

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) Recovery Plan Original Recovery Plan Approved: March 28, 1985 Page(s) Superseded: 19-34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(Travis and Williamson Counties, Texas) Recovery Plan Original Recovery Plan Approved: August 25, 1994 Page(s) Superseded: 86-88 Species Included: Bee Creek Cave harvestman (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) Recovery Plan Original Recovery Plan Approved: September 26, 2002 Page(s) Superseded: 18-21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) Recovery Plan Original Recovery Plan Approved: March 29, 1985 Page(s) Superseded: 16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) Recovery Plan Original Recovery Plan Approved: March 28, 1985 Page(s) Superseded: 13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) Recovery Plan Original Recovery Plan Approved: August 31, 1994 Page(s) Superseded: 16-17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) Recovery Plan Original Recovery Plan Approved: April 14, 1986 Page(s) Superseded: 19-41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Sneed and Lee Pincushion Cacti Recovery Plan Original Recovery Plan Approved: March 21, 1986 Page(s) Superseded: 19 Species Included: Sneed pincushion cactus (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) Recovery Plan Original Recovery Plan Approved: February 16, 1982 Page(s) Superseded: 6-7, 10-11, 13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Page(s) Superseded: 11-14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Page(s) Superseded: iii, 14-15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

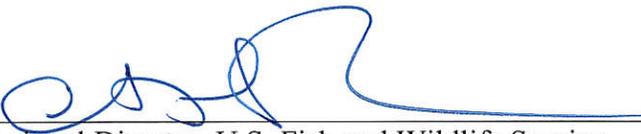
Page(s) Superseded: 14

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 *Erigeron rhizomatus* (Zuni Fleabane)

Original Approved: September 30, 1988

Original Prepared by: Paul Knight, New Mexico Energy, Minerals, and Natural Resources Department, Santa Fe, New Mexico

AMENDMENT 1

We have identified best available information that indicates the need to amend recovery criteria for this species since the Zuni Fleabane (*Erigeron rhizomatus*) 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 page 14 (U.S. Fish and Wildlife Service [Service] 1988: 14).

**For
U.S. Fish and Wildlife Service
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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 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 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 recovery criteria were collectively developed and reviewed by species experts that included biologists and botanists from the Bureau of Land Management (BLM), New Mexico Energy, Minerals and Natural Resources Department, Navajo Natural Heritage Program, U.S. Forest Service (Forest Service), and the Service. The development process was informed by the best available science regarding species biology and current threats. The recovery criteria were designed to be objective and quantifiable in order to meet the conditions needed to ensure species viability through sustainment of populations in the wild that demonstrate resiliency, redundancy, and representation (Wolf et al. 2015: entire).

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: 2) also have affirmed the need to frame recovery criteria in terms of threats assessed under the five delisting factors.

Recovery Criteria

Although there is a final Recovery Plan, we have decided to update criteria with new information to better incorporate objective/measurable criteria. When the Recovery Plan was finalized in 1988, limited data made it difficult to quantify habitat requirements with enough precision to establish detailed and measurable recovery criteria (Service 1988: entire).

Synthesis

The amended recovery criteria described below expand and clarify the biological recovery criteria described in the original recovery criteria, and implicitly require effective monitoring to provide the biological data for delisting. In 2007, we completed a 5-year review (Service 2007: entire). Currently, there are three known populations of Zuni fleabane (Chuska, Datil, and Zuni). The Chuska Population exists on lands owned and managed by the Navajo Nation and contains 15 subpopulations on the Navajo Nation in the Chuska Mountains (Christie 2004: 5–6).

The Datil and Zuni Populations are almost entirely located on lands managed by the Forest Service, with one subpopulation on lands managed by BLM in the Datil Population. The Datil Population is the largest (33 subpopulations), with at least one third of potential habitat yet to be surveyed (Roth and Sivinski 2014: 5). When comparing similar subpopulations in the Datil Population from 1991 to 2014, the number of individuals declined from 12,890 to 2,470 (Roth

and Sivinski 2014: Appendix). There was also a decline at the BLM subpopulation (Roth and Sivinski 2014: 15). As of 2014, both of the known subpopulations within the Zuni Population were occupied (306 individuals), though the population had declined since 2004 (1,300 individuals) (Roth and Sivinski 2014: 12).

Current Threat Status

Surface mining (uranium) is the major threat to occupied Zuni Fleabane habitat on lands. Surface mining could result in permanent habitat loss and the extirpation of subpopulations. Long term drought conditions, a probable result of a changing climate, has also been cited as a potential cause of some of the declines documented in the species (Roth and Sivinski 2014).

Forest Service Lands

All subpopulations on Forest Service lands are subject to potential surface mining (uranium). Efforts are underway by the Forest Service to remove the risk of surface mining to the subpopulations in the Datil/Zuni Populations via a mineral withdrawal.

