Recovery Plan for *Callihroe scabriuscula B.L. Robinson* (Texas Poppy-Mallow).
https://ecos.fws.gov/docs/recovery_plan/850329b.pdf

Draft Amendment 1

Superseding only Part II, pages 11 of the recovery plan.

U.S. Fish and Wildlife Service
Region 2
Albuquerque, New Mexico
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I. Background Information.

I.a. Summary of prior actions.

Listing:	46 FR 3184.
Date:	January 13, 1981.
Listed entity:	Texas poppy-mallow (*Callirhoe scabriuscula* Robins.).
Listed status:	Endangered.
Recovery Plan:	U.S. Fish and Wildlife Service (USFWS) 1985.
Prepared by:	Dr. Bonnie Amos.
Approved:	March 29, 1985.
Five-year review(s):	Initiated May 31, 2018 (83 FR 25034).

I.b. Reason for amendment.

Recovery plans should be consulted frequently, used to initiate recovery activities, and updated as needed. A review of the recovery plan and its implementation may show that the plan is out of date or its usefulness is limited, and therefore warrants modification. Keeping recovery plans current ensures that the species benefits through timely, partner-coordinated implementation based on the best available information. The need for, and extent of, plan modifications will vary considerably among plans. Maintaining a useful and current recovery plan depends on the scope and complexity of the initial plan, the structure of the document, and the involvement of stakeholders.

An amendment involves a substantial rewrite of a portion of a recovery plan that changes any of the statutory elements. The need for an amendment may be triggered when, among other possibilities: (1) the current recovery plan is out of compliance with regard to statutory requirements; (2) new information has been identified, such as population-level threats to the species or previously unknown life history traits, that necessitates new or refined recovery actions and/or criteria; or (3) the current recovery plan is not achieving its objectives. The amendment replaces only that specific portion of the recovery plan, supplementing the existing recovery plan, but not completely replacing it. An amendment may be most appropriate if significant plan improvements are needed, but resources are too scarce to accomplish a full recovery plan revision in a short time.

Although it would be inappropriate for an amendment to include changes in the recovery program that contradict the approved recovery plan, it could incorporate study findings that enhance the scientific basis of the plan, or that reduce uncertainties as to the life history, threats, or species' response to management. An amendment could serve a critical function while awaiting a revised recovery plan by: (1) refining and/or prioritizing recovery actions that need to be emphasized, (2) refining recovery criteria, or (3) adding a species to a multispecies or ecosystem plan. An amendment can, therefore, efficiently balance resources spent on modifying a plan against those spent on managing implementation of ongoing recovery actions.

Section 4(f)(1)(B)(ii) of the Endangered Species Act (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) also have affirmed the need to frame recovery criteria in terms of threats assessed under the five factors (ESA 4(a)(1)).

Recovery criteria serve as objective, measurable guidelines to assist in determining when an endangered species has recovered to the point that it may be downlisted to threatened, or that the species is no longer at risk of extinction and may be delisted. Delisting is the removal of a species from the Federal Lists of Endangered and Threatened Wildlife and Plants. Downlisting is the reclassification of a species from an endangered species to a threatened species. The term "endangered species" means any species (species, sub-species, or distinct population segment) that is in danger of extinction throughout all or a significant portion of its range. The term "threatened species" means any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.

Revisions to the Lists, including delisting or downlisting a species, must reflect determinations made in accordance with sections 4(a)(1) and 4(b) of the Act. Section 4(a)(1) requires that the Secretary determine whether a species is an endangered species or threatened species (or not) because of threats to the species. Section 4(b) of the Act requires that the determination be made "solely on the basis of the best scientific and commercial data available." Thus, while recovery plans provide important guidance to the Service, States, and other partners on methods of minimizing threats to listed species and measurable objectives against which to measure progress towards recovery, they are guidance and not regulatory documents.

Recovery criteria should help indicate when we would anticipate that an analysis of the species' status under section 4(a)(1) would result in a determination that the species is no longer an endangered species or threatened species. A decision to revise the status of or remove a species from the Federal Lists of Endangered and Threatened Wildlife and Plants, however, is ultimately based on an analysis of the best scientific and commercial data then available, regardless of whether that information differs from the recovery plan, which triggers rulemaking. When changing the status of a species, we first propose the action in the *Federal Register* to seek public comment and peer review, followed by a final decision announced in the *Federal Register*.

