush has limited capacity to adapt to long-term environmental changes (that is, limited representation). Even if the Swale Paintbrush is extant at sites outside of the Gray Ranch, the majority of these potentially extant historical sites are isolated, and, therefore, there is limited potential for interpopulation rescue in the event of local extirpations.

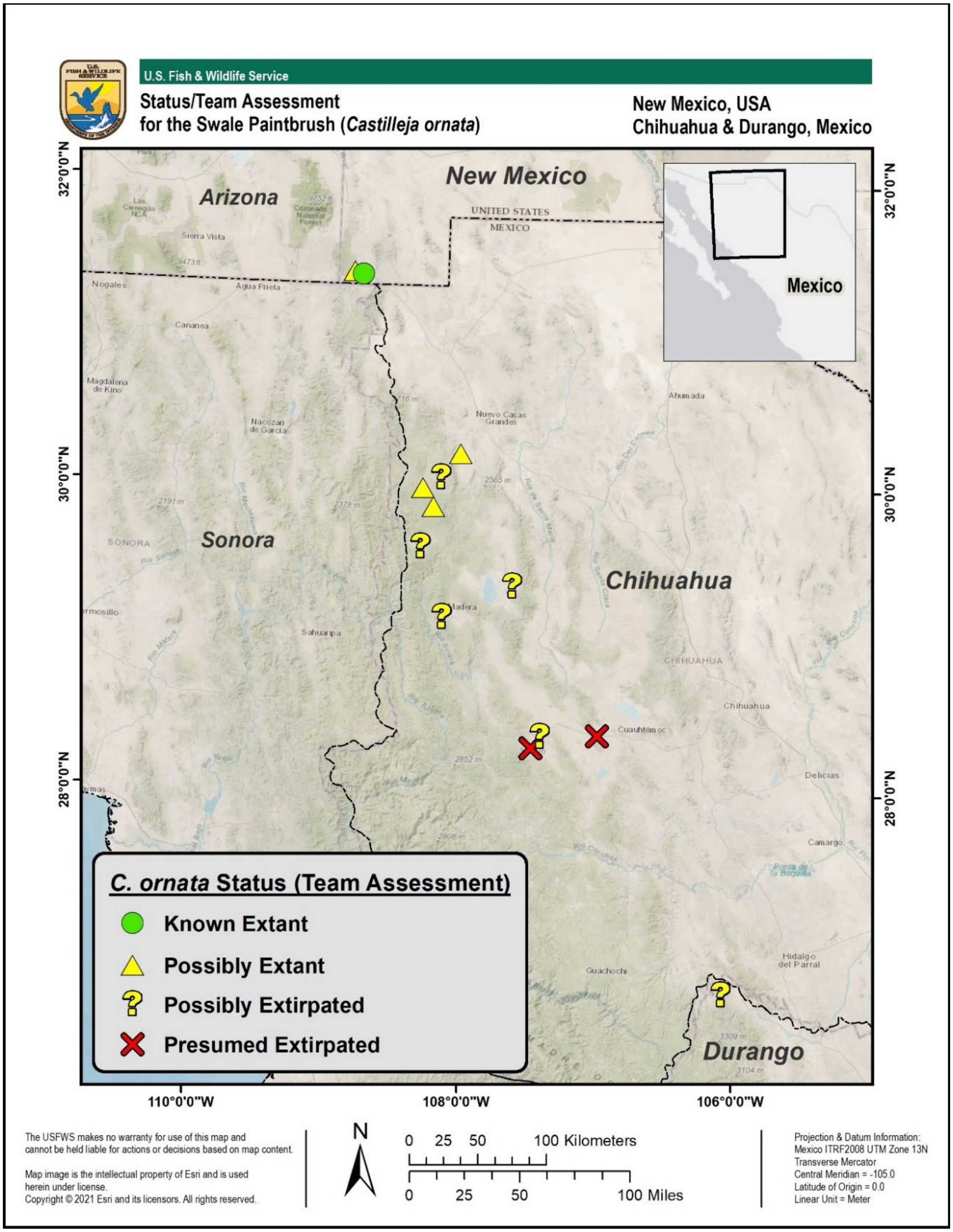

Figure 1. Occurrence of historical Swale Paintbrush locations based on herbaria specimens (N = 13). Symbol color and shape corresponds to the SSA Team's determination of Swale Paintbrush's ability to persist in the wild based on our disturbance and protected areas analysis.

New Mexico

1. Cowan Ranch Site: ***Possibly extant***. Swale Paintbrush was initially collected from, and last documented at, this site in 1993. Abundance of the species at this site was not noted.
2. Gray Ranch Site: ***Known extant***. Swale Paintbrush was initially collected from this site in 1993 and last documented at this site in 2021. In 2021, abundance of the species at this site was estimated as greater than 6,028 plants.

