

RECOVERY PLAN AMENDMENTS FOR 20 SOUTHWEST SPECIES

The U.S. Fish and Wildlife Service has identified best available information that indicates the need to amend recovery criteria for the below species. Each amendment is recognized as an addendum that supplements the existing recovery plan.

<p>Brady Pincushion Cactus (<i>Pediocactus bradyi</i>) Recovery Plan Original Recovery Plan Approved: March 28, 1985 Page(s) Superseded: 19-34</p>
<p>Endangered Karst Invertebrates (Travis and Williamson Counties, Texas) Recovery Plan Original Recovery Plan Approved: August 25, 1994 Page(s) Superseded: 86-88 Species Included: Bee Creek Cave harvestman (<i>Texella reddelli</i>) Bone Cave harvestman (<i>Texella reyesi</i>) Coffin Cave mold beetle (<i>Batrisodes texanus</i>) Kretschmarr Cave mold beetle (<i>Texamaurops reddelli</i>) Tooth Cave spider (<i>Tayshaneta=Neoleptoneta myopica</i>) Tooth Cave ground beetle (<i>Rhadine persephone</i>) Tooth Cave pseudoscorpion (<i>Tartarocreagris texana</i>)</p>
<p>Holy Ghost Ipomopsis (<i>Ipomopsis sancti-spiritus</i>) Recovery Plan Original Recovery Plan Approved: September 26, 2002 Page(s) Superseded: 18-21</p>
<p>Knowlton Cactus (<i>Pediocactus knowltonii</i>) Recovery Plan Original Recovery Plan Approved: March 29, 1985 Page(s) Superseded: 16</p>
<p>Kuenzler Hedgehog Cactus (<i>Echinocerus fendleri</i> var. <i>kuenzleri</i>) Recovery Plan Original Recovery Plan Approved: March 28, 1985 Page(s) Superseded: 13</p>
<p>Sacramento Prickly Poppy (<i>Argemone pleicantha</i> ssp. <i>pinnatisecta</i>) Recovery Plan Original Recovery Plan Approved: August 31, 1994 Page(s) Superseded: 16-17</p>
<p>Siler Pincushion Cactus (<i>Pediocactus sileri</i>) Recovery Plan Original Recovery Plan Approved: April 14, 1986 Page(s) Superseded: 19-41</p>
<p>Sneed and Lee Pincushion Cacti Recovery Plan Original Recovery Plan Approved: March 21, 1986 Page(s) Superseded: 19 Species Included: Sneed pincushion cactus (<i>Coryphantha sneedii</i> var. <i>sneedii</i>) Lee pincushion cactus (<i>Coryphantha sneedii</i> var. <i>leei</i>)</p>
<p>Socorro Isopod (<i>Thermosphaeroma thermophilum</i>) Recovery Plan Original Recovery Plan Approved: February 16, 1982 Page(s) Superseded: 6-7, 10-11, 13</p>

Star Cactus (*Astrophytum asterias*) Recovery Plan

Original Recovery Plan Approved: August 26, 2003

Page(s) Superseded: 11-14

Tobusch Fishhook Cactus (*Ancistrocactus tobuschii*) Recovery Plan

Original Recovery Plan Approved: March 18, 1987

Page(s) Superseded: iii, 14-15

Zapata Bladderpod (*Lesquerella thamnophila*) Recovery Plan

Original Recovery Plan Approved: July 14, 2004

Page(s) Superseded: 9-11

Zuni Fleabane (*Erigeron rhizomatus*) Recovery Plan

Original Recovery Plan Approved: September 30, 1988

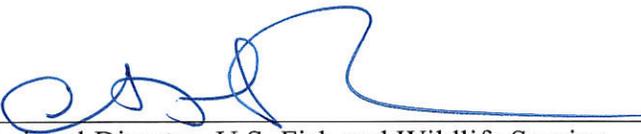
Page(s) Superseded: 14

For

**U.S. Fish and Wildlife Service
Southwest Region
Albuquerque, New Mexico**

August 2019

Approved:



