

**U.S. FISH AND WILDLIFE SERVICE
SPECIES ASSESSMENT AND LISTING PRIORITY ASSIGNMENT FORM**

SCIENTIFIC NAME: *Leavenworthia texana*

COMMON NAME: Texas golden gladecress

LEAD REGION: Region 2

INFORMATION CURRENT AS OF: April 2010

STATUS/ACTION:

Species assessment - determined species did not meet the definition of endangered or threatened under the Act and, therefore, was not elevated to Candidate status

New candidate

Continuing candidate

Non-petitioned

Petitioned - Date petition received: 11 May 2004

90-day positive - FR date:

12-month warranted but precluded - FR date:

Did the petition requesting a reclassification of a listed species?

FOR PETITIONED CANDIDATE SPECIES:

a. Is listing warranted (if yes, see summary of threats below)? yes

b. To date, has publication of a proposal to list been precluded by other higher priority listing actions? yes

c. If the answer to a. and b. is "yes", provide an explanation of why action is precluded: Higher priority listing actions, including court-approved settlements, court-ordered statutory deadlines for petition findings and listing determinations, emergency listing determinations, and responses to litigation, continue to preclude the proposed and final listing rules for the species. We continue to monitor populations and will change its status or implement an emergency listing if necessary. The "Progress on Revising the Lists" section of the current CNOR (<http://endangered.fws.gov/>) provides information on listing actions taken during the last 12 months.

Listing priority change

Former LP:

New LP:

Date when the species first became a Candidate (as currently defined): 8/17/97

Candidate removal: Former LP:

A – Taxon is more abundant or widespread than previously believed or not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status.

U – Taxon not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status due, in part or totally, to conservation efforts that remove or reduce the threats to the species.

F – Range is no longer a U.S. territory.

I – Insufficient information exists on biological vulnerability and threats to support

listing.

- M – Taxon mistakenly included in past notice of review.
- N – Taxon does not meet the Act’s definition of “species.”
- X – Taxon believed to be extinct.

ANIMAL/PLANT GROUP AND FAMILY: Flowering plant, Brassicaciae (Mustard family)

HISTORICAL STATES/TERRITORIES/COUNTRIES OF OCCURRENCE: Texas

CURRENT STATES/ COUNTIES/TERRITORIES/COUNTRIES OF OCCURRENCE:
Texas / San Augustine County, Sabine, County, Nacogdoches County (introduced) /U.S.A.

LAND OWNERSHIP: One existing known site is on State Highway right-of-way (50 percent) and the adjacent private land (50 percent). The other sites are on private land (100 percent). The four sites total less than 0.5 hectare (1.2 acres) in size. An estimated 85 percent of the current sites are located on private land. All historic sites (100 percent) were on private land and probably totaled about 1 hectare (2.5 acres) in size.

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LEAD FIELD OFFICE CONTACT: Clear Lake Field Office, Stephen D. Parris, 281-286-8282, steve_parris@fws.gov

BIOLOGICAL INFORMATION

Species Description

Leavenworthia texana (Texas golden glade cress) is a small annual member of the mustard family. The leaves are rosette-forming, and terminal leaf segments are wider-than-long and usually distinctly lobed with angular teeth. Flowering is February-March. Early and mid-season flowers are on scapes 3-9 centimeters (cm) (1.2-3.5 inches (in.)) long, but later flowers are usually borne in a raceme in which each flower is attached to the main stalk by a short stem on lateral branches. Petals are 7-10 mm (0.3-0.4 in.) long, bright deep-yellow with only slightly darker yellow bases. Older petals may have white tips. Seeds are 3-5 mm (.1-.2 in.) in diameter, strongly flattened, and narrowly winged.

Taxonomy

M.C. Leavenworth first collected the taxon in Choctaw County, Oklahoma, in 1835, and eventually named the specimens *Leavenworthia aurea*. (Mahler 1981, pp. 76-77). Leavenworth discovered and collected similar specimens near San Augustine (of San Augustine County, Texas) in 1836-1837. E. J. Palmer collected the species in the same area in 1915 and 1918, followed by D.S. and H.B. Correll in 1961-1962 (Mahler 1981, pp. 76-77). E.S. Nixon studied and mapped populations around San Augustine in 1979-1980 (George and Nixon 1990, pp. 117-127). W. M. Mahler (1987, pp. 239-242) also studied collected specimens and their habitat, and identified it as a separate species, *Leavenworthia texana*, endemic to San Augustine and Sabine counties, Texas. Genetic sequencing has shown that *L. aurea* has a unique insertion point, further supporting that *L. texana* is a separate species and not a variety of *L. aurea* (Poole *et al.*

2007).

