

Slender Rush-pea
(Hoffmannseggia tenella)

**5-Year Review:
Summary and Evaluation**



**U.S. Fish and Wildlife Service
Corpus Christi Ecological Services Field Office
Corpus Christi, Texas**

TABLE OF CONTENTS

1.0	GENERAL INFORMATION	3
1.1	Reviewers	3
1.2	Methodology Used to Complete the Review	3
1.3	Background	3
1.3.1	FR notice citation announcing initiation of this review	3
1.3.2	Listing history	3
1.3.3	Associated rulemakings	4
1.3.4	Review history	4
1.3.5	Species' recovery priority number at start of review	4
1.3.6	Recovery plan	4
2.0	REVIEW ANALYSIS	4
2.1	Application of the 1996 Distinct Population Segment (DPS) Policy	4
2.1.1	Is the species under review a vertebrate?.....	4
2.2	Recovery Criteria	5
2.2.1	Does the species have a final, approved recovery plan containing objective, measurable criteria?.....	5
2.2.2	Adequacy of Recovery Criteria	5
2.2.3	List the recovery criteria as they appear in the Recovery Plan.....	5
2.3	Updated Information and Current Species' Status	7
2.3.1	Biology and Habitat	7
2.3.1.1	New information on the species' biology and life history	7
2.3.1.2	Abundance, trends, and demographic features	8
2.3.1.3	Genetics and genetic variation	12
2.3.1.4	Taxonomic classification	12
2.3.1.5	Spatial distribution	13
2.3.1.6	Habitat or ecosystem conditions	13
2.3.2	Five-Factor Analysis	15
2.3.2.1	Present or threatened destruction, modification, or curtailment of its habitat or range.....	15
2.3.2.2	Overutilization for commercial, recreational, scientific, or educational purposes	17
2.3.2.3	Disease or predation.....	17
2.3.2.4	Inadequacy of existing regulatory mechanisms	18
2.3.2.5	Other natural or manmade factors affecting its continued existence.....	19
2.4	Synthesis	19
3.0	RESULTS	20
3.1	Recommended Classification.....	20
3.2	New Recovery Priority Number	20
4.0	RECOMMENDATIONS FOR FUTURE ACTIONS	20
5.0	REFERENCES	22

5-Year Review
Slender rush-pea (*Hoffmannseggia tenella*)

1.0 GENERAL INFORMATION

1.1 Reviewers

Lead Regional or Headquarters Office - Southwest (Region 2), Wendy Brown, Endangered Species Recovery Coordinator, (505) 248-6641.

Lead Field Office - Corpus Christi Ecological Services Field Office, Robyn Cobb, Fish and Wildlife Biologist, (361) 994-9005 extension 241.

Cooperating Field Office - Austin Ecological Services Field Office, Christ Best, Texas State Botanist, (512) 490-0057 extension 225.

1.2 Methodology used to complete the review:

This review was conducted through public review notification and a comprehensive review of all documents regarding slender rush-pea (SRP) that were available to the U.S. Fish and Wildlife Service's (Service) Corpus Christi Ecological Services Field Office (CCESFO). The Federal Register notice (71 FR 20714) announcing this review published on April 21, 2006, and solicited new information about SRP from other agencies, both Federal and State, non-governmental organizations, academia, and the general public. All information received, along with scientific information from Service files, the recovery plan, section 7 consultations, the state's Natural Diversity Database (formerly known as the Biological Conservation Database), unpublished reports, monitoring reports, conversations with and comments from biologists familiar with the species, and information available on the Internet was used in the preparation of this document. This 5-year review document was drafted by staff in the CCESFO. No part of this 5-year review was contracted to an outside party.

1.3 Background

1.3.1 FR Notice citation announcing initiation of this review: 71 FR 20714; April 21, 2006.

1.3.2 Listing History

Original Listing

FR notice: 50 FR 45614.

Date listed: November 1, 1985

Entity listed: *Hoffmannseggia tenella*

Classification: Endangered without Critical Habitat

1.3.3 Associated rulemakings: None

1.3.4 Review History:

Status Report of *Hoffmannseggia tenella* 1982
Slender rush-pea Final Recovery Plan 1988

A 5-year review was initiated on November 6, 1991 (56 FR 56882) for all species listed before 1991, but no document was prepared for this species. All information gathered on SRP subsequent to finalizing the Recovery Plan is considered new information for purposes of this review.

1.3.5 Species' Recovery Priority Number at start of 5-year review:

2 - The degree of threat is high, the recovery potential is high, and the listed entity is a species (48 FR 43098).

Recovery achieved: The recovery achieved was 1 (0-25% recovery achieved) as of the 2007 Recovery Data Call. Although the status of the species in the 2007 Recovery Data Call was indicated as stable, this determination refers to the condition of the 2 remaining, accessible populations. A third accessible population has disappeared within recent years and the status of the most southern populations is unknown; therefore, the species' status is probably more correctly considered to be in decline.

1.3.6 Recovery Plan or Outline:

Name of plan: Slender Rush-Pea (*Hoffmannseggia tenella*) Recovery Plan.

Date issued: September 13, 1988.

Dates of previous revisions, if applicable: No subsequent revisions have been made to the original recovery plan.

2.0 REVIEW ANALYSIS

2.1 Application of the 1996 Distinct Population Segment (DPS) policy:

2.1.1 Is the species under review a vertebrate?

No. The Endangered Species Act (Act) defines species to include any distinct population segment of any species of vertebrate wildlife. This definition limits the listing of distinct population segments (DPS) to only vertebrate species of fish and wildlife. Since the DPS policy is not applicable to this plant species, the policy is not considered further in this review.

2.2 Recovery Criteria

2.2.1 Does the species have a final, approved recovery plan containing objective, measurable criteria?

The SRP has a final, approved recovery plan, but when the recovery plan was finalized in 1988, limited data made it impossible to quantify habitat and abundance requirements with enough precision to establish downlisting and delisting criteria. Due to this lack of information, the recovery plan explains that “once more is learned about the ecological and life history requirements of the species and the success of management is determined, this plan will be reevaluated and, if appropriate, quantified downlisting and delisting criteria will be established” (USFWS 1988).