Chihuahua, Mexico

3. Nelson 6073: ***Possibly extant***. Swale Paintbrush was initially collected from, and last documented at, this site in 1903. Abundance of the species at this site was not noted.
4. Jones s.n.a. (9/16/1903) Site: ***Possibly extirpated***. Swale Paintbrush was initially collected from, and last documented at, this site in 1993. Abundance of the species at this site was not noted.
5. Keil 13388 Site: ***Possibly extant***. Swale Paintbrush was initially collected from, and last documented at, this site in 1979. Abundance of the species at this site was noted as "occasional."
6. Jones s.n.b (9/18/1903) Site: ***Possibly extant***. Swale Paintbrush was initially collected from, and last documented at, this site in 1903. Abundance of the species at this site was not noted.
7. LeSueur 899 Site: ***Possibly extirpated***. Swale Paintbrush was initially collected from, and last documented at, this site in 1936. Abundance of the species at this site was not noted.
8. Duek and Martin s.n. Site: ***Possibly extirpated***. Swale Paintbrush was initially collected from, and last documented at, this site in 1985. Abundance of the species at this site was not noted.
9. Palmer 320 Site: ***Possibly extirpated***. Swale Paintbrush was initially collected from, and last documented at, this site in 1908. Abundance of the species at this site was noted as "few plants."
10. Pérez Recoder 133626987 Site: ***Unverified***. Swale Paintbrush was initially observed at this site in 2022. No voucher specimen of the occurrence is documented. Abundance of the species at this site was not noted.
11. Straw and Forman 1846 Site: ***Possibly extirpated***. Swale Paintbrush was initially collected from, and last documented at, this site in 1960. Abundance of the species at this site was not noted.
12. Pringle 1545 Site: ***Presumed extirpated***. Swale Paintbrush was initially collected from, and last documented at, this site in 1887. Abundance of the species at this site was not noted.
13. Ellis, LeDoux, and Watkins 967 Site: ***Presumed extirpated***. Swale Paintbrush was initially collected from, and last documented at, this site in 1975. Abundance of the species at this site was not noted.

Durango, Mexico

14. Reveal, Hess, and Kiger 2752 Site: ***Possibly extirpated***. Swale Paintbrush was initially collected from, and last documented at, this site in 1971. Abundance of the species at this site was not noted.

Threats Analysis

The Swale Paintbrush has several limiting traits that make it vulnerable to extinction: short life span, reliance on a short-lived seedbank, a winter seed chilling requirement (to overcome seed dormancy), dependence on host species (*Castilleja* taxa are hemiparasites that exploit the roots of host plants for nutrients), specific habitat requirements (seasonally inundated areas within semi-arid, relatively high-elevation native grasslands), and specific habitat and grassland canopy gap maintenance requirements (such as seasonally appropriate fire, grazing or herbivory, drought, and/or inundation). While Swale Paintbrush's annual duration makes it heavily reliant on its seedbank for persistence, seed longevity in the soil seedbank could be as low as two years. Therefore, frequent replenishment of seedbanks is essential to population persistence. However, without adequate winter seed chilling, adequate growing season soil moisture, adequate grassland canopy gaps, suitable host species, and effective pollination, plants are unlikely to germinate, establish, and reproduce. For example, in 2017 (an unfavorable year), only two individuals were found during a survey of the only known extant population. Additionally, reproductive effort in a year with favorable conditions may be thwarted by competition; trampling; seasonally incompatible mowing, flooding, or fire; herbivory/granivory; and/or unsustainable seed harvest (such as from illegal collection).

Because drought is becoming a more intense, frequent, and enduring phenomenon and because desert grassland swales are vulnerable to conversion to agriculture, intensive grazing, water diversions, exotic plant introduction, shrub encroachment, and other changes in vegetative composition and cover, Swale Paintbrush's habitat is vulnerable to degradation and loss. Throughout Swale Paintbrush's historic range, there are few, if any, higher elevation basins and valleys that could serve as climate refugia for Swale Paintbrush as temperatures increase. Further, its grassland habitat is vulnerable to ecological conversion, especially under drought conditions. Prehistoric fire return intervals in Madrean grasslands range from 2.5 to 10 years, and grasslands are likely to convert to shrublands or woodlands when fire return intervals exceed 10 years (Kaib et al. 1996, pp. 253, 260, Swetnam and Baisan 1996, pp. 23, 25, Brown and Archer 1999, pp. 2393–2394, Poulos et al. 2013, pp. 3–4, NatureServe 2022, unpaginated). In the absence of appropriate fire return intervals, Swale Paintbrush is reliant on active management to prevent ecosystem conversion and maintain grassland canopy gaps. In New Mexico, woody plant invasion is typically managed via large-scale aerial herbicide treatments, which could have adverse, potentially catastrophic, consequences for Swale Paintbrush and its pollinators. In Mexico, many, if not all, Swale Paintbrush populations are presumed lost to conversion to agriculture, intensive grazing, and/or water diversions.

Currently, the primary risk factors influencing Swale Paintbrush viability are small population size; lack of redundancy; potentially limited adaptive capacity; climate change impacts (i.e., drought and increased cool season temperatures); niche competition; ecological conversion; habitat degradation, fragmentation, and loss; and the cumulative effects of multiple stressors. Foreseeable sources of habitat degradation, fragmentation, and loss include border wall construction and associated access roads, staging areas, and border surveillance activities. Additionally, illegal collection—which would have compounding impacts on the species' viability—has potential to become an emerging risk. These risk factors are described in detail in the SSA (Service 2023, chapter 3).

2. RECOVERY STRATEGY

The recovery strategy provides a concise overview of the envisioned recovered state for Swale Paintbrush, describes USFWS's chosen approach to achieve it, and includes the rationale for why the approach was chosen. Specifically, the recovery strategy articulates how the plan's statutory elements (recovery criteria, recovery actions, and estimates of time and cost) will work together to achieve Swale Paintbrush recovery.