The original Texas poppy-mallow recovery plan did not establish downlisting or delisting criteria due to the limited information at that time (U.S. Fish and Wildlife Service [USFWS] 1985, pp. iii, 11). This amendment to the recovery plan establishes downlisting and delisting criteria that address the recovery objectives and known threats, comply with updated recovery planning guidance, and incorporate new information on the species obtained during the ongoing 5-year review, initiated on May 31, 2018 (83 FR 25034).

I.c. Brief summary of the species' current status.

Texas poppy-mallow is a herbaceous, short-lived perennial plant that often produces relatively few seeds per year. During two years of below-average rainfall, only 11 percent of individuals in an ecological study in Runnels County flowered, and these produced an average of 56.1 seeds per plant (Cruze 1991, pp. 15, 18). However, when there is adequate soil moisture in April and May, individuals may produce up to 150 flowers and 20 seeds per capsule (Amos and Delmatier 2003, p. 3). Compared to plant species in general, this is a moderate level of fecundity.

The species has a predominantly outcrossing breeding system and is effectively pollinated by solitary bee species, including *Diadasia afflicta*, *Melissodes intorta*, and *M. tepanica*, that specialize on members of the genus *Callirhoe*; other bee and insect species visit the flowers, but are not effective pollinators (Amos 2001, p. 9). The seeds have a very limited dispersal range, most seeds in the soil lose viability within one year, and the seed bank is only weakly persistent (Cruze 1991, pp. 15, 19; Amos 2001, pp. 9–10). Therefore, gene flow is probably limited to the forage range of the effective pollinators. Populations depend on spring rainfall to produce seeds and fall rainfall for seed germination and establishment; known populations have declined drastically after extended drought (Amos 2001, pp. 12–14).

Texas poppy-mallow has a low level of genetic diversity, as indicated through the percent of polymorphic isozyme loci, compared to other endemic plants (Giles 1991, reported in Amos 2001, p. 12).

The recovery plan reported that Texas poppy-mallow had been documented from three sites; the largest population, estimated at 48,000 individuals in 1979, was destroyed by sand mining, and the other populations had declined (USFWS 1985, pp. 5–6). The Texas Natural Heritage Program conducted extensive surveys from 1987 through 1989 at 143 sites in 37 counties (Poole (1990). This project documented 9 new populations at 6 sites in Runnels, Coke, and Mitchell counties, totaling 2,817 individuals, and reported an additional population discovered in Coke County in 1990 by an environmental consultant (Poole 1990, pp. 1,3). All populations were found in areas of intact native vegetation on deep, loose sandy soils of the Tivoli and Brownfield Series near the Colorado River (Likes and Heatly are alternate names for the Tivoli and Brownfield soil map units, respectively). The species has now been documented in four counties—Runnels, Coke, Mitchell, and Scurry; however, the Coke County population has not been seen for 10 years and may be extirpated, and the Runnels County populations have declined or are extirpated (Amos 2008, 2019).

II. Methods used to revise the recovery criteria.

We reviewed information in our files and requested new information about Texas poppy-mallow from botanists at Texas Parks and Wildlife Department (TPWD) and researchers at academic institutions. Although we have not appointed a recovery team for Texas poppy-mallow, the rationale we use here for establishing recovery criteria was developed through recommendations of the South Texas Plant Recovery Team for revising the recovery criteria of several listed plants in South Texas. The appointed members of this team include representatives from TPWD, The Nature Conservancy, the University of Texas Rio Grande Valley, Sul Ross State University, U.S. Department of Agriculture Natural Resources Conservation Service (NRCS), Texas A&M-Kingsville, Lower Rio Grande Valley National Wildlife Refuge, and private landowners. Independent peer review of this draft amendment will be conducted concurrent with publication of a Notice of Availability in the *Federal Register*.