BLM Land

The Datil subpopulation in the BLM Sawtooth Area of Critical Environmental Concern currently has mineral rights withdrawn (BLM 2010: 54).

Navajo Nation

The Chuska Population occurs on Navajo Nation lands. Zuni Fleabane is currently listed as G2 (Endangered) on the Navajo Endangered Species list (Navajo Nation Division of Natural Resources 2008: 2). Biological Resource Land Use Clearance Policies and Procedures allow the Navajo Natural Heritage Program to restrict development activities in biologically important areas, in addition there is a clearance process required for any development activities on Navajo Nation Lands where sensitive species would be impacted (Navajo Nation Council 2008: entire). Lastly, the Dine Natural Resources Protection Act of 2005 has eliminated uranium mining activities on Navajo Nation Land (Navajo Nation Council 2005: entire).

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 no longer meets the definition of either an endangered or threatened species 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 endangered to threatened. The term “endangered species” means any species (species, subspecies, 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 delisting criteria for Zuni Fleabane, which will supersede those included in the Recovery Plan (Service 1988: 14) as follows:

Delisting Recovery Criteria

Current recovery criteria

Recovery criteria in the 1988 Recovery Plan (Service 1988: 14) are:

1. Complete a survey of all potential habitat of Zuni fleabane.
2. Develop and implement a habitat management plan and install permanent monitoring plots within several populations of the Zuni fleabane.
3. A demonstrated long-term stability (or increase) in population levels and habitat from the monitoring plots, and a continued assurance that the habitat of Zuni fleabane will not be threatened by mineral exploration, leasing, or development.

Amended recovery criteria

The Zuni Fleabane will be considered for delisting when:

1. Over a 20-year survey period, monitoring demonstrates a stable or increasing trend in abundance (including evidence of a stable demographic structure) across the Datil Population.* During a minimum of 80 percent of the survey period (i.e., 16 years), an estimated minimum population of 7,500 individual plants will remain extant in the Datil Population. Monitoring will demonstrate a minimum estimated patch occupancy rate (number of subpopulations with occupied habitat divided by total number of subpopulations) of 80 percent per annum.

Justification: A stable or increasing population size indicates that threats overall are not adversely affecting the population. In order to provide enough data for a rigorous statistical analysis, a minimum period of 20 years will be required to determine the demographic trends necessary to support a future delisting decision. A recovery minimum of 7,500 individuals within this population, in addition to a stable or increasing population trend, should provide adequate conservation of the species into the foreseeable future. Reaching the minimum recovery goal (7,500 individuals) every year of the survey period is highly unlikely due to localized stochastic variability at the subpopulation level. Reaching the estimated minimum numeric goal 80 percent of the survey period (16 years) allows for this variability while still providing for a viable population. Maintaining an estimated annual patch occupancy rate of 80 percent, allows for localized stochastic variability at the subpopulation level, while ensuring redundancy at the population level so catastrophic events do not cause population level extinction.

2. Over a 20-year survey period, monitoring demonstrates a stable or increasing trend in abundance (including evidence of a stable demographic structure) across the Chuska Population*. During a minimum of 80 percent of the survey period (i.e., 16 years), an estimated minimum population of 4,500 individual plants, will remain extant in the Chuska Population. Monitoring will demonstrate a minimum estimated patch

occupancy rate (number of subpopulations with occupied habitat divided by total number of subpopulations) of 80 percent per annum.

Justification: A stable or increasing population size indicates that threats overall are not adversely affecting the population. In order to provide enough data for a rigorous statistical analysis, a minimum period of 20 years will be required to determine the demographic trends necessary to support a future delisting decision. A recovery minimum of 4,500 individuals within this population, in addition to a stable or increasing population trend, should provide adequate conservation of the species into the foreseeable future. Reaching the minimum recovery goal (4,500 individuals) every year of the survey period is highly unlikely due to localized stochastic variability at the subpopulation level. Reaching the estimated minimum numeric goal 80 percent of the survey period (16 years) allows for this variability while still providing for a viable population. Maintaining an estimated annual patch occupancy rate of 80 percent, allows for localized stochastic variability at the subpopulation level, while ensuring redundancy at the population level so catastrophic events do not cause population level extinction.

3. Over a 20-year survey period, monitoring demonstrates a stable or increasing trend in abundance (including evidence of a stable demographic structure) across the Zuni population*. During a minimum of 80 percent of the survey period (i.e., 16 years), an estimated population of 800 individual plants, will remain extant in the Zuni population. Monitoring will demonstrate that both subpopulations remain occupied an estimated minimum of 75 percent of the survey period (i.e., 15 years). If future surveys discover additional subpopulations, then the 80 percent estimated patch occupancy rate described in criteria 1 and 2 would apply.