To ensure that Swale Paintbrush is capable of sustaining populations in the wild over time, the overall recovery strategy for the species is to improve resiliency, redundancy, and representation (the "3 Rs") across, and/or beyond, its range, such that the species can persist through plausible stochastic and catastrophic events and adapt to projected changes in environmental conditions. See the most current SSA for a detailed discussion of the 3 Rs.

Resiliency, redundancy, and representation would be improved by 1) conservation and/or enhancement of existing populations and the habitat areas and natural processes that support those populations, 2) conservation of representative Swale Paintbrush germplasm in ex-situ conservation facilities, 3) conservation of ecologically appropriate areas that Swale Paintbrush could occupy in the future, and 4) reintroduction of genetically appropriate Swale Paintbrush germplasm into (or discovery of Swale Paintbrush in) ecologically appropriate sites within historically occupied areas and/or the introduction of Swale Paintbrush into (or discovery of Swale Paintbrush in) additional ecologically appropriate sites. Additionally, the recovery approach includes improving knowledge about threats, risk factors, and tipping points (thresholds beyond which significant and often irreversible changes take place). The geographic scope of this strategy includes the U.S. states of New Mexico and Arizona and the Mexican states of Chihuahua, Durango, and Sonora.

Swale Paintbrush's recovery criteria include objectives for demographic resiliency, habitat resiliency, redundancy, representation, in-situ risk management, and ex-situ risk management. This recovery approach is aligned with achieving these objectives by ensuring that Swale Paintbrush's individual-, population-, and species-level needs (see "Species Needs," above) are met and that threats, or risks from threats, are sufficiently mitigated to ensure a high probability of persistence in the wild within the foreseeable future. Since environmental changes are relatively unmanageable, this includes ensuring that Swale Paintbrush has adequate adaptive capacity (representation) and available suitable habitat to "persist in place" or "shift in space" in response to environmental change (Thurman et al. 2020, entire).

The types of recovery actions needed to achieve the recovery criteria include education and outreach, conservation plans and agreements, habitat maintenance and/or enhancement treatments, monitoring, contingency plans, seed collection and collection storage and curation, population augmentation/reintroduction/introduction/discovery, and research. Temporally, recovery actions should be prioritized based on the immediacy and intensity of adverse consequences to the species that would result if the action was delayed or not taken (see "Recovery Actions," below). Implementation of this strategy and its associated recovery actions will involve working with local, County, State, and Federal agencies, Tribes, private landowners, and local communities and businesses in the U.S. and Mexico to establish and maintain ex-situ seed collections, discover new populations, mitigate risks from threats, monitor and maintain or enhance known populations, conserve strategic future habitat areas, establish additional populations, and otherwise overcome challenges and resolve information gaps.

Key uncertainties to resolve to support recovery planning and implementation include the Swale Paintbrush's extant range; range-wide habitat diversity; essential habitat features and habitat maintenance requirements; suitable host species; physiological requirements and thresholds in terms of temperatures, soil moisture, soil texture, and soil composition; seed dormancy; germination requirements; germination timing; seed longevity in storage and in the soil; response to different types, intensities, durations, and frequencies of disturbance and drought; self-compatibility; effective pollinators and their foraging distances; and seed dispersal distances. Additionally, current challenges to overcome include a limited capacity to evaluate the status of known extant and historically occupied occurrences, a limited capacity to manage stressors, and, potentially, a low species' capacity to adapt to changing conditions. As these and other uncertainties and challenges are resolved, we may adaptively refine our understanding of threats, risks, goals, objectives, recovery actions, and recovery action priorities, as appropriate. Additionally, the RIS and/or the SSA for the species may be updated as additional information becomes available about the species' biology, threats, and success of recovery activities. Monitoring is essential to evaluating and improving the efficacy of the recovery strategy, criteria, actions, and implementation strategy.

3. RECOVERY CRITERIA

Recovery criteria are statutorily required objective, measurable descriptions of a recovered state for Swale Paintbrush, as described in section 4 of the ESA. Recovery criteria describe the conditions of resiliency, redundancy, representation, and threat abatement that indicate when Swale Paintbrush may no longer meet the ESA definitions of an endangered species or threatened species. Recovery criteria present our best understanding of a species' recovered condition at the time of recovery plan development. Changes in available information, technologies, and our understanding of the species over time might mean that the recovered state envisioned by the recovery criteria differs from our assessment in a later status determination.

Downlisting Criteria

The following downlisting criteria, when met collectively, would indicate that Swale Paintbrush may be reclassified as a threatened species.

Downlisting Criterion 1 (Moderate Redundancy):

1. There are a total of four demographically resilient populations (see Criterion 2) within or among the states of Durango, Chihuahua, Sonora, New Mexico, and/or Arizona that are sufficiently geographically and ecologically distributed to minimize simultaneous adverse responses to stressors and, thereby, risks of range-wide impacts from plausible catastrophic events (such as landscape-scale herbicide treatments, prolonged regional drought, seasonally incompatible wildfires or flooding, utility-scale energy development, etc.).

Rationale for Criterion 1

Swale Paintbrush's species needs include sufficient distribution of populations to spread risk. In particular, this means sufficient distribution of resilient populations to guard against catastrophic events wiping out portions of the species' adaptive diversity and the species as a whole. We consider a species with at least four resilient populations, spread out geographically and ecologically (containing different ecological settings within or amongst resilient populations), to have moderate redundancy. Under a 100-year catastrophe cycle, this threshold represents the minimum population redundancy needed to attain a moderate (greater than 80%) probability of persistence of at least 1 population over the next 100 years (Ruckelshaus et al. 2003, p. 313, Brouwer 2020, unpaginated). Additionally, four populations are needed to moderately represent an outcrossing plant species' genetic diversity, or at least 60% of all alleles and 80% of common alleles (Neel and Cummings 2003, p. 224).