Regional Director, U.S. Fish and Wildlife Service

Date:

8/28/19

Recovery Plan for *Astrophytum asterias* (Star Cactus)

Original Approved: August 26, 2003

Original Prepared by: Loretta Schanen Pressly (U.S. Fish and Wildlife Service, Corpus Christi, TX)

AMENDMENT 1

We have identified best available information that indicates the need to amend recovery criteria for this species since the Star Cactus (*Astrophytum asterias*) Recovery Plan (Recovery Plan) was completed. In this proposed modification, we synthesize the adequacy of the existing recovery criteria, show amended recovery criteria, and the rationale supporting the proposed recovery plan modification. The proposed modification is shown as an appendix that supplements the Recovery Plan, superseding only the Executive Summary, page iii, and Section II, pages 11-14 (U.S. Fish and Wildlife Service (Service) 2003: iii, 11-14).

**For
U.S. Fish and Wildlife Service
Southwest Region
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BACKGROUND INFORMATION

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.

METHODOLOGY USED TO COMPLETE THE RECOVERY PLAN AMENDMENT

The process of review and modification of the existing recovery criteria for the star cactus was initiated using the 2013 status review (5-year review) as a foundation document because it was more recent than the Recovery Plan (Service 2013: entire). This status review was also comprehensive with regard to all information known about this species through the time period ending in 2012. To determine if new information had become available since completion of the 5-year review, inquiries were made with other Service staff (National Wildlife Refuge) and external partners regarding field work, surveys, research projects, botanical garden seed work, or other types of efforts that may have been undertaken between 2013 and June 2018. Additionally, we reviewed our files and conducted online searches for information that may have become available between 2013 and 2018.

In addition to the information review, the Service relied on the South Texas Plant Recovery Team (STPRT) for assistance in modifying recovery criteria for the Recovery Plan. The STPRT was formed in 2010 to oversee the recovery of nine species of listed plants in South Texas, including star cactus. On June 12-13, 2018, the STPRT met at Santa Ana National Wildlife Refuge to develop proposed recovery criteria revisions for the star cactus and two other listed plant species. Seven team members attended, including two private citizen botanists, three former or current university botanists, a Texas Parks and Wildlife Department (State) botanist, and a Service plant ecologist. Nine other Service employees also attended, including the Service's liaison to the recovery team and the Service's species lead for the three plants. There was an open discussion among all members, led by the Service's species lead and team liaison. The discussion was guided by an agenda with stated objectives, Google Earth files showing known population or metapopulation locations, and handouts of species information, existing criteria, and Endangered Species Act definitions. Following the meeting, Service biologists emailed meeting notes, and a draft table displaying existing versus proposed criteria developed during the meeting, to all team members (including members who were unable to attend the meeting in person) requesting review and comment. The proposed recovery criteria amendments will require formal peer review due to the modification of the original downlisting criteria and the establishment of new delisting criteria where none had existed in the original recovery plan. By using the STPRT, the Service was able to inform the State, non-governmental organizations, and the private sector about the proposal to revise recovery criteria and to involve experts from these stakeholder groups in the actual modification process.

ADEQUACY OF RECOVERY CRITERIA

Section 4(f)(1)(B)(ii) of the Endangered Species Act (Act) 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 delisting factors.

Recovery Criteria

The original Recovery Plan defined criteria for downlisting to threatened, but did not include criteria for delisting. The primary objective for the Recovery Plan is to ensure survival and promote recovery of star cactus in its natural habitat such that the species can be reclassified to threatened status. The Recovery Plan further states that the completion of criteria for downlisting to threatened would enable the development of a full recovery strategy and delisting criteria (U.S. Fish and Wildlife Service 2003, p. 11). See previous version of criteria in the Recovery Plan on pages 11-14.

Synthesis

The STPRT reviewed relevant research and unpublished information and shared their expert opinions to propose amended recovery criteria and updates to the status and threats assessment. The following is a summary of relevant information used by the STPRT to develop proposed updates.