Justification: A stable or increasing population size indicates that threats overall are not adversely affecting the population. In order to provide enough data for a rigorous statistical analysis, a minimum period of 20 years will be required to determine the demographic trends necessary to support a future delisting decision. Because of its smaller size a recovery minimum of 800 individuals within this population, in addition to a stable or increasing population trend, should provide adequate conservation of the species into the foreseeable future. Reaching the estimated minimum recovery goal (800 individuals) every year of the survey period is highly unlikely due to localized stochastic variability at the subpopulation level. Reaching the estimated minimum numeric goal 80 percent of the survey period (16 years) allows for this variability while still providing for a viable population. With only two subpopulations, both subpopulations must remain occupied concurrently over a reasonable period of time (75 percent of the 20-year survey period) to demonstrate redundancy.

4. The permanent withdrawal from mineral entry for Zuni Fleabane occupied habitat on Forest Service lands or the development and implementation of a habitat management plan (HMP) will be completed. The HMP should include a minimum of a 100 meter (300 foot) surface disturbance buffer around occupied Zuni Fleabane habitat, and

would prioritize avoidance of occupied habitat, and ensure connectivity for pollination between subpopulations.

Justification: Adequate regulatory mechanisms need to be in place to provide assurances that land use threats (surface mining and any type of surface development) do not threaten the continued existence of Zuni fleabane or its habitat. The HMP should be incorporated into regulatory agency management plans. By incorporation into agency management plans, adequate protection is ensured that Zuni Fleabane will persist post-delisting.

5. A Service approved post-delisting monitoring plan will be implemented.

Justification: A post-delisting monitoring plan is necessary to ensure the ongoing conservation of the species and the continuing effectiveness of management actions.

6. A robust seed banking program should be established, thus providing the potential for species resiliency and recovery over evolutionary time.

Justification: The establishment of a seed banking program would protect the species in perpetuity, would provide the ability of a transplant program in the future, and would provide a measure of species' resiliency in the face of climate change.

* The Service recognizes the difficulty in identifying individual plants in the field due to the rhizomatous nature of this species. When and if an alternate, repeatable and reliable method for quantifying Zuni Fleabane abundance is developed and adopted by experts (in consultation with the Service), it will be considered in any future listing decision.

Rationale for Recovery Criteria

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 Act (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 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.

In addition to minimizing and ameliorating the threats identified above, the recovery criteria for Zuni Fleabane address the conservation principles of the 3-Rs: representation, resiliency, and redundancy (Wolf et al. 2015: 204). Based on the best available information that includes the input and data from species experts during our recovery criteria review, these amended recovery criteria provide quantifiable measures for identifying and implementing recovery actions, a means to measure progress towards recovery, and the ability to recognize when recovery will be achieved.

Resiliency

Resiliency ensures that populations are sufficiently large to withstand stochastic events, and the identified threats have been ameliorated. A stable or increasing trend in abundance indicates that annual mortality is compensated by recruitment events, and at the scale of the population this indicates the resiliency of subpopulations. A minimum of 5,000 individuals has emerged as a conservation metric across taxa (Traill et al. 2007: 164); this number allows for the maintenance of genetic diversity (representation) within each population and across the species. Chuska and Datil Populations fluctuate around this population level so should be able to be maintained at this level (their respective numeric goals were generated from the median calculated from limited available data). Because of its smaller area (only two known sub-populations) of suitable habitat, 800 individuals should be sufficient to maintain the Zuni Population. We used these numbers as the minimum number of individuals needed to maintain a viable population. A robust monitoring plan will need to be designed and implemented to provide the data necessary to identify statistically significant trends at the population and species level. The establishment of a seed banking program that would protect the species in perpetuity, and would provide the ability of a transplant program in the future, would provide a measure of species' resiliency in the face of climate change.

Redundancy

Redundancy provides for security against extinction from catastrophic events that could impact a single population. An estimated annual patch occupancy rate of 80 percent allows for annual variability in localized patch occupancy due to stochastic events, while ensuring both population persistence (redundancy) and the localized resiliency of subpopulations. As there are only two known subpopulations in the Zuni Population, both subpopulations must remain occupied concurrently over a reasonable period of time (75 percent of the 20-year survey period) to demonstrate redundancy. Maintaining each population (Datil, Chuska, and Zuni) builds redundancy into the conservation framework at the species level.

Representation

Maintaining populations across a range of environmental conditions builds representation into the conservation framework at the species level by requiring functioning populations in three distinct geographic areas spread across the species range. Two large populations (7,500 and 4,500 individuals) help maintain genetic diversity across the species range.