Downlisting Criterion 2 (Demographic Resiliency):

2. Resilient populations* exceed 5,000 flowering individuals and consist of at least 4 patches** in at least one of each set of consecutive seed longevity years*** for the duration of at least three drought cycles. Additionally, resilient populations have an average population growth rate greater than 1.00 over the duration of at least three drought cycles. **Populations are defined as patches of Swale Paintbrush plants within 3 kilometers (1.86 miles) of the next nearest patch.* ***Patches are defined as groups of Swale Paintbrush individuals separated by greater than 20 meters (33 feet) between next nearest individuals.**** Use of consecutive seed longevity years ensures that there is at least one year within the lifespan of a seed in which the soil seed bank is significantly replenished. If seed longevity is 2 years, such as for surrogate species, this means in each set of two consecutive years. If Swale Paintbrush seed longevity is determined to be, e.g., six years, this would mean in each set of six consecutive years.

Rationale for Criterion 2

Swale Paintbrush species needs include self-sustaining populations across the species' range, where self-sustaining populations are demographically, genetically, and physiologically robust. Population abundance (in terms of number of mature individuals) and population abundance trend, combined, have been found to be highly predictive of extirpation risk, with smaller population sizes and/or decreasing population abundance trends increasing extirpation risk (O'Grady et al. 2004, p. 516). Additionally, Swale Paintbrush populations need sufficient patch sizes to attract pollinators, minimize inbreeding, and remain physiologically robust (Kaye and Lawrence 2003, pp. 8–12), as well as a sufficient number of patches to conserve within-population genetic diversity and withstand adverse stochastic events (such as growing season fire, mowing, or herbivore damage to a patch).

Adequate abundance enables populations to maintain genetic diversity (capacity to minimize expression of deleterious alleles and to adapt to changing conditions and emerging stressors) and to survive and recover from adverse events (such as severe storms) or prolonged adverse conditions (such as drought). We based our thresholds for this metric on evolutionary minimum viable population size estimates (MVPs). Evolutionary MVPs are based on the effective or census adult population size needed to maintain evolutionary potential, or "to balance the loss of quantitative genetic variation with the gain from mutation," in perpetuity (Traill et al. 2007, pp. 2–3, Honnay 2008, pp. 114–117, Jamieson and Allendorf 2012, p. 597). Therefore, we consider populations with greater than 5,000 mature plants to have high resiliency (Traill et al. 2007, p. 164, 2010, p. 3, Brouwer 2020 unpaginated). This threshold represents the minimum census population size needed to maintain adaptive potential (sustain allelic diversity against genetic drift). We based our population separation distance of 3 kilometers (1.86 miles) on NatureServe's Habitat-based Plant Element Occurrence Delimitation Guidance (2020, p. 13).

Population resiliency increases with increasing population growth rate, or lambda (λ). Lambda is a holistic metric for assessing a population's trajectory. Lambda represents the documented capacity of a species' vital rates (rates of reproduction, recruitment, and survival) to sustain population abundance through time. We consider a lambda greater than one to have high condition. This threshold represents a growing population with potential to recover from population declines, such as from multi-year drought.

Additionally, populations need a sufficient number of robust subpopulations to enable populations to self-rescue and recover from adverse stochastic events (Kaye and Lawrence 2003, pp. 8–12; Ruckelshaus et al. 2003, pp. 308–315). We consider a population with at least four patches within the last set of consecutive seed longevity years to have high demographic resiliency. This threshold represents consideration of both conserving genetic diversity and minimizing extirpation risk. Four populations are needed to moderately represent an outcrossing plants species' genetic diversity (see Criterion 1), and 4 populations are needed for extinction risk over 100 years to fall below 20% under a 100-year catastrophe cycle (Ruckelshaus et al. 2003, p. 313). We based our patch separation distance on a primary seed dispersal distance of within 10 meters (33 feet) of parent plants (Vittoz and Engler 2007, p. 111, Thomson et al. 2011, p. 1303).

Downlisting Criterion 3 (Habitat Resiliency):

3. Habitat quality at the four demographically resilient populations is in high condition, including $\geq 50\%$ and $\leq 70\%$ May–July grassland canopy cover; site grass cover comprised of at least 50% perennial, native, C_4 (warm season) grass species (including suitable host species, such as alkali sacaton and/or blue grama); <10% shrub cover; negligible or manageable non-native species vegetative cover; and negligible or manageable competition with other annual forb species (such as amaranth species (*Amaranthus* spp.)).

Rationale for Criterion 3

Swale Paintbrush species needs include self-sustaining populations across the species' range, where self-sustaining populations have a sufficient quantity of high-quality habitat and are free of, or have manageable, threats. Swale Paintbrush plants need suitable warmth, light, soil moisture, and nutrients for germination, growth, and reproduction. Habitat quality considerations give us a sense of whether the processes and conditions that support these needs are persisting. Habitat quality depends on natural processes, such as hydrological cycles and periodic disturbances, that maintain grassland integrity. In the absence of natural disturbance, management interventions like prescribed fire, strategic grazing and/or mowing, etc. may be necessary to maintain grassland integrity. With the alteration of natural processes, without management interventions, grasslands are vulnerable to conversion to shrub steppe. We base our thresholds for habitat conditions on both Swale Paintbrush species needs and tipping points for the conversion of grasslands to shrub steppe. Additional details about suitable habitat conditions and factors facilitating conversion of grasslands to shrub steppe are described in the most recent SSA.

