

## Beardless Chinchweed (*Pectis imberbis*)

### Draft Recovery Plan



*Pectis imberbis* (beardless chinchweed) in flower. Photo by Tom Deecken, with permission.

Beardless chinchweed (*Pectis imberbis*) Draft Recovery Plan

Beardless Chinchweed (*Pectis imberbis*)  
Draft Recovery Plan

Southwest Region  
U.S. Fish and Wildlife Service  
Albuquerque, NM

Approved:           DRAFT          

Regional Director, Southwest Region,  
U.S. Fish and Wildlife Service

Date:

## **DISCLAIMER**

Recovery plans delineate such reasonable actions as may be necessary for the conservation and survival of listed species. Plans are published by the U.S. Fish and Wildlife Service (USFWS) or National Marine Fisheries Service (NMFS) and are sometimes prepared with the assistance of recovery teams, contractors, State agencies, and others. Recovery plans do not necessarily represent the views, official positions, or approval of any individuals or agencies involved in the plan formulation, other than the USFWS or NMFS. They represent the official position of the USFWS or NMFS only after they have been signed by the Regional Director (USFWS) or Assistant Administrator (NMFS).

Recovery plans are guidance and planning documents only; identification of an action to be implemented by any public or private party does not create a legal obligation beyond existing legal requirements. Nothing in this plan should be construed as a commitment or requirement that any Federal agency obligate or pay funds in any one fiscal year in excess of appropriations made by Congress for that fiscal year in contravention of the Anti-Deficiency Act, 31 U.S.C. 1341, or any other law or regulation.

Approved recovery plans are subject to modification as dictated by new findings, changes in species status, and the completion of recovery actions. Please check for updates or revisions at the websites below before using or citing.

## **ACKNOWLEDGEMENTS**

The recovery planning process, including this Draft Recovery Plan, has benefitted from the advice and assistance of many individuals, agencies, and organizations. Special thanks go out to Heather Whitlaw and Julie McIntyre, Arizona Ecological Services Office, and Angela Anders, Southwest Regional Office, for reviews of drafts. Valuable input and information were provided by many, including the following:

Arizona Game and Fish Department: Kendra Loubere and Sabra Tonn

National Forest Service: Angela Dahlby, James Heithold, and John Kraft

National Park Service: Jeff Conn, Helen Fitting, and Marcus Jernigan

Private Botanists: Clare Aslan, Steven Buckley, Tom Deecken, Ken Keil, Linda Kennedy, Sheila Murray, Jesus Sanchez-Escalante, Martha Sample, Robert Schmalzel, and Sara Souther

### **Lead Authors:**

Julie Crawford, Plant Ecologist, and Erin Fernandez, Fish and Wildlife Biologist, Arizona Ecological Services, Southwest Region, Fish and Wildlife Service

## LITERATURE CITATION AND AVAILABILITY

Literature citation should read as follows:

U.S. Fish and Wildlife Service. 2023. Beardless Chinchweed (*Pectis imberbis*) Draft Recovery Plan. Southwest Region, Albuquerque, NM, USA. 32 pp.

An electronic copy of this Draft Recovery Plan will be made available at:  
<https://ecos.fws.gov/ecp/species/1348>

## **BEARDLESS CHINCHWEED (*PECTIS IMBERBIS*) DRAFT RECOVERY PLAN**

### **BACKGROUND**

#### **Recovery Plan Overview**

This document presents the U.S. Fish and Wildlife Service's (USFWS) plan for the conservation and recovery of beardless chinchweed (*Pectis imberbis*). On June 15, 2021, beardless chinchweed was listed as endangered under the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et seq.; ESA) and eight units of critical habitat were designated in southern Arizona totaling 4,291 hectares (10,604 acres) (86 FR 31830; Table 1). Beardless chinchweed is assigned a recovery priority number of **5c** in a range from 1 to 18, with species ranking 1 having the highest recovery priority (48 FR 43098; USFWS 1983). The **5** indicates that this species faces a high degree of threat and has a low recovery potential; the **c** indicates there is a potential conflict, in this case with mining activity at two population locations. The degree of threat to the species is high due to ongoing sources of habitat loss, degradation, and modification, including nonnative plant invasion and an altered fire regime, mining activity, border activity, as well as threats to individual beardless chinchweed from drought, herbivory by wildlife and grazing by livestock, erosion, sedimentation, burial, and small population size. Beardless chinchweed has a low recovery potential due to the extent of nonnative plant invasion in its habitat in both Arizona and Mexico, difficulty in controlling nonnative grasses, and difficulty restoring native species.

Pursuant to section 4(f) of the ESA, a recovery plan must, to the maximum extent practicable, include (1) a description of site-specific management actions as may be necessary to achieve the plan's goals for the conservation and survival of the species; (2) objective, measurable criteria which, when met, would support a determination under section 4(a)(1) that the species be removed from the List of Endangered and Threatened Species; and (3) estimates of the time and costs required to carry out those measures needed to achieve the plan's goal and to achieve intermediate steps toward that goal.

In 2016, the USFWS adopted a new recovery planning process called "Recovery Planning and Implementation" (RPI). This is a streamlined approach to recovery planning and is intended to reduce the time needed to develop recovery plans, increase the relevancy of recovery plans over a longer timeframe, and add flexibility to recovery plans so they can be adjusted to new information or circumstances. Under the RPI framework, a recovery plan includes the statutorily required elements pursuant to section 4(f) of the ESA, along with a concise introduction and explanation of our strategy to achieve species recovery. This recovery plan is based on a separate Species Status Assessment Report for beardless chinchweed (USFWS 2020, entire), which describes the life history and biology of the species, the current status of the species, and the threats that impact the species. The Species Status Assessment Report for beardless chinchweed is briefly summarized below. Additionally, under the RPI process, a separate working document called the Recovery Implementation Strategy (RIS) is developed that provides a stepped-down schedule from the more general description of the recovery actions described in the recovery plan. The RIS describes in detail specific activities necessary for

implementing this plan's recovery actions. The RIS will be adaptable by incorporating new information as needed without revising the recovery plan unless there is a need to also change statutory elements. Both the Species Status Assessment Report and the RIS will be updated as necessary and are available at: <https://ecos.fws.gov/ecp/species/1348>.

### **Species Status Assessment Report Overview**

The following overview summarizes life history information, habitat needs, distribution and abundance, and threats to beardless chinchweed. For a more thorough review of these topics, see the Species Status Assessment (USFWS 2020, entire).

Beardless chinchweed is an erect, many-branched, perennial herb with yellow ray and disk flowers growing at the tips of the branches. The species blooms from August to October, reproduces solely by seed, and is thought to be pollinated by native bees, butterflies, and flies, and to live from 5 to 10 years. Beardless chinchweed do not flower until they reach a height of over 0.5 m (1.6 ft) tall. Many researchers suggest grazing pressure from livestock and herbivory from deer during the flowering and fruiting period can eliminate reproduction resulting in reduced population size and genetic diversity (Souther, 2020, p. 1; Sanchez Escalante 2019, p. 17; Deecken pers. comm. February 8, 1995; Falk and Warren 1994, p. 157; Fishbein and Warren 1994, p. 20; Phillips et al. 1982, p. 8).

Beardless chinchweed occurs in desert grasslands and oak savannas (at lower elevations) and oak woodlands (at higher elevations) in southeastern Arizona and Chihuahua and Sonora, Mexico, at elevations from 1,158 to 1,737 meters (3,799 to 5,699 feet). Plants typically occur on steep, south-facing, sunny to partially shaded hillslopes, with eroding bedrock and open areas with little competition from other plants, such as along trails, roads, cow paths, and on mine tailings or overburden. While the species is often found within disturbed areas, excessive disturbance may adversely impact the species or create conditions that are less favorable. For example, general road maintenance and widening could disturb or remove populations along roads and create erosion (Phillips et al 1982, p. 8). Of the 7 extant United States populations, the Ruby Road 1 and Scotia Canyon populations and the State of Texas Mine subpopulation of Coronado National Memorial occur along roadcuts; similarly, the Visitor Center subpopulation of the Coronado National Memorial population contains some plants which occur along a maintained trail. These plants could be damaged or removed by road or trail maintenance. In addition, nonnative plant introduction and spread often occur in areas of disturbance, such as along roadways, trails, in mining sites, and in areas of recreational use (Gelbard and Belnap 2003, p. 421; Brooks 2007, pp. 153-154; Anderson et al. 2015, p. 1).

The habitat is typically characterized by large-scale low severity fire every 10 to 20 years and following periods of adequate moisture. When invaded by nonnative grasses and forbs, this habitat has more frequent fires that have longer flames, faster rates of spread, and higher intensity and frequency than historical low severity burns of native desert grasslands. Fires alter hydrology and erosion processes by consumption of the protective canopy, ground cover, and organic matter. When plants and litter are removed by fire, ground surface protection is decreased, less rainfall is intercepted, and less infiltration occurs (Pierson et al. 2011, p. 443). The exposed bare soil becomes susceptible to increased runoff generation and sediment detachment and transport (Pierson et al. 2011, p. 444). Amplified runoff postfire carries

sediment (Pierson et al. 2011, p. 443), causing erosion or burial of beardless chinchweed plants. In addition, nonnatives outcompete native plants, including beardless chinchweed, for water, nutrients, sunlight, and space; reduce native biodiversity; alter vegetation cover and canopy height; and change ecosystem dynamics by limiting resources like fruits, seeds, forage, and habitat to animal species.

