

Interim Core Map Documentation for Navasota Ladies'-Tresses

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Species Summary

Navasota ladies'-tresses (*Spiranthes parksii*; Entity ID 837) is an endangered monocotyledonous plant found in Texas. The U.S. Fish and Wildlife Service (FWS) has not assigned designated critical habitat for Navasota ladies'-tresses. This species inhabits the Post Oak Savanna vegetation type of east-central Texas, with optimal habitat being influenced by periodic wildfire (FWS 1994; FWS 2019). Additional habitat information is provided in **Appendix 1**.

EPA Review Notes

The developers created this core map using the U.S. Environmental Protection Agency's (EPA) process available at: <https://www.epa.gov/endangered-species/process-epa-uses-develop-core-maps-pesticide-use-limitation-areas>. EPA reviewed the draft interim map and documentation and evaluated if: (1) the map and documentation are consistent with EPA's process; (2) areas included or excluded from the interim core map are consistent with the biology, habitat, and/or recovery needs of the species; (3) data sources are documented and appropriate; and (4) the Geographic Information System (GIS) data and mapping process are consistent with the stated intention of the developer. EPA agrees that this map is a reasonable depiction of core areas for this species and was consistent with the agency's mapping process. This documentation was not prepared by EPA, and EPA may have edited this documentation for clarity or other purposes. Some views expressed in this documentation may not necessarily be the views of EPA or its staff.

The core map developed for this species is considered interim and can be used to develop pesticide use limitation areas (PULAs). This core map incorporates information developed by FWS and made available to the public; however, the core map has not been formally reviewed by FWS. This interim core map may be revised in the future to incorporate expert feedback from FWS.

This core map does not replace or revise any range or designated critical habitat developed by FWS.

Description of Core Map

The core map for the Navasota ladies'-tresses is biological information type based on observations represented in the species' most recent 5-Year Review (FWS 2022). The document includes a map of these observations. Additional known location information was examined but was not used in core map development. Landcover associated with the species habitat was also used to refine the core map (TPWD 2025).

The core map developed in this document for the Navasota ladies'-tresses spans 127,983 acres (Figure 1). A summary of acreage by National Landcover Database (NLCD 2021) land use type is provided in

Table 1.

Based on the EPA's "best professional judgment classification" system, CSI has graded this core map as "moderate" (4) because recovery unit boundaries were georeferenced from an image, then buffered to account for uncertainty in this process. Additionally, these areas of occupancy were clipped to the species range and had area not associated with pine oak savanna and contiguous cultivated areas of at least 25 acres removed to form the core map. More information about this classification system and its definitions can be found in the core map process document (EPA 2024a).

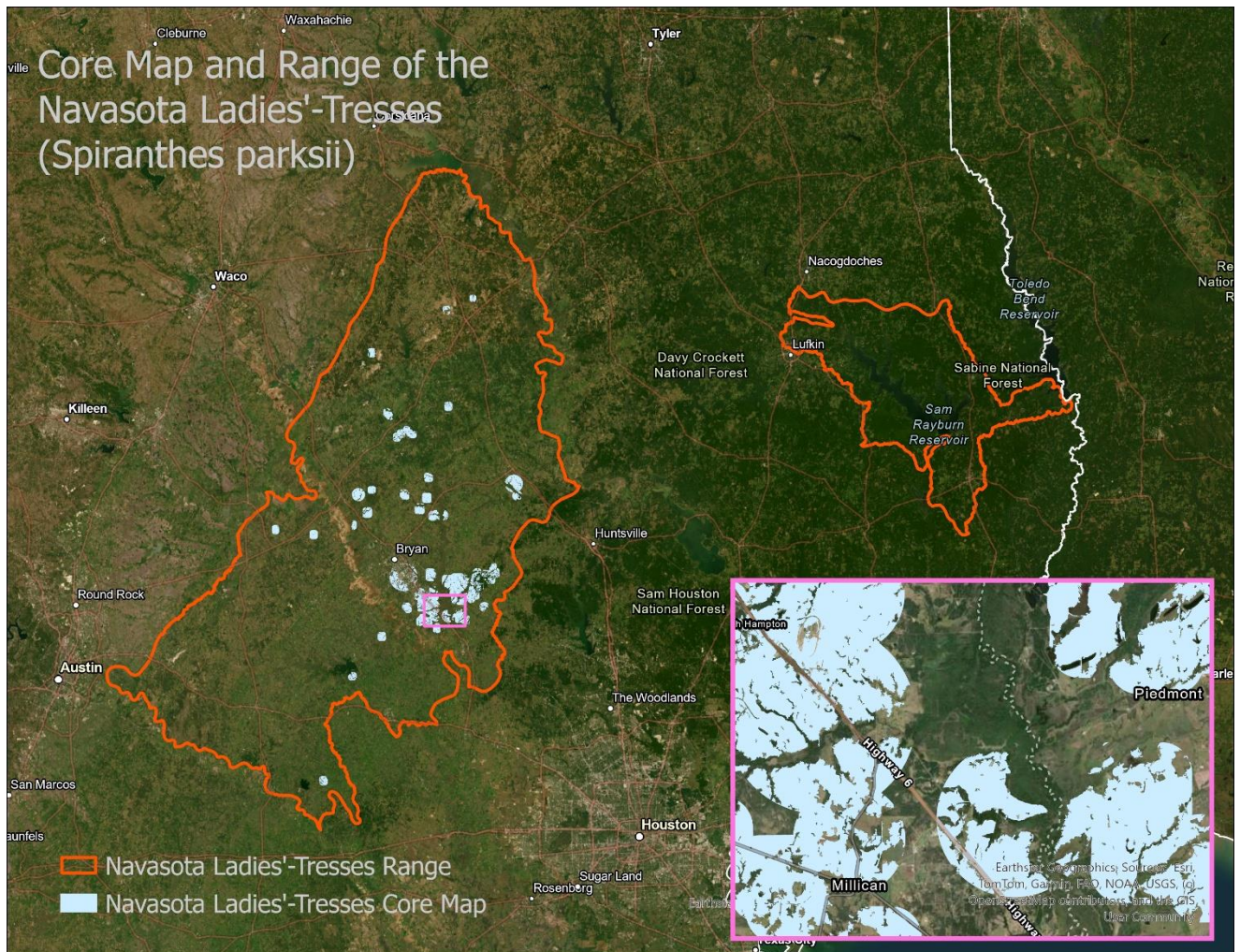


Figure 1. Interim core map for the Navasota ladies'-tresses (*Spiranthes parksii*; Entity ID 837). The core map spans 127,983 acres, while the range is 6,901,103 acres.