III. Rationale for establishing the recovery criteria.

Recovery criteria should address the biodiversity principles of resilience, redundancy, and representation (Shaffer and Stein 2000, pp. 307—310; National Marine Fisheries Service and USFWS 2010, pp. 5.1-14–5.1-19). The USFWS bases assessments of species viability, defined as the likelihood of persistence over time, on analyses of a species' resilience, redundancy, and representation. Resilience refers to the population size necessary to endure stochastic environmental variation (Shaffer and Stein 2000, pp. 308-310). Redundancy refers to the number and geographic distribution of populations or sites necessary to endure catastrophic events (Shaffer and Stein 2000, pp. 308-310). Representation refers to the extent of genetic and ecological diversity, both within and among populations, necessary to conserve long-term adaptive capability (Shaffer and Stein 2000, pp. 307-308).

III.a. Rationale for downlisting criteria. In this amendment, we base the criteria for downlisting to the threatened status on the minimum conditions necessary so that the species is no longer in danger of extinction, but is still likely to become endangered within the foreseeable future. These criteria are defined by minimum viable population (MVP) sizes, the number and distribution of populations, and the abatement of threats through the conservation and protection of populations and habitats. These criteria must specify which individuals can contribute to determinations of MVP, and must also describe when and how population sizes can be determined and how populations are to be delimited.

The metric for resilience is MVP, the smallest population size that has a high probability of surviving a prescribed period of time. For example, Mace and Lande (1991, p. 151) propose that species or populations be classified as vulnerable when the probability of persisting 100 years is less than 90 percent. The MVP has not been calculated for Texas poppy-mallow, nor do we possess all the baseline demographic and life history data needed to perform these calculations. Table 1 is an adaptation of a method for estimating plant MVPs published in Pavlik (1996, p. 137). Species with traits that all fall under column A would have MVPs of about 50 individuals. Those with traits that all ascribe to column C would have MVPs around 2,500 individuals. We added an intermediate column (B) to Pavlik's table to account for species with intermediate or unknown traits. The bold letters in the table indicate values, if known, for Texas poppy-mallow.

Two factors require fewer individuals (perennial lifespan and climax successional status). Two factors are intermediate or unknown (moderate fecundity and unknown survivorship). Five factors require more individuals (outcrossing, herbaceous growth form, no ramet production, short longevity of seed viability, and high environmental variation (wide variation in annual precipitation)), suggesting an estimated MVP for Texas poppy-mallow of about 1,600 individuals. We have adopted this provisional estimate of MVP as the criterion of resilience for reclassification to the threatened status.

Table 1. Minimum viable population guidelines applied to Texas poppy-mallow (adapted from Pavlik 1996, p. 137).

Factor	A. MVP of 50 individuals for species with these traits.	B. Intermediate MVP of 1,000 individuals for species with intermediate or unknown traits.	C. MVP of 2,500 individuals for species with these traits.
Longevity	**Perennial**		Annual
Breeding System	Selfing		**Outcrossing**
Growth Form	Woody		**Herbaceous**
Fecundity	High	**Moderate**	Low
Ramet Production	Common		**Rare or None**
Survivorship	High	**Unknown**	Low
Longevity of Seed Viability	Long		**Short**
Environmental Variation	Low		**High**
Successional Status	**Climax**		Seral or Ruderal

This estimate of MVP is based only on numbers of mature individuals (those that have flowered at least once or are judged capable of flowering) because juveniles that die before they reproduce do not contribute to the effective population size or future genetic diversity. Basing the criterion on mature individuals will also make it easier to judge when the criterion has been met, since population surveys that do not distinguish mature plants from seedlings would appear to fluctuate wildly, depending on how recently seeds had germinated and the proportion of surviving seedlings. Since the proportion of plants that flower is much greater during years when rainfall in April and May are above average than in years of below-average April–May rainfall (Cruze 1991, pp. 4, 20), population sizes are best judged during years of above-average April–May rainfall.