Star cactus sites are located in the U.S. and Mexico, occurring within at least three different geologic formations and/or soils. Since the publication of the Recovery Plan, research examining five subpopulations of star cactus in Texas found that four of the five were genetically diverse (high level of heterozygosity within the subpopulations), but not genetically distinct (low level of genetic differentiation between the subpopulations) (Terry et al. 2012, p. 182; South Texas Plant Recovery Team 2018, unpaginated). The low levels of genetic differentiation among the subpopulations sampled (Terry et al. 2012, p. 187) indicates that star cacti occurring in the border region of Texas are likely a single population. This is not surprising, given that almost all of the known star cactus locations in the U.S. are located within only about a 125-km² area.

Threats Assessment

All known populations of star cactus occur on private land, where state and federal regulations provide only minor protection to endangered plants (U.S. Fish and Wildlife Service 2013, pp. 19-20). Herein, the term “fully protected” is defined as management of populations on Federal or State lands as part of an approved management plan (e.g., National Wildlife Refuge Comprehensive Conservation Plan), or a formal stewardship agreement for private landowners that includes management and monitoring of the populations, habitat, and threats.

Continued threats from energy-related development in Starr County now includes wind power (N. Elizondo, Starr County Industrial Foundation pers. comm. 2018, unpaginated). Energy-related development can directly affect star cacti and star cactus habitat located on private lands (Reemts et al. 2014, pp. 123 and 125). According to Sonia Najera (TNC, pers. comm. 2018), the installation of service roads and other permanent structures can also have indirect effects on surrounding habitats containing rare plants by altering the area’s hydrology, for example, elevated service roads within wind farms can potentially divert and channel water through drainage culverts thereby changing water surface flow and soil erosion rates.

Potential impacts related to the construction and presence of a border wall are unknown. Given that all known populations of star cactus in Texas are on privately owned land, it is possible that unexplored but suitable star cactus habitat occurs in areas identified for new segments of the border wall. Depending upon its design and location relative to star cactus sites, the border wall could also potentially influence the dispersal of pollen or movements of star cactus pollinators (South Texas Plant Recovery Team 2018, unpaginated).

The widespread decline of bees (Stokstad 2007, p. 970; Cameron et al. 2011, p. 662) and other pollinators is a threat to the star cactus due to its dependence upon pollinators, primarily cactus-specialist bees, to transfer pollen for seed production (Janssen et al. 2010, p. 97). Strong and Williamson (2007, p. 344) suggested that low numbers of pollinators in their Starr County study site might explain why significantly more fruits and seeds were produced by hand-pollinated star cactus compared to controls that were open and available for visitation by natural pollinators.

Herbivory from mammals, especially Mexican ground squirrels (*Spermophilus mexicanus*) and Audubon's cottontails (*Sylvilagus audubonii*), can pose a serious threat to *A. asterias*. Risk of mortality from herbivory is the greatest in smaller plants ranging in size from 3 to 6 cm (Ferguson et al. 2013, pp. 147-148). Photographic data collected in Texas demonstrated *S. audubonii* consuming an entire cactus plant in one feeding period (Ferguson et al. 2013, p. 147).

Climate change may affect star cactus populations and distribution, as the frequency and duration of drought is projected to increase (U.S. Fish and Wildlife Service 2013, pp. 21-23). In Mexico, researchers identified star cactus as a species that will experience increasingly unsuitable conditions due to the increase of temperature and reduction in precipitation associated with climate change (Carrillo-Angeles et al. 2016, p. 310).

Las Estrellas Preserve, in Starr County, Texas, and managed by The Nature Conservancy (TNC), is the only known site under conservation (i.e., a "fully protected" site) with a star cactus population. Another conservation organization has proposed fee title acquisition in the near term of another privately owned star cactus site in Starr County. If this acquisition comes to fruition, this locality would potentially constitute a second conservation (fully protected) site for star cactus.

AMENDED RECOVERY CRITERIA

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 protections afforded by the Act are no longer necessary and the star cactus 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 endangered to threatened. The term "endangered species" means any species (species, sub-species, or distinct population segment) which 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.

