

Recovery Plan for *Phlox nivalis* ssp. *texensis* (Texas Trailing Phlox).

Draft Amendment 1

Superseding only Part II, pages 13-14 of the Recovery Plan.

U.S. Fish and Wildlife Service
Region 2
December 2018

Approved: _____ DRAFT _____ Date: _____
Regional Director, Region 2
U.S. Fish and Wildlife Service

I. Background Information.

a. Summary of prior actions.

Listing: 56 FR 49636
Date: September 30, 1991
Listed status: Endangered
Recovery Plan: Texas Trailing Phlox (*Phlox nivalis* ssp. *texensis*) Recovery Plan
Prepared by: Dr. Michael J. Warnock, Sam Houston State University,
Huntsville, Texas
Approved: March 28, 1995
Five-year review(s): August 30, 2018
Species Status Assessment: September 2018

b. Reason for amendment.

The original Texas Trailing Phlox Recovery Plan (Recovery Plan) contains two downlisting criteria, yet no delisting criteria (U.S. Fish and Wildlife Service (USFWS) 1995, pp. 13-14). Since the publication of the Recovery Plan in 1995, the USFWS completed a 5-year status review (USFWS 2018a), a Species Status Assessment (SSA) (USFWS 2018b), and updated the Minimum Viable Population (MVP) estimate (Poole *et al.* 2000). The SSA found that only seven populations of Texas trailing phlox are known to exist, they are endemic to a small geographic area, and the subspecies' genetic diversity is unknown; therefore, representation and redundancy values remain low (USFWS 2018b). Known population estimates are well below the current MVP (Poole *et al.* 2000) estimates used to define downlisting in the 1995 Recovery Plan, thus the subspecies exhibits low resiliency. The 5-year status review of Texas trailing phlox did not recommend a change in listing status (USFWS 2018a, p. 6). Based on this information, we recommend updating the Recovery Plan to include revised downlisting and delisting criteria that include new MVP and subspecies' information.

II. Methods used to revise recovery criteria.

The draft SSA was peer-reviewed in October 2018 and reviewer recommendations will be incorporated into the final document. We will request peer-review of this recovery plan amendment during the public comment period for the revised recovery criteria.

There is no regionally-approved recovery team that oversees the Texas trailing phlox. However, we worked closely with members of the plant conservation community in East Texas to gather information about the subspecies and its population demographics. We gathered information from: botanists and Texas Natural Diversity Database managers at Texas Parks and Wildlife Department (TPWD); The Nature Conservancy (TNC); the Big Thicket National Preserve (BTNP, U.S. National Park Service); private landowners and land managers; and, academic institutions (Stephen F. Austin State University – Pineywoods, University of Texas-Austin).

To define quantitative Texas trailing phlox delisting criteria, our rationale is that successful conservation and recovery efforts will alleviate threats to this subspecies and lead to stable or improving demographic trends. We defined a population monitoring period based on the subspecies' life history in order to show that threats have been alleviated and there is a change in the demographic trends. If it is determined at the end of this monitoring period that threats are alleviated and demographic trends remain stable or improve, then we will review its listing status as considered under the Endangered Species Act (ESA).

III. Adequacy of the original recovery criteria.

Section 4(f)(1)(B)(ii) of the ESA requires that each recovery plan shall incorporate, to the maximum extent practicable, “objective, measurable criteria which, when met, would result in a determination...that the species be removed from the list.” Legal challenges to recovery plans (see *Fund for Animals v. Babbitt*, 903 F. Supp. 96 (D.D.C. 1995)) and a Government Accountability Audit (GAO 2006) have also affirmed the need to frame recovery criteria in terms of threats assessed under the five delisting factors.

a. Recovery Criteria in the current Recovery Plan (USFWS 1995, pp. 13-14).

Preliminary downlisting requirements were identified. The Texas trailing phlox will be considered for reclassification from endangered to threatened status when:

1. At least 12 self-sustaining populations, in at least 3 counties, have been established. A population will be considered self-sustaining if it reaches and maintains a population number of at least 100 plants. The numbers of plants and populations must be verified through adequate monitoring.

