

Interim Core Map Documentation for the Britton's Beargrass (*Nolina brittoniana*, Entity ID 974)

Version 1

Review Completed: April 2026

Core Map Developer: U.S. Environmental Protection Agency (EPA) Office of Pesticide Programs (OPP)

Species Summary

The Britton's beargrass (*Nolina brittoniana*, Entity ID 974), found in the Lake Wales region of Florida, is a terrestrial monocot plant that prefers Florida xeric scrub and sandhill habitats. For the purposes of core map creation, the habitat was assumed to include open disturbed area with sandy soils such as areas containing powerlines and along roadsides. The species may occur adjacent to, but not on, agricultural fields or orchards/groves. The U.S. Fish and Wildlife Service (FWS) has not designated critical habitat for this species. Additional information on the species is provided in **Appendix 1**. The core map was created similarly to how the core maps were created for other species in the Lake Wales Ridge region of Florida, detailed information on the GIS steps is provided in **Appendix 2**.

Description of the Core Map

The core map for Britton's beargrass is based on species biological information including location descriptions and habitat. Locations included the Lake Wales Ridge geomorphic formation, locations of protected/managed lands within the Lake Wales region, and known occurrences associated with HUC-12¹ watersheds or the species range. Habitats were identified within these locations that are intended to represent Florida scrub, sandhill, and recently disturbed habitat. Occurrence points for the species focused on the research grade observations from iNaturalist (see **Appendix 1** for additional information).

Figure 1 depicts the interim core map for the Britton's beargrass. **Table 1** includes a summary of example pesticide use sites associated with the combined core map based on the available landcover classes found in the National Land Cover Database (NLCD). The predominant NLCD areas captured by the Florida scrub/sandhill habitat are scrub/shrub and woody wetlands. Areas with higher human influences, such as urban/developed, are also found within limited areas of the core map. These areas of higher human influence are typically found in the managed/protected lands included in the core maps. The Florida scrub and sandhill habitat make up 17% of Lake Wales Ridge region.

The core map for the Britton's beargrass is interim and will be used to develop Pesticide Use Limitation Areas (PULAs) that include the specific species. While the core map is based on public species information developed by FWS including the species 5-year review and recovery plan, the core map has not been formally reviewed by FWS. As a result, the interim core map and any associated PULAs may be revised in the future after receiving additional feedback from the FWS species experts.

¹ At the 12-digit Hydrologic Unit Code (HUC12). HUC12 watersheds represent areas ranging 10-40 thousand acres

The interim core map has a “moderate” (4) best professional judgement level for data interpretation due to assumptions made when selecting the Florida scrub and sandhill habitats, which serves as the basis for the core map, and the uncertainties and precision of the occurrence data. Expert review of the selected habitats that represent Florida scrub or sandhill by FWS and/or FNAI ecologist would reduce the uncertainty associated with these assumptions. The occurrence information available from iNaturalist are locations that have been “fuzzed” to obscure the exact location of the species occurrence. However, EPA used the HUC-12 watersheds or ranges to identify a generalized area for each occurrence, which increases the likelihood (and confidence) that the location is captured in addition to other nearby occurrences of the species. EPA also used the biodiversity matrix from the FNAI to confirm the presence of Florida scrub or sandhill habitat or a species occurrence for each HUC-12. Additional perspective on these known occurrences may be provided during FWS review. FWS review of the interim core map may improve the confidence confirming or updating the data interpretation related to the habitat and reducing the uncertainty associated with the resolution of occurrence points.

The core map does not replace or revise the range, or any future critical habitats developed by FWS for the species.

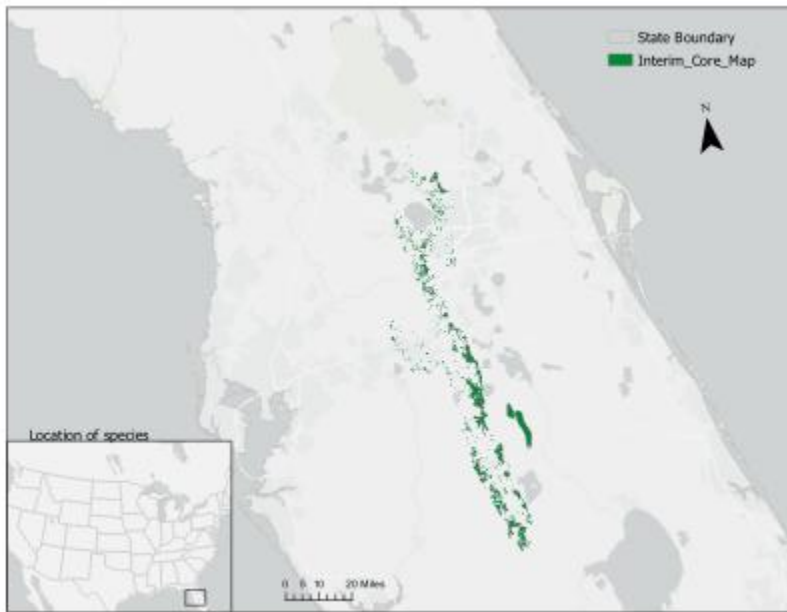


Figure 1. Britton’s beargrass interim core map, totaling approximately 182,276 acres.

Table 1. Percentage of Interim Core Map Represented by NLCD² Land Covers and Associated Example Pesticide Use Sites/Types.