We provide downlisting criteria for the star cactus, which will supersede those included in the original Recovery Plan (Service 2003: iii, 11-14), and introduce delisting criteria for the species as follows:

Downlisting Recovery Criteria

Current recovery criteria

1. Maintain or establish ten geographically distinct, fully protected, self-sustaining populations of star cactus in the United States or Mexico, each with a minimum of 2,000 individuals and an age class structure reflecting that plants are reproducing and becoming naturally established within the population.
2. Develop and implement a formal conservation agreement for star cactus between the United States and Mexico.

Amended recovery criteria

1. Maintain or establish at least 5 sites (>1 km of separation between sites) within each of a total of 3 designated recovery units in Texas and Mexico. Recovery units will be based on geology and/or soils. Each site will contain at least 2,500 individuals, 50% of which will be of reproductive age as determined by a size of ≥ 4 cm diameter. The sites must occur across the species known range within each recovery unit; however, coalescence of sites due to recovery or discovery of new sites will not reduce the number of recognized sites.

Justification: The leading threat to star cactus throughout its range currently, and at the time of listing, is habitat loss. The STPRT proposes five sites within each of three recovery units to maintain species redundancy and representation across geographically diverse areas. Based on recent genetic studies (Terry et al. 2012, p. 182; South Texas Plant Recovery Team 2018, unpaginated), the STPRT proposes to use the term “sites” instead of “populations” to specify recovery criteria within designated recovery units. The term “sites” clarifies the criteria by allowing the STPRT to count clusters or groupings of star cactus located at least 1 km apart (NatureServe 2004, unpaginated) while avoiding the uncertainty of which groupings may or may not constitute a scientifically valid population.

The original recovery criteria called for an MVP of 2,000 individuals based upon standard guidelines for calculating MVP for rare plants (Pavlik 1996, p. 137). The original recovery criteria also called for an MVP composed of an “age class structure reflecting that plants are reproducing and becoming naturally established within the population”. In order to clarify what constitutes an age class structure that is reproducing and becoming established, the STPRT proposes an MVP of 2,500 individuals, 50% of which will be of reproductive age. Based on concerns about low seedling survivorship of this species (Birnbaum 2009, p. 44; Texas Parks and Wildlife Department 2012, unpaginated) the STPRT felt that a minimum of 50% reproductively mature plants would reflect the age class structure needed to demonstrate that plants are reproducing and becoming naturally established within the site. Research indicates that star cactus individuals reach maturity upon attaining a diameter of at least 4 cm (Janssen et al. 2010, pp. 7 and 13; U.S. Fish and Wildlife Service 2013, pp. 10-11).

2. All sites described above in downlisting criterion 1 must be fully protected in perpetuity and managed appropriately for the species, its habitat, and pollinators.

Justification: There are few regulatory mechanisms available that provide protection for listed plants that occur on private lands. The STPRT recommends that fully protected sites include management and protection of star cactus individuals, habitat, and pollinators. Management should support ecological processes that contribute to the life history of star cactus, such as habitat structure (solar cover), pollinator habitat, and native vegetation. Management should also include measures to lessen or alleviate relevant threats (e.g. habitat loss or collection pressure) to star cactus and to measure the species' numbers, habitat quality, and threats (U.S. Fish and Wildlife Service 2003, p. 12). Based upon findings by Janssen et al. (2010, p. 97), the specialist bee *Diadasia rinconis* and other species of cactus bees, rely upon adequate nesting sites and the presence of multiple species of cacti blooming throughout their foraging season to provide a continuous source of pollen (Janssen et al. 2010, p. 97). Whenever possible, fully protected sites should also include habitat buffers around star cactus locations managed for other existing populations of cacti species to support cactus specialist bees and that are large enough to maintain the native community of flora and fauna. Additionally, protected sites and surrounding buffers should be managed to prevent invasive grasses or other threats from encroaching (South Texas Plant Recovery Team 2018, unpaginated).