Table 1. Acres by National Land cover Database (NLCD 2021) class within the core map of the Navasota ladies'-tresses. Total core map area (based on NLCD pixel count): 127,943 acres.¹

NLCD_Land_Cover_Class	Acres	%
Hay/Pasture	64,514	49.3
Deciduous Forest	19,118	14.6
Mixed Forest	17,420	13.3
Evergreen Forest	6,958	5.3
Developed, Open Space	4,909	3.8
Developed, Low Intensity	3,508	2.7
Shrub/Scrub	2,903	2.2
Woody Wetlands	2,454	1.9
Developed, Medium Intensity	2,428	1.9
Herbaceous	1,991	1.5
Developed, High Intensity	842	0.6
Barren Land	371	0.3
Open Water	332	0.3
Emergent Herbaceous Wetlands	195	0.1

Evaluation of Known Location Information

There were four evaluated datasets examined for potential known location information:

- Descriptions of locations provided by FWS;
- Occurrence locations in iNaturalist;
- Occurrence locations in the Global Biodiversity Information Facility (GBIF); and
- Occurrence locations in NatureServe.

Compliance Services International evaluated these four datasets before developing the core map. Overall, there were no usable research-grade observations found in iNaturalist or GBIF². The FWS location

¹ This acreage is slightly different from the core map acreage (127,983) due to the pixelation of NLCD land cover. The core map is not developed from raster data.

² According to iNaturalist, an observation is designated as “research grade” if it 1) is verifiable with date, coordinates, photos/sounds, and not captive; 2) achieves community agreement defined as “more than 2/3 of identifiers needs to agree on the species level ID or lower;” and 3) “must pass a data quality assessment, which includes checks for accurate date and location, evidence of a wild organism, and clear evidence of the organism itself”

(<https://help.inaturalist.org/en/support/solutions/articles/151000169936-what-is-the-data-quality-assessment-and-how-do-observations-qualify-to-become-research-grade->).

information provided significant refinement from species range. These areas were converted into usable spatial data to form the extent of the core map. Further refinements to this extent were made based on species range and the removal of non-pine oak savanna land and cultivated areas of at least 25 acres from the core map.

NatureServe public element occurrence (EO) data were also evaluated and are considered by CSI to be a good corroboration of the dataset used.

Approach Used to Create Core Map

The core map was developed using EPA's process for developing core maps for species listed by the FWS and their designated critical habitat (referred to as "the process"). This core map was developed by CSI using the four steps described in the process document:

1. Compile available information for a species;
2. Identify core map type from among the following defined types: critical habitat, range, and biological information. From EPA, summaries of each core map type are provided below (EPA 2024a).
3. Develop the core map for the species; and
4. Document the core map.

For step 1, CSI compiled available information for Navasota ladies'-tresses (*Spiranthes parksii*) from FWS, as well as observation information available from various publicly available sources including iNaturalist, GBIF, and NatureServe. The information compiled for Navasota ladies'-tresses (*Spiranthes parksii*) is included in **Appendix 1**. Influential information that impacted the development of the core map includes descriptions of the species habitat from the Recovery Plan (FWS 1984) and its amended version (FWS 2019):

- *Spiranthes parksii* is clearly associated with the Post Oak Savanna vegetation type of east-central Texas. The plant has not been encountered in "natural prairie" sites or in mesic alluvial floodplains of the Navasota River or the Brazos River. Areas supporting the highest number of individuals are lightly wooded, lightly grazed, stream banks of minor tributaries associated with the Navasota and Brazos drainages... the association of essentially all known individuals in cleared areas indicate that these plants focus on a late successional niche that occurs within an established woodland (FWS 1984).
- Optimal habitats are intact post oak savannas that are influenced by periodic wildfire (FWS 2019).

For step 2, CSI used the compiled information including the species range and known location information to determine the core map type. Compliance Services International compared the known location data to the range and found that known locations from FWS (extant population sites that are mostly within the range) were usable as a refinement of range in determining the core map extent. Other known location data from GBIF, iNaturalist, and NatureServe were searched for but not used to develop the core map.

Within the extant population sites for the Navasota ladies'-tresses, which represent where the species is known to occur, a refinement was applied based on habitat to remove areas not associated with pine oak savanna and contiguous cultivated lands > 25 acres, which are areas inconsistent with species habitat description.

For step 3, CSI used the best-available data sources to generate the core map. Data sources are discussed in EPA's core map process document. For this interim core map, CSI followed EPA's decision framework to arrive at a core map type of biological information. Designated critical habitat was eliminated as a core map type because the Navasota ladies'-tresses does not have designated critical habitat. The range core map type was not selected because the species range is not refined.

Geographical areas known to be inhabited by the Navasota ladies'-tresses were identified in FWS documentation; these areas were used to represent the core map. **Appendix 2** provides more details on the GIS analysis and data used to generate the core map.