The metric of redundancy is the number and distribution of populations. We are not aware of a scientific method to determine the minimum number of populations needed to assure long-term survival of a species; relatively large numbers of protected populations distributed over a wider geographic range confer greater redundancy. The criterion of redundancy for endangered plant recovery typically ranges from 5 to 20 populations; species that form stable, long-lived populations can be secure with fewer populations, and species with unstable, short-lived populations require greater redundancy. The short lifespan of individuals and the decline and loss of many of the known populations suggest that populations of Texas poppy-mallow are

ephemeral, or may migrate within areas of potential habitat. Based on these factors, the recovery of Texas poppy-mallow requires at least 10 viable populations overall.

The metric of representation is derived from the geographic distribution of populations as well as the genetic variation within and between populations. All known populations of Texas poppy-mallow occur in Tivoli and Brownfield fine sands (NRCS 2019) in Runnels, Coke, Mitchells, and Scurry counties, indicated in Figure 1. To conserve the full range of the species' genetic diversity and ecological adaptation, it must be conserved throughout its geographic range. We have tentatively identified three recovery units in the southeast, middle, and northwest portions of the geographic range (Figure 1); these recovery units may be revised if data on the species' population genetics or ecological adaptation indicate more logical delineations. To increase redundancy within recovery units, each unit must have at least three viable populations.

In order to apply the criteria of population size, number, and distribution, it is necessary to delineate populations. As used here, a population consists of groups of individuals within which gene flow, by means of seed dispersal or pollination, occurs often. Metapopulations refer to two or more populations between which gene flow is infrequent. Separate groups of individuals between which gene flow does not occur constitute separate populations. Viable populations of rare plants often consist of metapopulations of numerous small populations that each migrate through areas of contiguous habitat, periodically merging or dividing over spans of many years. We hypothesize that Texas poppy-mallow may also follow this pattern. Therefore, the recovery criteria may be applied to metapopulations as defined here. Since seed dispersal has a very limited range, gene flow of Texas poppy-mallow is limited by the forage range of its pollinators (described in Section I.c). Although we do not know the forage ranges of these specialist solitary bee species, these ranges are likely to be less than 5 kilometers (km) (3 miles) (mi) (Greenleaf *et al*. 2007). Hence, individuals separated by distances greater than 5 km may be considered separate populations or metapopulations.

Successful management and conservation could result in multiple viable populations expanding until they coalesce into larger populations. This improvement in the species' viability would nevertheless appear to reduce the number of viable populations, making it more difficult to meet the downlisting criteria. Therefore, for the purpose of determining the fulfillment of these criteria, previously separate viable populations that expand and merge into larger populations may continue to be tracked as separate populations.

The long-term viability of populations requires that they are protected from development and other threats, and are managed in a manner that promotes the species' conservation. There are few publicly-owned lands within the geographic range of Texas poppy (other than one state park and highway rights-of-way). However, protection and management may be accomplished through conservation easements or long-term conservation agreements with private landowners.

III.b. Rationale for delisting criterion. The delisting criterion (for removal from the list of threatened and endangered species) consist of attaining the downlisting criteria levels described above and sustaining or improving this status long enough to demonstrate that Texas poppy-mallow is no longer likely to become endangered in the foreseeable future. This will require a defined period of monitoring that is long enough to detect demographic trends and responses to

climate changes, and to distinguish the longer-term trends from annual fluctuations driven by variations in annual rainfall. For this purpose, population sizes may be determined by the greatest numbers observed during consecutive spans of 5 years. We provisionally estimate that at least 5 periods of 5 years are needed to detect demographic trends. Therefore, when all downlisting criteria have been met, Texas poppy-mallow may be delisted when these criteria are sustained or improved for at least 25 years.

IV. Amended Recovery Criteria.

a. Downlisting Recovery Criteria. Justifications for all downlisting criteria are described above in Section III.a.

1. Texas poppy-mallow is documented in 10 or more protected, viable populations, with at least 3 viable populations in each of 3 recovery units. Populations and metapopulations are delineated by unpopulated gaps of at least 5 km (3 mi). However, as described in Section III.a., viable populations that expand and merge with other populations may be considered separate populations for the purpose of meeting this criterion.

2. Viable populations have 1,600 or more mature individuals. Mature individuals have flowered at least once or are judged capable of flowering. Population surveys should be conducted during the peak of flowering and fruiting, from April through June.