Habitat/Life History

Leavenworthia texana, along with the endangered *Lesquerella pallida* (white bladderpod), occurs only on the Weches outcrops of east Texas in San Augustine and Sabine counties (George and Nixon 1990, p. 120). The Weches geologic formation consists of a layer of calcareous soils as a result of the rich marine fossil component, lying above a layer of glauconite clay up to 50 cm (20 in.) below the surface. Because of the presence of mudstone, the soils are generally rocky and shallow. The formation averages 8 kilometers (5 miles) in width as it parallels Highway 21 through north San Augustine and Sabine counties. Erosion of the complex has produced steep, flat-topped hills and escarpments, dissected by deep valleys. It has also created the unique ecology of islands of thin, loamy, alkaline soils (pH 7-8), within the normally deep, sandy, acidic soils (pH 4-5) of the pine woods region. The glauconite layer of the Weches is impermeable to water, making the thin upper soils seepy and wet much of the year, but often hard and dry during the summer. This, and the alkalinity of the soils, produces conditions unique to Weches outcrops, generally supporting open-sun, herbaceous, and specialized plant communities (Mahler 1987, p. 240; George and Nixon 1990, pp. 120-122). Down-slope seepage across Weches terraces may also be important to maintaining the hydrology required by *L. texana*. The open, seepy Weches glades support highly diverse plant communities with more than 100 species, representing at least 39 plant families, documented on Weches glades (George and Nixon 1990, pp. 122-124). Most are small, herbaceous, and either annuals or biennials (George and Nixon 1990, pp. 125-126).

Historical Range/Distribution

Leavenworthia texana was historically recorded at 8 locations, all in a narrow line along north San Augustine and Sabine counties, following the Weches formation (Texas Parks and Wildlife Department (TPWD) 1974-1988). Two historic locations have been lost to glauconite mining, and a nearby glauconite mine has probably altered the water regime at another historic site.

Current Range/Distribution

Leavenworthia texana is currently known from two sites in San Augustine County, one in Sabine County, and one introduced population in Nacogdoches County (Turner 2003, p. 5). The Tiger Creek site is less than 0.1 hectare (0.25 acre) between a pasture fence and gravel road southwest of Highway 21 in San Augustine County. The Kardell site is less than 9 square meters (100 square feet) on the side of Sunrise Road south of Highway 21 in San Augustine County. In Sabine County, the Geneva site is approximately 9 square meters (100 square feet) west of Texas Highway 21 south of Geneva. In Nacogdoches County, the Simpson Farms site supports an introduced population of about 18 square meters (200 square feet) east of Nacogdoches on the north side of Highway 21. The potential for locating new populations is diminished by the absence of a comprehensive soil survey for San Augustine County. The designation of soil series and soil map units along the Weches formation is probably the most crucial need to effectively locate new habitat. The Nature Conservancy identified 44 potential sites of occurrence with the use of GIS data, including aerial, geologic, and hydrologic data sources. Access was granted to about 14 of these sites, but little Weches habitat, and no new *L. texana* populations, were discovered (Turner 2003, p. 4).

Population Estimates/Status

The Tiger Creek site had 91 plants in 1999, 67 in 2000, 96 in 2001, 42 in 2003, 40-50 in 2005, 200 in 2007; and 98 in 2009. The Kardell site had 490 plants in 1999, 96 in 2000, 520 in 2001, 0 in 2005, and 29 in 2009. The Geneva site had 319 plants in 1999, 57 in 2003, 40 in 2005, 200 in 2006, 1000 in 2007, and 260 in 2009. The Simpson Farms site had 300 plants in 2001, 57 in 2003, 1000 in 2007, and 721 in 2009 (Table 1).

Table 1: Population estimates/status for Texas golden gladeecress.

	Tiger Creek	Kardell	Geneva	Simpson Farms
1999	91	490	319	
2000	67	96		
2001	96	520		300
2002				
2003	42		57	57
2004				
2005	40-50	0	40	
2006			200	
2007	200		1000	1000
2008				
2009	98	29	260	721