ADDITIONAL SITE SPECIFIC RECOVERY ACTIONS

Not Applicable

COSTS, TIMING, PRIORITY OF ADDITIONAL RECOVERY ACTIONS

Not Applicable

LITERATURE CITED

- Bureau of Land Management (BLM). 2010. Socorro Field Office Resource Management Plan, Socorro, New Mexico. https://eplanning.blm.gov/epl-front-office/projects/lup/56599/67448/73390/RMP_Socorro_2010_08_20.pdf, accessed June 29, 2018.
- Christie, K. 2004. *Erigeron rhizomatus*: Survey and Status Report for the Navajo Nation. Navajo Natural Heritage Program, Window Rock, Arizona.
- General Accounting Office (GAO). 2006. Endangered Species: Time and Costs Required to Recover Species Are Largely Unknown. GAO-06-463R. Washington, DC. <https://www.gpo.gov/fdsys/pkg/GAOREPORTS-GAO-06-463R/pdf/GAOREPORTS-GAO-06-463R.pdf>, accessed June 12, 2018.
- Navajo Nation Council. 2005. Dine Natural Resources Protection Act of 2005. <https://www.nrc.gov/docs/ML0723/ML072340482.pdf>, accessed June 12, 2018.
- Navajo Nation Division of Natural Resources. 2008. Navajo Endangered Species List. https://www.nndfw.org/nnhp/nnhp_nesl.pdf, accessed June 12, 2018.
- Roth, D., and R. Sivinski. 2014. Status Report for Zuni Fleabane of the Cibola National Forest, New Mexico. Report to U.S. Forest Service, Cibola National Forest, Albuquerque, New Mexico.
- Trill L.W., C. J. A. Bradshaw, and B.W. Brook. 2007. Minimum viable population size: A meta-analysis of 30 years of published estimates. *Biological Conservation* 139:159–166.
- U.S. Fish and Wildlife Service (Service). 1988. Zuni Fleabane (*Erigeron rhizomatus*). Recovery Plan. U.S. Fish and Wildlife Service. Albuquerque, New Mexico. https://ecos.fws.gov/docs/recovery_plan/880930.pdf, accessed June 12, 2018.
- U.S. Fish and Wildlife Service (Service). 2007. Zuni Fleabane (*Erigeron rhizomatus*). 5-year review: Summary and Evaluation. U.S. Fish and Wildlife Service. New Mexico Ecological Services Field Office Albuquerque, New Mexico. https://ecos.fws.gov/docs/five_year_review/doc1153.pdf, accessed June 12, 2018.
- Wolf, S., Hartl, B., Carroll, C., Neel, M.C., and Greenwald, D.N. 2015. Beyond PVA: why recovery under the Endangered Species Act is more than population viability. *BioScience* 65:200–207.

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 Zuni Fleabane (*Erigeron rhizomatus*) Recovery Plan (Recovery Plan revision 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/ecp0/profile/speciesProfile?spcode=Q1W4>).

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 four responses to the request for public comment. These included comments from private citizens, the Center for Biological Diversity, and the Energy and Wildlife Action Coalition.

Public comments ranged from providing minor editorial suggestions to specific recommendations on amendment content. We have considered all substantive comments; we thank the reviewers for these comments and to the extent appropriate, we have incorporated the applicable information or suggested changes into the final Recovery Plan amendment. 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 revised recovery plan 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 our 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.

Comment (11): One commenter was concerned with the definitive threshold for the number of plants needed to downlist or delist this species. In the recovery criteria amendments, there is no clear indication of what constitutes a single plant; the rhizomatous nature of this species makes it impossible to estimate definitive thresholds for status updates. Establishing specific numbers of plants for recovery without justification could lead to premature delisting and possible extinction.

Response: The Service recognizes the difficulty in identifying individual plants in the field due to the rhizomatous nature of this species. However, the available literature on this species (e.g. Roth & Sivinski 2014) do attempt to quantify individual numbers as did previous surveys. When and if an alternate, repeatable and reliable method for quantifying Zuni Fleabane abundance is developed by experts, it will be considered in any future listing decision. Additionally, the numeric criteria are only one component of recovery, any listing decision would involve a full assessment of the status of the species and its threat outlook.

Comment (12): Numbers reported in 1991 were significantly higher than those proposed for recovery, and these proposed numbers are not representative of viable populations.

Response: The 1991 numbers are not reliable in any way, according to Roth & Sivinski 2014, "Sivinski and Lightfoot made rough estimates of population size at 19 locations in the Datil/Sawtooth mountain region in 1991. These estimates did not count individual plants in the larger populations and were only impressions of relative abundance after walking through

habitats with numerous rhizomatous plants”. The counts were more rigorous in 2014 (Roth & Sivinski), the numeric recovery goals in the proposed amendment are several times greater than the estimated counts in 2014. There is no extant PVA for the species, thus the combination of numeric goals, stable/increasing trends, and occupancy metrics across the range of the species should provide the necessary biological platform for species recovery.