3. Develop and implement a formal conservation agreement for star cactus between the U.S. and Mexico.

Justification: The range of the star cactus spans the border between the United States and Mexico, and the status of star cactus in each country is important for the overall conservation of the species. A binational conservation agreement for the species should be coordinated through the Trilateral Agreement, a Memorandum of Understanding between Canada, Mexico, and the United States for transnational species' conservation. This coordination will provide (further) protective measures for the species and may be integral for range-wide recovery, as significant opportunities for recovery projects may exist outside of the United States.

Delisting Recovery Criteria

Current recovery criteria

None

Amended recovery criteria

1. Over a 60-year period, maintain the 5 fully protected sites in each designated recovery unit at the MVP of 2,500 individuals per site with at least 50% being of reproductive age. All sites will be fully protected, self-sustaining sites occurring across the species known range within each recovery unit.

Justification: The STPRT estimates that trend detection will require periodic monitoring through at least 3 generations. Based upon growth rate data, it takes 15-25 years for star cactus to reach maturity (Janssen et al. 2010, p. 13; U.S. Fish and Wildlife Service 2013, pp. 10-11). Therefore, at an average of 20 years per generation, a 60-year time span (3 generations x 20 years) is necessary to ensure the species is sufficiently resilient to withstand stochastic events.

All classification decisions consider the following five factors: (1) is there a present or threatened destruction, modification, or curtailment of the species' habitat or range; (2) is the species subject to overutilization for commercial, recreational scientific or educational purposes; (3) is disease or predation a factor; (4) are there inadequate existing regulatory mechanisms in place outside the ESA (taking into account the efforts by states and other organizations to protect the species or habitat); and (5) are other natural or manmade factors affecting its continued existence. When delisting or downlisting a species, we first propose the action in the *Federal Register* and seek public comment and peer review. Our final decision is announced in the *Federal Register*.

Rationale

Representation across geographically diverse areas within the species range increases the species' ability to adapt to change. Therefore, the STPRT proposes 5 sites within each of three Recovery Units, with the Recovery Unit locations defined by geology and soils. The use of Recovery Units will result in one or more fully protected MVPs in both countries.

The STPRT proposes an MVP of 2,500 individuals due to concerns about low survivorship of star cactus. In 2007, 240 star cactus seedlings were reintroduced to Las Estrellas Preserve, a protected area containing a naturally occurring population of star cactus. After 14 months, approximately 64% of the seedlings survived, but 5 years post-planting only 14% remained (Birnbaum 2009, p. 44; Texas Parks and Wildlife Department 2012, unpaginated). A similar project, also conducted at Las Estrellas Preserve, reported 52% seedling survival after 1.5 years (Reemts et al. 2014, p. 122).

Although some cactus individuals may survive for many decades in the wild (Terry 2005, p. 124), the STPRT proposes delisting recovery criteria that achieves an MVP over 3 generations of 20 years each (a 60-year time span). A generation span is the time required for a newly formed seed to disperse, germinate, grow to a mature size, flower, and disperse new seeds.

The term "sites" clarifies the criteria by allowing clusters or groupings of star cactus located at least 1 km apart (NatureServe 2004, unpaginated) to be counted while avoiding the uncertainty of which groupings may or may not constitute a scientifically valid population. However, the discovery or restoration of a new star cactus site within 1 km of two previously recognized sites (i.e., coalescence) will not result in the reduction of the total number of sites to one (South Texas Plant Recovery Team 2018, unpaginated).

Star cactus reintroduction may be a viable option to restore or supplement numbers of star cactus in its historical range. Birnbaum et al. (2011, p. 43) found that seedlings have a much higher survival rate than seeds within the first 14 months. Reemts et al. (2014, p. 122) reported that

after 1.5 years, about half of the 5-year old greenhouse-raised star cacti that were reintroduced to areas with historical populations were still alive and had grown in size. Reintroduction may be a viable strategy for achieving fully protected star cactus sites; however, long-term success of reintroduced plants is still unknown and an approved reintroduction plan for this species is needed. As of 2018, star cactus does not occur on refuge tracts in Starr County, but refuge land may provide fully protected sites in the future using reintroduced plants.