Discussion of Approaches and Data that were Considered but not Included in Core Map

LANDFIRE

CSI considered using the LANDFIRE dataset to represent habitat areas for the species, to be incorporated into core map development. The LANDFIRE dataset includes a layer—the Existing Vegetative Type—with land cover classes that could be matched to the Navasota ladies'-tresses habitat. Ultimately, the extant sites were chosen to represent the core map area, refined to excluded areas not associated with pine oak savanna land; the Texas Parks and Wildlife Department (TPWD) land cover dataset better represents these areas than the LANDFIRE database. Therefore, the LANDFIRE dataset is generally appropriate for refinement of terrestrial species location but was not needed for this species.

Appendix 1. Information compiled for Navasota Ladies'-Tresses

1. Recent FWS documents

- 5-Year Review (2009): https://ecosphere-documents-production-public.s3.amazonaws.com/sams/public_docs/species_nonpublish/2162.pdf
- 5-Year Review (2022) https://ecosphere-documents-production-public.s3.amazonaws.com/sams/public_docs/species_nonpublish/3914.pdf
- Recovery Plan (1984) https://ecos.fws.gov/docs/recovery_plan/840921.pdf
- Recovery Plan Amendment (2019): https://ecos.fws.gov/docs/recovery_plan/Final%20Draft%20Navasota%20Ladies-tresses%20RP%20Amendment.pdf

2. Background information

- Status: Federally listed as endangered in 1982.
- Resiliency, redundancy, and representation (the 3Rs) were not evaluated for this species.
- Habitat, Life History, and Ecology
 - *Spiranthes parksii* is clearly associated with the Post Oak Savanna vegetation type of east-central Texas. The plant has not been encountered in “natural prairie” sites or in mesic alluvial floodplains of the Navasota River or the Brazos River. Areas supporting the highest number of individuals are lightly wooded, lightly grazed, stream banks of minor tributaries associated with the Navasota and Brazos drainages. As is the case with most species of the *S. cernua* complex, *S. parksii* appears to be part of a successional community (Sheviak, 1982). However, the association of essentially all known individuals in cleared areas indicate that these plants focus on a late successional niche that occurs within an established woodland (FWS 1984).
 - Optimal habitats are intact post oak savannas that are influenced by periodic wildfire (FWS 2019).
 - Documentation indicates that Navasota ladies'-tresses occur up to 305 meters away from drainage courses (FWS 2006). Seasonal variation in soil water content shows that Navasota ladies'-tresses occur in areas with high water content likely related to their preferential association with stream banks and drainages in the post oak savanna (Ariza 2013). Due to the association with these types of watercourses, it is likely that metapopulations disperse along these watercourses (FWS 2019).
 - Mature individual plants transition among three life history stages annually; flowering stalk, vegetative rosette, and dormant underground stage. The perennial tubers develop leaf rosettes between September to May with maximum leaf size generally occurring late February to early March. Flowering peaks in October with anthesis and fruiting in October or November and seed dispersal occurring in December (Hammons, 2008). The plant remains underground from April until September as fleshy tuberous roots with no above ground leaves, stems, or flowers (FWS 2022).
 - Known *S. parksii* populations are commonly associated with Arol, Burlewash, Shirol and Singletion soil series of the Manning and Wellborn geologic formations (FWS 2022).
 - Elevations for *S. parksii* range between 60-110 meters above sea level (FWS 2022).

- Taxonomy
 - *Spiranthes parksii* was described as a new species by Correll (1947). The Flora of North America treatment (Sheviak and Brown 2002) continues to recognize the species, on this basis:

The tetraploid chromosome number and apomictic development of polyembryonic seeds indicate that *Spiranthes parksii* is a member of the *S. cernua* complex. The broad petals with central green stripe, several veins (instead of the three typical of the group), and erose-emarginate apical margin furthermore evidently represent partial peloria. Peloria is common in *S. cernua*, especially in the prairies, although in most cases it involves the suppression of the lip rather than the elaboration of the petals to a condition approximating the lip, as is the case in *S. parksii*. With a very limited distribution in east-central Texas, *S. parksii* might therefore represent merely a local, minor form of *S. cernua*. Other characteristics, however, including the small flower size and often upturned lateral sepal apices, lie outside the normal range of variation in *S. cernua* and suggest that the plants represent a distinct species” (FWS 2009).

- Relevant Potential Pesticide Use Sites
 - ‘Conservation recommendations included avoiding use of herbicides within *S. parksii* habitat, and continued support for research and recovery of the species’ (FWS 2009).

- Relevant Recovery Criteria and Actions
 - Criteria for Downlisting (FWS 2022)
 1. One or more viable populations or metapopulations occur in each of the seven USGS hydrologic unit code (HUC) 8-digit watersheds: (Navasota HUC8 12070103, Lower Brazos - Little Brazos HUC8 12070101, Lower Trinity-Tehuacana HUC8 12030201, Lower Trinity-Kickapoo HUC8 12030202, Yegua HUC8 12070102, Lower Colorado-Cummins HUC8 12090301, and the Lower Angelina HUC8 12020005) within its known range. To be considered viable, each population or metapopulation will consist of at least 1,500 mature individuals and will total at least 10,500 individual plants across the seven HUCs (see Figure 2).
 2. The populations or metapopulations that meet criterion 1 occur in protected natural areas. Protected natural areas include lands owned by federal, state, or local government agencies, or by private landowners, that are legally protected for the purpose of conserving native plants and animals and their habitats. Examples include, but are not limited to, state parks, state natural areas, and state wildlife management areas, conservation easements on private lands, lands owned and managed for conservation by non-profit organizations, and legally binding long-term management agreements with other public agencies or private landowners. To be considered under this criterion, the potential habitats of [*S. parksii*] must be managed in a manner that promotes the continued survival of the species.
 - Criteria for Delisting (FWS 2022)
 1. The criteria for downlisting to threatened, described above [as item 1], have been met: One or more populations or metapopulations, each consisting of consisting of 1,500 or more mature individuals, occur in protected natural areas within each of the 7 HUC-8 watersheds of the species’ geographic range.
 2. Periodic monitoring indicates that the minimum viable population level of 1,500

individuals within each protected natural area remains stable or increases over a period of at least 39 years. Monitoring (censuses) of each protected natural area must be conducted annually for the first 10 years and subsequently every 5 years up to the 39- year timeline.