The Recovery Plan (USFWS 1995, p. 13) defines a “population” as: (1) a group of plants separated by a distance of at least 2 kilometers (km) (1.2 miles (mi)) from any other plants of Texas trailing phlox; or, (2) a group of at least 300 plants covering an area, at the maximum, of one km² (247 acres). A “plant” is defined as a cluster of

Texas trailing phlox stems with no above-ground connection to other groups of stems, and separated by a distance of at least 5 decimeters (dm) (1.6 feet (ft)).

2. Sufficient, documented protection measures and management plans have been established for these 12 self-sustaining populations. Long-term, binding agreements are preferable for populations on private lands since they provide the management continuity necessary to achieve and ensure recovery.

If, at any point following downlisting, these requirements are no longer being attained, the Texas trailing phlox should be immediately returned to “endangered” status.

b. Analysis.

The Recovery Plan does not explain how the criteria of the 100 plants per population, nor the 12 self-sustaining populations were developed. Additionally, the Recovery Plan does not define how the extent of the population size (acreage) was derived. When the Recovery Plan was published in 1995, there were only two known sites in southeast Texas, including the type locality in Hardin County, and another site from Tyler County. Since then, 17 sites have been observed in Hardin, Polk, and Tyler counties; however, all are considered extirpated. The most recent survey and monitoring data indicates a total of seven extant populations for Texas trailing phlox (USFWS 2018b).

There is not a current estimate of the number of individuals on a global scale for the subspecies; however, population estimates have ranged from 1 plant (found at Resource Management Services, Tyler County in 2018) to over 500 plants (found at Campbell Timber, Hardin County in 1996) (USFWS 2018b). Many plants of the southern pine ecosystems, including the Texas trailing phlox, are well adapted to and/or require frequent burning. However, timing and frequency of burning is important as plants, including their reproductive parts (i.e. flowers), can be destroyed or damaged during burns, thus terminating the opportunity for pollination to occur during that season. For the Texas trailing phlox, this subspecies has rebounded and flowered after growing season burns in the summer months, however, timing and frequency of burns is critical to prevent impacts to reproductive processes of this subspecies. Fire is an important process to maintain optimal canopy structure for Texas trailing phlox. Not all populations are managed with prescribed burns on a routine basis and encroachment of habitat is the likely culprit for reduced population abundance and distribution across its range. Maxey and Warnock (1996) investigated the impacts of management (i.e. prescribed burning, canopy thinning, and combined management) on the subspecies. They found that reproduction is best with an open canopy of pines (5-25 percent); less than 40 percent coverage of subcanopy pines (pines and hardwoods); and less than 40 percent shrub coverage (Maxey and Warnock 1996, p. 37).

Because prescribed burning is an effective management tool and has been used to create optimal habitat conditions, the recovery potential of the subspecies remains high. However, none of the populations met or exceeded the current MVP value of 100 individuals for downlisting. Although we lack data that speaks to the quantity of habitat needed by Texas trailing phlox, Maxey and Warnock (1996) describe optimal habitat quality conditions. Therefore, we

determine that the criterion should reflect optimal habitat conditions as described by Maxey and Warnock (1996).

To define the resiliency of Texas trailing phlox, we incorporate the MVP and quality habitat standards. The MVP estimate of a population should reflect the best available scientific literature and the needs of the species to sustain its viability. Currently, the Recovery Plan defines downlisting as either 100 individual plants or a group of 300 plants covering 1 km². A conventional MVP, as outlined in Pavlik's guidelines (1996, p. 137), uses the biologic and demographic information known about a species to estimate a MVP size in order to prevent extinction. A conventional MVP does not exist for the Texas trailing phlox, as the baseline data needed to perform these calculations is not available. We lack consistent population counts across the subspecies range, and genetics work on the relatedness of the plants within and between populations which is important for a conventional MVP. However, Poole *et al.* (2000) estimated the MVP using Pavlik's method (1996). Their MVP estimate states that each population of Texas trailing phlox needs about 600 reproductive individual plants (Poole *et al.* 2000, pp. 63-66).