2.2.2 Adequacy of recovery criteria: The recovery plan does not have recovery criteria (see 2.2.1).

2.2.3 List the recovery criteria as they appear in the recovery plan, and discuss how each criterion has or has not been met, citing information.

Instead of formal recovery criteria, the SRP recovery plan contains overarching objectives designed to protect the species and its habitat from destruction resulting from human activities and to maintain, through management, healthy populations at levels where the species could be downlisted, and eventually delisted. These objectives include: 1) maintenance of existing populations through cooperation with landowners and habitat management, 2) provision of permanent Service or conservation organization protections for the known populations, 3) establishment of additional populations in natural habitats, 4) obtaining the biological information needed for effective management, and 5) developing public support for the preservation of the species (USFWS 1988). Some of these objectives have been partially accomplished, although none has been fulfilled to the extent that they will ensure the continued existence of SRP.

Objective 1 is maintenance of existing populations through cooperation with landowners and habitat management. As of 2007, extant populations of the SRP are known to occur on a Texas Department of Transportation (TxDOT) right-of-way (ROW), in a privately-owned cemetery belonging to the Catholic Diocese of Corpus Christi, and presumably still on a large ranch in Kleberg County. Some attempts have been made by Texas Parks and Wildlife Department (TPWD), TxDOT, and the Service to maintain the existing populations that occur in the TxDOT ROW and the cemetery. In 1989, The Nature Conservancy (TNC), under contract to the Service, identified and contacted the landowners for the cemetery (The Diocese of Corpus Christi). The Diocese signed on as a TNC Texas Land Steward and agreed to mowing recommendations designed to allow the SRP to persist while halting the advancing invasion of non-native forage grasses (Ballew 1989). Over the intervening years, the local priest directly in charge of the cemetery has also responded to requests from the Service, TPWD, and others to avoid damage from vehicles, the piling of brush atop the SRP population, and to allow seed

collection (French 1992). The Service and TPWD have continued to intermittently contact the cemetery priest to discuss management actions.

The TxDOT operates under a Memorandum of Understanding (MOU) with TPWD to avoid damage and to implement beneficial practices for listed and other rare plants where they occur on TxDOT ROWs (TxDOT 1999). The TPWD recommendations for timing and height of mowing, herbicide use and/or avoidance, application of herbicides under appropriate wind conditions, avoidance of material stockpiling on sensitive habitats, avoidance of seeding and planting with invasive species, and recommendations to confer with TPWD prior to taking actions were part of this MOU.

Objective 2 involves providing permanent Service or conservation organization protections for the known populations. No permanent Service or conservation organization protections have been established for the populations on private land. However, the cemetery owner has been amenable to beneficial management practices for the SRP. The highway ROW populations belong to the state and are being managed under an agreement between the TPWD and TxDOT. The populations known from the large ranch in Kleberg County are scattered, not accessible for monitoring or management, occur within rangeland as opposed to farmland, and the continued existence and level of threats to these sites are unknown.

Objective 3 is the establishment of additional populations in natural habitats. Even though determination of germination and establishment requirements were undertaken by three separate entities, no additional populations have been established. The Corpus Christi Botanical Garden (CCBG), Kika de la Garza Plant Materials Center (PMC), and the San Antonio Botanical Gardens (SABG) carried out germination and establishment work in greenhouse settings where seeds were successfully germinated and seedlings established in pots. However, the CCBG was unable to keep seedlings alive during the hottest part of the summer (Bush 1990, Lloyd-Reilley 1997, P. Cox pers. comm. 2007). None of the potted seedlings produced by CCBG, PMC, or SABG were ever planted. The CCBG did transplant 3 clumps of SRP from St. James' Cemetery into an area of the botanical garden and subsequently planted seeds from these transplants beside the parent plants. These seeds germinated and grew into a colony of 30 plants during a two-year period (Bush 1990). No records of further monitoring are available for this transplanting effort; however in December 2007, a survey was undertaken of the area where the transplants were placed. Surveyors failed to locate any SRP plants and indicated that portions of the CCBG were overrun with Guineagrass (*Panicum maximum*) and other non-native, invasive grasses (S. Sill pers. comm. 2008). Consequently, the Service does not consider this establishment of an additional population.

Objective 4 involves obtaining biological information needed for effective management. Biological and ecological information for SRP has been obtained in a piecemeal fashion and large information gaps still exist for habitat requirements, population dynamics, population ecology, genetic relationships among populations, and relationships to closely related species.

Objective 5 was established to develop public support for the preservation of the species. In the arena of building public support, efforts for SRP have been limited. The species has been included in TPWD's publications of Texas rare plants (www.tpwd.state.tx.us.org) and has a species profile with Nature Serve (www.natureserve.org/explorer). The species was included in a 1995 Texas Agricultural Extension Service workshop to educate landowners, farmers, agricultural researchers, utility and drainage ROW managers about listed plants and the process used by the U.S. Environmental Protection Agency (EPA) to develop its Bulletins for Endangered Species. The bulletins were an outreach tool to protect listed species from pesticides and toxics by requiring the use of best management practices. The SRP is included as a highway ROW species in the Environmental Impact Statement (EIS) for TxDOT's Roadside Pest Management Program (www.dot.state.tx.us/publications/maintenance/dseis_final.pdf).

2.3 Updated Information and Current Species' Status

2.3.1 Biology and Habitat

2.3.1.1 New Information on the species' biology and life history:

Data collected on the biology and ecology of SRP since the recovery plan was finalized in 1988 have primarily come from efforts to propagate and establish the species in greenhouse settings, from one project that compared soils between two population sites, and from investigations into the effects of competition from a non-native, invasive grass, the Kleberg bluestem (*Dichanthium annulatum*). Anecdotal observations of the species in the field have also contributed information about the growth form and condition of the plants and the habitat.