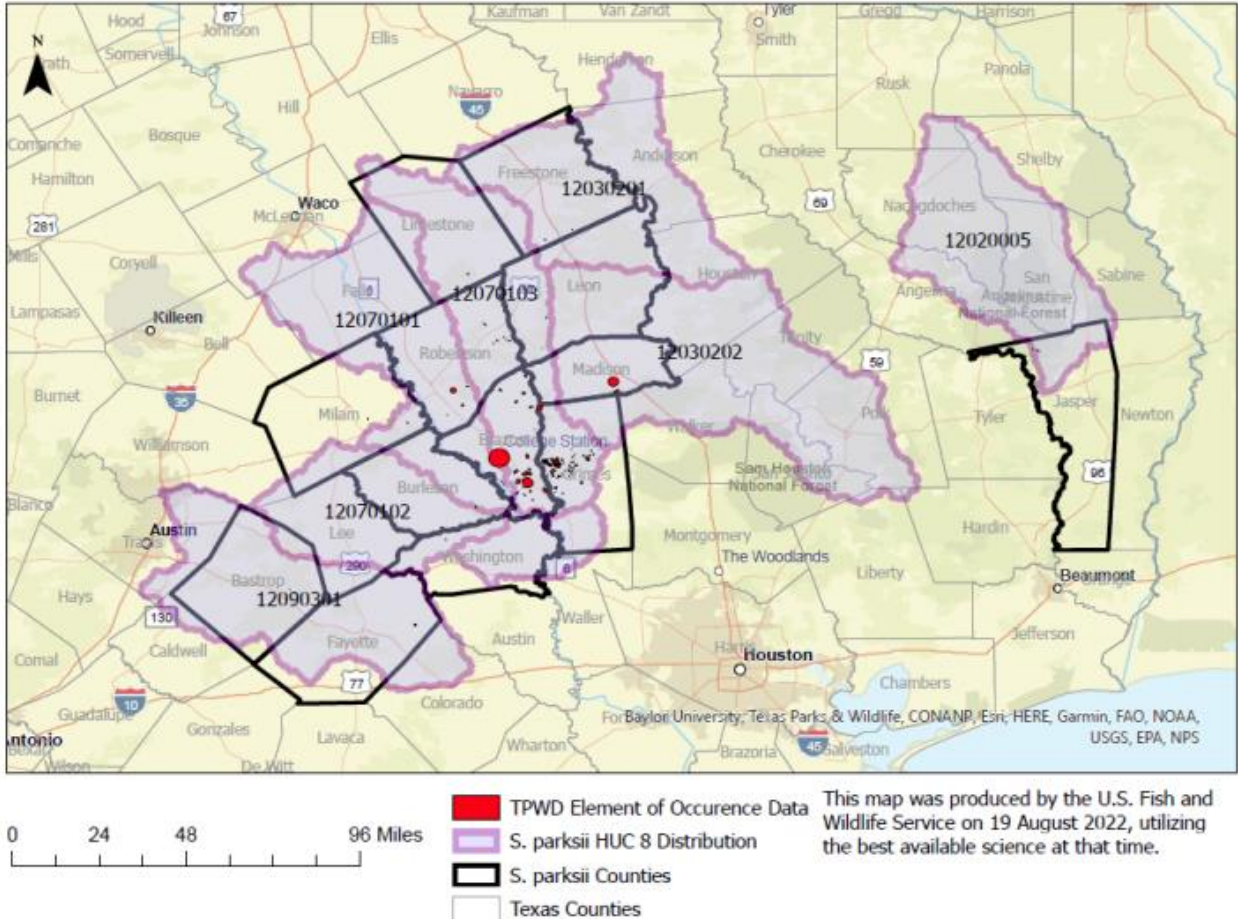


Figure 2. Current distribution of *S. parksii* across 13 Texas counties and 7 USGS 8-digit Hydrologic Unit Codes (HUC) along with the TPWD Element of Occurrence Data. Copied from Figure 1 of the most recent 5-Year Review (FWS 2022).

- Recommendations for Future Actions (FWS 2022)
 1. Continue to survey and monitor known populations of *S. parksii*.
 2. If possible given workloads, recommend conducting an up-to-date census of the accessible populations and revise the TXNDD Elemental Occurrence records database.
 3. If possible given workload constraints, additional surveys may be conducted in areas (including outside of the current range) where habitat suitability models indicate *S. parksii* habitat may occur, but the species has never been previously documented.
 4. Work cooperatively with private landowners who are interested in conserving and managing the species on their lands.
 5. Work with our partners including federal, state, tribal, non-profit, and private landowners to establish long-term protection for known occupied sites via conservation easements with long term management plans.

3. Range

- Historic Range: 'When Navasota ladies'-tresses was listed in 1982, it was known only from Brazos County' (FWS 2009).
- Current Range: '*S. parksii* is endemic to east-central Texas with 24 documented sites occurring across 13 Texas counties, Bastrop, Brazos, Burleson, Freestone, Fayette, Grimes, Jasper, Leon, Limestone, Madison, Milam, Robertson, and Washington' (FWS 2022) (Figure 3).