In general, there are genetic concerns with small population sizes, including reduced availability of compatible mates, genetic drift, and inbreeding depression (Ellstrand and Elam 1993). Small populations of Texas trailing phlox have low resilience, leaving them particularly vulnerable to stochastic events, such as extreme flooding or rain occurrences. The influence of stochastic variation in demographic (reproductive and mortality) rates is much higher for small population sizes than large ones. Stochastic variation in demographic rates causes small populations to fluctuate randomly in size. Typically, the smaller the population, the greater the probability that fluctuations can lead to extirpation. Based on the MVP estimate by Poole *et al.* (2000) and the need for robust population sizes to withstand stochastic events, we believe that use of the MVP is an appropriate component of the criterion to measure viable population size.

In order to apply the MVP criterion and to describe the redundancy of Texas trailing phlox, it is necessary to delineate populations by defining their connectivity, their distribution across the landscape, and the overall number. For plant species that reproduce sexually and require pollination, connectivity is often described in terms of flight distances of pollinators and capability of foraging. Pollinators specifically for the Texas trailing phlox include carpenter bees (M. Quinn, pers. comm. 2008), Nessus sphinx moth (*Amphion floridensis*) (G. Grant, pers. comm. 2017), and Tiger swallowtail butterfly (*Papilio glaucus*) (G. Grant, pers. comm. 2014), but can also include flies, bees, and butterflies (TPWD 1997, p. 1; USFWS 1995, p. 9; Maxey and Warnock 1996, p. 10). Poole *et al.* (2000, p. 3) notes that there is also the potential for large terrestrial arthropods to act as pollinators. Although we have anecdotal evidence that suggests what species are potential pollinators for Texas trailing phlox, we do not know if these species are effective pollinators. Based on the flower morphology, we know that Texas trailing phlox is an outcrossing subspecies pollinated by moths and butterflies (Bogler 1992, p. 5), thus, having healthy populations of these pollinators is essential to its reproduction. However, it is not known whether flowers are obligate or facultative outcrossers (Maxey and Warnock 1996, p. 10; USFWS 1995, p. 9). Further, we cannot draw definitive conclusions about the needed foraging distances for these pollinators. Populations that are closer together geographically and within pollinator foraging distances are likely to attract more pollinators and have an increase in these

pollination services (i.e. seed production, flowering plants). These populations also provide the necessary breeding and foraging resources for the pollinating species. We conclude that populations connected by a distance of at least 2 km (1.24 mi) allow for pollinator visitation and foraging, as well as exchange of genetic material. Therefore, we agree with the original criterion in that we should define a population as being at least 2 km from another Texas trailing phlox population.

Redundancy of Texas trailing phlox is defined by the distribution and number of populations. Species that have resilient populations spread throughout their historical range are less susceptible to extinction. Viable populations should have gene flow either through pollination or seed dispersal. Exchange of genetic material is more feasible with connected populations. Texas trailing phlox seeds are dispersed only short distances (i.e. explosive seed dispersal) and therefore, stochastic events are the plausible mechanism for longer distance dispersal and exchange of genetic material. We anticipate that populations exchange gene flow either through stochastic events and/or through pollinators. Historically more populations likely occurred on the landscape, which would have connected the existing extant populations. However, with habitat alteration and modification, suitable habitat was depleted or the plant was directly affected. The Texas trailing phlox is distributed throughout a 3-county geographic range in Texas including Hardin, Tyler, and Polk counties. Therefore, we believe that the criterion should include the known geographic range of the subspecies.

The USFWS recognizes that there are seven known extant populations, including four natural and three ex-situ sites (USFWS 2018a, 2018b). Historically there were more populations; however, impacts from habitat modification, loss, and/or fragmentation caused numbers to decline. These impacts continue to be the primary stressor to the subspecies. The 5-year review points to the need: for extensive collaboration with private landowners and land managers; to develop a habitat suitability map; and, to develop a controlled propagation and reintroduction plan (USFWS 2018a, pp. 4-5).