At the time the recovery plan was finalized in 1988, the state of knowledge regarding the biology and ecology of SRP was very limited but did include the information that this species is a perennial legume that occurs in patches of native short- and mid-grass prairie adjacent to watercourses, such as permanent and intermittent creeks. The range of the species at the time of listing was restricted to the Texas Coastal Bend counties of Nueces and Kleberg (USFWS 1988). No populations outside of these two counties have been reported since that time.

The species has a long woody taproot and is capable of forming colonies (Poole 1988). The SRP has monoclinous flowers, bearing both male and female reproductive parts in the same flower (Poole 1988). The species appears to be reproductively active during the spring and summer months, however this activity can be prolonged into the fall in a sporadic fashion in response to rainfall events, even if the prevailing climatic conditions are dry (Mahler 1982a, Bush 1990). Fruiting dates are documented from February through July (USFWS 1988) and seed/fruit dispersal dates from March through June (Mahler 1982a). Dates of germination and leafing in the wild had not been observed when Poole (1988) summarized the species information in a report to TPWD and this information is still lacking.

Seed pods have been found to contain two to four seeds and germination experiments and seedling plantings in greenhouse settings have shown that SRP can be readily germinated and established in pots (Bush 1990, Lloyd-Reilly 1997, Pressly 2002, P. Cox pers. comm. 2006, P. Cox pers. comm. 2007). Although Bush (1990) observed SRP producing runners with plantlets that rooted, Pressly (2002) found that above-ground stems stapled to the ground did not produce roots at the nodes. Observations in the field and in the greenhouse have documented that blooms are open only one day and that flowers do not begin to open until mid-morning, closing by mid-afternoon (around 3 pm) (Bush 1990, S. Kowalski pers. comm. 1996). No pollinators or seed dissemination agents have been reported (Poole 1988, Bush 1990).

Data from a research project to determine the effects of shading on the growth and development of SRP, indicated that 30%, 40%, and 50% shade in a greenhouse setting, did not negatively affect the germination and establishment rate of SRP (Pressly 2002). However, a competition study, using potted plantings of SRP and Kleberg bluestem together, did show a decrease in the success rate of SRP's germination and establishment from 99% in the control group (no bluestem in the pots) to 7% in the group that was planted with the bluestem (Pressly 2002). Several reasons were postulated for the negative effects seen in the presence of the bluestem, including the grass' rapid growth rate compared to the SRP, allowing the bluestem to effectively use up available nutrients and water more quickly, as well as possible allelopathy by bluestem (release of a substance(s) into the surrounding soil that would inhibit the growth of other plants) (Pressly 2002). A third observation by Pressly (2002) was that the above-ground biomass produced by the grass seemed to contribute to production of heat and humidity resulting in fungal growth on the SRP seedlings.

2.3.1.2. Abundance, population trends, demographic features, or demographic trends:

Population trends for SRP cannot be adequately addressed because 4 of the 10 historic population sites have not been revisited since 1964 (2 most southeastern sites) and 1993 (2 sites on former National Guard training lease) due to lack of access to privately-owned land (Table 1). These 4 sites may still be relatively unchanged because they are located in rangeland where the land use/land cover has not undergone wide-scale conversion to row-crop agriculture and residential development, which has happened in the northern portion (Nueces County and the northern edge of Kleberg County) of the SRP's range (Figure 1). However, the degree to which the SRP's habitat at these 4 sites may have been altered by invading, nonnative, introduced grasses is unknown.

Table 1. Documented distribution of Slender rush-pea based primarily on Texas Parks and Wildlife's element of occurrence records (EOR).

YEAR	TPWD EOR #	INVESTIGATOR	COUNTY	SITE DESCRIPTION	HERBARIUM* SPECIMEN	# PLANTS IN POPULATION	EXTANT IN 2007
1922	3	L.J. Bottimer	Nueces	Robstown, along railroad tracks in city limits	TEX	Not reported.	Never relocated
1931	4	F.E. Clements	Nueces	Between Robstown and Alice	TEX	Not reported.	Never relocated - nondescript location
1964	2	F. Jones	Kleberg	Four miles south of headquarters - Laureles Division	TEX-CCM	Not reported.	Never revisited - no access. Pasture openings in clay loam
1964	No EOR #	F. Jones	Kleberg	Three miles south of headquarters - Laureles Division	TEX-CCM	Not reported.	Never revisited - no access. In clayey soils – side of road
1964	1	F. Jones 1964 Correll & Correll – 1970 Mahler - 1982 G. Ajilvsgi – 1982 R. O'Brien - 1986	Nueces	20 acres of a 1,014-acre tract at Petronilla Creek and SH 70 bridge ROW.	SMU, LL, FSU, CCM, TEX	3 plants. In 1986, approx. 100 plants.	<u>No</u> - Site has been revisited a number of times since 1982, with number of plants found to vary. As of 2004, plants no longer visible at the site
1976	No EOR #	M. Johnson	Nueces	Vacant lot in Bishop	TAIC	Not reported.	Never relocated
1985	5	J. Poole	Nueces	St. James Cemetery, Bishop	TEX	Approximately 10,000 plants.	<u>Yes</u> - revisited frequently between 1985 and 2007
1993	6	R. O'Brien & L. Elliot	Nueces-Kleberg	U.S. 77 right of way at the Nueces-Kleberg county line - east side and west side	NR	Not reported.	<u>Yes</u> - plants are on the east side of the right of way, but the plants on the west side are gone. In maintained ROW where not dominated by invasives.
1993	7	B. Carr	Kleberg	National Guard training area lease - both sides of intermittent creek	NR	Several hundred plants on east side of creek.	Never revisited - no access Bordo Nuevo Pasture – both sides of intermittent creek
1993	8	B. Carr	Kleberg	National Guard training area lease - adjacent to road leading southwest of windmill	NR	Approximately 50 plants.	Never revisited - no access. W of road leading SW of windmill –other patches on upper slopes along creek