3. Protected populations occur on lands that are legally protected and managed to conserve the Region's native flora and fauna, including Texas poppy-mallow and its habitats. Examples include, but are not limited to, conservation easements on private lands, lands owned and managed for conservation by non-profit organizations, publicly-owned land managed for conservation purposes, and legally binding long-term management agreements with private landowners.

b. Delisting Recovery Criterion. Justifications for all delisting criteria are described above in Section III.b.

1. Periodic monitoring indicates that the downlisting criteria have been met, and that demographic trends have subsequently remained stable or have increased over a period of 25 years. Ideally, monitoring (censuses) of each protected population should be conducted during years of above-average April–May rainfall; trend detection should be based on the largest populations observed during each 5-year period.

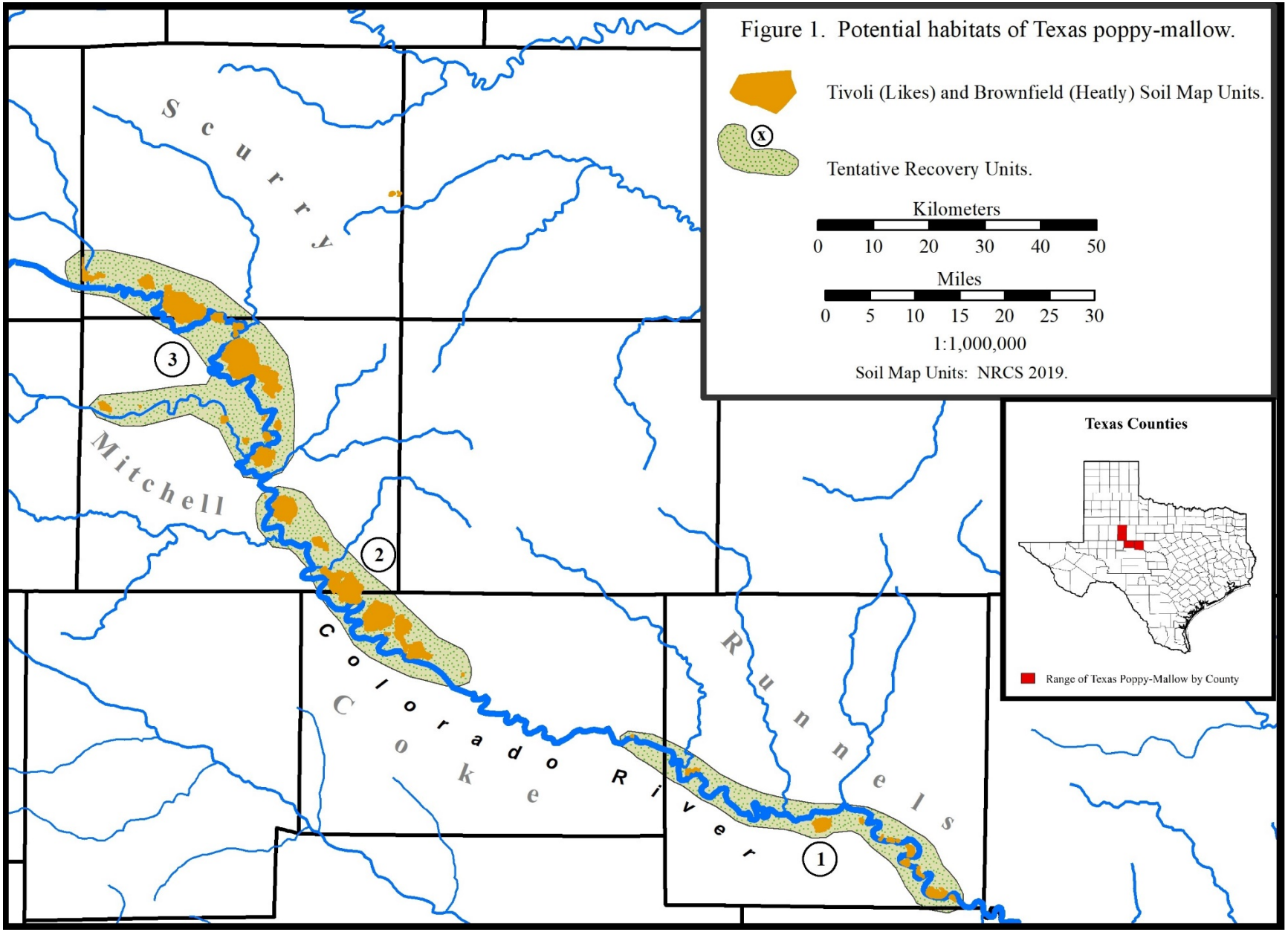
Figure 1. Potential habitats of Texas poppy-mallow.
Tivoli (Likes) and Brownfield (Heatly) Soil Map Units.
Tentative Recovery Units.
Kilometers
0 10 20 30 40 50
Miles
0 5 10 15 20 25 30
1:1,000,000
Soil Map Units: NRCS 2019.
Texas Counties
Range of Texas Poppy-Mallow by County
Scurry
Mitchell
Coke
Runnels
Colorado River
1
2
3