We recognize that the viability of Texas trailing phlox could rely on ex-situ populations and, therefore, these should be considered as part of both downlisting and delisting criterion as long as the populations are self-sustaining. The Recovery Plan identified preliminary downlisting criteria to need 12 self-sustaining populations. Given that this is the best scientific information available, we conclude that the 12 populations provide a sufficient level of redundancy to downlist the subspecies. Texas trailing phlox has not met this criterion for any portion of time. To secure redundancy of the subspecies into the foreseeable future, we estimate that additional populations would be needed, at least three additional populations within the known geographic range. Thus, we conclude that 15 self-sustaining populations should provide sufficient redundancy to delist. It is unknown how habitat modification, loss, and fragmentation associated with industry (oil/gas, timber); land management practices; and climate change will affect Texas trailing phlox. Long-term, binding agreements are needed to ensure conservation of the habitat in perpetuity. Protected populations that contribute to delisting must be monitored to detect demographic trends and responses to these stressors.

Given optimal conditions, the Texas trailing phlox may live for at least 6 years (Maxey and Warnock 1996, p. 37). Anecdotal survey records suggest that Texas trailing phlox can persist

longer than 6 years, as the subspecies is a longer-living perennial. For example, individuals planted in 2007 are still thriving at the Hancock site in Tyler County (R. Bounds, pers. comm. 2018). Therefore, we estimate that the average lifespan of the Texas trailing phlox to be around 10 years (USFWS 2018b). Since the Texas trailing phlox is a longer-lived species, monitoring should be reflective of this life history trait. In order to capture long-term trends, an average of 3 generation cycles has historically been used to assess variability and effects on population viability. Therefore, we estimate that the 15 populations should be monitored for 30 years.

IV. Amended Recovery Criteria.

a. Downlisting Recovery Criteria.

Based on the information in the SSA (USFWS 2018b) and the 5-year review (USFWS 2018a), we developed downlisting criteria that justify a reclassification from endangered to threatened. Texas trailing phlox will be considered for downlisting when:

1. At least 12 self-sustaining populations, distributed across the known geographic range of Hardin, Polk, and Tyler counties, Texas, are established. There should be at least three populations located in each county in order to provide adequate representation. The remaining three populations can be distributed in any fashion among the available habitat across the geographic range. A population will be considered self-sustaining if it reaches and maintains a population number of at least 600 reproductive individual plants. A population is considered a group of plants separated by a distance of at least 2 kilometers (km) (1.2 miles (mi)) from any other Texas trailing phlox plants, as to promote healthy populations of pollinators and the exchange of genetic material. A “plant” is defined as a cluster of Texas trailing phlox stems with no above-ground connection to other groups of stems, and separated by a distance of at least 5 decimeters (dm) (1.6 feet (ft)). Habitat will be of sufficient quality as defined by Maxey and Warnock (1996), that it promotes the success of Texas trailing phlox.

The numbers of plants and populations must be verified through adequate monitoring. Populations can include both natural and ex-situ (introduction and reintroduction) efforts. To be considered under this criterion, the habitats of Texas trailing phlox must be managed in a manner that promotes the continued survival of the subspecies. Management can include, but is not limited to, prescribed burning and/or restoration of longleaf pine habitat.

2. Sufficient, documented protection measures and management plans have been established for these 12 self-sustaining populations. Long-term, binding agreements that aim to conserve and protect the subspecies, and its habitat, are preferred. Private lands should be a priority focus for these agreements; however, protected areas can and should include lands owned by federal, state, or local government agencies.

b. Delisting Recovery Criteria.

Texas trailing phlox will be considered for delisting when:

1. To secure redundancy of the subspecies into the foreseeable future, we conclude that more populations would be needed for delisting. Therefore, at least 15 populations distributed across the known geographic range of Hardin, Polk, and Tyler counties, Texas, have been established. At least four populations should be located in each of the counties in order to provide representation of the potential genetic and ecological diversity of the subspecies. The remaining three populations can be distributed in any fashion among the available habitat within the range. A population will be considered self-sustaining if it reaches and maintains a population number of at least 600 reproductive individual plants. Ex-situ efforts should be focused within the known geographic range unless habitat suitability mapping proves otherwise. Habitat will be of sufficient quality, as defined by Maxey and Warnock (1996), that it promotes the success of Texas trailing phlox.
2. Monitoring efforts indicate that the MVP level of 600 reproductive plants at each population has remained stable or has increased over a monitoring time period of 30 years. Monitoring must be routine in order to gauge subspecies' viability. Site-specific management plans should outline the strategy to attain optimal habitat quality conditions that promotes the Texas trailing phlox.

IV. Literature Cited.

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