Habitat factors directly influencing Swale Paintbrush persistence include grass cover (including host species cover) and grassland canopy gaps. The majority of Swale Paintbrush individuals observed in Animas Valley in 2021 were growing in areas with 50 to 70% canopy cover (Service 2021, unpublished data). Further, less than approximately 50% grass cover is associated with increased shrub cover in mesic grasslands (Ratajczak et al. 2014, pp. 2633, 2640). Native grasses, including host species, could be outcompeted by invasive, exotic plants. Invasive exotic plants could also outcompete Swale Paintbrush for available gaps, soil moisture, and soil nutrients. In addition to exotic species, native annuals may also be capable of outcompeting Swale Paintbrush for available canopy gaps. In other areas of the Animas Valley with mesic soils and suitable grassland canopy gaps, Powell's amaranth (*Amaranthus powellii*) and sharpleaf groundcherry (*Physalis acutifolia*)—native, annual forbs—have been observed dominating gaps (Service 2024, unpublished data).

In addition to grass cover, habitat factors facilitating conversions of grasslands to shrub steppe include declines in C_4 grasses, $\geq 10\%$ shrub cover, and/or fire return intervals of greater than 3–10 years (Kaib et al. 1996, pp. 253, 260, Swetnam and Baisan 1996, pp. 23, 25, Brown and Archer 1999, pp. 2393–2394, Poulos et al. 2013, pp. 3–4, Ratajczak et al. 2014, p. 2633, NatureServe 2022 unpaginated). Adequate C_4 grass cover is important because 1) C_4 grasses suppress establishment of juvenile shrubs (Ratajczak et al. 2014, p. 2642 and references therein) and 2) both of Swale Paintbrush's known host species (alkali sacaton and blue grama) are C_4 grasses. Low shrub cover is important because ecological transitions of mesic grasslands to shrublands escalate at approximately 10% shrub cover (Ratajczak et al. 2014, p. 2641).

Downlisting Criterion 4 (Representation):

4. A) Sufficient suitable habitat exists in the vicinity of the four resilient populations to enable them to "shift-in-space" (Thurman et al. 2020, p. 521) to track suitable environmental conditions through 2099 under Shared Socioeconomic Pathway (SSP) 8.5 or other appropriate projections, and

   B) Seed set in the four resilient populations indicates that reproduction is not limited by pollen quantity or quality: natural seed set and seed mass are not significantly lower (≥ 90% CI) than seed set and seed mass in flowers that receive hand-pollination assistance nor than seed mass from 2021 Swale Paintbrush collections.

Rationale for Criterion 4

Swale Paintbrush species needs include an ability to adapt to both near-term and long-term changes in its physical and biological environments. This ability to adapt to new environments—referred to as adaptive capacity—is essential for viability, as species need to continually adapt to their continuously changing environments (Nicotra et al. 2015, p. 1269). We can best gauge representation by examining the breadth of genetic, phenotypic, and ecological diversity found within a species and its ability to disperse into and colonize new areas. Criterion 1, above, addresses ecological diversity. Criterion 4 addresses adequate genetic diversity and phenotypic plasticity to adapt-in-place and adequate available suitable habitat to shift-in-space in response to environmental change (Thurman et al. 2020, entire).

The adaptive capacity to persist-in-place involves altering physical or behavioral traits (phenotypes) to match new environmental conditions through either plasticity (variety in gene expression) or genetic change (Nicotra et al. 2015, p. 1270–1272, Beever et al. 2016, p. 132). An example of plasticity is shifting flowering time to track with changes in the timing of seasonal precipitation. An example of genetic change is selection for loss of physiological seed dormancy as winters warm. A species' capacity for adaptive genetic change increases with increasing genetic diversity. Alternately, species with low genetic diversity experience decreased fitness, which can result in fewer, less resilient offspring. For plants, quantity and quality of pollen influence gene flow, genetic diversity, reproductive success, and overall fitness. Seed set (fecundity) and seed mass are positively correlated with genetic diversity (Hensen and Oberprieler 2005, pp. 67–71). Seed set and seed mass are also indicators of whether reproduction is limited by pollen quantity or quality. Therefore, we consider a population where natural seed set and seed mass are not significantly lower that the seed set and seed mass in flowers that receive hand-pollination assistance to have adequate phenotypic plasticity and/or genetic diversity to adapt-in-place. These thresholds are relative to hand-pollinated plants because hand-pollinated plants represent lack of pollen limitation. They are also relative to 2021 seed mass to ensure that genetic diversity isn't declining from known historic conditions (100 count seed mass = 0.005417 (± 0.000368, 90% CI) grams).

The adaptive capacity to shift-in-space involves tracking suitable bioclimatic conditions by migrating into new areas that provide for the species' needs (Thurman et al. 2020, p. 521). To shift in space, a species needs "stepping stones" of habitat that will remain, or are projected to become, suitable within the foreseeable future (Hannah et al. 2014, p. 392). These stepping stones need to be within a species' dispersal distance of one another and span relevant bioclimatic gradients, such as temperature and soil moisture (Hannah et al. 2014, p. 392, Barber et al. 2016, p. 1434). Typically, stepping stones need to be elevational or latitudinal to enable a species to track suitable conditions (Barber et al. 2016, p. 1434). A specific threshold for this sub-criterion is not determinable at this time, because additional information about Swale Paintbrush's dispersal syndromes and dispersal distances, and about environmental gradients at the resilient populations, would be needed to evaluate to determine whether or not adjacent suitable habitat is sufficient to support adaptation via migration (Fitzpatrick et al. 2008, p. 5).