THREATS

A. The present or threatened destruction, modification, or curtailment of its habitat or range.

Leavenworthia texana habitat has been impacted by highway construction, residential development, conversion to pasture and cropland, and widespread use of herbicides. Two sites have been lost to glauconite mining (Service 2005, p.2). Over-grazing has been identified as a possible threat to Weches glades at one site (Carr 2006, p. 5; Singhurst 2006). The primary current threat to remaining *L. texana* habitat appears to be the continued invasion of non-native weedy shrubs and vines into Weches glades, converting them to dense shrub-thickets which preclude herbaceous growth. The most serious invaders are Macartney rose (*Rosa bracteata*) and Japanese honeysuckle (*Lonicera japonica*), but also include Japanese brome (*Bromus japonicus*), Japanese bush-clover (*Lespedeza striata*), privet (*Forestiera ligustrina*), bermuda-grass (*Cynodon dactylon*), broomsedge (*Andropogon virginicus*), spurge (*Euphorbia spathulata*), blackhaw viburnum (*Viburnum rufidulum*), and ivy treebine (*Cissus incisa*). Control measures (brush-clearing) carried out in 1995 resulted in reappearance of *L. texana* after a 10-year absence at the Tiger Creek site (Nemec 1996, p. 4). Future control measures could have a similar effect at other historic locations. However, at least one observer (Carr 2006, p. 7) has noted that Macartney rose serves to protect some *L. texana* from grazing by cattle. All sites remain vulnerable to conversion to cropland or range, over-grazing and glauconite mining.

According to the Intergovernmental Panel on Climate Change (IPCC), average Northern Hemisphere temperatures during the second half of the 20th century were very likely higher than during any other 50-year period in the last 500 years and likely the highest in at least the past

1,300 years (IPCC 2007, p. 1). It is very likely that cold days, cold nights and frosts have become less frequent over most land areas and hot days and hot nights have become more frequent over the past 50 years: (IPCC 2007, p. 1). It is also likely that heat waves have become more frequent over most land areas, and the frequency of heavy precipitation events has increased over most areas (IPCC 2007, p. 1).

The IPCC (2007, p. 6) predicts that changes in the global climate system during the 21st century are very likely to be larger than those observed during the 20th century. For the next two decades a warming of about 0.2°C (0.4°F) per decade is projected (IPCC 2007, p. 6). Afterwards, temperature projections increasingly depend on specific emission scenarios (IPCC 2007, p. 6). Various emissions scenarios suggest that by the end of the 21st century, average global temperatures are expected to increase 0.6°C to 4.0°C (1.1°F to 7.2°F) with the greatest warming expected over land (IPCC 2007, p. 6-8). The IPCC says it is very likely hot extremes, heat waves, and heavy precipitation will increase in frequency (IPCC 2007, p. 8).

A warmer climate with more extreme precipitation events may adversely affect *Leavenworthia texana* by altering the glade habitat the species is known to occupy. It may also improve habitat conditions for invasive plant species and/or for other plants.

B. Overutilization for commercial, recreational, scientific, or educational purposes.
Overutilization is not known to be a threat to the *Leavenworthia texana*.

C. Disease or predation.

One currently occupied site (Kardell) is grazed by cattle, placing the existing population at risk to predation and trampling (Carr 2006, p. 9). Four historic sites were also grazed by cattle, which may have been a factor contributing to their extirpation through predation and trampling (Carr 2006, p. 9).

D. The inadequacy of existing regulatory mechanisms.

Three populations are on private land, while the fourth site is located partially on private land. There are no Federal, State, or local laws or regulations that afford protection to plants on private land in Texas. *Leavenworthia texana* generally shares its habitat with *Lesquerella pallida*, which is listed as endangered under the Act. This has allowed the *L. texana* to benefit from conservation measures targeted toward *Lesquerella pallida*, especially at the Tiger Creek site (Carr 2006, p. 12). We conclude that *Leavenworthia. texana* is threatened by a lack of existing regulatory mechanisms.

E. Other natural or manmade factors affecting its continued existence.

A drought during 1999 and 2000 had a pronounced effect on *Leavenworthia texana* reproduction. The Tiger Creek population declined from 91 to 67, and the Kardell population declined from 490 to only 96 (Turner 2000).

CONSERVATION MEASURES PLANNED OR IMPLEMENTED

○ *Leavenworthia texana* occurs in the same habitat as the Federally endangered *Lesquerella pallida*. Brush-clearing carried out in 1995 for *Lesquerella pallida* resulted in a return of

Leavenworthia texana to one site after a 10-year absence (Nemec 1996, p. 5). However, non-native shrubs have again invaded this site, limiting *Leavenworthia texana* and *Lesquerella pallida* numbers.