Precipitation within the mountain ranges supporting beardless chinchweed is bimodal with dormant season snow and rain, and growing season monsoon rain. Climate models indicate that the transition to a more arid climate is already underway and predict that in this century the arid regions of the southwestern U.S. will become drier (i.e., decreased precipitation) and warmer (i.e., increased surface temperatures), and have fewer frost days, decreased snow pack, increased frequency of extreme weather events (heat waves, droughts, and floods), declines in river flow and soil moisture, and greater water demand by plants, animals, and humans. For beardless chinchweed, we assume winter precipitation is needed for germination and growth, while summer and early fall precipitation is needed for flowering, seed set, and growth.

Beardless chinchweed historically occurred within the Atascosa-Pajarito, Huachuca, Patagonia, and Santa Rita Mountains and Canelo Hills of Cochise, Pima, and Santa Cruz counties, Arizona, as well as in Chihuahua and Sonora, Mexico. These plants are known from seven extant populations and nine extirpated populations in Arizona, primarily on Forest Service and National Park Service lands (Figures 1 and 2; Tables 1 and 2). In addition, there are six populations in northern Mexico for which we have no current information; we presume these populations are extant, but with few individuals.

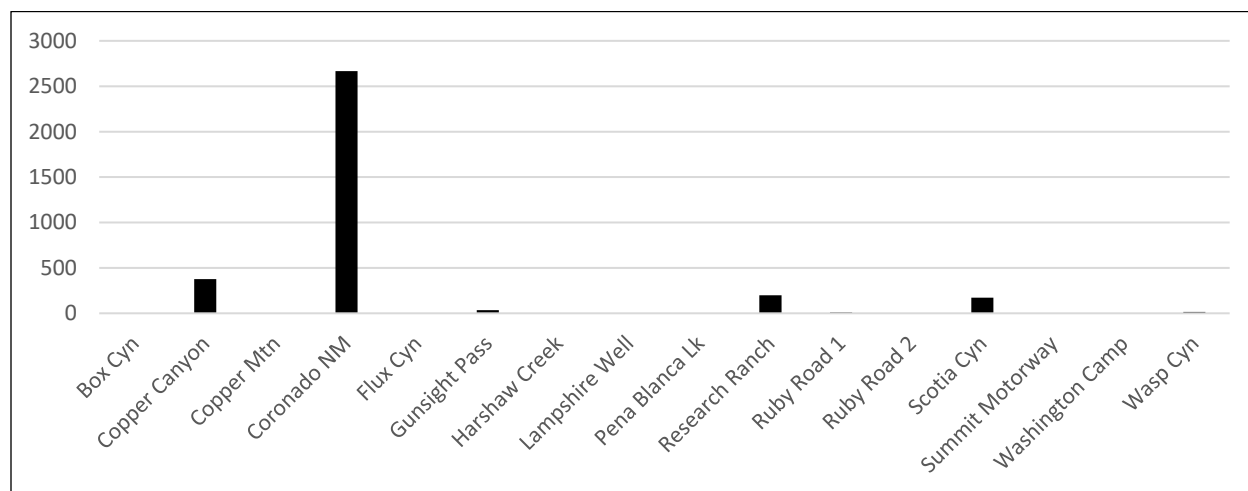


Figure 1. Number of known beardless chinchweed (*Pectis imberbis*) individuals per U.S. population as of 2021. Note, Gunsight Pass, Ruby Road 1, and Wasp Canyon all contain so few individuals that they are difficult to see on the graph, with 34, 10, and 15 individuals, respectively.

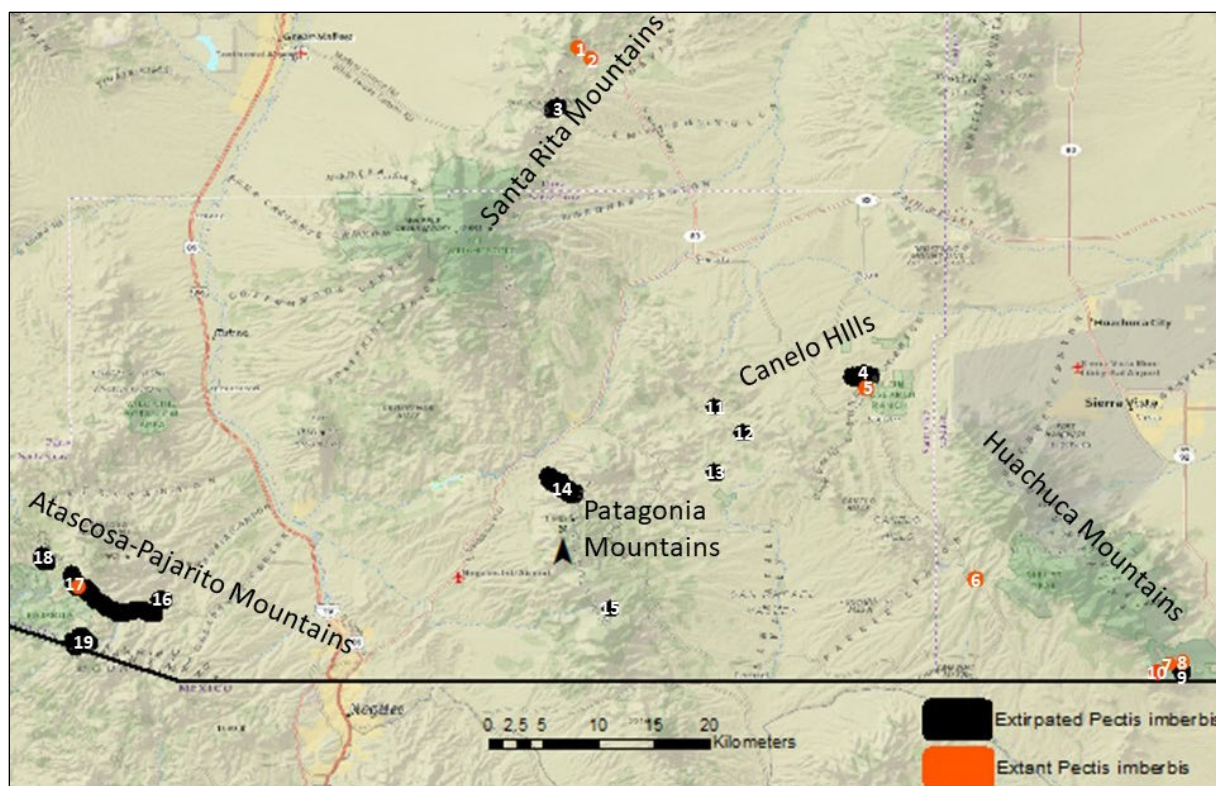


Figure 2. Status and general locations of known beardless chinchweed (*Pectis imberbis*) populations and subpopulations in southern Arizona; numbers correlate to populations in Table 1 below.

Table 1. Population names, general locations, land ownership, and abundance of the known beardless chinchweed (*Pectis imberbis*) populations in Arizona. Element Occurrence Identifier (EO\_ID) and SF numbers are the numbers given by the Heritage Database Management System and are provided to cross walk population and subpopulation names. Note that the singular Ruby Road population reported in the 2020 Species Status Assessment Report (USFWS 2020, entire) has been divided into two populations herein (Ruby Road 1 and 2) due to a 1980 herbarium specimen location not considered previously; this population has not been relocated on subsequent visits in 2017 and 2021 and is considered extirpated. Populations are differentiated by row coloring.

Mountain Range	Population Name (EO_ID)	Subpopulation Name	Map No. in Figure 2	Critical Habitat Unit	Land Ownership	No. of Individuals
Santa Rita Mountains	McCleary Canyon-Gunsight Pass (24168)	East of Gunsight Pass (1 <sup>st</sup> SF); McCleary Canyon 2 (2 <sup>nd</sup> SF)	1	1	USFS	34 in 2020
Santa Rita Mountains	McCleary Canyon-Wasp Canyon (26575)	N/A	2	1	USFS	15 in 2020



Beardless chinchweed (*Pectis imberbis*) Draft Recovery Plan

Mountain Range	Population Name (EO_ID)	Subpopulation Name	Map No. in Figure 2	Critical Habitat Unit	Land Ownership	No. of Individuals
Santa Rita Mountains	Box Canyon Road (6756)	N/A	3	n/a	USFS	Extirpated
Canelo Hills	Audubon Research Ranch (3259)	Post Canyon	4	2	Private, USFS, BLM	Extirpated
Canelo Hills	Audubon Research Ranch (24169)	Tributary of O'Donnell Canyon	5	2	Private, USFS, BLM	198 in 2021
Huachuca Mountains	Scotia Canyon (1539)	N/A	6	3	USFS	172 in 2021
Huachuca Mountains	Coronado National Memorial (19775)	State of TX Mine (Lower State of Texas Mine – 5 <sup>th</sup> SF; State of Texas Mine - 6 <sup>th</sup> SF; N of Montezuma Canyon Rd. and SE of State of TX Mine – 8 <sup>th</sup> SF)	7	4	NPS	160 between 2015-2021
Huachuca Mountains	Coronado National Memorial (19775)	Visitor Center (Backside Maintenance Shed – SF 1; Drainage with Blue Waterfall – 2 <sup>nd</sup> SF; Lower Cave Trail and Upper Cave Trail – 3 <sup>rd</sup> SF; Montezuma Wash -7 <sup>th</sup> SF; Maintenance Shed – 9 <sup>th</sup> SF)	8	4	NPS	2,506 between 2014-2021
Huachuca Mountains	Coronado National Memorial (19775)	Joe's Canyon Trail (4 <sup>th</sup> SF)	9	4	NPS	Extirpated
Huachuca Mountains	Copper Canyon (26040)	Dupee Tank Wash (1 <sup>st</sup> SF)	10	n/a	USFS	124 in 2020
Huachuca Mountains	Copper Canyon (26040)	West Slope Montezuma Pass (2 <sup>nd</sup> SF)	10	n/a	USFS	35 in 2021
Huachuca Mountains	Copper Canyon (26040)	Ann Tank Wash (3 <sup>rd</sup> SF)	10	n/a	USFS	209 in 2021