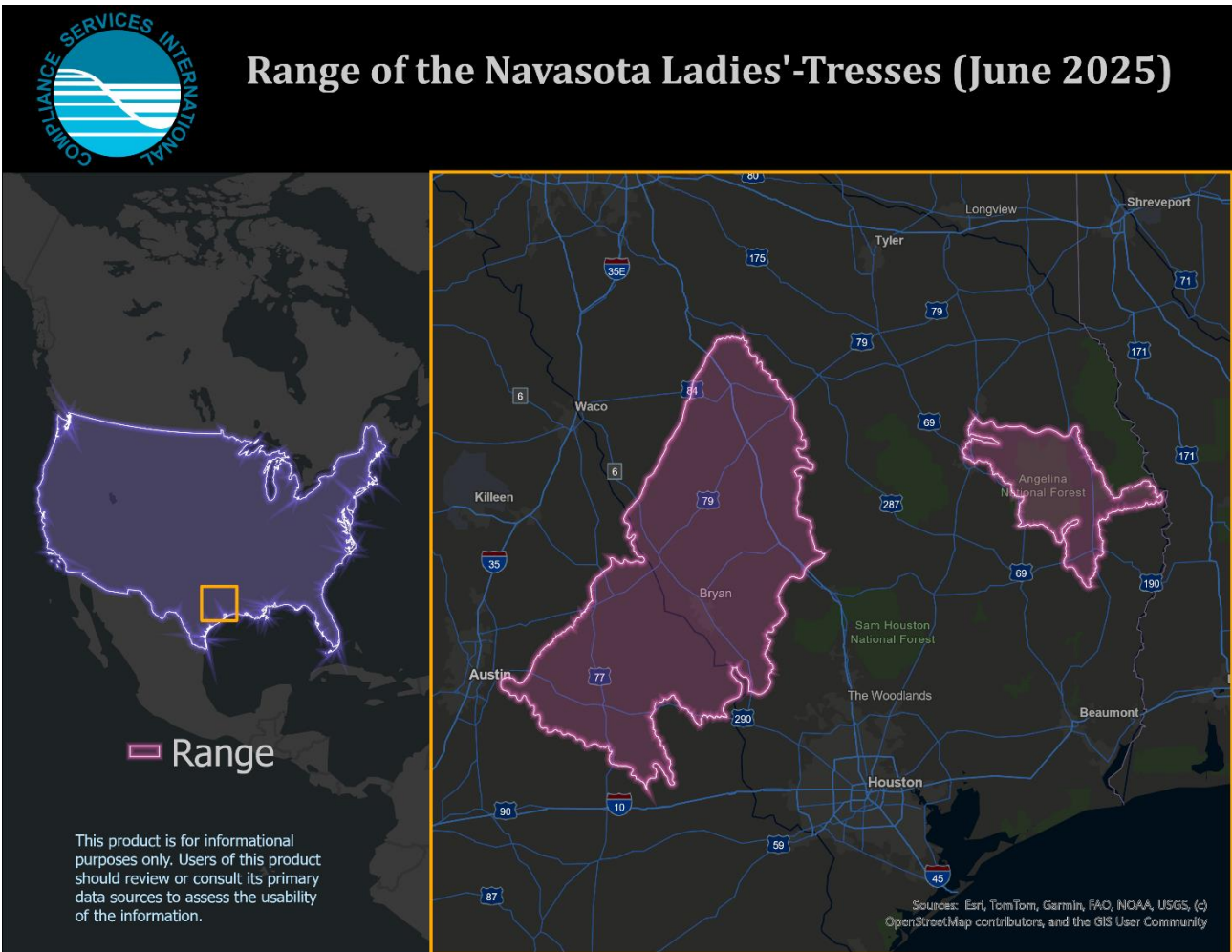


Figure 3. Range of the Navasota Ladies'-Tresses (FWS 2025).

4. Description of Critical Habitat

- Critical habitat has not been designated for this species.

5. Known Locations

- 'As previously discussed in the 2009 5-year review, Section 7 of the Act significantly contributes to the recovery of the species by 1) identification of new locations, 2) long term monitoring of known locations, and 3) meeting recovery criteria goals (Service, 2009). Since the 2009 5-year review there have been 6 consultations contributing to the conservation and recovery of the species (Table 2). Four of these consultations resulted in the identification of new locations with documented occurrences of the species. In addition, the previous 5-year review (Service, 2009), identified 24 sites as protected reserves. Of these 24 sites, 20 have been surveyed annually for individual *S. parksii* occurrences and 4 for sites were surveyed for species presence/absence only. Table 2 depicts the highest *S. parksii* counts in 3 columns 1) from the 2009 5-year review (24 reserves), 2) 2009 to 2021 (reserves and new sites), and Historic to 2021 (highest counts from each site). Based on this information, the estimated population is 5,780 individual plants. However, it should be noted that 56% of this population (9 sites totaling 3,230 individuals) do not have any protective mechanisms in place.

Table 2. Summary of ESA Section 7 consultations resulting in conservation actions contributing to the recovery of the *S. parksii* from 2009 to 2021. Copied from Table 1 of the most recent 5-Year Review (FWS 2022).