Comment (13): One commenter proposed that the conservation of this species be included in the management plans of federal agencies since recommendations are not binding. Mining should not be the sole focus in adapting management practices to aid in recovery for this species; there have been significant declines in the population, documented in 2014, which did not occur due to mining. Recovery depends on sound management, so management actions need to be proven effective prior to status updates.

Response: Recovery actions and practices are separate from the amended recovery criteria. A suite of conservation efforts will need implemented in order to reach and maintain recovery of the species. Mining is specifically addressed as it was identified as a major threat (a listing factor) in the original listing.

Summary of Peer and Partner Review Comments

In accordance with the requirements of the Act, we solicited independent peer review from the Bureau of Land Management, the National Park Service, the Navajo Natural Heritage Program, and the New Mexico Division of Forestry. 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 Zuni fleabane, botany, and the Colorado Plateau. (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 four peer reviewers (which includes two partner agencies). We received comments from all four reviewers. Peer reviewers that responded were from the Bureau of Land Management (Federal Agency), the National Park Service (Federal Agency), the Navajo Natural Heritage Program (Tribal Government), and the New Mexico Division of Forestry (State Agency). Several reviewers provided additional specific information, including citations; 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): One commenter suggested that the Service consider that this plant demonstrates a stable or increasing trend of at least 5,000 individuals over at least 20 years

within the Datil population at minimum in order to be considered for delisting. Stochastic variability can be taken into account by determining a confidence interval for numbers of plants instead of years-for example, at least 5,000 plants/year within a 5% confidence interval allows there to be some years where a population above 4750 individuals would be acceptable. Otherwise, if the Datil Population holds steady at 5,000 plants for 16 years and then suddenly decreases below 5,000 plants for the next 4 years, this would still trigger consideration for delisting. Another difficulty with this plant, because it is rhizomatous, is determining/quantifying individuals. Individuals can be quantified by numbers of “clumps” or numbers of stems within a given area. Both approaches are problematic.

Response: If the “Datil Population holds steady at 5,000 plants for 16 years and then suddenly decreases below 5,000 plants for the next 4 years” was the case, then the first criteria “monitoring demonstrates a stable or increasing trend in abundance across the Datil Population” would not be met. Thus, the combination of a “stable or increasing trend” and the numeric goal together allow for some stochasticity in the system while moving towards recovery. In order to maintain a “minimum” of 5,000 individuals over the survey period, then a higher number of individuals would be required *in situ* to maintain that “minimum”. Additionally, as recovery criteria are reached, “delisting” is not triggered. A listing decision would follow a petition where the recovery criteria simply provide a measure against which recovery can be analyzed. Lastly, the Service recognizes the difficulty in identifying individual plants in the field due to the rhizomatous nature of this species. However, the available literature on this species (e.g. Roth & Sivinski 2014) do attempt to quantify individual numbers as did previous surveys. When and if an alternate, repeatable and reliable method for quantifying Zuni Fleabane abundance is developed by experts, it will be considered in any future listing decision.

Peer Review Comment (2): This criteria would require annual range-wide monitoring of all subpopulations to determine presence/absence of plants. Is this currently part of the monitoring program that is in place for the Datil population?

Response: Monitoring data is a necessary component of recovery for almost all listed entities. In this case the onus is on the primary landowner (U.S. Forest Service).). Currently, there is no consistent monitoring program, one would need to be developed and implemented. Additionally, the numeric criteria and patch occupancy criteria may be “estimated” over the survey period via a robust monitoring program. The word “estimated” has been added to the final criteria.

Peer Review Comment (3): The commenter is concerned with a 60% occupancy rate.

Response: The Datil population is described as a metapopulation (Roth & Sivinski 2014). For a metapopulation to persist, then the annual Colonization Rate/Extinction Rate > 1 (across all component populations) (or a 51% occupancy rate). Thus the 60% rate is set higher than necessary for a metapopulation construct to persist over time. However due to the long lived rhizomatous nature of this species, the estimated 60% occupancy rate will be increased to 80%. Again, when considered in concert with the “stable or increasing trend” and minimum numeric criteria, a robust recovery platform emerges.

Peer Review Comment (4): The commenter is concerned with the numeric criteria for the Chuska Mountain population.

Response: The criteria states “an estimated minimum population”, a complete annual census is not necessary. The development and implementation of a thoughtful and comprehensive monitoring protocol would yield the necessary estimates. The numeric criteria is necessary as it serves as a surrogate for the maintenance of genetic diversity and as a buffer against demographic and ecological stochasticity. Establishing a new numeric criteria that may be more appropriate for the Chuska Mountain metapopulation will be explored during our current editorial review.