Beardless chinchweed (*Pectis imberbis*) Draft Recovery Plan

Mountain Range	Population Name (EO_ID)	Subpopulation Name	Map No. in Figure 2	Critical Habitat Unit	Land Ownership	No. of Individuals
Huachuca Mountains	Copper Canyon (26040)	Copper Canyon Road (4 <sup>th</sup> SF)	10	n/a	USFS	9 in 2020
Canelo Hills	Copper Mountain (19797)	N/A	11	n/a	USFS	Extirpated
Canelo Hills	Lampshire Well (19795)	N/A	12	5	USFS	Extirpated
Canelo Hills	Harshaw Creek (19796)	N/A	13	6	USFS	Extirpated
Patagonia Mountains	Washington Camp (9710)	N/A	14	7	USFS	Extirpated
Patagonia Mountains	Flux Canyon (6755)	N/A	15	n/a	USFS	Extirpated
Atascosa-Pajarito Mountains	Peña Blanca Lake (4861)	N/A	16	8	USFS	Extirpated
Atascosa-Pajarito Mountains	Ruby Road Peña Blanca Canyon 1 (10753)	N/A	17	n/a	USFS	10 in 2017
Atascosa-Pajarito Mountains	Ruby Road Peña Blanca Canyon 2 (26552)		18			Extirpated
Atascosa-Pajarito Mountains	Summit Motorway (12393)	N/A	19	n/a	USFS	Extirpated
<b>TOTAL</b>						<b>3,472</b>

Table 2. Population names, general locations, land ownership, and status of the known beardless chinchweed (*Pectis imberbis*) populations in Chihuahua and Sonora, Mexico. Populations are differentiated by row coloring.

Location	Population Name	Subpopulation Name	Map No. in Figure 3	Critical Habitat Unit	Land Ownership	Status (No. Of Individuals)
Sonora	Canon de la Petaquilla	n/a	20	n/a	unknown	presumed small
Sonora	Horconcitos	n/a	21	n/a	unknown	presumed small
Chihuahua	Batopililas	n/a	22	n/a	unknown	presumed small
Chihuahua	Guasaremos	n/a	23	n/a	unknown	presumed small

Location	Population Name	Subpopulation Name	Map No. in Figure 3	Critical Habitat Unit	Land Ownership	Status (No. Of Individuals)
Sonora	Los Conejos	n/a	24	n/a	unknown	presumed small
Sonora	Canyon Estrella	n/a	25	n/a	unknown	presumed small

Three of the seven extant U.S. populations contain fewer than 50 plants (Figure 1, Table 1). From surveys spanning the period from 1944 to 2021, we are aware of at least 3,472 individuals across the range within the U.S., although with mortality and recruitment over this period, this number may have changed (Table 1). The two populations occurring in the Santa Rita Mountains may be threatened by a proposed mine: one is in the path of a proposed alignment of a secondary access road and powerline for the proposed Rosemont Mine, while the other is within the processing facility portion of the proposed Rosemont Mine (Westland 2010, p. iv). Collectively, these 2 populations represent 28.6 percent of the 7 total extant beardless chinchweed populations across the U.S. and the only extant plants in the Santa Rita Mountain range. The proposed mine has been the subject of litigation (Tucson Sentinel, 2022).

The largest population, occurring on National Park Service (NPS) lands at Coronado National Memorial, contains 76.8 percent of all known U.S. plants and occurs as close as 1.4 kilometers (0.87 miles) of the international U.S.-Mexico border where a border wall has been constructed and much illegal and corresponding law enforcement activity occurs. There is a higher probability of impact to individual beardless chinchweed from these activities compared to other populations. Similarly, the Copper Canyon Population contains 10.9 percent of all known U.S. plants and occurs as close as 150 meters (492 feet) from the vehicle barrier and border road at the international border. From aerial footage collected by Wildlands Network (2021), we can see this area already has a two-track road and evidence of other disturbance within the area. We are also aware that illegal border activity and corresponding law enforcement actions occur within the Atascosa-Pajarito Mountains, Patagonia Mountains, Santa Rita Mountains, and the Canelo Hills, all of which support beardless chinchweed.

The historical range of beardless chinchweed is larger than the current range, with more populations, now extirpated, found historically in southeastern Arizona and historical herbarium collections from Chihuahua and Sonora, Mexico (Figures 2 and 3). All populations in the U.S. and Mexico were thought to be small, and no collections have been made in Mexico since 1940 (SEINet, entire; Warren and Reichenbacher 1991, p. 25). Populations are found primarily on southern exposures in the mountain ranges of the region. The documented invasion of nonnative grasses throughout most of beardless chinchweed range has greatly increased competition and altered fire regimes in these areas. Pressures also come from other activities, such as mining, illegal border crossings and apprehensions, herbivory and grazing, and off highway vehicle use. Many of the historical locations no longer support beardless chinchweed due to this habitat alteration.

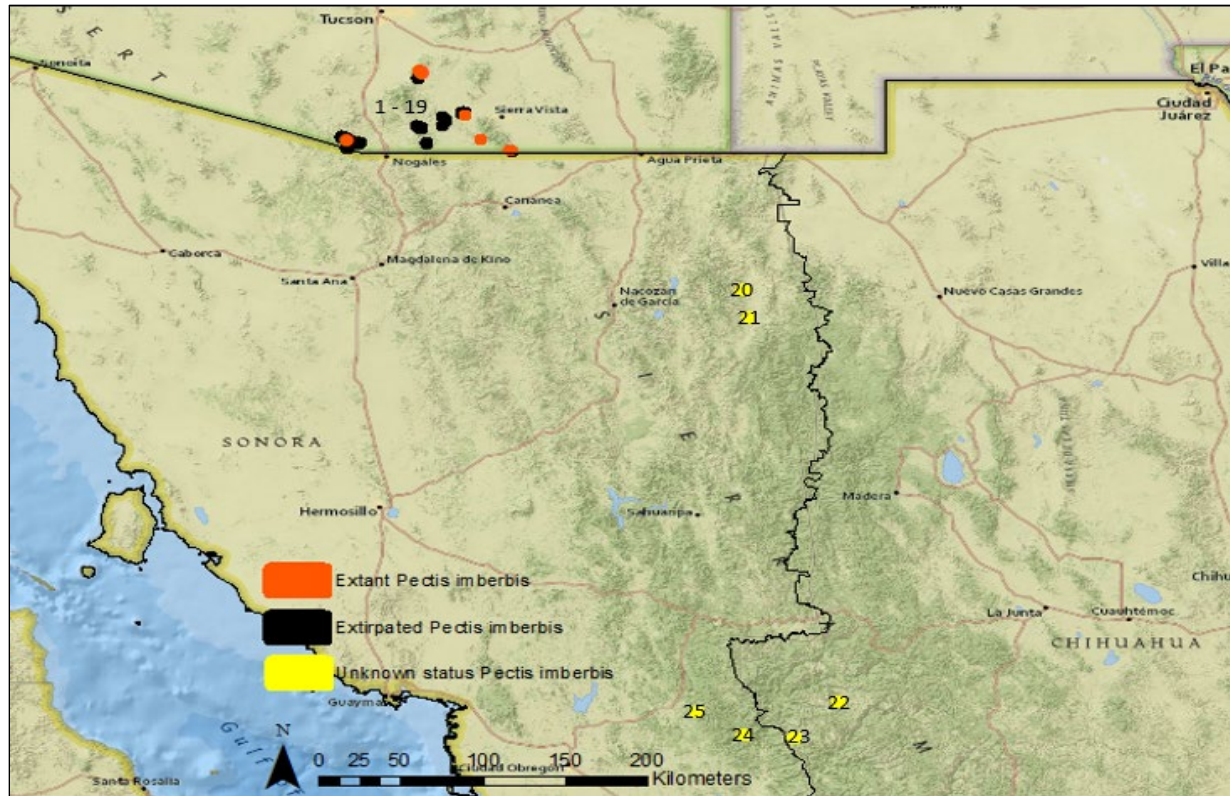


Figure 3. Status and general locations of all beardless chinchweed (*Pectis imberbis*) populations and subpopulations across the species' range in southern Arizona and northern Mexico; numbers correlate to populations in Tables 1 and 2 above.

Genetic analysis of this species has not been conducted within or among populations or mountain ranges. Topographic, vegetational, and elevational variation among populations is limited. Therefore, we have defined three representation areas based on geographic separation of known populations and assume genetic variability occurs, at a minimum, among these three areas (Figure 4). Recovery criteria are based on populations within these three representation areas.