- The Service supported a 3-year status survey conducted by The Nature Conservancy of Texas (TNC) that was completed in 2006. GIS and GPS data were established for each known site for future surveys and monitoring, and existing habitat areas were characterized and quantified for future comparison (Carr 2006).
- *Leavenworthia texana* seeds have been collected and placed in three State horticultural labs and the National Seed Storage Lab. A cooperative agreement between the Service and Stephen F. Austin State University has facilitated propagation efforts at their Pineywoods Native Plant Center for cultivation, research, long-term storage, and seed source for reintroduction efforts.
- The Nature Conservancy completed the “Conservation Area Plan for the San Augustine Glades” in 2003. The plan identifies the size and configuration of functional conservation units that will restore and maintain long-term viability of Weches communities.
- Through a Partners for Wildlife project, approximately 2.4 hectares (6 acres) on, and adjacent to, the Weches Outcrop in San Augustine County was mulched in November, 2008, to remove encroaching brushy species and to re-establish suitable glade habitat. The site will be carefully monitored for the possible appearance of the *Leavenworthia texana*. Reseeding may also be considered at this site if a sufficient seed base can be established.
- The landowner used mechanical methods to remove brush at the Tiger Creek site during the winter of 2008-2009 (Singhurst 2009a), presumably to improve grazing conditions for his cattle. It is not known what effect this action may have upon *Leavenworthia texana*.

SUMMARY OF THREATS

Known historical sites have been impacted by conversion to pasture and cropland, widespread use of herbicides, and over-grazing. Two sites have been lost to glauconite mining. The primary current threat is the invasion of non-native and weedy shrubs and vines into Weches glades, converting them to dense shrub-thickets which preclude herbaceous growth. The most serious invaders are Macartney rose and Japanese honeysuckle. Brush-clearing has proven to be very effective at reversing the downward trend of *Leavenworthia texana* populations, but must be conducted on a continuing basis.

We find that *Leavenworthia texana* is warranted for listing throughout all of its range, and, therefore, find that it is unnecessary to analyze whether it is threatened or endangered in a significant portion of its range.

RECOMMENDED CONSERVATION MEASURES: Recommended measures include: 1) continued landowner contact of existing and potential sites; 2) extensive surveys of species and its associates; 3) continued searches for new populations; 4) development of Candidate Conservation Agreements; 5) implementation of management actions to control non-native

invasives and over-grazing, as funding becomes available; 6) permanent protection of at least one known site through in-fee title or a conservation easement; and 7) a comprehensive soil survey for San Augustine County to effectively locate new habitat to survey.

LISTING PRIORITY

THREAT			
Magnitude	Immediacy	Taxonomy	Priority
High	Imminent	Monotypic genus	1
		Species	2*
	Non-imminent	Subspecies/population	3
		Monotypic genus	4
		Species	5
		Subspecies/population	6
Moderate to Low	Imminent	Monotypic genus	7
		Species	8
		Subspecies/population	9
	Non-imminent	Monotypic genus	10
		Species	11
		Subspecies/population	12

Rationale for listing priority number:

Magnitude: The magnitude of threat to *Leavenworthia texana* is considered high at this time. It historically occurred at at least 8 sites in east Texas (TPWD 1974-1988). It is now restricted to four sites involving a total area of less than .4 hectare (1 acre), and a total population ranging from as low as 163 to a maximum of 2200 (Turner 2003, p. 10; Carr 2006, p. 10; Keith 2007). Since the species occurs mostly on private land, all sites are vulnerable to conversion to cropland or rangeland, or to glauconite mining. All sites are currently affected by invasion of non-native plants, significantly reducing population numbers each year (Carr 2006, p. 9).

Imminence: The degree of threat is considered imminent at this time. All known sites are undergoing degradation by non-native shrubs and vines, restricting growth and reproduction of *Leavenworthia texana*. With only four known sites, *L. texana* remains extremely vulnerable to natural events and ongoing threats. Unless existing and new populations are adequately protected, and management actions implemented to remove non-natives, *L. texana* will remain in immediate danger of extinction.

Yes Have you promptly reviewed all of the information received regarding the species for the purpose of determining whether emergency listing is needed?

Is Emergency Listing Warranted? No. The landowners involved are aware of the importance of this species and have been cooperative in maintaining the current land use at the remaining

known sites. Pre-listing efforts to find additional sites and the protection and management of known sites, should be the focus for the species at this time.

DESCRIPTION OF MONITORING: The Nature Conservancy of Texas conducted extensive surveys for *Leavenworthia texana* in 2005 and 2006 (Carr 2006, pp. 1-12). Eric Keith, with Raven Environmental Services in Huntsville, TX, visited three of *L. texana* sites in early March of 2007 (Keith 2007). Jason Singhurst, botanist, TPWD, visited each of the four known sites on February 25, 2009 to determine population numbers and status of the sites (Singhurst, 2009b).