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APPENDIX A – SUMMARY OF PUBLIC, PARTNER, AND PEER REVIEW COMMENTS RECEIVED

Summary of Public Comments

The Service published a notice of availability in the *Federal Register* on January 31, 2019 (84 FR 790-795) to announce that the draft amendment for the Star Cactus (*Astrophytum asterias*) Recovery Plan (Recovery Plan) was available for public review, and to solicit comments by the scientific community, State and Federal agencies, Tribal governments, and other interested parties on the general information base, assumptions, and conclusions presented in the draft amendment. An electronic version of the draft recovery plan amendment was also posted on the Service's Species Profile website

(https://ecos.fws.gov/docs/recovery_plan/Combined%20edits%20-%20Final%20Draft%20Recovery%20Plan%20Amendment%20for%20Star%20Cactus%209-11-18.pdf).

We also developed and implemented an outreach plan that included (1) publishing a news release on our national webpage (<https://www.fws.gov/news/>) on January 30, 2019, (2) sending specific notifications to Congressional contacts in Districts (include appropriate Districts, consult the corresponding Outreach Plan or contact your Regional Public Affairs Officer for more information), and (3) sending specific notifications to key stakeholders in conservation and recovery efforts. These outreach efforts were conducted in advance of the *Federal Register* publication to ensure that we provided adequate notification to all potentially interested audiences of the opportunity to review and comment on the draft amendment.

The Service received two responses to the request for public comments from the Center for Biological Diversity and the Energy and Wildlife Action Coalition. Public comments ranged from providing minor editorial suggestions to specific recommendations on the amendment content. We have considered all substantive comments; we thank the reviewers for these comments. In general, these comments did not lead to significant changes in the draft amendment. Below, we provide a summary of public comments received; however, some of the comments that we incorporated as changes into the Recovery Plan amendment did not warrant an explicit response and, thus, are not presented here.

Comment (1): Concern that, “criteria are being added in the absence of any scientific peer review and that this will lead to a failure on the Service’s part to follow the best-available science.”

Response: Peer review was conducted following the publication of the Notice of Availability, and in accordance with the requirements of the Endangered Species Act (Act). Below, we provide a detailed summary of peer review comments and responses, where appropriate.

Comment (2): Concern that, “the decision to update recovery criteria for these 42 species as a group is indicative of the Service moving away from utilizing recovery teams and outside scientific expertise.”

Response: Section 4 of the Act provides the Service with the authority and discretion to appoint recovery teams for the purpose of developing and implementing recovery plans. The current effort to update recovery plans with quantitative recovery criteria for what constitutes a recovered species is not indicative of the future need for, and does not preclude the future utilization of, recovery teams to complete recovery planning needs for listed species.

Comment (3): New and significant information has been developed in the years since the existing Recovery Plan was adopted. Updating this plan can serve to better inform the Service, the regulated community, and Federal, State, and local resource agencies.

Response: A recovery plan should be a living document, reflecting meaningful change when new substantive information becomes available. Keeping a recovery plan current increases its usefulness in recovering a species by ensuring that the species benefits through timely, partner-coordinated implementation based on the best available information.

Comment (4): The Service should consider whether the updated recovery criteria would be less burdensome on Federal agencies and the regulated community than the existing criteria.

Response: Recovery plans are guidance documents that outline how best to help listed species achieve recovery, but they are not regulatory documents. Recovery plans are intended to establish goals for long-term conservation of listed species and define criteria that are designed to indicate when the threats facing a species have been removed or reduced to such an extent that the species may no longer need the protections of the Act.

Recovery criteria are achieved through the funding and implementation of recovery actions by both the Service and our partners. In addition to the existing recovery actions included in each of these recovery plans, the amendments address the need for any new, site-specific recovery actions triggered by the modification of recovery criteria, along with the costs, timing, and priority of any such additional actions. Because recovery plans are not regulatory documents, 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 a recovery plan should be construed as a commitment or requirement that any Federal agency obligate or provide funds.