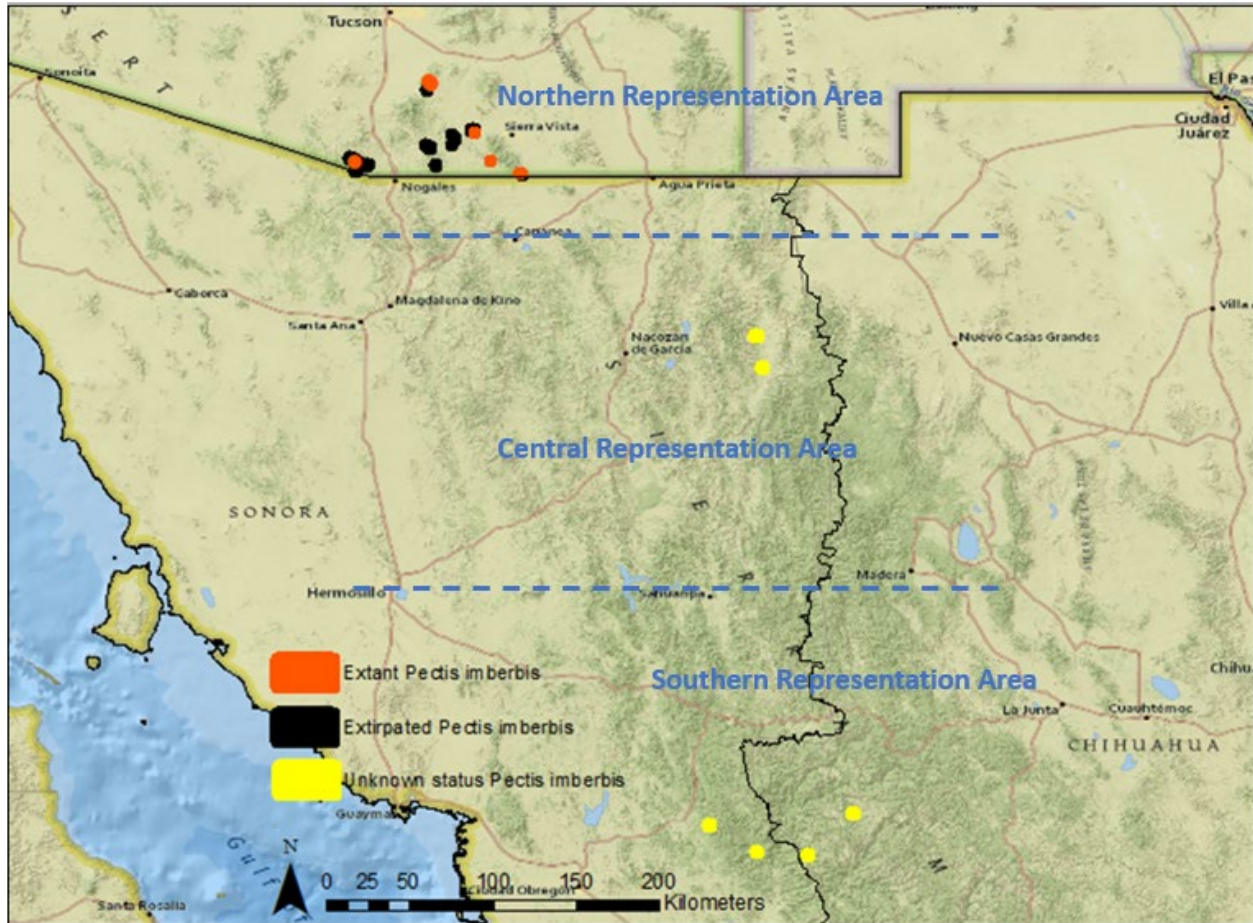


Figure 4. Three beardless chinchweed representation areas (Northern, Central, and Southern) in southern Arizona and northern Mexico.

Section 4(a) of the ESA describes five factors that may lead to endangered or threatened status for a species. These include: A) the present or threatened destruction, modification, or curtailment of its habitat or range; B) overutilization for commercial, recreational, scientific, or educational purposes; C) disease or predation; D) the inadequacy of existing regulatory mechanisms; or E) other natural or manmade factors affecting its continued existence. Beardless chinchweed faces varying levels of risk into the future from natural and anthropogenic threats, including the following: nonnative species invasion and alteration of natural fire regimes (Factor A); drought and climate change (Factor E); herbivory by wildlife and grazing by livestock (Factor C); and erosion, sedimentation, and burial from road and trail maintenance, mining activity, border activity; and post-wildfire runoff (Factor A). In addition, low numbers and limited distribution, which characterize many beardless chinchweed populations, increase susceptibility of populations to all threats and limit recruitment and genetic diversity (Factor E), thus reducing resiliency and representation. Factors B and D are not known to threaten beardless chinchweed at this time.

## **RECOVERY GOAL and VISION, STRATEGY, OBJECTIVES, AND CRITERIA**

### **Recovery Goal and Vision**

The recovery goal is to ensure the long-term persistence of beardless chinchweed in the wild over time (viability) through increasing the number of individuals, populations, and subpopulations; restoring and conserving habitat; and reducing threats to the species and its habitat, thus allowing for removal of beardless chinchweed from the list of threatened and endangered species (i.e., recovery).

For the species to be recovered, we envision that beardless chinchweed will demonstrate:

1) resiliency, by having naturally occurring and successfully introduced viable populations; and  
2) redundancy and representation, by having genetically and ecologically diverse populations distributed in multiple locations throughout the species' range. Threats to long-term viability will be reduced and habitat restored and conserved such that there is sufficient habitat quantity and quality to support the long-term survival of the species and its pollinators.

### **Recovery Strategy**

The USFWS uses the conservation biology principles of resiliency, redundancy, and representation (collectively known as the "3Rs") as a lens to evaluate the current and future condition of the species. Resiliency describes the ability of populations to withstand demographically or environmentally stochastic events (arising from random factors). Representation describes the ability of a species to adapt to changing environmental conditions. Redundancy describes the ability of a species to withstand localized catastrophic events. To ensure viability, beardless chinchweed requires multiple resilient populations distributed throughout its geographic range. The recovery strategy includes: 1) increasing resiliency by augmenting, introducing, and maintaining sufficiently large populations to withstand stochastic events, 2) maintaining representation of the genetic and ecological diversity of the species throughout its geographic range, and 3) increasing redundancy by introducing additional populations and subpopulations to provide a safety margin to withstand catastrophic events.

Recovery of the species will require the establishment of additional self-sustaining populations and subpopulations throughout the known historical geographic range of the species in areas with suitable habitat. It will also require augmentation of existing populations and subpopulations throughout the geographic range of the species to increase the number of individuals in each population. This increase in numbers of populations, subpopulations, and individuals is essential to protect the species against extinction. Because it is believed that the main cause of the decline of the species is the loss and degradation of its habitat (primarily due to nonnative plant invasion and alteration of the fire regime, drought and climate change, border related activity, and mining activity), the recovery strategy focuses upon elimination, reduction, and mitigation of these threats. Additional threats, such as small population size, herbivory by wildlife and grazing by livestock, trampling by wildlife and livestock, erosion, sedimentation, and burial are also addressed in the recovery strategy. It will be challenging to remove or ameliorate all threats to the species (particularly nonnative invasion and drought and climate change) as they are widespread and complex to manage; however, in some cases, these threats can be reduced or mitigated.

## Recovery Objectives

Recovery objectives identify outcomes that will lead to achieving the goal of recovery and delisting. Recovery objectives for beardless chinchweed are:

1. Increase the size and number of populations and subpopulations (i.e., improve resiliency and redundancy) within the known historical geographic range of the species through successful beardless chinchweed propagation, augmentation of existing populations and subpopulations, introduction of new populations and subpopulations, and re-introduction of populations and subpopulations.
2. Ensure long-term beardless chinchweed conservation through the establishment of ex-situ plant and seed collections housed at multiple Center for Plant Conservation-approved botanical institutions and seed banks.
3. Improve our understanding of current conditions, trends, threats, and outcomes of management actions through monitoring of all beardless chinchweed, its habitat, and its pollinators.
4. Properly manage, restore, and protect the quantity and quality of desert grassland, oak savanna, or oak woodland habitat areas supporting all beardless chinchweed for the long-term survival of the species and its pollinators.
5. Improve our understanding of beardless chinchweed geography, ecology, biology, pollination, viability, genetics, threats, compatible land uses, and habitat restoration through scientific research, thereby enabling better management of beardless chinchweed.

## Recovery Criteria

“The term ‘endangered species’ means any species which is in danger of extinction throughout all or a significant portion of its range other than a species of the Class Insecta determined by the Secretary to constitute a pest whose protection under the provisions of this chapter would present an overwhelming and overriding risk to man.” 16 USC §1532 (6). “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.” 16 USC §1532 (20). When we evaluate whether a species warrants downlisting (reclassification from endangered to a threatened status) or delisting (removal from the list of threatened and endangered species), we consider whether the species meets either of these statutory definitions. A recovered species is one that no longer meets the ESA definitions of threatened or endangered due to amelioration of threats.

Determining whether a species should be downlisted or delisted requires consideration of the same five factors that were considered when the species was listed, as discussed above, and which are specified in section 4(a)(1) of the ESA and at 50 C.F.R. 402.02.

Recovery criteria are conditions that, when met, indicate that a species may warrant downlisting or delisting. Thus, recovery criteria are mileposts that measure progress toward recovery. Because the appropriateness of delisting is assessed by evaluating the five factors identified in the ESA, the recovery criteria below pertain to these factors. These recovery criteria are our best assessment at this time of what the species needs to be downlisted from endangered to threatened, and delisted. Because we cannot envision the exact course that recovery may take, and because our understanding of the vulnerability of a species to threats is likely to change as

more is learned about the species and the threats, it is possible that a status review may indicate that downlisting or delisting is warranted even if not all recovery criteria are met. Conversely, it is possible that the recovery criteria could be met, and a status review may indicate that downlisting or delisting is not warranted. For example, a new threat may emerge that is not addressed by the current recovery criteria.