IV. Literature Cited.

Amos, B.B. 2001. The life history and vulnerability of the endangered Texas poppy mallow (*Callirhoë scabriuscula*, Malvaceae). Pp. 8–15 in Texas Rare Plant Conference Proceedings, Lady Bird Johnson Wildflower Center and U.S. Fish and Wildlife Service, September 6–7, 2001, Austin, Texas.

Amos, B. 2008. The reproductive biology of the endangered Texas poppy mallow and its cost to conservation. Symposium presentation abstract, Botanical Society of America Conference, July 26—30, 2008, Vancouver, British Colombia.

Amos, B. 2019. Email to Chris Best, U.S. Fish and Wildlife Service, February 12, 2019.

Amos, B.B. and C.H. Delmatier. 2003. Case study: Texas poppy-mallow (*Callirhoë scabriuscula* Robins., Malvaceae). Presentation at the Saltcedar and Water Resources in the West Symposium, July 16, 2003, San Angelo, Texas. 13 pp.

Cruze, P.B. 1991. Studies of the seed bank and population dynamics of an endangered species, Callirhoe scabriuscula. Master of Science thesis. Angelo State University, San Angelo, Texas. 44 pp.

Giles, S.D. 1991. A comparative investigation of genetic diversity of *Callirhoë scabriuscula* (Malvaceae) and *Callirhoë involucrata*. Master of Science Thesis. Angelo State University, San Angelo, Texas.

Greenleaf, S.S., N.M. Williams, R. Winfree, and C. Kremen. 2007. Bee foraging ranges and their relationship to body size. Oecologia 153: 589-596.

National Marine Fisheries Service and U.S. Fish and Wildlife Service. 2010. Interim Endangered and Threatened Species Recovery Planning Guidance Version 1.3. National Marine Fisheries Service, Silver Spring, Maryland. 122 pp.

Natural Resources Conservation Service. 2019. Web Soil Surveys for Coke, Mitchell, Runnels, and Scurry counties, Texas. https://websoilsurvey.nrcs.usdaa.gov/app/WebSoilSurvey.aspx Accessed February 11–13, 2019.

Pavlik B. 1996. Defining and measuring success. *In* D. Falk, C. Millar, and P. Olwell [eds.], Restoring diversity: strategies for reintroduction of endangered plants, 127–155. Island Press, Washington, D.C., USA.

Poole, J.M. 1990. Habitat delineation and subsequent searches for *Callirhoe scabriuscula*. Texas Natural Heritage Program, Endangered Resources Branch, Texas Parks and Wildlife Department. Austin, Texas. 4 pp. + 2 appendices.

Shaffer, M.L. and B.A. Stein. 2000. Safeguarding our Precious Heritage. Pages 301-321 in B.A. Stein, L.S. Kutner, and J.S. Adams (eds.), Precious Heritage: The status of biodiversity in the United States. Oxford University Press. 399 pp.

U.S. Fish and Wildlife Service. 1985. Texas poppy-mallow (*Callirhoe scabriuscula* Robins.) Recovery Plan. U.S. Fish and Wildlife Service, Albuquerque, New Mexico. Iv + 36 pp.