Comment (5): The Service should consider whether the recovery criteria are achievable, because including unattainable recovery criteria could render such plans meaningless, or impede other processes under the Act.

Response: The National Marine Fisheries Service and U.S. Fish and Wildlife Service Interim Endangered and Threatened Species Recovery Plan Guidance (2010) emphasizes the development of recovery criteria that are specific, measurable, achievable, realistic, and time-referenced (SMART). The achievable component of SMART criteria implies that the authority, funding, and staffing needed to meet recovery criteria are feasible, even if not always likely. In developing recovery criteria specifically, we attempt to establish criteria that are both scientifically defensible and achievable to the greatest extent possible. At times, however, the feasibility of achieving certain criteria can be, or appear to be, constrained by the particular, difficult circumstances that face a species. Even in such cases, criteria serve to guide recovery

actions and priorities for the species. Furthermore, as recovery progresses, periodic reevaluation of the species status through the 5-year review process may reveal that the barriers to achieving certain criteria have been removed or that circumstances or our understanding of the species have evolved. In that event, the Service can revise recovery criteria to ensure that they reflect the strategy most likely to succeed in the goal of recovery.

Comment (6): The Service should consider conservation efforts that have been put into place for the listed species since the previous iteration of the recovery plan, especially where the Service has supported conservation efforts, in formulating recovery criteria that will be established or amended by the revised draft plan.

Response: While section 4 of the Act directs the Service to specifically develop and implement recovery plans, several other sections of the Act and associated programs and activities also provide important opportunities to promote recovery. Information from these programs and activities about the biological needs of the species can inform recovery planning (including the formulation or revision of recovery criteria) and implementation. These conservation efforts have been considered during the development of this and other recovery plans.

Comment (7): The Service should determine whether ongoing species conservation efforts beneficially address one or more of the listing factors set forth in the Act implementing regulations addressing species listings and designation of critical habitat.

Response: All Service decisions that affect the listed status or critical habitat designation of a particular species, including our 5-year review of each listed species, are made by analyzing the five factors described in section 4 of the Act. Such an analysis necessarily includes an assessment of any conservation efforts or other actions that may mitigate or reduce impacts on the species. While our objective with this particular effort was to establish objective, measurable criteria for delisting, conservation actions play a crucial role in determining if and when those criteria have been satisfied.

Comment (8): The Service should be mindful of the impacts that recovery plan criteria can have on the section 7 process of the Act for the regulated community, because the Service and other Federal resource agencies sometimes request that recovery criteria be addressed in biological assessments and other planning processes under the Act addressing listed species.

Response: Recovery plans can both inform, and be informed by section 7 processes of the Act. When revising a recovery plan, existing section 7 consultations may provide helpful information on: recent threats and mechanisms to avoid, minimize, or compensate for impacts associated with those threats; a summarized status of the species; and indication of who important partners may be. Section 7 consultations can inform the need for revised recovery actions, recovery implementation schedule activities, recovery criteria, or species status assessments to provide more comprehensive recovery planning while the species remains listed.

Comment (9): The Service should include the full panoply of current information available for the species in all revised draft recovery plans.

Response: Our recovery planning guidance recommends that recovery planning be supported by compilation of available information that supports the best possible scientific understanding of the species. Although it is not necessary to exhaustively include all current information within the text of the recovery plan, to the extent that this information is specifically relevant and useful to recovery, the recovery plan may summarize such material or incorporate it by reference. Supporting biological information may also be included within a species status assessment or biological report separate from the recovery plan document itself.

Comment (10): The Service should consider whether the existing recovery plan should be revised or replaced in its entirety rather than amended in part.