Downlisting Criterion 5 (In-Situ Risk Management):

1. At least two of the resilient populations are in areas managed by government agencies or private conservation organizations that identify maintenance of Swale Paintbrush populations and habitat as primary management objectives for the areas in official planning or management documents for the life of those documents. Threats to the populations are monitored and manageable.

Rationale for Criterion 5

Swale Paintbrush needs include high-quality habitat in areas that are free of, or have manageable, threats. The Swale Paintbrush has several limiting traits that make it vulnerable to extinction: short life span, reliance on a short-lived seedbank, a winter seed chilling requirement, dependence on host species, specific habitat requirements, and specific habitat and grassland canopy gap maintenance requirements (see "Threats Analysis," above). Each of these dependencies/requirements likely has a tipping point, at which Swale Paintbrush viability is likely to rapidly decline without management intervention or successful adaptation to changing conditions (Dakos et al. 2019, entire). Therefore, threats to Swale Paintbrush viability from seedbank exhaustion, warming winters, drought, intensive grazing, shrub invasion, and altered disturbance regimes should become manageable, once populations are monitored, to trigger management intervention if critical thresholds approach.

Our threshold of two demographically resilient, monitored, and managed populations balances the species' need for redundancy with a management need for information gathering and adaptability in the face of uncertainty (Lynch et al. 2022, entire). Multiple actively managed populations enable conservation actions to be compared across sites.

Leaving some populations less intensively managed enables areas managed for Swale Paintbrush conservation to be compared with relatively unmanaged areas or areas managed under other priority objectives, such as livestock forage production or dust abatement. This approach will enable managers to assess the species' response to different treatments as well as to the stressors themselves (in no treatment areas) to determine if conservation management specifically for Swale Paintbrush is effective and/or needed. Management intervention may not be needed, for example, if Swale Paintbrush is successfully adapting to changing environmental conditions (Dakos et al. 2019, entire).

Downlisting Criterion 6 (Ex-Situ Risk Management):

6. An ex-situ recovery seed bank (maternal line collections of Swale Paintbrush seed stored at two or more cold storage seed banks to gene-bank the species and support research and re-release of plants into the wild (conservation translocations)) is established. The recovery seed bank adequately represents the genetic diversity from within each population and across the species' range and contains adequate maternal lines and/or seeds per maternal line to support recovery activities without exhausting the quantity or genetic representation that would be reasonably anticipated to be needed for the successful reintroduction of populations in the event of population extirpation. All accessible known populations, including newly discovered and/or introduced populations, are represented in collections at both facilities, and populations are periodically recollected from the wild before existing collections are anticipated to lose viability.

Rationale for Criterion 6

Swale Paintbrush species needs include sufficient distribution of populations to spread risk, where risk includes catastrophic events wiping out portions of the species adaptive diversity and the species as a whole. Securing representative maternal line seed collections from all known Swale Paintbrush populations at multiple ex-situ seed storage facilities increases redundancy and safeguards adaptive diversity. If wild populations become extirpated or lose significant genetic diversity or demographic viability, ex-situ collections can be used to (re)introduce—or to genetically or demographically rescue—populations in the wild. However, to maintain this safety net, ex-situ seed collections need to be curated to ensure that seed longevity in ex-situ storage is known and that collections can be replenished before ex-situ seed viability expires.

Genetically representative collections are crucial because genetic diversity maintains adaptive capacity, which is essential for population persistence and evolutionary potential (Chung et al. 2023, pp. 1–2 and references therein). An abundance of maternal lines supports genetic diversity within seed collections. Geographically and ecologically representative collections are crucial because different populations may be locally adapted to different environmental conditions and, therefore, may be more or less adapted to current or future environmental conditions at source or recipient sites (Hoban and Schlarbaum 2014, entire, Meek et al. 2023, entire). Mismatched seed sources can result in adverse consequences for population fitness and viability (Van Rossum and Hardy 2022, p. 2). Geographical representation (especially along latitudinal and elevational gradients (Barber et al. 2016, p. 1434)) supports appropriate source climate matching, and ecological representation supports appropriate source environment matching (McLennan et al. 2025, p. 8). Additionally, an abundance of seed is needed because the number of individuals out-planted during a translocation is critical for rescuing or establishing populations (Bellis et al. 2024, pp. 7, 9, 11). Greater than 550 individuals may be needed to (re)establish a Swale Paintbrush population (Bellis et al. 2024, p. 11). Having an inadequate supply of seed, therefore, may confer negligible conservation benefit.

More than one storage facility is essential because it increases the reliability that seed will be viable and available as needed. Any facility may experience a catastrophe (such as a fire, flood, or tornado), but it's unlikely that two geographically separate facilities would experience catastrophes simultaneously (Center for Plant Conservation 2019, p. 1-25). Redundancy in facilities can also safeguard against intermittent capacity limitations (such as staff vacancies or budget constraints) that could limit a facility's ability to monitor, replenish, or provide access to seeds as needed (Center for Plant Conservation 2019, p. 1-45). Further, diversifying the types of facilities helps to appropriately manage the use, and balance the values, of ex-situ collections. A local facility, where seed is readily accessible, is helpful for monitoring the status of collection viability, knowing when to replenish collections, conducting research on the species needs, and accessing seeds for conservation needs in the wild. A long-term, national storage facility, where seed is more secure, is helpful for ensuring that genetic material remains available for resurrecting a species from extinction or for biotechnological innovations.