Peer Review Comment (5): The commenter is concerned with the occupancy rate for the Zuni Mountain population. With only two known extant populations, the commenter is concerned that even if both subpopulations were unoccupied for five years concurrently the recovery criteria would be met.

Response: There may be years where neither known sub-population is occupied (or no plants are detected), though again, when considered in concert with the “stable or increasing trend” and minimum numeric criteria, a robust recovery platform emerges. Additionally, adjacent Forest Service lands and lands of the Pueblo of Zuni have not been comprehensively surveyed and there may be several other local sub-populations.

Peer Review Comment (6): Putting in the 20 year annual criteria assumes that programs/land managers are going to be able to go to every subpopulation every year to determine presence/absence. This is currently not happening. I think a more realistic approach would be to assume a subpopulation-wide monitoring interval of 5-10 years for each of the populations. In this case, requiring a 60 (or ideally at least 70%) patch occupancy rate for at least 5 monitoring intervals (over a period of 25-50 years) would be more realistic.

Response: The “stable or increasing” trend data and the data used to create an “estimated minimum population” will be the product of a robust monitoring protocol and not a complete annual census. The same should be true for the “annual patch occupancy rate.” This was clarified in our final amendment.

Peer Review Comment (7): My significant concern is that different monitors may have different approaches to "counting plants". I've worked with rare rhizomatous perennials (*Carex specuicola* and *Actaea arizonica*) and there is always a problem with historical monitoring in that the methods for counting plants were both the *Carex* and the *Actaea* that they cannot be counted in a reliable way.

Response: The Service recognizes the difficulty in identifying individual plants in the field due to the rhizomatous nature of this species. However, the available literature on this species (e.g. Roth & Sivinski 2014) do attempt to quantify individual numbers as did previous surveys. When and if an alternate, repeatable and reliable method for quantifying Zuni Fleabane abundance is developed by experts, it will be considered. We explain this difficulty explicitly in the amended criteria.

Peer Review Comment (8): I would like to see that monitoring plan as a part of this document, since that is the thing that is most unreliable in your plan. I am not sure that any monitoring plan

can be made to work really well, and if it doesn't, that puts everything else in the document in question.

Response: Though the development and implementation of a monitoring plan has been proposed in the draft recovery criteria amendments, we have not yet completed a monitoring plan. A team of experts will work together to create a monitoring plan.

Peer Review Comment (9): I have many concerns with using a stochastic patch occupancy model (SPOM). First, I do not think the multiple agencies with ownership have the means to inform this type of model. Also, I didn't find SPOMs that inform on rhizomatous species (e.g. lack of seedlings). Finally, these are more often used with animals and are less practiced with plants. I have attached articles that highlight issues with these types of models (Menges 2000, Zeigler et al. 2013, and Wolf et al 2015).

Response: The amended criteria do not necessitate or describe a SPOM *per se*. The Datil population was described as a metapopulation (Roth & Sivinski 2014). The patch occupancy metric is designed to focus management at the subpopulation/EO level instead of focusing on a few sites which have a high estimated count. Additionally, focusing management at the sub-population level ensures redundancy within the population level and across the species range.

Peer Review Comment (10): The use of arbitrary numbers (700 or 5,000) for recovery is not widely accepted and I have many concerns for this species. There are other ways to quantitatively determine recovery. The one study (Traill et al. 2007) that promotes this approach is one study that is not widely recognized across the botanical community. And this (attached) review discusses the shortcomings of the Traill et al study: A general target for MVPs: unsupported and unnecessary, Flather et al 2011.

Response: There is no extant PVA for the species, thus the combination of numeric goals, stable/increasing trends, and occupancy metrics across the range of the species should provide the necessary biological platform for species recovery.

Peer Review Comment (11): It seems that "abundance" has been globally misused. I recommend replacing "abundance" with "stable demographic structure." Abundance is an unreliable (and expensive) indicator of resiliency. See Development of Protocols to Inventory or Monitor Wildlife, Fish or Rare Plants (USDA/USFS, June 2006, pg. 3-5, 3-6) for a comparison of, and recommendations about, these monitoring indicators.

Response: The numeric criteria (abundance) is necessary as it serves as a surrogate for the maintenance of genetic diversity and as a buffer against demographic and ecological stochasticity (providing population and species level resiliency). The Service recognizes the importance of a "stable demographic structure" which is a necessary component of a "stable and increasing trend", i.e. annual recruitment exceeds annual mortality. The criteria were modified in the final amendment to include a specific reference to a "stable demographic structure".