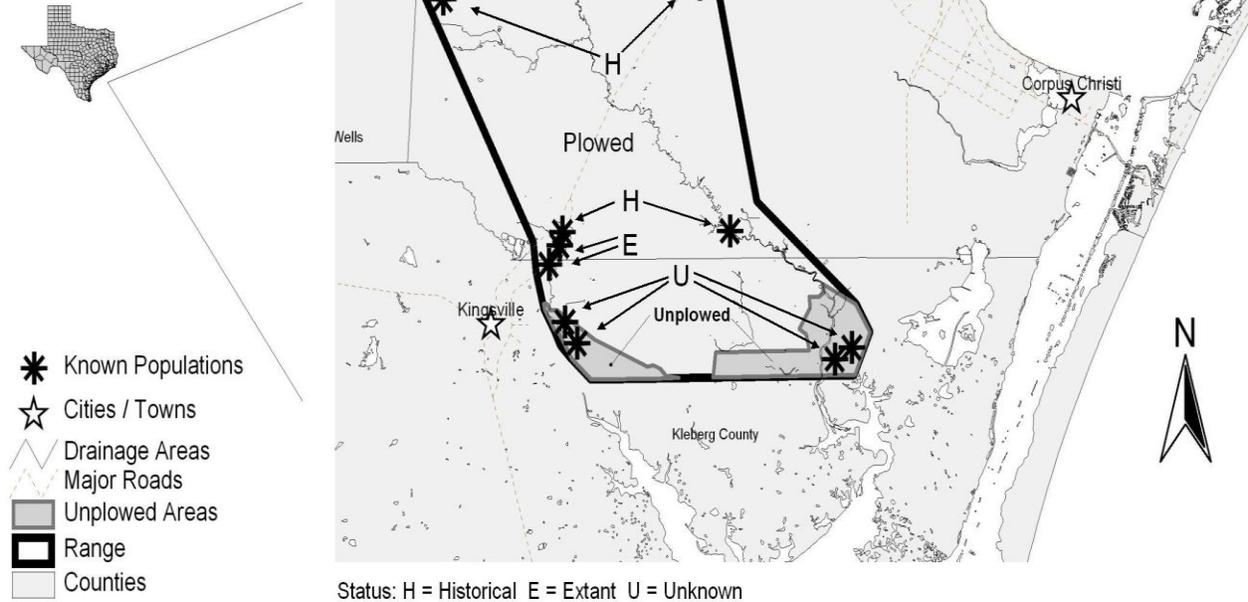
*HERBARIA:

CCM - Corpus Christi Museum of Science & History
 FSU - Florida State University
 LL - Lundell Herbarium
 TPWD's EOR - Element of Occurrence Record

SMU – Southern Methodist University Herbarium
 TAIC – Texas A&M - Kingsville
 TEX – University of Texas at Austin Herbarium

Figure 1.

Major Land Use/Land Cover
Within Slender Rush Pea's
Range in Nueces and Kleberg
Counties, Texas



At 3 other historic sites, the presence of the SRP has never been reconfirmed because original location descriptions were too vague to relocate the populations. Two of these 3 sites (as described on herbarium specimen labels) would now be found within developed portions of the towns of Robstown and Bishop. The population at Petronilla Creek/Highway 70, extant at the time of listing (1985), appears to have died out, probably due to invasion by non-native, introduced grasses (D. Price, pers. comm. 2006).

As of 2007, the continuing presence of SRP can only be confirmed at St. James Cemetery and along Hwy 77 (a population that was discovered in 1993). Therefore, of the 10 historically documented occurrences, only two are still accessible and known to be extant.

With regard to abundance of SRP, information on numbers of individual plants is available for only 5 of the 10 sites: The Petronilla Creek -Highway 70 site, the St. James Cemetery, the Highway 77 ROW, and the 2 populations at the former National Guard Training Center lease. Detection of individual SRP plants is difficult because the SRP is a small, inconspicuous plant (stems ranging from 8 to 30 cm in length) that grows among short-grass prairie species such as buffalograss (*Buchloe dactyloides*). The species is also multi-stemmed, and at least in the case of the cemetery, numbers of individuals are so high that transects and plots are needed to sample population size (Berger 2006). Although transects and plots have been set up at the Petronilla Creek/Highway 70 and Highway 77 sites at various times, rigorous and repetitive monitoring has not been consistently carried out over a period of time. More commonly, these sites have been revisited by individuals who noted conditions of the plants and habitats but did not attempt to census the populations.

The numbers of individual SRP plants at the Petronilla Creek/Highway 70 crossing was first documented in 1982 at which time Mahler (1982a) found 3 plants. Since 1982, the following numbers of individual plants have been reported from this site: 100 plants (1986), 10 plants (1994), zero plants (TxDOT 2002), and one clump with five stems in 2004 (Berger 2006). In a 2006 TPWD email correspondence to TxDOT, Price (pers. comm. 2006) acknowledged that the species had occurred at this site until recently and attested to the area being overtaken by invasive grasses.

The St. James Cemetery contains the largest known population of SRP with an estimate of at least 10,000 individuals at the time the site was first reported (Poole 1985). Since that original approximation, most of the descriptions of the cemetery population have been qualitative in nature, including a 1996 description of the plants being “just about everywhere” (Kowalski pers. comm. 1996). Recently, D. Price observed thousands of plants throughout a wide area of the cemetery; however, no census or sampling was undertaken (Berger 2006).

In 1993, SRP was discovered in the TxDOT Highway 77 ROW by botanists surveying for rare plants along the planned route for a fiber optic cable. This occurrence is downstream and within three-quarters of a mile of the St. James Cemetery population. Transect counts done on the southeast side of the highway in 1993 and 1994 produced counts of 523 plants and 903 plants, respectively (Poole and Janssen 1997). More recently, TPWD estimated “hundreds” of plants on the southeast side of the ROW (Price pers. com. 2006). Across this road (on the west ROW) and slightly further south, the SRP found in 1993 has disappeared and non-native grasses now predominate at this site.