The downlisting criteria for beardless chinchweed consist of a combination of conditions that, when met, indicate the species may warrant reclassification from endangered to a threatened status. These criteria are described in detail in the Downlisting Criteria section of this document. Full recovery of the species to the point that protections of the ESA are no longer necessary (delisting) involves similar criteria as that of downlisting, sustained for a longer period, and is described in detail in the Delisting Criteria section of this document.

**Note:** please see below for justifications and definitions of specific terms used in the recovery criteria.

#### *Downlisting Criteria*

The following are objective, measurable criteria which, when met, would result in a determination that beardless chinchweed will be considered for reclassification as a threatened species:

1. Fifteen or more populations (see Justification for Recovery Criteria below for definitions of populations and subpopulations) occur throughout the species' geographic range in the U.S. and Mexico, including populations in the three representation areas as follows:
    - a.i. Northern Representation Area in Arizona extant populations: 1) McCleary Canyon - Gunsight Pass, 2) McCleary Canyon - Wasp Canyon, 3) Audubon Research Ranch, 4) Scotia Canyon, 5) Copper Canyon, 6) Coronado National Memorial. These populations may be successfully augmented to attain required sizes.
    - a.ii. Northern Representation Area in Arizona extirpated populations with critical habitat: 7) Lampshire Well, 8) Harshaw Creek, 9) Washington Camp, and 10) Ruby Road Peña Blanca Canyon 1. These populations will be successfully re-introduced in strategic sites.
    - b. Central Representation Area in Sonora, Mexico – at least two populations. These populations may include successfully introduced, re-introduced, or augmented populations in strategic sites.
    - c. Southern Representation Area in Sonora and Chihuahua, Mexico – at least three populations. These populations may include successfully introduced, re-introduced, or augmented populations in strategic sites.
- Of the fifteen populations referenced above, at least:
- d. One population needs to support a minimum of 2,500 individuals within two or more subpopulations.
  - e. Six populations need to support a minimum of over 300 individuals within three or more subpopulations.



- f. Eight populations need to support a minimum of 100 individuals within at least two subpopulations.

These population numbers will be maintained for a total of at least 15 years over a 20-year period, as indicated by monitoring every 1 to 3 years during the flowering season, including during the three most recent monitoring events.

To count toward achieving this criterion, existing, introduced, or re-introduced populations that are used to evaluate this criterion may be augmented for the first 10 years to achieve population and subpopulation numbers. To show that populations are viable, no augmentation can occur within populations being evaluated under this criterion in the last 10 years of the 20-year period for populations considered as contributing to possible downlisting.

2. All of the populations referenced in criterion #1 must have documented natural recruitment that is greater than or equal to documented plant loss during three or more monitoring events (every 1 to 3 years) of the 20-year period.
3. A collection of seed representing the geographical, morphological, and genetic diversity of beardless chinchweed is regularly collected following Center for Plant Conservation guidelines (2019, p. 1-14) during the period of recovery and maintained in at least one Center for Plant Conservation partner botanical or seed storage institution for conservation purposes.
4. A living collection of plants representing the geographical, morphological, and genetic diversity of beardless chinchweed and following Center for Plant Conservation guidelines (2019, p. 3-13) is established within 10 years of the finalization of this recovery plan and is maintained in perpetuity in at least one botanical institution for educational and conservation purposes.
5. The land within a 500-meter radius around each of at least six populations supports  $\geq 80$  percent cover of native plant species. The land within a 1,000-meter radius around each of at least an additional five populations supports  $\geq 65$  percent cover of native plant species. The land within a 1,000-meter radius around each of at least the remaining four populations support  $\geq 50$  percent cover of native plant species.
6. To ensure the continued existence of beardless chinchweed and to help meet population-based criterion number one, conservation and management plans address the threat of desert grassland, oak savanna, and oak woodland habitat loss and degradation and the direct threats to beardless chinchweed and their pollinators. Specifically, the following must be met:
  - a. In areas supporting extant or reintroduced beardless chinchweed populations, land management and site-specific plans are developed and partially implemented, such that over a 20-year period:
    - i. there is a reduction in nonnative vegetation and promotion of native vegetation and a natural fire regime (Factors A and E),
    - ii. there is a reduction in beardless chinchweed herbivory by wildlife and grazing by livestock (Factor C),

- iii. there is a reduction in erosion, sedimentation, burial, trampling, and removal of beardless chinchweed and associated native plants caused by border activity, mining activity, grazing activity, and other activities (Factor A), and
  - iv. there is habitat restoration using locally sourced native plants and seed on lands impacted by the before mentioned threats (Factors A and E).
- b. data on the conservation and management of beardless chinchweed is collected and shared regularly among land managers and researchers.

### Delisting Criteria

The following are objective, measurable criteria which, when met, would result in a determination that beardless chinchweed will be considered for removal from the endangered species list:

1. Fifteen or more populations occur throughout the species' geographic range in the U.S. and Mexico, including populations in the three representation areas as follows:
  - a.i. Northern Representation Area in Arizona extant populations: 1) McCleary Canyon - Gunsight Pass, 2) McCleary Canyon - Wasp Canyon, 3) Audubon Research Ranch, 4) Scotia Canyon, 5) Copper Canyon, 6) Coronado National Memorial. These populations may be successfully augmented to attain required sizes.
  - a.ii. Northern Representation Area in Arizona extirpated populations with Critical Habitat: 7) Lampshire Well, 8) Harshaw Creek, 9) Washington Camp, and 10) Ruby Road Peña Blanca Canyon 1. These populations will be successfully re-introduced in strategic sites.
  - b. Central Representation Area in Sonora, Mexico – at least two populations. These populations may include successfully introduced, re-introduced, or augmented populations in strategic sites.
  - c. Southern Representation Area in Sonora and Chihuahua, Mexico – at least three populations. These populations may include successfully introduced, re-introduced, or augmented populations in strategic sites.

Of the fifteen populations referenced above, at least:

- d. One population needs to support a minimum of 2,500 individuals within two or more subpopulations.
- e. Six populations need to support a minimum of over 300 individuals within three or more subpopulations.
- f. Eight populations need to support a minimum of 100 individuals within at least two subpopulations.

These population numbers will be maintained for a total of at least 25 years over a 30-year period, as indicated by monitoring every 1 to 3 years during the flowering season, including during the three most recent monitoring events. Note the down- and delisting criteria are the same with the exception that there is a longer period of recovery for delisting.

To count toward achieving this criterion, existing, introduced, or re-introduced populations that are used to evaluate this criterion may be augmented for the first 10 years to achieve population and subpopulation numbers. To show that populations are viable, no augmentation can occur within populations being evaluated under this criterion in the last 20 years of the 30-year period for populations considered as contributing to possible delisting.

2. All of the populations referenced in #1 above must have documented natural recruitment that is greater than or equal to documented plant loss during three or more monitoring events (every 1 to 3 years) of the 30-year period.
3. A collection of seed representing the geographical, morphological, and genetic diversity of beardless chinchweed is regularly collected following Center for Plant Conservation guidelines (2019, p. 1-14) during the period of recovery and maintained in at least two Center for Plant Conservation partner botanical or seed storage institutions for conservation purposes.
4. A living collection of plants representing the geographical, morphological, and genetic diversity of beardless chinchweed and following Center for Plant Conservation guidelines (2019, p. 3-13) is established within 10 years of the finalization of this recovery plan and is maintained in perpetuity in at least two botanical institutions for educational and conservation purposes.
5. The land within a 500-meter radius surrounding at least six populations supports  $\geq 80$  percent cover of native plant species. The land within a 1,000-meter radius surrounding an additional five populations supports  $\geq 65$  percent cover of native plant species. The land within a 1,000-meter radius surrounding the remaining at least four populations support  $\geq 50$  percent cover of native plant species.
6. To ensure the continued existence of beardless chinchweed and to help meet population-based criterion number one, conservation and management plans address the threat of desert grassland, oak savanna, and oak woodland habitat loss and degradation and the direct threats to beardless chinchweed and their pollinators. Specifically, the following must be met:
  - a. In areas supporting extant or reintroduced beardless chinchweed populations, land management and site-specific plans are developed and fully implemented, such that over a 30-year period:
    - i. there is further reduction in nonnative vegetation and promotion of native vegetation and a natural fire regime (Factors A and E),
    - ii. there is further reduction in beardless chinchweed herbivory by wildlife and grazing by livestock (Factor C),
    - iii. there is a further reduction in erosion, sedimentation, burial, trampling, and removal of beardless chinchweed and associated native plants caused by border activity, mining activity, grazing activity, and other activities (Factor A), and
    - iv. there is further habitat restoration using locally sourced native plants and seed on lands impacted by the before mentioned threats (Factors A and E).

- b. data on the conservation and management of beardless chinchweed continues to be collected and shared regularly among land managers and researchers.

### Justification for Recovery Criteria

Justification for recovery criteria consists of an explanation of concepts and rationale in the context of the species viability (resiliency, redundancy, and representation), and amelioration of threats, as described below.