Delisting Criteria

In addition to the above downlisting criteria, when met collectively, the following delisting criteria may indicate that Swale Paintbrush no longer meets the ESA definitions of either a threatened species or endangered species, and may be able to be removed from the Federal Lists of Endangered and Threatened Wildlife and Plants:

Delisting Criterion 7 (High Redundancy):

7. There are a total of six (two additional) demographically resilient populations (see Criterion 2) that are sufficiently geographically and ecologically distributed to minimize simultaneous adverse responses to stressors and, thereby, risks of range-wide impacts from plausible catastrophic events for at least 3 drought cycles. Amongst the six resilient populations, at least two pairs of nearest neighbor populations are in close enough proximity to one another that they may be able to

demographically and/or genetically rescue one another (that gene flow, including seed dispersal, between them is plausible).

Rationale for Criterion 7

Swale Paintbrush species needs include multiple resilient populations distributed across a relatively extensive species' geographic range with adequate independence for species' persistence through catastrophic events (see Criterion 1) and adequate connectivity to conserve the potential for genetic and/or demographic rescue in the event of local declines or extirpations. While the geographic isolation of populations reduces risks of species extinction from catastrophic events, it also minimizes potential for genetic and/or demographic population rescue or recolonization in the event of population bottlenecks or extirpations. Therefore, long term viability is enhanced by paired "rescue populations." We consider populations in close enough proximity for pollen and seed to periodically transfer between them to be potentially capable of rescuing one another and, therefore, to be paired "rescue populations." We consider a species with at least two sets of paired "rescue populations" to have adequate connectivity to conserve the potential for genetic and/or demographic rescue in the event of local declines or extirpations. Under a 100-year catastrophe cycle, this threshold represents the minimum population redundancy needed to attain a high (greater than 95%) probability of persistence of at least 1 population over the next 100 years (Ruckelshaus et al. 2003, p. 313, Brouwer 2020, unpaginated). Further, more than five populations of outcrossing species are needed to highly represent species-level genetic diversity, or to meet the benchmark of capturing all common alleles (>5% frequency) with 95% probability (Neel and Cummings 2003, p. 223, Lu-Irving et al. 2023, p. 10). Six populations are likely to represent at least 80% of all alleles and 90% of common alleles (Neel and Cummings 2003, p. 224, Lu-Irving et al. 2023, pp. 8, 10).

Definitions and Rationales for Timeframes

Seed Longevity

Seed longevity refers to the lifespan of a seed before it loses viability. Here we refer to the to-be-determined longevity of Swale Paintbrush seed in the soil seed bank (in the wild). We use this timeframe because seed longevity is critical to understanding when population extirpation from seed bank exhaustion may be approaching. For our population thresholds, using a timeframe of each set of consecutive seed longevity years ensures that there is at least one year within the lifespan of a seed in which the soil seed bank is significantly replenished. If seed longevity is 2 years, such as for surrogate species, this means in each set of two consecutive years. If Swale Paintbrush seed longevity is determined to be longer, such as six years, this would mean in each set of six consecutive years. For monitoring timelines, we set a monitoring timeframe alternative at three seed longevity cycles. This threshold represents three generations, where we redefine generation time as the maximum age to maturity or between two successive generations within a maternal line (versus the average time between two successive generations within a population). Three generations is adopted from IUCN Red List criteria (IUCN Species Survival Commission 2012, p. 28).

Life of Official Planning or Management Documents

The life of planning or management documents typically ranges from 5–30 years, where memorandums of understanding may be as short as 5 years, and resource management (land use) plans may have lifespans of 20–30 years. The intention of this timeframe is to ensure that conservation management commitments are in place for the foreseeable future (not contingent on the listing of Swale Paintbrush as threatened or endangered and, therefore, not likely to cease upon delisting).

Drought Cycles

A drought is a prolonged period when precipitation is less than normal, and a drought cycle is the frequency between repetitive phases of drier than normal conditions, including the duration of intervening years of average or above average precipitation. Drought cycles in Hidalgo County since 2000 appear to be approximately every 10 years (U.S. Drought Monitor 2025), but the length of drought cycles may change under warming conditions. We use three drought cycles as a timeline for demonstrating population resilience to ensure that populations are persisting despite any increases in drought intensity, duration, or frequency. We use one drought cycle as an alternative timeframe for post-delisting monitoring to document continued viability, once delisted, through Swale Paintbrush's most significant natural stressor, drought. Ten years, coincidentally, is an alternate to three generations as a timeframe for IUCN Red List criteria (IUCN Species Survival Commission 2012, p. 28).

4. RECOVERY ACTIONS

Recovery actions, statutorily required components of every Recovery Plan, are site-specific management actions needed to achieve the recovery criteria, as described in section 4 of the ESA. Recovery criteria describe the conditions of resiliency, redundancy, representation, and threat abatement that indicate when Swale Paintbrush may no longer meet the ESA definitions of an endangered species or threatened species. Section 4(a)(1) of the ESA directs USFWS to consider the following five factors when evaluating whether a species meets the definition of a threatened or endangered species under the ESA:

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.

Therefore, we describe the threats that recovery actions address in terms of these five factors.