Action Agency	Non-Federal Entity/Project	Counties	Avoidance, Minimization and Conservation Measures
FWS Habitat Conservation Plan (HCP)	Oncor Electric Company	Bastrop, Freestone, Leon, Limestone, Milam, Robertson	Habitat will be assessed for suitability and occupancy on project specific basis for 30-year term of permit. Occupied areas will be avoided. Occupied areas that cannot be avoided will be mitigated 2:1. Use of BMPs in ROW
U.S. Corps of Engineers (USACE) and Open Street Map (OSM)	TRRC, Texas Westmorland Coal Mining Company, Jewett Mine	Freestone, Leon	<i>S. parksii</i> surveys conducted. Site identified at one occupied site and was avoided.
USACE and OSM	TRRC, Luminant Mining Company, Kosse Mike	Limestone, Robertson	<i>S. parksii</i> surveys conducted. Two individual <i>S. parksii</i> relocated to “transplant” location with documented <i>S. parksii</i> occurrences known as the Limestone County reference population. Reference population avoided and surveyed annually.
USACE	CenterPoint	Grimes	\$600,000 donation to TPWD for <i>S. parksii</i> conservation.
USACE	Targa Downstream LLC, Grand Prix South Pipeline	Freestone, Leon, Madison	\$501,482 donation to TPWD for <i>S. parksii</i> conservation.
U.S. Department of Transportation (DOT) and Federal Railroad Administration (FRA)	High Speed Rail	Freestone, Grimes, Leon, Limestone, Madison, Walker	<i>S. parksii</i> surveys conducted. Occupied areas avoided with 25 individuals. Use of Best Management Practice (BMP) to reduce indirect impacts to occupied areas. Modeled Habitat that cannot be avoided will be mitigated at appropriate rations (1:1 optimal and 1:0.5 marginal).

Table 3. Summary of *S. parksii* individuals (annual high count) across 24 monitored locations. Four of these monitoring sites were established since the 2009 5-year review. Texas Municipal Power Authority (TMPA) conservation agreement was terminated in March 2021. Locations established after the 2009 5-Year Review have no protection mechanisms or conservation agreements. Copied from Table 2 of the most recent 5-Year Review (FWS 2022).

Owner	Ownership	County	Site Name	Established pre-2009 5-year review	Acres	Highest Count Historical to 2009	Highest Count 2009-2021	Highest Count on Record	USGS HUC 8
Brazos Valley Solid Waste Management Agency (BWSWMA)	Fee title	Grimes	1-12	Yes	140.5	774	415	774	Navasota 12070103
BWSWMA	Fee title	Grimes	C3 (private)	Yes	22.5	200	374	374	Navasota 12070103
City of College Station	Fee title	Brazos	Lick Creek Park	Yes	75	70	Presence absence surveys only	70	Navasota 12070103
Smiling Mallard Development, Ltd.	Deed Restriction	Brazos	Indian Lakes	Yes	32	200	Presence absence surveys only	200	Navasota 12070103
TMPA	Private Property	Grimes	C1	Yes	21.1	216	425	425	Navasota 12070103
TMPA	Private Property	Grimes	C2	Yes	47	229	202	229	Navasota 12070103
TMPA	Private Property	Grimes	C3	Yes	16.5	130	418	418	Navasota 12070103
TMPA	Private Property	Grimes	C4	Yes	81.2	227	1583	1583	Navasota 12070103
TMPA	Private Property	Grimes	C5	Yes	18.3	33	175	175	Navasota 12070103
Texas Department of Transportation (TxDOT)	Conservation Easement	Brazos	State Hwy 40 Preserve	Yes	38	117	Presence absence surveys only	117	Navasota 12070103
TxDOT	Fee title	Brazos	State Hwy 6 Preserve	Yes	8	1000	Presence absence surveys only	1000	Navasota 12070103
U.S. Forest Service	Fee title	Jasper	Angelina National Forest	Yes	1	10	N/A	10	Lower Angelia 12020005
University of Texas	Fee title	Bastrop	Stengl Lost Pines	Yes	1	1	5	5	Lower Colorado-Cummins 12090301
Texas Westmorland, Jewett Mine	Leased	Leon	BL1	No	0.31	N/A	77	77	Navasota 12070103
Kosse Mine	Leased	Limestone	Reference Site	No	17	N/A	279	279	Navasota 12070103
CenterPoint	Private Property	Grimes	Twin Peaks Site	No	60	N/A	23	23	Navasota 12070103
High Speed Rail	Private Property	Madison	CenterPoint ROW	No	6	N/A	21	21	Lower Trinity-Kickapoo 12030202
Total								5,780	

GBIF: <https://www.gbif.org/species/2805362>

- GBIF includes 117 occurrence records; one of which is georeferenced. The georeferenced record was not usable because it is a preserved specimen, not a human observation. (Figure 4)
- There were no resulting coordinates to map against the species range to evaluate their utility in representing species extent.

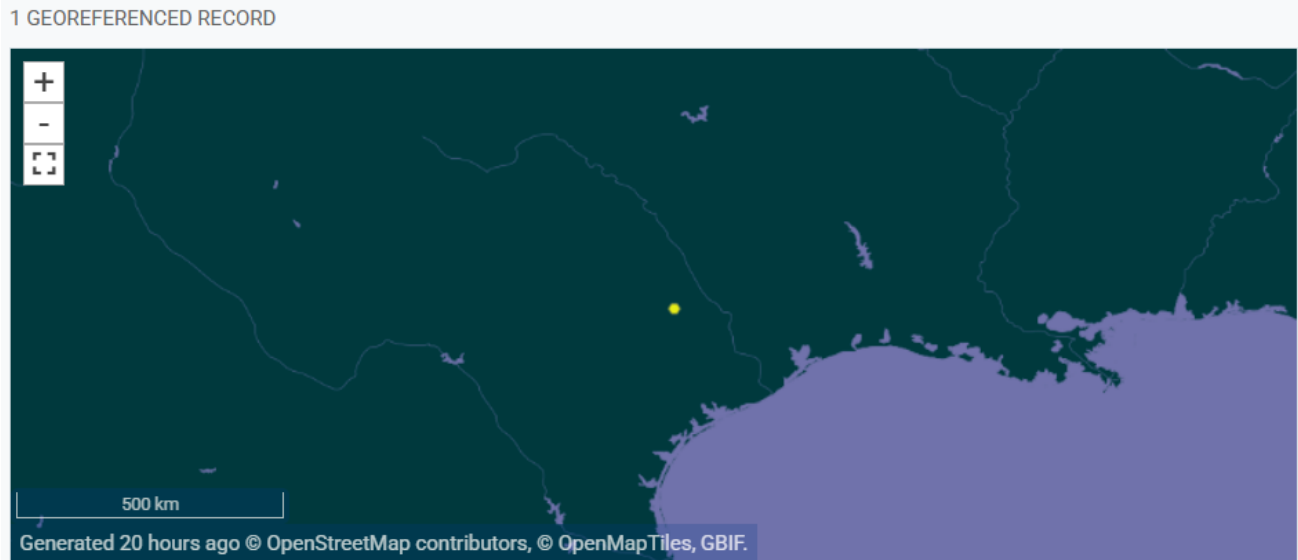


Figure 4. GBIF occurrences for the Navasota Ladies'-Tresses (GBIF 2025).