Peer Review Comment (12): Surface mining as a major threat does not explain the significant decline documented in 2014 from Forest Service and BLM lands. There has been no mining on

FS or BLM lands since 1991, when populations were first documented. The decline is likely due to prolonged drought conditions (Roth and Sivinski 2014). The primary threat document on Navajo Nation lands is activities related to oil & gas development. Please update to reflect actual current threat status.

Response: Long-term drought conditions may have impacted Zuni fleabane populations, this threat will be added to the final amendment. Existing energy development on Navajo Nation lands may have impacted Zuni fleabane populations, however any new energy development must be approved through several clearance processes on the Navajo Nation as described in the amendment.

Peer Review Comment (13): What about oil & gas development as a current threat, which has already impacted the largest known population on Navajo lands?

Response: See response to Peer Review Comment 12 above.

Peer Review Comment (14): Please be aware that there is a difference between repeat surveys and inventories vs. population trend monitoring. An estimated minimum population implies annual surveys of all subpopulations to get annual count estimates. Is that feasible or realistic? Monitoring of a representative sample would be more accurate and feasible.

Response: See response to Peer Review Comment 6 above.

Peer Review Comment (15): In 1991, just one subpopulation in the Datil population was estimated at more than 5,000 individuals, at which point the species was already listed threatened. 1991 estimates of half of the Datil subpopulations was at least twice as many plants (>10,000). Significant declines throughout the 33 Datil subpopulations estimated fewer than 3000 plants total in 2014. Clearly, 5,000 plants is not a viable or stable number of plants.

Response: The 1991 estimate was described as an overestimate (Sivinski & Roth 2016) by the original surveyor (R. Sivinski). However, the final amendment will increase the numeric criteria to reflect a value near the median of the two population estimates (1991 and 2014).

Peer Review Comment (16): A minimum patch occupancy rate of 60 percent per annum is unacceptably low for a long lived perennial rhizomatous plant and implies that as long as there is even one plant present in a patch our goal is achieved. This could hardly be considered a viable subpopulation. Even at 100% occupancy this is not acceptable.

Response: Please see response to Peer Review Comment 3 above.

Peer Review Comment (17): It is unclear whether you are proposing population trend monitoring, repeat surveys, or both for a recovery minimum of 5,000 individuals. Please clarify.

Response: See response to Peer Review Comment 6 above.

Peer Review Comment (18): To the best of my knowledge we do not have information on localized stochastic variability at the subpopulation level. Reaching the minimum recovery goal of 5,000 individuals every year is unlikely based on life history traits.

Response: See response to Peer Review Comment 16 above.

Peer Review Comment (19): How does maintaining an annual patch occupancy rate of 60 percent ensure redundancy at the population level so catastrophic events do not cause population level extinction? Please explain.

Response: See response to Peer Review Comment 3 above.

Peer Review Comment (20): In Delisting Criterion 2, what is 5,000 extant plants in the Chuska Population based on? This implies surveying all populations on an annual basis to get this estimate? See previous comments.

Response: The criteria reads states “an estimated minimum population”, a complete annual census is not necessary. The development and implementation of a thoughtful and comprehensive monitoring protocol would yield the necessary estimates. The numeric criteria is necessary as it serves as a surrogate for the maintenance of genetic diversity and as a buffer against demographic and ecological stochasticity. Establishing a new numeric criteria that may be more appropriate for the Chuska Mountain metapopulation will be explored during our current editorial review.

Peer Review Comment (21): A recovery minimum of 5,000 individuals within the Chuska Population, in addition to a stable or increasing population trend implies annual surveys to estimate all known sites plus population trend monitoring. I do not believe this is achievable. See previous comments.

Response: The criteria reads states “an estimated minimum population”, a complete annual census is not necessary. The development and implementation of a thoughtful and comprehensive monitoring protocol would yield the necessary estimates.

Peer Review Comment (22): What do you mean by localized stochastic variability? This is a long lived rhizomatous perennial plant, not an annual. I do not expect to see large variability in population size from year to year.

Response: See response to Peer Review Comment 3 above.

Peer Review Comment (23): The commenter is concerned with the occupancy rate of only 60%, especially when considering the long lived rhizomatous nature of the species.

Response: See response to Peer Review Comment 3 above.

Peer Review Comment (24): How is 700 extant plant in the Zuni Population justified? 700 plants for 2 geographically separate populations might be more plants than there were in 2014, but is significantly less than when the plants were listed. Even the number of plants present in

1991 was clearly not a stable population as indicated in the documented significant decline since then.

Response: See response to Peer Review Comment 15 above.

Peer Review Comment (25): Patch occupancy of 60 % is a seriously declining population for a long lived perennial plant that likely does not reproduce from seeds.

Response: See response to Peer Review Comment 3 above.