USFWS assigns recovery action priority numbers (1-3) to rank recovery actions. The assignment of priorities does not imply that some recovery actions are of low importance but instead implies that lower priority items may be deferred while higher priority items are being implemented. Recovery action priority numbers are based on the following:

> Priority 1: An action that must be taken to prevent extinction or to prevent the species from declining irreversibly.
>
> Priority 2: An action that must be taken to prevent a significant decline in species population/habitat quality, or some other significant negative impact short of extinction.
>
> Priority 3: All other actions necessary to provide for full recovery of the species.

Six broad recovery actions, summarized below, will be implemented to recover Swale Paintbrush:

1. Promote landowner and governmental awareness and conservation of Swale Paintbrush throughout its range.
2. Identify and conserve existing Swale Paintbrush populations and the areas and natural processes that support those populations, as well as ecologically appropriate areas that Swale Paintbrush could occupy in the future.
3. Improve our understanding of the status, trends, and habitat conditions of Swale Paintbrush populations by developing and implementing a monitoring plan that regularly and consistently measures the sites in Criterion 7. The monitoring should be done in a manner sufficient to detect a statistically significant increasing or decreasing trend over three seed-longevity cycles or one drought cycle, whichever is greater.
4. Identify tipping points for Swale Paintbrush and its habitat and develop contingency plans, commensurate with available resources, to avert tipping points.
5. Ensure long-term Swale Paintbrush conservation through the establishment of ex-situ plant and seed collections housed at multiple Center for Plant Conservation-affiliated botanical institutions and seed banks.
6. Increase the size and number of Swale Paintbrush populations, either through discovery and management of extant populations or through planting and/or transplanting (i.e., improve resiliency, representation, and redundancy).
7. Initiate research needed to inform recovery and share results among land managers and researchers.

Table 4 further describes these recovery actions by listing their priority numbers and the recovery criteria and threats (section 4(a)(1) factors) that they address. Specific short-term details of recovery action implementation are described in the RIS for the species, which will be updated as additional information becomes available about the species' biology, threats, and success of recovery activities.

Table 4. Recovery action summary table.

Recovery Action ID Number	Recovery Action	Recovery Action Priority Number	Related Recovery Criteria	4(a)(1) Factors
1	Promote landowner and governmental awareness and conservation of Swale Paintbrush throughout its range.	1	1, 2, 3, 4, 5, 6, 7, 8	A, B, C, D, E
2	Identify and conserve existing Swale Paintbrush populations and the areas and natural processes that support those populations as well as ecologically appropriate areas that Swale Paintbrush could occupy in the future.	1	1, 2, 3, 4, 5, 6, 7	A, B, C, D, E
3	Improve our understanding of the status, trends, and habitat conditions of Swale Paintbrush populations by developing and implementing a monitoring plan that regularly and consistently measures the sites in Criterion 7.	2	1, 2, 3, 4, 5, 7	A, B, C, D, E
4	Identify tipping points for Swale Paintbrush and its habitat and develop contingency plans, commensurate with available resources, to avert tipping points.	1	1, 2, 4, 5, 6, 7	A, B, C, D, E
5	Ensure long-term Swale Paintbrush conservation through the establishment of ex-situ plant and seed collections housed at multiple Center for Plant Conservation-approved botanical institutions and seed banks.	1	1, 2, 3, 4, 5, 7, 8	A, B, C, D, E
6	Increase the size and number of Swale Paintbrush populations either through discovery and management of extant populations or through planting and/or transplanting (i.e., improve resiliency, representation, and redundancy).	1	1, 2, 4, 5, 6, 7	A, B, C, D, E
7	Initiate research needed to inform recovery and share results among land managers and researchers.	2	1, 2, 3, 4, 5, 6, 7, 8	A, B, C, D, E

5. ESTIMATED TIME AND COSTS TO ACHIEVE RECOVERY

Estimates of time and cost, as defined in section 4 of the ESA, must reflect, to the maximum extent practicable, the total amount of time and costs it will take to achieve the recovery (delisting) of Swale Paintbrush. The cost estimates provided do not account for possible future inflation.

We estimate that the full implementation of the recovery actions would improve the status of Swale Paintbrush so that it could be delisted within 30 years (3 drought cycles) following the adoption of this recovery plan and cost approximately 8 million dollars ($8,077,000). We note that the recovery program may change over time, or the timeframe estimated to implement the recovery actions to achieve recovery of the species may take longer than expected. The recovery of Swale Paintbrush will depend largely on the commitment and the ability of USFWS and partners to implement the recovery actions necessary to achieve the recovery criteria.

Table 5. Recovery action time and cost table. Values in $1,000.

Time Frame	Action 1 Cost	Action 2 Cost	Action 3 Cost	Action 4 Cost	Action 5 Cost	Action 6 Cost	Action 7 Cost	Total Cost by Year
Year 1	2	10	40	10	18	300	100	**480**
Year 2	11	10	40	10	0	300	100	**471**
Year 3	2	10	40	10	0	300	100	**462**
Year 4	2	10	40	10	0	300	100	**462**
Year 5	2	10	40	10	0	300	100	**462**
Years 6–10	10	1,050	200	10	18	0	100	**1,388**
Years 11–20	20	3,100	400	20	36	0	100	**3,676**
Years 21–30	20	100	400	20	36	0	100	**676**
Total Cost by Recovery Action	**69**	**4,300**	**1,200**	**100**	**108**	**1,500**	**800**	***Total Cost of Recovery = 8,077***

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