- iNaturalist: <https://www.inaturalist.org/taxa/120405-Spiranthes-parksii>
 - iNaturalist considers the Navasota Ladies'-Tresses to be an “inactive taxon;” no further information is provided and therefore this dataset was not used in core map development.
- NatureServe Explorer: <https://explorer.natureserve.org/>
 - Available public occurrence information from NatureServe Explorer is more robust than from GBIF (one observation of a preserved specimen) and iNaturalist (no observations)
 - EOs were used for comparison with the overall dataset.

Taken together, the available public occurrence data did not support expanding the core map outside of the species range.

Appendix 2. GIS Data Review and Method to Develop Core Map

The core map for this species is based on biological information, which includes the habitat used by this species found within a spatial extent based on known occurrences from the most recent 5-Year Review document. The core map identifies all areas within the extent matching the species' habitat description from **Appendix 1**. Professional judgment was used to match “Veg ID” classes in the Ecological Mapping Systems of Texas

dataset as described below (Texas Parks & Wildlife Department 2023). This land cover dataset is regarded as a high-quality state-level dataset that is appropriate to identify terrestrial habitat for plant species such as the Navasota ladies'-tresses.

1. References and Software

- Ecological Mapping Systems of Texas (TPWD)2023): <https://tpwd.texas.gov/gis/programs/landscape-ecology/by-ecoregion-vector>.
- Software used: ArcGIS Pro version 3.5.2.
- FWS 5-Year Review (2022): https://ecosphere-documents-production-public.s3.amazonaws.com/sams/public_docs/species_nonpublish/3914.pdf.
- FWS Species Range: <https://ecos.fws.gov/ecp/species/1570>.

2. Datasets Used in Core Map Development

2.1. Range

The range for this species was last updated by FWS on June 24, 2025. A shapefile including species range for this species was downloaded from the FWS ECOS website on July 24, 2025. The shapefile was converted to a feature class stored in a file geodatabase and reprojected to WKID #102008 ("North America Albers Equal Area Conic").

- The area of the range was calculated automatically by loading it into the software (ArcGIS Pro version 3.5.2) and reading its area from the attribute table ("Shape_Area"), then converting its units (square meters) into acres with a conversion factor of 0.000247105.

This shapefile was added to an ArcGIS Pro map and compared against the known locations from the most recent FWS 5-year review (FWS 2022). The range was used to establish the outer boundary ("extent") of the core map.

2.2. FWS 5-Year Review (2022)

The most recent 5-Year Review includes the most up-to-date map of known extant populations of the Navasota ladies'-tresses that have been documented by FWS. These sites are catalogued in the document's Figure 1, which additionally includes information about counties and Hydrologic Unit Code (HUC) watersheds that are relevant to the Navasota ladies'-tresses. Layers of both boundary types were obtained by CSI and used in the scoping phase of core map development. The HUC boundaries are level 8 (HUC-8) in that figure (Figure 2) and could have provided an additional level of refinement. However, CSI's decision to use the known occurrence information precluded the need to make use of the county and HUC layers, as all occurrences fall within the extent of both datasets.

However, the same map was used to identify known location sites using georeferencing techniques specified in **Appendix 2** Section 2.3. Generally, sites were manually converted to a polygon layer (often rectangular or circular observations, though some were more complex) and then buffered by 1 kilometer (km) to account for uncertainty in the georeferencing process. This buffered layer represents the core map extent, though additional refinements were made based on biological information and the species not being expected to inhabit

cultivated land.

2.3. Ecological Mapping System of Texas

Once the species extent was established using the most recent 5-Year Review document, the TPWD landcover dataset was used to identify areas within the extent corresponding to the habitat of the Navasota ladies'-tresses. The "Veg ID" layer was clipped to extent and professional judgment was used to identify land cover types associated with the species' habitat.

TPWD land cover classes within the species spatial extent were reviewed to identify suitable habitat layers according to FWS's habitat descriptions. Based on the habitat description for the species from the Recovery Plan and reproduced in Appendix 1, which includes the text "*Spiranthes parksii* is clearly associated with the Post Oak Savanna vegetation type of east-central Texas," the land cover classes with a "Common Name" field containing the text "Post Oak Savanna" were included; all other values were excluded (Table 4).

Table 4. Texas Parks and Wildlife Department (TPWD) land cover classes associated with the habitat of the Navasota ladies'-tresses within its extent. These are all land cover types with a "Common Name" field containing the text "Post Oak Savanna" (TPWD 2023).

Common Name
Post Oak Savanna: Live Oak Motte and Woodland
Post Oak Savanna: Oak - Hardwood Slope Forest
Post Oak Savanna: Oak - Redcedar Slope Forest
Post Oak Savanna: Post Oak - Yaupon Motte and Woodland
Post Oak Savanna: Post Oak Motte and Woodland
Post Oak Savanna: Sandyland Grassland
Post Oak Savanna: Sandyland Woodland and Shrubland
Post Oak Savanna: Savanna Grassland

2.4. EPA Cultivated Lands > 25 Acres

The Navasota ladies'-tresses is not expected to be found in agricultural areas, so a refinement to exclude areas of agriculture was applied. This was determined according to a recent Biological Evaluation of Bicyclopyrone, which states that for the Navasota ladies'-tresses: "Plants are unlikely to establish on agricultural use sites due to habitat preference for drainages and ephemeral streams in post oak savanna." (EPA 2024b).