Response: Under guidance established in 2010, partial revisions allow the Service to efficiently and effectively update recovery plans with the latest science and information when a recovery plan may not warrant the time or resources required to undertake a full revision of the plan. To further gauge whether we had assembled, considered, and incorporated the best available scientific and commercial information into this recovery plan revision, we solicited submission of any information, during the public comment period, that would enhance the necessary understanding of the species' biology and threats, and recovery needs and related implementation issues or concerns. We believe the recovery plan amendment, which targets updating recovery criteria, is appropriate for the species. However, we will also continue to evaluate the accuracy and usefulness of the existing recovery plan with respect to current information and status of conservation actions, and may pursue a full revision of the plan in the future, if appropriate.

Summary of Peer and Partner Review Comments

In accordance with the requirements of the Act, we solicited independent peer review of the draft amendment from qualified representatives from the following: The Nature Conservancy – Texas Chapter U.S. Department of Agriculture's Natural Resource Conservation Service, Texas Parks and Wildlife Department (current and retired former representatives), Texas Department of Transportation, Texas State University, Lady Bird Johnson Wildflower Center, Janssen Biological, and Land Steward Consultants, Ltd. Peer review was conducted concurrent with the *Federal Register* publication. Criteria used for selecting peer reviewers included their demonstrated expertise and specialized knowledge related to *Astrophytum asterias* and their knowledge of biology, ecology, demography, management, conservation, and propagation/reintroduction methods of native South Texas plant species. The qualifications of the peer reviewers are in the decision file and the administrative record for this Recovery Plan amendment.

In total, we solicited review and comment from six peer reviewers and three partner agencies. We received comments from two peer reviewers and one partner agency reviewer. Peer reviewers that responded included one representative from Land Steward Consultants, Ltd. and one from The Nature Conservancy - Texas Chapter. Partner agency reviews included one from Texas Parks and Wildlife Department. In general, the draft amendment was well-received by the peer and partner reviewers and garnered positive comments. The reviewers provided minor edits, comments, and additional specific information including one new citation and clarification

of some details in the text; we thank the reviewers for these data and we have added the information where appropriate.

We considered all substantive comments, and to the extent appropriate, we incorporated the applicable information or suggested changes into the final Recovery Plan amendment. Below, we provide a summary of specific comments received from peer and partner reviewers with our responses; however, we addressed many of the reviewers' specific critiques and incorporated their suggestions as changes to the final amendment. Such comments did not warrant an explicit response, and as such, are not addressed here. We appreciate the input from all commenters, which helped us to consider and incorporate the best available scientific and commercial information during development and approval of the final Recovery Plan amendment.

Peer Review Comment (1): The reviewer asked if it is possible to include in the revised criteria a minimum acreage to the star cactus sites to be established or maintained. The reviewer stated that sites would have to be large enough to maintain the surrounding habitat that promotes essential pollinators and vegetation community.

Response: Since the size of a functional community could vary depending upon many factors, such as topography, distance to water sources, species assemblages, land use, disturbance, etc., we believe placing a minimum acreage might restrict the ability to implement appropriate management and protection actions. However, we added additional language to the justification paragraph for amended downlisting criteria #2 to stipulate that habitat buffers should be large enough to maintain the native community of flora and fauna and to support pollinators.

Peer Review Comment (2): The reviewer took exception to our use of the term "fully protected" stating that the term is a misnomer; no site can ever be fully protected, especially without mineral rights and because sites are subject to climate change and management issues.

Response: Rather than delete or rename this term, we inserted our definition of "fully protected" at the beginning of the Threats Assessment section of the amendment to clarify what this term means when used in the context of star cactus recovery criteria.

Peer Review Comment (3): The reviewer called our attention to a relevant study regarding herbivory threats that published after the 2013 Five-year Review and not captured in the amendment document.

Response: We added a new paragraph addressing the threat of mammal herbivory to the amendment under the Threats Assessment section and added the new citation to the Literature Cited section.

Peer Review Comment (4): The reviewer asked that habitat buffers include management for other existing populations of cacti species to support specialist bees.

Response: We added additional language to the justification paragraph for amended downlisting criteria #2 to stipulate that fully protected sites should also include habitat buffers that are managed for other existing populations of cacti species to support cactus specialist bees.