COORDINATION WITH STATES:

Indicate which State(s) (within the range of the species) provided information or comments on the species or latest species assessment: In August 2005 and March 2007 the Service contacted TPWD and requested information on the status of this species. In October 2005, TPWD agreed this species should remain a candidate species. In April 2007, TPWD indicated that they had no new information to contradict candidate status for this species (TPWD 2007). The Service contacted TPWD in March 2008 regarding any new information for this species, and received no reply. In March 2009, TPWD agreed with the Service's assessment for this species (TPWD 2009). The State also provided us with population estimates from their February 2009 visit to the four known *Leavenworthia texana* sites (Singhurst 2009b). TPWD indicated in March of 2010 that they had no new information concerning this species (Gordon 2010). *L. texana* is not included in the State Wildlife Action Plan.

Indicate which state(s) did not provide any information or comments: None.

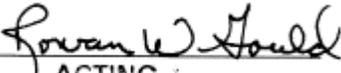
LITERATURE CITED

- Carr, W. R. 2006. Notes on populations of white bladderpod and Texas golden gladeceess in San Augustine County, Texas. The Nature Conservancy of Texas. 12pp.
- George, R.J., and E.S. Nixon. 1990. The herbaceous flora of three Weches formation outcrops in eastern Texas. Sida 14(1):117-127.
- Gordon, W. 2010. E-mail correspondence with Wendy Gordon, Nongame and Rare Species Program Leader, Texas Parks and Wildlife Department, Austin, TX (March 30, 2010).
- Intergovernmental Panel on Climate Change (IPCC). 2007. Climate change 2007: synthesis report, summary for policymakers. Intergovernmental Panel on Climate Change, Fourth Assessment Report. Released on 17 November 2007. 23 pp. Available from: http://www.ipcc.ch/pdf/assessment-report/ar4/syr/ar4_syr_spm.pdf.
- Keith, E. 2007. Telephone interview with Eric Keith, Biologist, Raven Environmental Services, Huntsville, TX (April 17, 2007).
- Mahler, W.F. 1981. Notes on rare Texas and Oklahoma plants. Sida 9:76-86.

- Mahler, W.F. 1987. *Leavenworthia texana*, a new species from Texas. *Sida* 12:239-242.
- Nemec, K. A. 1996. 1995-1996 white bladderpod conservation efforts. U. S. Fish and Wildlife Service, Clear Lake Ecological Services Field Office, TX. 9pp.
- Poole, J. M., W. R. Carr, D. M Price and J. R. Singhurst. 2007. *Rare Plants of Texas*. Texas A & M University Press, College Station, Texas.
- Singhurst, J. 2006. Telephone interview with Jason Singhurst, Botanist, Texas Parks and Wildlife Department , Austin, TX (April 24, 2006).
- Singhurst, J. 2009. E-mail correspondence with Jason Singhurst, Botanist, Texas Parks and Wildlife Department, Austin, TX (April 7, 2009).
- Texas Parks and Wildlife Department (TPWD). 1974-1988. Texas Natural Heritage Program element occurrence records.
- Texas Parks and Wildlife Department (TPWD). 2007. E-mail correspondence with TPWD biologists, TX (April 13, 2007).
- Texas Parks and Wildlife Department (TPWD). 2009. Letter to Adam Zerrenner, Field Supervisor, FWS, Austin, TX (March 5, 2009).
- Turner, R. 2000. Telephone interview with Rick Turner, Biologist, The Nature Conservancy, Nacogdoches, TX (March 2000).
- Turner, R. 2003. Conservation Area Plan for the San Augustine Glades. The Nature Conservancy. 25pp.
- U. S. Fish and Wildlife Service (Service). 2005. *Leavenworthia texana* field notes. Clear Lake Ecological Services Field Office, Houston, TX. May 25, 2005. 4pp.

APPROVAL/CONCURRENCE: Lead Regions must obtain written concurrence from all other Regions within the range of the species before recommending changes, including elevations or removals from candidate status and listing priority changes; the Regional Director must approve all such recommendations. The Director must concur on all resubmitted 12-month petition findings, additions or removal of species from candidate status, and listing priority changes.

Approve:  May 21, 2010
Acting Regional Director, Fish and Wildlife Service Date

Concur:  October 22, 2010
ACTING : Director, Fish and Wildlife Service Date

Do not concur: _____
Director, Fish and Wildlife Service Date

Director's Remarks:

Date of annual review: April 2010
Conducted by: Edith Erfling