Also in 1993, two SRP sites were found on the former National Guard Training Area located on a portion of a large ranch in Kleberg County. This training area was temporarily leased to the Department of Defense (DOD) and plant surveys were carried out by DOD to ascertain their responsibilities for management of listed species. Slender rush-pea plants were found on both sides of an intermittent creek and were estimated at several hundred individuals on one side and approximately 50 plants on the other (Texas Natural Diversity Database (TNDD) 2007). This site has not been revisited since 1993 because the DOD lease expired and access was no longer available.

2.3.1.3 Genetics, genetic variation, or trends in genetic variation:

Information regarding levels of genetic variation within populations, between populations, and gene flow across populations is lacking. In 2003, researchers from the U.S. Geological Survey (USGS), Texas A&M University (TAMU), and Sul Ross University initiated genetics studies on several endangered plant species, including SRP. By the end of 2006, they had developed a library of clones from microsatellite-enriched DNA fragments of SRP (J. Manhart, pers. comm. 2006). The Service does not yet have sufficient information to understand the conservation implications of SRP genetics. Due to the small population sizes that were documented at several sites, and the distance between known populations, the SRP has the potential to be experiencing inbreeding depression. In light of the small number of known populations, some with very few individual plants, and lacking a thorough genetic analysis of the species, the gene pool is currently believed to be extremely limited. Any loss of individuals, much less populations, could severely threaten the species (Poole 1988).

2.3.1.4 Taxonomic classification or changes in nomenclature:

Slender rush-pea was described in 1936 by Tharp and Williams from a specimen collected in 1931 at a site somewhere between the town of Robstown in Nueces County, and the town of Alice in Jim Wells County. According to Poole (1988), there have been no disagreements on the identification, classification, or nomenclature of this species. Mahler (1982a) located specimens at the following herbaria: Florida State University (FSU), Lundell Herbarium (LL), Southern Methodist University Herbarium (SMU), Texas A&M-Kingsville (TAIC),

University of Texas at Austin Herbarium (TEX), and the Corpus Christi Museum of Science and Technology (CCM).

Slender rush-pea is in the class Magnoliopsida, order Fabales, and family Fabaceae (Poole 1988). There are currently no other scientific or common names for this species (Poole 1988). Although the final rule (FR) listed SRP as belonging to the pea family, Fabaceae, it was later listed under the family Leguminosae. These two family names are used interchangeably. Family Fabaceae is the more widely accepted classification for legumes like the SRP. In addition, the International Union for Conservation of Nature and Natural Resources (IUCN) clarified the correct spelling of the genus as *Hoffmannseggia*, not *Hoffmanseggia* (USFWS 1985).

2.3.1.5 Spatial distribution, trends in spatial distribution, or historic range:

Judging from the locations of both historic and currently extant populations, SRP appears to be restricted to unplowed native prairie habitats within Nueces and Kleberg Counties. The known range of SRP, as delineated by known population locations (Table 1), extends from Robstown, Nueces County, on the most northeastern extent of the range to east-central Kleberg County, then west to a point near Kingsville, and north to the vicinity of the Nueces/Jim Wells County line, encompassing approximately 221,000 acres (89,500 hectares) (Figure 1).

In Nueces County, the characteristic habitat for SRP primarily occurs as strips of remnant native prairie that have been left untilled and undeveloped within or on the periphery of towns and within highway ROWs (Figure 1). These remnant strips of habitat occur, for the most part, near drainage features such as Petronilla Creek and Caretta Creek.

There is a possibility that this species still exists at the 4 population sites found farther south and southeast in Kleberg County. However, these sites have not been revisited since their discoveries in 1964 and 1993 (USFWS 1988, Berger 2006). All 4 occur entirely on privately-owned land (one large ranch) and access to revisit these areas has been restricted.

2.3.1.6 Habitat or ecosystem conditions:

Slender rush-pea occurs in the eco-region known as the Gulf Prairies and Marshes biotic zone (Correll and Johnston 1970). The original native prairie land cover over the vast majority of the area where this species is found has been converted to row crop agriculture (Figure 1) for production of cotton, sorghum, and corn (Franki et al. 1965, Poole 1988). In Nueces County, the more northern portion of SRP's range, between 60% and 70% of the land has been converted to row crops (HTO 2008a). In the southernmost portion of the species range in Kleberg County, native rangeland and/or improved pasture is the dominant land use (HTO 2008b), although some row-cropping has also occurred. Habitats at some historic

and extant SRP population sites consist of remnant, undeveloped strips of native prairie in towns or highway ROWs, while the 4 most southerly population locations are in unplowed rangeland (Table 1). Current land use at the two accessible populations includes highway ROW maintenance activities (primarily mowing) at the Highway 77 population site and grounds maintenance at the St. James Cemetery. Large portions of the approximately 15-acre (6-hectare) cemetery remain in a natural state, although parts of the graveyard are still actively used as a burial ground. Maintenance activities within the cemetery include mowing of the entire tract, upkeep of the road and gravesites, and occasional brush clearing.