#### *Explanation of Concepts*

##### Down and De-Listing Criteria #1

- **Population** – Resilient beardless chinchweed populations must be large enough that stochastic events do not eliminate the entire population. We define a population as one or more beardless chinchweed subpopulations that occur within 1 km (0.62 mi) of other beardless chinchweed subpopulations allowing for gene flow through cross-pollination. Currently, there are seven extant populations across four widely separated mountain ranges and the Canelo Hills in the United States and six populations in three mountain ranges in northern Mexico that are presumed extant.
- **Number of Populations** – We have documentation of 21 separate historical populations across the range of the species. The criteria in this recovery plan require at least 15 populations to ensure redundancy. These include at least ten populations from the Northern Representation Area, two from the Central Representation area, and three from the Southern Representation Area. For the Northern Representation Area, we based the ten populations on current habitat condition of historical population areas containing >50 percent native vegetation. We do not know the current habitat condition of any population within the Central or Southern Representation areas but assume at least two locations in the Central and three locations in the Southern Representation Areas will have > 50 percent native vegetation and the ability to support beardless chinchweed populations.
- **Representation Area** – Definition: An area representing the geographical separation between the three groupings of populations, with all populations in the U.S. belonging to the Northern Representation Area; Canon de la Petaquilla and Horconcitos belonging to the Central Representation Area; and Batopililas, Guasaremos, Los Conejos, and Canyon Estrella belonging to the Southern Representation Area.
- **Subpopulation** – For populations of beardless chinchweed to be resilient and redundant, they need multiple subpopulations per population, so that local stochastic events do not eliminate the entire population. This allows the population to recover through seed dispersal from other subpopulations within the population. Subpopulations of beardless chinchweed plants must occur within geographic proximity to facilitate gene flow through pollen exchange and seed dispersal. We define a subpopulation within a population as separated by between 300 and 999 m (984.3 to 3,278 ft).

- **Number of Individuals and Subpopulations** – The number of individuals and subpopulations needed for recovery was derived from Pavlik (1996, p. 137) and the population factors of the Beardless Chinchweed Species Status Assessment (USFWS 2020). Pavlik recommends minimum viable population sizes ranging from 50 individuals to 2,500 individuals for the conservation of rare plants, depending on various life-history characteristics of the taxon (1996, p. 137). We applied Pavlik’s methods for determining minimum viable population sizes for rare plants based on their life history characteristics and estimated beardless chinchweed would require a minimum population size of 1,683 individuals. However, because we currently have one population with greater than 2,600 individuals, we want to retain the existing resiliency. Therefore, in this one population, the criteria require a minimum of 2,500 plants, allowing for natural loss of approximately up to 100 plants over time. This population must contain two or more subpopulations. In the Beardless Chinchweed Species Status Assessment (USFWS 2020), populations in high condition contain three or more subpopulations and more than 300 individuals (the criteria in this recovery plan require 6 populations with a minimum of this abundance). For a population to be in moderate condition, it must contain two or more subpopulations and support between 100 and 300 individuals (the criteria in this recovery plan require 8 populations with a minimum of this abundance).
- **Time Period** – The period required to meet Recovery Criterion 1.
  - **The 20-Year** period for stability or increase in population size is required to meet Downlisting Criterion 1. This time-period was based on the fact that beardless chinchweed plants are thought to live a maximum of 10 years; thus 20 years is two plant lifetimes.
  - **The 30-year** period for stability or increase in population size required to meet Delisting Criterion 1 assures that target numbers of beardless chinchweed are maintained through fluctuations in nonnative invasion, high severity fire, drought, and other disturbances, thus demonstrating that the species is resilient. For populations that require introduction or re-introduction, this occurs following 10 years of site restoration and preparation, seed collection, and propagation trials.
- **Successfully introduced plants** – Definition: Post-introduction monitoring indicates that introduced plants (augmented at existing populations, introduced at new populations, or re-introduced at historical populations) are fully functioning (reproducing and past a juvenile stage of development) in their environment. Because introduced plants may experience mortality after introduction, additional introductions and time may be necessary to improve introduction success and help achieve Recovery Criterion 1.
- **Strategic site** – Definition: desert grassland, oak savanna, or oak woodland habitat that provides the resource needs of beardless chinchweed as outlined in the Species Status Assessment Report (USFWS 2020). It is dominated by a native vegetation community, has adequate precipitation, and has long term habitat protection in place preventing impacts from mining, border activity, herbivory by wildlife and grazing by livestock during flowering and fruiting periods, and other threats.

Down and De-Listing Criteria #2

- **Natural recruitment** – Definition: In natural beardless chinchweed populations, juveniles that survive the first year of life.

Down and De-Listing Criteria #3 and #4

- **Geographic range** – Definition: Area within southern Arizona and northern Mexico that historically supported beardless chinchweed populations.
- **Center for Plant Conservation Guidelines** – Collection of no more than 10 percent of an individual or population seed production in one season and, for living collections, at least one plant per maternal line is maintained at a botanical garden, tissue culture lab, or in the nursery.

Down and De-Listing Criteria #5

- **Area of Native Plant Dominance** – A 1,000-meter radius around beardless chinchweed populations dominated by native plants ( $\geq 65$  percent cover) ensures that the threat of nonnative species invasion is minimized and there is quality habitat for beardless chinchweed pollinators and beardless chinchweed population expansion. A 500-meter radius around beardless chinchweed was selected for highest quality habitat with the fewest invasives ( $\geq 80$  percent cover of native plant species); this requirement is less than that of the 1,000-meter radius due to the difficulty and expense of restoring heavily invaded habitat.

Down and De-Listing Criteria #6

- **Partially vs. Fully Implemented** – Definition: The degree to which management plans are implemented such that the impacts of threats are reduced (partially implemented) versus no longer an imminent concern (fully implemented). Reduction of threats will be determined by baseline measurement and repeated measurements following treatment. We recognize that it will take commitments of time, funding, and personnel to fully implement these plans; therefore, downlisting only requires partial implementation.

*Rationale for Recovery Criteria –Achieving Species Viability (3Rs), and Ameliorating Threats*

Below we justify our recovery criteria in the context of the 3Rs (resiliency, redundancy, and representation) used to assess the species' long-term viability, and how our recovery criteria address threats to beardless chinchweed.

3Rs:

**Resiliency** is met by having enough individuals and subpopulations within populations to withstand disturbances such as random fluctuations in germination rates (demographic stochasticity), variations in rainfall (environmental stochasticity), or the effects of anthropogenic activities. Little is known regarding the numbers of plants required to achieve resilient beardless chinchweed populations; however, in general having more individuals across populations will provide greater resiliency. This plan's Recovery Criteria (down- and delisting) call for 1 population to support a minimum of 2,500 individuals for a very resilient population within the high resiliency condition, 6 populations to support a minimum of 300 individuals for high resiliency condition, and 8 populations to support a minimum of 100 individuals for moderate resiliency condition. The literature suggests that for rare plants, a minimum population size of

100 is needed to prevent inbreeding depression (Maschinski and Albrecht 2017, p. 392; Jameison and Allendorf 2012, p. 580). The single population with the very high resiliency level is based on Pavlik (1996, p. 137) and falls below the number of plants currently in our largest known population at Coronado National Memorial. Greater resiliency will enable the species to better withstand the effects of its various threats and increase the likelihood of species viability. Subpopulation requirements are explained below in Redundancy. Figure 5 illustrates the number of individuals known currently from the U.S. populations compared with these plan goals.

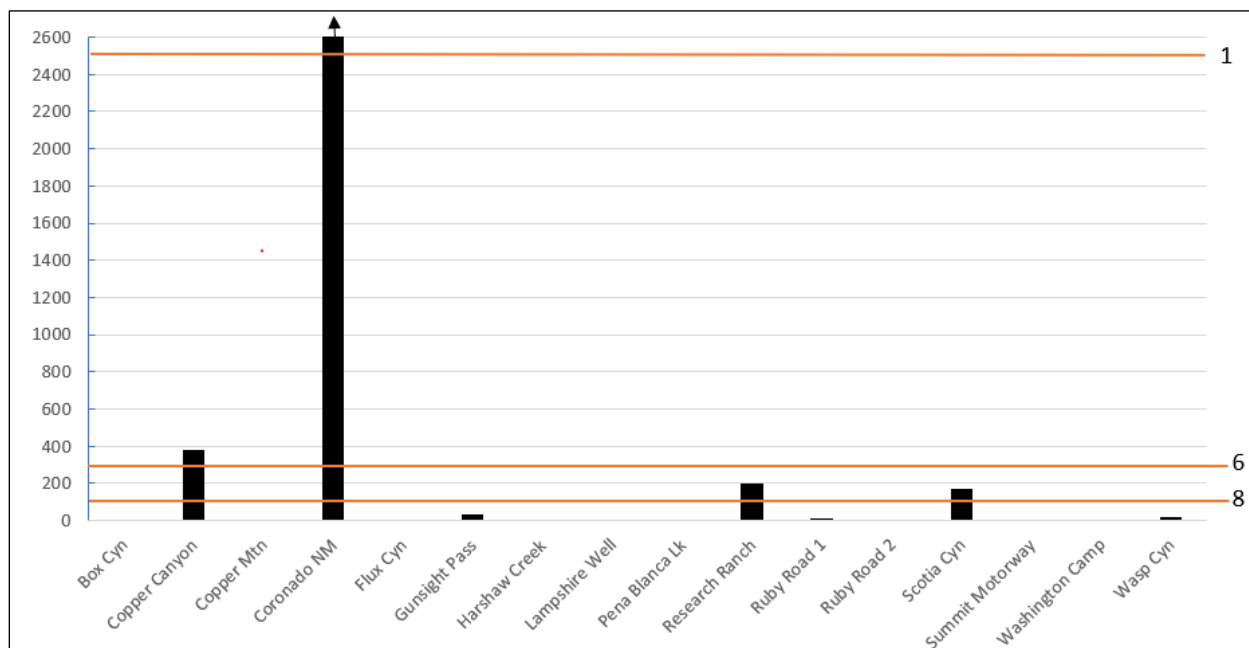


Figure 5. Illustration of the number of beardless chinchweed (*Pectis imberbis*) individuals known from populations in the U.S. as of July 2022 (black bars) vs. the number of individuals needed to meet recovery goals (red lines; a single population at  $\geq 2,500$  individuals; six populations at  $\geq 300$  individuals; and eight populations at  $\geq 100$  individuals).