Peer Review Comment (26): A recovery minimum of 700 individuals is arbitrary. If you insist on providing a number of plants, you need to provide a solid justification, in addition to a definition of what represents one plant.

Response: The Service recognizes the difficulty in identifying individual plants in the field due to the rhizomatous nature of this species. However, the available literature on this species (e.g. Roth & Sivinski 2014) do attempt to quantify individual numbers as did previous surveys. When and if an alternate, repeatable and reliable method for quantifying Zuni Fleabane abundance is developed by experts, it will be considered in any future listing decision. See response to Peer Review Comment 15 above.

Peer Review Comment (27): To the best of my knowledge there is no documentation of localized stochastic variability. Based on existing reports, the populations were considered very stable between 1991 and 2004, with a sharp decline reported 10 years later in 2014, presumably due to prolonged drought conditions. We have no information that documents whether this was a slow decline over the 10 year period or whether it happen from one year to the next.

Response: See response to Peer Review Comment 3 above.

Peer Review Comment (28): A HMP needs to be in place whether there is a permanent withdrawal from mineral entry or not, for each of the 3 populations, regardless of ownership. Management actions need to be proven effective and successful in protecting the species before delisting can occur.

Response: In order to reach and maintain the recovery criteria presented, the creation and implementation of management plans is encouraged. A plan must be implemented as a measurable recovery criteria if mineral withdrawal is not accomplished, as only a handful of new mines could completely eradicate the Datil population.

Peer Review Comment (29): How does a disturbance buffer around occupied habitat ensure connectivity for pollination between subpopulations? Are these subpopulation that close to each other?

Response: This information has been edited in the final amendment to clarify that a disturbance buffer, avoidance of occupied habitat, and ensuring connectivity between occupied habitat should be included in a management plan.

Peer Review Comment (30): Do regulatory agencies have management plans? Should this be land management agencies and their individual resource management plans?

Response: Our intent is to connect any HMP to any management plan that has regulatory authority for that agency, in some cases that would be a “Resource Management Plan”.

Peer Review Comment (31): The commenter would like the amended criteria to explain the details of a post-delisting monitoring plan.

Response: The details of a monitoring plan and its requirements would be determined and explained within a de-listing decision in the Federal Register. Additional monitoring may be conducted by agency personnel.

Peer Review Comment (32): There is no criterion that addresses drought impacts or oil & gas development, which are considered current and active threats

Response: Oil and gas development was not described as a threat in the most recent status report Roth & Sivinski (2014). Additionally, the development of a Habitat Management Plan as prescribed under the “Adequate Regulatory Mechanism” criteria would provide protection from any potential oil and gas development in the future.

Peer Review Comment (33): The vast majority of taxa in the Traill et al. (2007) analysis were animals. This is arbitrary and not acceptable for a species threatened with extinction. Even species specific Population Viability Analysis has been largely debunked as a means to provide reasonable population viability estimates, especially in the absence of rigorous long term population trend data and seed bank studies (see references provided in accompanying letter). If you wish to use a specific metric for a PVA you need to commit to collect the data first, at a minimum. This is like putting the cart before the horse.

Response: The numeric criteria is necessary as it serves as a surrogate for the maintenance of genetic diversity and as a buffer against demographic and ecological stochasticity. The 1991 estimate (Zuni and Datil populations) was described as an overestimate (Sivinski & Roth 2016) by the original surveyor (R. Sivinski). However, the final amendment will adjust the numeric criteria to reflect a value near the median of the available population estimates. There is no extant PVA for the species, thus the combination of numeric goals, stable/increasing trends, and occupancy metrics across the range of the species should provide the necessary biological platform for species recovery.

Peer Review Comment (34): No data is provided to support the statement that the Chuska and Datil populations fluctuate around a population level of 5,000 individuals.

Response: See response to Peer Review Comment 33 above.

Peer Review Comment (35): No data is provided to support the statement that 700 individuals should be sufficient to maintain the Zuni Population. What is the area of suitable habitat for any of these 3 populations? Even if the suitable habitat is smaller in area, one can hardly conclude

that this implies that 700 plants therefore represent a viable population. In addition, this statement contradicts the above minimum viable population size of 5,000 individuals needed.

Response: The numeric criteria in the final amendment was adjusted to reflect a value near the median of the available population estimates for all three populations (Datil, Zuni, and Chuska).

Peer Review Comment (36): An annual patch occupancy rate of 60 percent may ensure persistence perhaps for a highly variable annual species, but unlikely for a long-lived rhizomatous perennial. What stochastic events are we referring to? Rainfall? Drought? Perhaps this allows for a measure to account for and document variability for annual species, but how it would ensure population persistence is very unclear.

Response: See response to Peer Review Comment 3 above.