All documented SRP sites occur in patches of short-grass native prairies adjacent to intermittent or permanently flowing creeks, with the exception of the two most southeastern Kleberg County populations described by Jones in 1964 as being in a “pasture opening on clay loam” and on a “clayey roadside” (TNDD 2007). His limited descriptions of habitat and the lack of specific locality information for these two populations have made it impossible to determine whether there are any types of drainage features nearby. Mahler (1982a, 1982b) described the SRP population at the Petronilla Creek/Highway 70 ROW site as growing in gullied, eroded land and in disturbed habitat. He suggested that the species is a “member of the lower seral stages of succession, perhaps even a pioneer species” or an “invader species of highly disturbed soils where it persists until crowded out by other species.” He also suggested that the SRP did not have the ability to persist in severely disturbed areas such as land that had been disked, plowed, cropped or changed to improved pasture. This site is described in the recovery plan as occurring in open mesquite brush, in bare patches among other short, native grasses and forbs (USFWS 1988). The SRP’s apparent association with sloping banks of drainages may be related to the fact that the only remaining native prairie plant community throughout much of its range is limited to patches or strips in areas such as sloping creek banks that were difficult to plow or build upon. Growing near watercourses may also help to facilitate seed dispersal for this species, as evidenced at the National Guard training area where populations occur in unplowed rangeland adjacent to natural drainages. However, this is speculation that has not been substantiated by data collection.

According to TPWD, SRP is associated with both short- and mid-grasses including buffalograss, Texas wintergrass (*Stipa leucotrica*), and Texas grama (*Bouteloua rigidiseta*). Other components of the native plant community growing in association with SRP include huisache (*Acacia farnesiana*), huisachillo (*Acacia schaffneri*), spiny hackberry (*Celtis laevigata*), brasil (*Condalia hookeri*), retama (*Parkinsonia aculeata*), lotebush (*Ziziphus obtusifolia*), tasajillo (*Opuntia leptocaulis*), and prickly pear (*Opuntia engelmannii*) (USFWS 1988, TNDD 2007). Slender rush-pea occurs on slopes (about 20° max), along drainages, and are usually located in areas of short or sparse vegetation, due to its inability to compete with taller grasses. The final rule listing SRP as endangered (USFWS 1985) described SRP as persisting in barren openings or where low, native grasses

occur on clayey soils of blackland prairie until it is crowded out by competition from other encroaching species. Poole (1988) described the species as widely scattered and only a component of the herbaceous vegetation at the Petronilla Creek site; however, at the cemetery the species was described as a sub-dominant of the herbaceous layer. The SRP has also been found on slopes close to mesquite-granjeno woodland areas and in areas where shrub cover is low in stature.

The primary soils associated with SRP are clays from the Victoria association derived from Beaumont clays and materials from the Lissie formation (Franki et al. 1965). The SRP occurs in areas of Victoria Clays which are calcareous, crumbly, clay soils that are self-mulching and greatly cultivated for crops. Original descriptions of SRP's habitat indicated that the species grew on clayey soils near creeks (Poole 1988, USFWS 1988), but more recent soil comparisons have altered this perspective. According to the USDA's Nueces County soils survey (Franki et al. 1965), the St. James Cemetery overlies the Victoria soils series; however, results of a soils investigation conducted by Texas A&M University-Kingsville (TAMUK) at the St. James Cemetery site and the Highway 77 ROW site indicated that soils directly underlying the SRP population were not clayey (Brannon et al. 1997). Although the results of this investigation showed the 2 population sites to have similar soils, these researchers found the cemetery substrate supporting SRP to contain 40-41% sand with only 14-20% clay, and therefore, classified it as a loamy top soil according to a soil textural triangle. Soils at the Highway 77 site contained only 19-23% clay, and were classified as a silty-loam. It appears that SRP may occur on soils lower in clay concentration than previously reported. The soils at the National Guard Training Ground site in Kleberg County were described as "lightly colored and textured, with a grayish silt or sand, being noticeably different from black clays on adjacent uplands" (TNDD 2007, B. Carr pers. comm. 2007). These observations indicate that SRP grows on smaller, unmapped areas of soils called inclusions that are found within larger mapped units such as Victoria clays.

2.3.2 Five-Factor Analysis (threats, conservation, and regulatory mechanisms):

2.3.2.1 Present or threatened destruction, modification, or curtailment of its habitat or range:

Limited geographic distribution, fragmentation of remaining habitat into isolated populations, and small population size may be factors affecting this species. Historically, conversion of native prairie to row crops and improved pasture was probably the largest factor contributing to losses of SRP populations and habitat (Poole 1988). The range of SRP has likely been considerably contracted by these types of land conversion activities in Nueces and Kleberg counties (See Section 2.3.1.6 above). Slender rush-pea populations were probably reduced in size or eliminated altogether as habitat was converted to cropland or deliberately planted

to monoculture pastures of non-native grasses. Increased cover by woody species may also have impacted some SRP habitat (USFWS 1988).

More recently, threats to the integrity of the remaining habitat have increased as non-native pasture grasses, including Kleberg bluestem, King Ranch bluestem, Coastal Bermudagrass, and other introduced grasses have continued to spread throughout this region (Mahler 1982a, Poole 1988, Kuvlesky et al. 2002). These grasses are opportunistic species, either producing copious amounts of seed that can be spread both deliberately and/or inadvertently, or spreading rapidly by vegetative means. Seeding of highway and pipeline ROWs and highways to reduce erosion has helped to increase the distribution of some of these non-native grasses into the native prairie remnants that constitute natural habitat for SRP, as seen at the Petronilla Creek and Highway 77 ROW sites (Poole 1988). The condition of short-grass prairie habitat within the unplowed rangeland in Kleberg County is not known. Prescribed winter burns and cattle grazing are the primary land management known to occur in this area.

Non-native, pasture grasses, predominantly Kleberg bluestem, King Ranch bluestem (*Bothriochloa ischaemum*), and Coastal Bermudagrass (*Cynodon dactylon*), have encroached and altered the composition of the native vegetation community at the three accessible SRP population sites at Petronilla Creek/Highway 70, Highway 77 ROW, and St. James Cemetery (Mahler 1982a, Poole 1988, D. Price pers. comm. 2006). These non-native grasses tend to produce dense monocultures with few short-grass native species able to persist (Mahler 1982a). Woody species, including honey mesquite (*Prosopis glandulosa*), huisache, retama, and others have also become more prevalent in the remnant prairie fragments where SRP persists (Mahler 1982a, USFWS 1988, Ruth 2000).