**Redundancy** is met by having multiple populations and subpopulations distributed across the species' range. Because beardless chinchweed plants in populations are separated from plants in other populations, they are less likely to be simultaneously affected by catastrophic events (e.g., high severity fire) or locally important events (e.g., border activity). Therefore, with increased redundancy, the species will be more likely to withstand such events, reducing the risk of extinction. The Recovery Criteria (down- and delisting criteria) require a minimum of 15 populations distributed across the range of the species. Additionally, this plan calls for five populations to support a minimum of three subpopulations for highest resiliency, six populations to support a minimum of two subpopulations for moderate resiliency, and four populations to support a minimum of two subpopulations for low resiliency.

**Representation** is met by maintaining populations within the Northern, Central, and Southern Representation Areas across the geographic distribution of beardless chinchweed. No genetic studies of this species have been performed. We assume there will be different genetic and ecological diversity between the three Representation Areas based on geography and differences in habitat features and elevations.

**Viability:**

In summary, viability of beardless chinchweed, or persistence in the wild over the long-term, is achieved by increasing population resiliency and redundancy and maintaining species representation. Resiliency is improved by successful augmentation and/or discovering new individuals. Redundancy is increased by the introduction or re-introduction of new populations and subpopulations. Representation is maintained by providing the opportunity for genetic exchange within populations and by maintaining populations in the Northern, Central, and Southern Representation Areas. Additionally, primary threats to the species and its habitat, such as nonnative plant invasion and altered fire regimes; border related activity; mining activity; herbivory by wildlife and grazing by livestock; erosion, sedimentation, and burial; or other impacts must be addressed to ensure beardless chinchweed viability.

**Threats:**

The primary factors of concern for beardless chinchweed are Factors A, C, and E. Table 3 below indicates how these primary threats to the species, in the context of the five ESA listing factors, are addressed in the recovery criteria.

**Table 3.** Summary of how significant threats to beardless chinchweed (*Pectis imberbis*) are addressed in the recovery criteria in the context of the five ESA listing factors.

Factor Addressed	Threat Addressed	Criterion Number and Explanation
Factor A - Present or threatened destruction, modification, or curtailment of its habitat or range	Nonnative plant invasion and alteration of fire regimes	<b>Criteria 5 &amp; 6</b> address the need to reduce nonnative plant introduction and spread and ensure a more natural fire regime in beardless chinchweed habitat.
	Erosion, sedimentation, & burial from road & trail maintenance, mining activity, border activity, livestock activity, post-wildfire runoff, & other threats	<b>Criteria 6</b> address the need to prevent loss of habitat, individual beardless chinchweed plants, and pollinators to a variety of activities.
Factor C – Disease or predation	Herbivory by wildlife and grazing by livestock	<b>Criteria 2 &amp; 6</b> address the need to help ensure flowering and fruiting individuals reach seed production and dispersal.
Factor E – Other natural or manmade factors affecting its continued existence	Drought and climate change	<b>Criteria 1, 2, 3, 4, 5, &amp; 6</b> address the threat of drought and climate change by: increasing numbers of banked seeds and plants in botanical institutions; increasing population size and the number of subpopulations and populations; and providing habitat protection and threat reduction.



Factor Addressed	Threat Addressed	Criterion Number and Explanation
	Low numbers and limited distribution	<b>Criteria 1, 2, 3, 4, 5, &amp; 6</b> address the threat of low numbers and limited distribution by: increasing numbers of banked seeds and plants in botanical institutions; increasing population size, the number of subpopulations, and populations; and providing habitat protection and threat reduction.

## ACTIONS NEEDED

Recovery of beardless chinchweed will be accomplished through implementation of the site-specific recovery actions outlined in Tables 4a-e below. In general, implementation of the recovery actions will involve participation from State and Federal agencies, counties, local communities, Tribes, non-federal landowners, nongovernmental organizations, academia, and the public. Recovery actions, organized by recovery objective, are accompanied by estimates of the time and cost required to achieve the plan's goal to recover beardless chinchweed. The site-specificity of the recovery actions is provided primarily at the geographic scale of the population. We assign priorities to each action. Priority 1 actions must be taken to prevent extinction or to prevent the species from declining irreversibly in the foreseeable future. Priority 2 actions must be taken to prevent a significant decline in population size or habitat quality, or some other significant negative impact. Priority 3 actions are all other actions that are necessary for the species' full recovery. The assignment of priorities does not imply that some recovery actions are of low importance, but instead implies that lower priority items may be deferred while higher priority items are being implemented.

The separate RIS for beardless chinchweed provides additional detailed, site-specific activities needed to implement the actions identified here (USFWS 2023). We intend to update the RIS as frequently as needed by incorporating new information, including the findings of future 5-year status reviews. The RIS provides activities that will be continually updated as recovery implementation progresses. Therefore, we anticipate being able to provide a greater degree of site-specificity in the RIS than for the recovery actions in the recovery plan. For example, introduction locations will be determined based on present-year circumstances. We will revise this recovery plan only if there are needed changes in the recovery criteria, actions, or time and cost estimates.

As stated in the Disclaimer, recovery plans are advisory documents, not regulatory documents. A recovery plan does not commit any entity to implement the recommended strategies or actions contained within it for a particular species, but rather provides guidance for ameliorating threats and implementing proactive conservation measures, as well as providing context for implementation of other sections of the ESA, such as section 7(a)(1) conservation programs, 7(a)(2) consultations on Federal agency activities, or development of Habitat Conservation Plans under section 10(a)(1)(B).

## Estimated time and cost of recovery

We expect the status of beardless chinchweed to improve such that we can achieve downlisting criteria in approximately 30 years (2052). We expect to achieve recovery (delisting) in

approximately 40 years (2062) for a total estimated cost of \$21,578,080. We anticipate that achieving recovery will take approximately 10 years to restore and prepare sites, collect seeds, and conduct propagation trials, followed by the 20 (downlisting) or 30 (delisting)-year period of beardless chinchweed population and habitat amplification and maintenance. The total cost is the estimated cost of completing the recovery actions such that the recovery criteria have been met, and includes those costs borne by all parties. The calculation of the total estimated cost to recovery is included in the Recovery Action Tables (Tables 4a-e). The actions identified in the Recovery Action Tables are those that, based on the best available science, the USFWS thinks are necessary to achieve recovery of beardless chinchweed. Time to recovery is based on the expectation of full funding, implementation as provided for in the Beardless Chinchweed Recovery Plan and RIS, and full cooperation of partners. The estimated cost to implement the first 20 years of recovery actions is \$17,431,100 (i.e., intermediate cost). Note that actions taken to improve desert grassland, oak savanna, or oak woodland habitats for this species will benefit other listed plant and animal species, and costs for improving habitat of any other listed or rare species found within these desert grassland, oak savanna, or oak woodland habitat will reduce the recovery cost of this species.

Table 4a-e. Recovery Action Table: Estimated Cost, Time, and Priority for Recovery Actions for beardless chinchweed (*Pectis imberbis*). These actions apply to the sites of all current beardless chinchweed populations, as well as future beardless chinchweed introduction and re-introduction sites. The threats we have identified for beardless chinchweed, and which are addressed below, include Factors A (the present or threatened destruction, modification, or curtailment of its habitat or range), C (disease or predation), and E (other natural or manmade factors affecting its continued existence).

**4a. Objective 1.** Increase the size and number of populations and subpopulations (i.e., improve resiliency and redundancy) through successful beardless chinchweed propagation, augmentation of existing populations and subpopulations, introduction of new populations and subpopulations, and re-introduction of populations and subpopulations.

Priority #	Action #	Site-Specific Action	Recovery Criteria	Action Duration (years)	Estimated Total Cost (\$)	Addresses Threat
1	1a	Survey for and locate potential sites for beardless chinchweed introduction or re-introduction with appropriate habitat.	1	10	22,500	Factor A; Factor E
1	1b	Work with landowners, managers, and researchers to complete all necessary compliance, permits, and approvals for augmentation, introduction, and re-introduction.	1	20	14,000	Factor A; Factor E
1	1c	Attain beardless chinchweed seeds for augmentation of existing beardless chinchweed populations and introduction or re-introduction of new beardless chinchweed	1, 3, & 4	20	[See Action # 2a, below]	Factor A; Factor E

Beardless chinchweed (*Pectis imberbis*) Draft Recovery Plan

Priority #	Action #	Site-Specific Action	Recovery Criteria	Action Duration (years)	Estimated Total Cost (\$)	Addresses Threat
		populations in strategic sites using appropriate genetic stock to increase the redundancy (number of populations) and resiliency (size of populations) of the species.				
1	1d	Develop methods for sexual propagation of beardless chinchweed.	1,3, & 4	20	60,000	Factor A; Factor E
2	1e	Determine if there is one or more mycorrhizal fungus species associated with or nurse species required for beardless chinchweed.	1,3, & 4	20	[See Action # 1d, above]	Factor A; Factor E
1	1f	Grow out beardless chinchweed propagules from appropriate genetic stock.	1, 3, & 4	20	[See Action # 1d, above]	Factor A; Factor E
1	1g	Augment existing beardless chinchweed populations and introduce or re-introduce new beardless chinchweed populations and subpopulations in strategic sites using appropriate genetic stock to increase the redundancy (number of populations) and resiliency (size of populations) of the species.	1, 2, & 3	5	274,800	Factor A; Factor E

**4b. Objective 2.** Ensure long-term beardless chinchweed conservation through the establishment of ex-situ plant and seed collections housed at multiple Center for Plant Conservation approved botanical institutions and seed banks.