Here agricultural areas are represented by EPA's modified cultivated layer, which includes areas spanning at least 25 acres. This was done as follows:

1. Use the Pairwise Erase tool to exclude cultivated areas > 25 acres from the previous layer used in geoprocessing ("TPWD_pcObs1km_sel_pd") according to a layer developed by EPA ("CultivatedAreas_Over25acres"). Save as a new layer,

“TPWD_pcObs1km_sel_pd_peCultivated25ac”.

2. (Optional) Export features from the previous layer (“TPWD_pcObs1km_sel_pd_peCultivated25ac”) into a new layer recognizable as the Navasota ladies’-tresses core map, “Navasota_ladies_tresses_CoreMap”.

3. Creating the Core Map

3.1. Defining Extent

The core map for the Navasota ladies’-tresses was developed using extant populations of the species and refinements based on land cover to include pine oak savanna and removing cultivated lands with a contiguous area > 25 acres. The extent used for core map development was created as follows:

1. Save an image with extant populations information (Figure 2) to a directory. Use the Raster to Geodatabase tool to import the image into a geodatabase, saved as a new layer (“Fig1”). Choose to export this layer—and all subsequent layers—into the preferred projection (WKID #102008). Render it partially transparent (70% transparent was chosen).
2. Initiate a georeferencing session and georeference the previous layer (“FigA1”) using control points and an underlying layer of state boundaries. This is to facilitate the creation of points layers representing areas of known occurrence in subsequent steps.
3. In the working geodatabase, create a new empty polygon feature class that will represent extant populations of the Navasota Ladies’-Tresses (“NLT_obs”).
4. In an Edit session, manually create polygon features within the “NLT_obs” feature class as close as possible to the areas represented in Figure 2. Save edits.
5. Use the Pairwise Buffer tool to buffer the polygons from the previous layer (“NLT_obs”) by 1 km to account for the circular shape area and the uncertainty associated with the georeferencing process. Save as a new layer, “NLT_obs_pb1km”.
6. Use the Pairwise Dissolve tool to dissolve features from the previous layer (“NLT_obs_pb1km”) into a feature class with a single shape, saved as “NLT_obs_pb1km_pd”.

3.2. Refinement based on Biological Information

The total extent of the Navasota ladies’-tresses core map—which comprises extant populations of the species—includes a significant area and number of different land cover types that do not align with descriptions of Navasota ladies’-tresses habitat. To improve confidence in the core map, a refinement based on biological information was applied to the core map extent.

The best-available dataset for suitable species habitat was found to be the land cover dataset from the Texas Parks & Wildlife Department. This spatial layer was used as a refinement of the core map area as follows:

1. Load into a GIS the three ecoregion-based land cover layers from the Texas Parks & Wildlife Department (TPWD) that are associated with the locations of the extant population sites:
 - East Central Texas Plains
 - South Central Plains
 - Texas Blackland Prairies
2. Use the Merge tool to merge the three ecoregions-based layers from the previous step into a single layer representing land cover in these three ecoregions, saved as “TPWD_merge”.
3. Use the Pairwise Clip tool to clip the previous layer (“TPWD_merge”) by the core map extent developed in Step 6 (“NLT_obs_pb1km_pd”) and save as a new layer, “TPWD_pcObs1km”.
4. (Optional) Delete the merged ecoregion layer created in Step 8 (“TPWD_merge”). This is strictly done to facilitate file size transfer and is not necessary to the process.
5. Use the Select by Attributes tool to select land cover classes from the previous layer (“TPWD_pcObs1km”) that match any of the eight classes representing Pine Oak Savanna listed in **Appendix 2** Section 2.3. Export selected features as a standalone layer, “TPWD_pcObs1km_sel”.
6. Use the Pairwise Dissolve tool to dissolve features from the previous layer (“TPWD_pcObs1km_sel”) into a feature class with a single shape, saved as “TPWD_pcObs1km_sel_pd”.

3.3. Cultivated Lands-based Refinement

The Navasota ladies’-tresses is not expected to be found in agricultural areas, so a refinement to exclude areas of agriculture was applied. This decision is consistent with EPA’s treatment of the species in a recent Biological Evaluation (BE) for Bicyclopyrone (EPA 2024b).

Here agricultural areas are represented by EPA’s modified cultivated layer, which includes areas spanning at least 25 acres. This was done as follows:

1. Use the Pairwise Erase tool to exclude cultivated areas > 25 acres according to a layer developed by EPA (“CultivatedAreas_Over25acres”). Save as a new layer (“TPWD_pcObs1km_sel_pd_peCultivated25ac”).
2. (Optional) Export features from the previous layer (“TPWD_pcObs1km_sel_pd_peCultivated25ac”) into a new layer recognizable as the Navasota Ladies’-Tresses core map, “Navasota_ladies_tresses_CoreMap”.

4. Datasets Considered but Not Used in Core Map Development

4.1. LANDFIRE

CSI considered using the LANDFIRE dataset to represent habitat areas for the species, to be incorporated into core map development. The LANDFIRE dataset includes a layer—the Existing Vegetative Type—with land cover classes that could be matched to the Navasota ladies’-tresses habitat. Ultimately, the extant sites were chosen to represent the core map area, refined to excluded areas not associated with pine oak savanna land; the TPWD land

cover dataset better represents these areas than the LANDFIRE database. Therefore, the LANDFIRE dataset is generally appropriate for refinement of terrestrial species location but was not needed for this species.

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