Kleberg bluestem, native to India, China, North Africa, and Egypt, is considered highly competitive, with long creeping rhizomes and continual seed production throughout the year under favorable conditions. Drought tolerance has enabled people to use this grass as a stabilizer on roadsides and pipeline ROWs, and seeds are highly mobile by several means of transport (Drawe 2004). The shallow, fibrous roots of many grass species such as Kleberg bluestem allow quicker absorption of moisture and nutrients than is capable by tap-rooted species, such as SRP, which must wait for deeper moisture penetration (D'Antonio and Mahall 1991). Results from a root competition study conducted by Pressly (2002) on plants taken from the Kika de la Garza PMC included a 93% mortality of SRP grown in conjunction with Kleberg bluestem. Pressly suggested that the faster growing grasses absorbed nutrients more quickly than the native SRP, contributing to a higher growth rate in the non-native grasses. Pressly (2002) also alluded to the potential that allelopathic properties of Kleberg bluestem may have been a factor that hindered SRP growth, an observation backed up by research showing that Kleberg bluestem inhibits seed germination of other south Texas forbs (Kuvlesky et al. 2002). The SRP in greenhouse cultivation did seem to

suffer from fungal infections caused by heat and humidity, apparently resulting from the amount of above-ground plant material produced by the grass. Mature SRP individuals may be less susceptible to competition than new seedlings (Pressly 2002).

In addition to subsurface competition, fast growing non-native grasses can spread quickly and potentially out-compete SRP for both space and sunlight (Pressly 1998). Greenhouse shadecloth studies using SRP plants grown at the Kika de la Garza PMC demonstrated significant differences in petiole heights and lengths between non-shaded (controls) versus shaded treatments and also differences in the growth pattern (Pressly 2002). Non-shaded plants grew in a prostrate manner while the petioles of the shaded plants grew upwards (Pressly 2002). However, this greenhouse study did not show significant mortality of SRP at 30%, 40%, or 50% shading (Pressly 2002).

Localized disturbances causing losses of individual SRP plants have been attributed to highway construction projects as well as ROW maintenance procedures, maintenance of gas pipelines, and excavation of burial plots (Poole 1988). Survey reports indicated some damage to SRP individuals at St. James Cemetery caused by mowing with blades set low to the ground. Other observations at the cemetery reported on damage associated with equipment tracking through the population, and from piling of cleared brush on top of SRP. Consequently, TPWD recommended mowing at a height of no less than 6 inches (approximately 15 cm), which has been incorporated into cemetery grounds-keeping procedures (Perez 1992). Also, a management agreement between TxDOT and TPWD included recommendations to continue established mowing practices on the Highway 77 ROW with a full-width mowing 4 times a year and a strip mowed every 6 weeks between May through December.

2.3.2.2 Overutilization for commercial, recreational, scientific or educational purposes:

No information exists to indicate that SRP is used for commercial or recreational purposes and this was not considered a threat at the time of listing. Use for scientific purposes has been limited in scope to seedpod collection for germination and establishment experiments, and in one instance, transplantation of several clumps of SRP from the St. James Cemetery into a native plant community at the CCBG (Bush 1990).

2.3.2.3 Disease or predation:

This was not known as a threat at the time of listing. Poole (1986) did observe that 4 SRP plants at the Petronilla/Hwy 70 population “looked as though rabbits had been biting them.” However, no other evidence, anecdotal or otherwise, exists regarding the effects of grazing or browsing on this species. Data on abundance and distribution of cottontails (*Sylvilagus floridanus*) and jackrabbits

(Lepus californicus) in Nueces and Kleberg counties is lacking; however, it is possible that rabbit populations may have become more concentrated in the remnant strips of habitat in Nueces County. Plants may be susceptible to insect vectors and/or grazing effects, but no research has been conducted to document such effects. No new information regarding the predation or disease of SRP has been found.

2.3.2.4 Inadequacy of existing regulatory mechanisms:

At the time of listing, the species was not protected by State or Federal law. Slender rush-pea was listed as endangered without critical habitat in November of 1985. Section 9(a)(2)(B) of the Endangered Species Act (Act) prohibits removal and possession of endangered plants from areas under Federal jurisdiction, However, we are currently unaware of any SRP populations on Federal lands.

Under Chapter 88 of the Texas Parks and Wildlife Code, any Texas plant that is placed on the Federal list as endangered is also required to be listed by the State in the same manner. Therefore, SRP is afforded endangered status by TPWD. In addition to the State of Texas regulations pertaining to listing, other State laws may apply. The State prohibits taking and/or possession of listed plants for commercial sale, or sale of all or any part of an endangered, threatened, or protected plant from public land. Scientific permits are required for purposes of collection of endangered plants or plant parts from public lands for scientific or education purposes. Commercial permits must be obtained from TPWD to collect endangered plants from private land only if the collector intends to sell the plants or plant material. The destruction or removal of any plant from State lands without a permit from TPWD is unlawful. Two populations of SRP are known from TxDOT ROWs, although the presence of plants at one of these (Petronilla Creek/Highway 77) has not been confirmed in the last four years. Activities that might affect these populations require prior coordination between TxDOT and TPWD, and potential permits being issued from TPWD. The TxDOT and TPWD currently cooperate under a Memorandum of Understanding, originally signed in 1992 and revised in 1998, that governs management actions that target conservation of listed species on State highway ROW's.

The majority of SRP populations occur on private land. The Act, as amended in 1982, does not require that private landowners take any measures to protect listed plant species on their lands, unless they are receiving Federal funding, a Federally-issued permit, or a Federally-sponsored project is taking place on their land. According to the Act, listed plants may be removed from private lands at any time unless prohibited by State law. At this time, the largest SRP population known to be extant occurs on a privately-owned cemetery where its protection to date has depended on management practices that have primarily consisted of mowing, thereby keeping invasive grasses from overtaking the native prairie species. Long-term protection is not guaranteed. However, the cemetery owner has indicated that no development of gravesites is planned in the portion of the

property where SRP is found (R. Cobb, pers. comm. 2008). The landowner has also been receptive to management suggestions from TPWD and the Service.