Priority #	Action #	Site-Specific Action	Recovery Criteria	Action Duration (years)	Estimated Total Cost (\$)	Addresses Threat
1	2a	Regularly collect beardless chinchweed seed representing the geographical, morphological, and genetic diversity of the species using Center for Plant Conservation guidelines.	1, 3, & 4	40	94,200	Factor A, Factor E

Beardless chinchweed (*Pectis imberbis*) Draft Recovery Plan

Priority #	Action #	Site-Specific Action	Recovery Criteria	Action Duration (years)	Estimated Total Cost (\$)	Addresses Threat
1	2b	Conserve beardless chinchweed seed in Center for Plant Conservation approved facilities and periodically test the seed to estimate the rate of viability loss during seed storage.	3 & 4	40	40,000	Factor A, Factor E
3	2c	Maintain beardless chinchweed plants in captivity at botanical gardens and other USFWS approved facilities for educational purposes, seed amplification, and introduction.	4	O	160,000	Factor A, Factor E

**4c. Objective 3.** Improve our understanding of current conditions, trends, threats, and outcomes of management actions through monitoring of all beardless chinchweed, its habitat, and its pollinators.

Priority #	Action #	Site-Specific Action	Recovery Criteria	Action Duration (years)	Estimated Total Cost (\$)	Addresses Threat
1	3a	Monitor all beardless chinchweed, its habitat, and its pollinators every one to three years.	2 & 6	40	156,880	Factor A; Factor C; Factor E
1	3b	Monitor impacts to beardless chinchweed, its habitat, and its pollinators from mining activity, border activity, grazing and herbivory activity, and other threats every one to three years.	2 & 6	40	160,000	Factor A; Factor C; Factor E
1	3c	Monitor impacts to beardless chinchweed, its habitat, and its pollinators from nonnative plant invasion every one to three years.	2, 5, & 6	40	80,000	Factor A
2	3d	Review the status of beardless chinchweed periodically.	6	40	16,000	Factor A; Factor C; Factor E

**4d. Objective 4.** Properly manage, restore, and protect the quantity and quality of desert grassland, oak savanna, or oak woodland habitat areas supporting all beardless chinchweed for the long-term survival of the species and its pollinators.

Beardless chinchweed (*Pectis imberbis*) Draft Recovery Plan

Priority #	Action #	Site-Specific Action	Recovery Criteria	Action Duration (years)	Estimated Total Cost (\$)	Addresses Threat
1	4a	Work with land managers, owners, and planners to develop and update management plans to protect beardless chinchweed its habitat, and its pollinators.	6	15	40,000	Factor A; Factor C; Factor E
2	4b	Implement management plans to restore desert grassland, oak savanna, or oak woodland habitat impacted by mining activity.	6	40	93,600	Factor A
3	4c	Implement management plans to reduce impacts from border activity in habitat areas supporting beardless chinchweed and its pollinators.	6	O	114,100	Factor A
1	4d	Implement management plans to reduce impacts from grazing and herbivory activity in habitat areas supporting beardless chinchweed and its pollinators.	2 & 6	O	128,000	Factor A
1	4e	Implement management plans to reduce nonnative plant invasion in habitat areas supporting beardless chinchweed and its pollinators.	5 & 6	O	12,701,000	Factor A
3	4f	Reduce other threats to beardless chinchweed that are identified through research.	1, 2, 5, & 6	40	x	Factor A; Factor B; Factor C; Factor D; Factor E
2	4g	Protect through acquisition, conservation easement, or other conservation mechanism appropriate to the land status, habitat areas supporting beardless chinchweed and its pollinators, as well as sites supporting suitable desert grassland, oak savanna, or oak woodland habitat where	1 & 5	20	7,248,000	Factor A; Factor E

Beardless chinchweed (*Pectis imberbis*) Draft Recovery Plan

Priority #	Action #	Site-Specific Action	Recovery Criteria	Action Duration (years)	Estimated Total Cost (\$)	Addresses Threat
		beardless chinchweed could be introduced or reintroduced.				

4e. **Objective 5.** Improve our understanding of beardless chinchweed geography, ecology, biology, pollination, viability, genetics, threats, compatible land uses, and habitat restoration, through scientific research, thereby enabling better management of beardless chinchweed.

Priority #	Action #	Site-Specific Action	Recovery Criteria	Action Duration (years)	Estimated Total Cost (\$)	Addresses Threat
1	5a	Identify research needs and conduct scientific studies on the geography, habitat, ecology, biology, pollination, viability, and genetics of beardless chinchweed and share results among land managers and researchers.	6	15	100,000	Factor A; Factor B; Factor C; Factor E
3	5b	Identify beardless chinchweed research needs and conduct scientific studies on threats, compatible land uses, and habitat restoration, and share results among land managers and researchers.	6	15	75,000	Factor A; Factor C; Factor E

## LITERATURE CITED

- Anderson, L., S. Roccliffe, N. Roccliffe, and A. Dunn. 2015. The role of tourism and recreation in the spread of non-native species: A systematic review and meta-analysis. PLoS ONE 10(10):1-15.
- Brooks, M. 2007. Effects of land management practices on plant invasions in wildland areas. Pp 147-162 In: W. Nentwig (Editor) 2007 Biological Invasions. Springer.
- Center for Plant Conservation. 2019. Best Plant Conservation Practices to Support Species Survival in the Wild. 245pp.
- Deecken, T. 1995. Letter to Sam Spiller, Field Supervisor U.S. Fish and Wildlife Service 02/08/95.
- Falk, D. and P. Warren. 1994. *Pectis imberbis*. p. 157 In: Rare plants of the Coronado National Forest: Population studies and monitoring recommendations. Report by The Nature Conservancy Arizona Chapter prepared for the Coronado National Forest. 181 pp.
- Fishbein, M. and P. Warren. 1994. Population studies of sensitive plants of the Lone Mountain Ecosystem Management Area, Coronado National Forest, Arizona.
- Gelbard, J. and J. Belnap. 2003. Roads as Conduits for Exotic Plant Invasions in a Semiarid Landscape. Conservation Biology. 17(2):420-432.
- Jameison, I. and F. Allendorf. 2012. How does the 50/500 rule apply to MVPs? Trends in Ecology and Evolution. 27(10):578-584.
- Maschinski, J. and M. Albrecht. 2017. Center for plant conservation's best practice guidelines for the reintroduction of rare plants. Plant Diversity 39:390-395.
- Pavlik, B. 1996. Defining and measuring success. Pp. 127-155 In: D. Falk, C. Millar, and M. Olwell (editors), Restoring Diversity: Strategies for reintroduction of endangered plants. Island Press, Washington, D.C. 505 pp.
- Phillips, A. III, B. Phillips, L. Green III, J. Mazzoni and N. Brian. 1982. Status report on *Pectis imberbis* Gray. For U. S. Fish and Wildlife Service. Albuquerque, New Mexico. 13 p.
- Pierson, F., C. Williams, S. Hardegree, M. Weltz, J. Stone, and P. Clark. 2011. Fire, plant invasions, and erosion events on western rangelands. Rangeland Ecology & Management 64(5): 439-449.
- Sanchez Escalante, J. 2019. Surveys for *Cirsium wrightii* and other rare plants (*Graptopetalum bartramii*, *Pediomelum pentaphyllum*, *Pectis imberbis*, *Leucosyris blepharophylla*, and *Eryngium sparganophyllum*) in northeastern Sonora and northern Chihuahua, Mexico. Final Report to US Fish and Wildlife Service. 58 pp.

SEINet Portal Network. 2022. <http://swbiodiversity.org/seinet/index.php>. Accessed on September 8, 2022.

Souther, S. 2020. Demographic and reproductive analysis of *Pectis imberbis* A. Gray. Interim report. March 2020. 7 pp.

Tucson Sentinel. 2022. Appeals court refuses new hearing on block of Rosemont Copper Mine. Article by Paul Ingram. September 9, 2022.

U.S. Fish and Wildlife Service (USFWS). 2023. Beardless Chinchweed (*Pectis imberbis*) Draft Recovery Implementation Strategy. Southwest Region, Tucson, Arizona, USA. 26 pp.

U.S. Fish and Wildlife Service (USFWS). 2020. Species Status Assessment Report for *Pectis imberbis* (beardless chinchweed) Version 2.0. Southwest Region, Tucson, Arizona, USA. 109 pp.

U.S. Fish and Wildlife Service (USFWS). 1983. 48 FR 43098. Endangered and Threatened species listing and recovery priority guidelines. Sept 21, 1983.

Warren, P. and F. Reichenbacher. 1991. Sensitive plant survey of Fort Huachuca, Arizona. February 1991. 61 pp.

Westland, Inc. 2010. Evaluation of seven forest sensitive plant species. Report prepared for Rosemont Copper Company, November 12, 2010. 63 pp.

Wildlands Network. 2021. First ever map and priority restoration areas of the -Mexico border wall through New Mexico and Arizona. July 2021 <https://wildlandsnetwork.org/news/first-ever-map-of-border-wall-released>. Accessed April 14, 2022.