2.3.2.5 Other natural or manmade factors affecting its continued existence:

No other natural or manmade factors are known to affect SRP at this time.

2.4 Synthesis

The endangered SRP occupies less than 15% of its former range (as delineated by the extent of known populations). Within this range, the SRP's known distribution is patchy and discontinuous. In the past, the species decline was primarily attributed to the destruction of Gulf Coast Prairie habitat, particularly in Nueces County, as it was converted to cropland and improved pastures. Some localized losses of habitat have been attributed to residential development and highway construction. More recently, the greatest degree of threat to the continued existence of the SRP is the degradation of remaining habitat by invasive, non-native grasses. The SRP has disappeared from one location that was overrun with Kleberg bluestem and other non-natives within the last 4 years. The 2 remaining populations that can be monitored require active maintenance, such as mowing, to keep the non-natives in check. Rapid growth, drought tolerance, and height characteristics of Kleberg bluestem, Coastal bermudagrass, and other non-native grasses have made these species attractive for pasture plantings and erosion control. Coupled with the ability of these non-native species to spread rapidly on their own, they pose increasing threats to short-grass species like the SRP. Greenhouse studies of shading and competition show that SRP grows poorly in the presence of Kleberg bluestem, a common invader in this region of Texas. Limited distribution and small populations of SRP make them vulnerable to natural or human-induced events, resulting in the encroachment of exotic, invasive grasses.

The SRP may occur in greater abundance in the southern part of its range where land cover has not been converted to row crops. However, the extent to which native short-grass prairie patches remain in good condition is unknown. Additional surveys for the SRP are needed, particularly in Kleberg County. Unfortunately, soil maps may not prove particularly useful in locating potential habitat, as the SRP appears to be associated with smaller, unmapped inclusions of sandier soils that overlay larger areas of Victoria clays.

The degree of threats from other factors is not well understood because little biological and ecological research has been undertaken for this species. Because SRP's pollinators are unknown, the level of indirect threat to SRP's reproduction from a variety of pesticide application programs is uncertain. Also, without genetics information, the degree of relatedness of populations is unknown, and it is therefore difficult to determine whether habitat fragmentation is having an effect on the species.

The SRP should remain as endangered. Recovery criteria for downlisting and delisting have not been developed. Our best available information indicates that the species

appears to be declining as evidenced by the loss of one population from a State highway ROW. Although the largest population appears to be stable in terms of the plant's presence and the population's areal extent, this site is being invaded by non-native grasses and requires active management, e.g. mowing, to keep the native prairie components intact. This is also true at the one other accessible population site on the Highway 77 ROW. Therefore, based on the relatively recent loss of one population, the extent of past habitat alteration throughout the species' range, and the continued threat of invading non-native grasses, no change in classification is warranted.

3.0 RESULTS

3.1 Recommended Classification:

- Downlist to Threatened
- Uplist to Endangered
- Delist:
 - Extinction*
 - Recovery*
 - Original data for classification in error*
 - No change is needed

3.2 New Recovery Priority Number: No change; remain as 2.

4.0 RECOMMENDATIONS FOR FUTURE ACTIONS

Continued loss and degradation of habitat due to invasion by non-native, fast-spreading grasses is the most pressing threat to the continued existence of SRP populations at sites in Nueces County. There is an immediate need to implement and experiment with management actions involving mowing treatments, selective applications of herbicides, hand removal, and potentially even prescribed burning to control exotics at the cemetery and the Highway 77 ROW sites. Monitoring of SRP response will be needed to document effectiveness of various management techniques. Effective methodologies should be incorporated into management plans for both populations. Annual monitoring should be carried out to determine if populations are stable, increasing, or declining. The Service and/or TPWD should establish a cooperative agreement with the cemetery owner to assist the landowner in implementing the management plan. Based on the results of SRP's response to various management treatments, TxDOT should consider changes to their management of the Highway 77 ROW, including changes to mowing schedules.

A systematic approach to surveying for new populations is needed, particularly in Kleberg County where the natural habitat is potentially in better condition. If additional populations are located in rangeland settings, the effects of prescribed burns on SRP should be analyzed.

A reintroduction plan should be established for the SRP to allow experimental plantings into natural habitat, particularly at the former population sites on the western side of the Highway

77 ROW and at the Petronilla Creek/Highway 70 ROW. The SRP has proven to be easily germinated from untreated seed and prospects seem good for propagating the species. A thorough genetics analysis of SRP is needed to develop a sound reintroduction plan.

Knowledge regarding species' habitat requirements, population biology, and population ecology needs to be gathered and analyzed in order to develop down-listing and delisting recovery criteria. Additional research needs include determination of habitat requirements, demographic trends, population biology, reproductive biology, and pollinators.

The recovery plan for SRP needs to be revised to incorporate all new information on biology, ecology, and management recommendations. Objective and measurable recovery criteria that relate directly to the 5 listing factors should be developed.

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U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW of Slender rush-pea (*Hoffmannseggia tenella*)

Current Classification: Endangered

Recommendation resulting from the 5-Year Review:

- Downlist to Threatened
- Uplist to Endangered
- Delist
- No change needed

Appropriate Listing/Reclassification Priority Number, if applicable: Not applicable

Review Conducted By: Robyn Cobb, U.S. Fish and Wildlife Service, Corpus Christi Ecological Services Field Office

FIELD OFFICE APPROVAL:

Lead Field Supervisor, U.S. Fish and Wildlife Service

Approve Alan M. Starnes Date 06-27-08

REGIONAL OFFICE APPROVAL:

Assistant Regional Director, Ecological Services, U.S. Fish and Wildlife Service, Region 2

Approve Nancy J. Roman Date 7-11-08