Example pesticide use sites/types	NLCD Class/Value	% Area
Forestry	Deciduous Forest (41)	0%
Forestry	Evergreen Forest (42)	10%
Forestry	Mixed Forest (43)	2%

² Dewitz, J., 2023, National Land Cover Database (NLCD) 2021 Products: U.S. Geological Survey data release, <https://doi.org/10.5066/P9JZ7AO3>

Example pesticide use sites/types	NLCD Class/Value	% Area
Agriculture	Pasture/Hay (81)	27%
Agriculture	Cultivated Crops (82)	0%
Mosquito adulticide, residential	Open space, developed (21)	8%
Mosquito adulticide, residential	Developed, Low intensity (22)	4%
Mosquito adulticide, residential	Developed, Medium intensity (23)	1%
Mosquito adulticide, residential	Developed, High intensity (24)	0%
Invasive species control	Woody Wetlands (90)	28%
Invasive species control	Emergent Herbaceous Wetlands (95)	3%
Invasive species control	Open water (11)	0%
Invasive species control	Grassland/herbaceous (71)	2%
Invasive species control	Scrub/shrub (52)	13%
Invasive species control	Barren land (rock/sand/clay; 31)	1%
Total Acres	Interim Core Map Acres	~182,276 acres

Evaluation of Known Location Information

There are five datasets with known location information reviewed for the Britton's beargrass:

- Descriptions of locations provided in FWS reports
- Occurrences provided in iNaturalist
- Occurrences provided in the Global Biodiversity Information Facility (GBIF)
- Occurrences provided in NatureServe
- Biodiversity matrix from the Florida Natural Areas Inventory (FNAI)

All available data sources for known locations were evaluated before developing the species core map. The FWS documents included a summary of FNAI occurrences by ID or description and a list of named federal, state or NGO protected areas where the species is known to occur. The specific FNAI occurrences are not publicly available; however, descriptions of area summaries are available in the FNAI biodiversity matrix. Named protected areas are available from the state of Florida and in the Protected Lands Database (PAD-US 3.0). iNaturalist database includes research grade observations for the species. The species had robust data with 30 or more research grade observations from the last 15 years. Additional occurrences from the GBIF database were reviewed but not added to the iNaturalist point locations because coordinate information was not available or were duplicates of the iNaturalist locations. To reduce uncertainty related to the obscured point occurrences from iNaturalist, each point was associated with a generalized area based on the HUC-12 watershed to identify an area where the point is likely to occur. These generalized areas for each species were compared against other publicly available occurrence data for confirmation.

Like the review of available occurrence information from the public NatureServe Explorer, the biodiversity matrix grids for the species were checked after developing the core map to confirm each grid contained Florida scrub or sandhill habitats and/or a species occurrence. No changes were made to the core map after reviewing the FNAI biodiversity matrix. **Appendix 1** includes additional details on the

evaluation of the occurrence points and comparisons to NatureServe, the FNAI biodiversity matrix, and protected areas.

Approach Used to Create Core Map

The core map was developed using the “Process EPA Uses to Develop Core Maps for Draft Pesticide Use Limitation Areas for Species Listed by the U.S. Fish & Wildlife Service (FWS) and their Designated Critical Habitats”³ (referred to as “the process”). The development of the Britton’s beargrass core map followed the 4 steps described in the process document:

1. Compile available information for the species
2. Identify core map type
3. Develop the core map
4. Document the core map

For step 1, EPA compiled available species information for the Britton’s beargrass in this document from the FWS documentation, as well as known location/occurrence information available from various publicly available sources (including iNaturalist, GBIF, NatureServe, FWS reports). **Appendix 1** provides the compiled information for the species. Influential information that impacted the development of the core map includes:

- Location of the Lake Wales Ridge geomorphic formation
- Habitat requirements for the plant: Florida scrub, sandhill and disturbed habitats with sandy soil
- Available occurrence data
- Named location descriptions found in the FWS documentation

The species range map for the Britton’s beargrass is based on county boundaries, and it does not have critical habitat. The location of the Lake Wales Ridge geomorphic formation and the habitats for the species are well understood with clear descriptions found in available FWS species documentation. For this reason, information from the FWS documentation was used to develop biological information core map.

EPA mapped the biological information for the species using information including (1) the Lake Wales Ridge geological formation, (2) habitats representative of Florida scrub, sandhill, or recently disturbed areas, (3) named locations for the species available in FWS reports, and (4) occurrences generalized to HUC-12 boundaries.

To develop the core map, a habitat map was created that represents Florida scrub, sandhill, and recently disturbed habitat as well as the selected protected/managed land areas found within the Lake Wales Ridge region. The habitat map was then clipped using the species-specific outer extent. Some additional details are described below and in **Appendix 2**.

Mapping the selected biological information was completed over several steps. First, the Lake Wales Ridge geological formation, and the Florida scrub, sandhill and recently disturbed habitats were mapped. FWS species experts identified the following geomorphic formation as part of the Lake Wales Ridge

³ Dated 2024, available online at: <https://www.epa.gov/endangered-species/process-epa-uses-develop-core-maps-pesticide-use-limitation-areas>

Region: Bombing Range Ridge, Winter Haven Ridge, and Mount Dora Ridges. These geomorphic formations are available in the Florida Geomorphology Province data layer.

Next, the Florida scrub, sandhill, and recently disturbed areas found within the Lake Wales Ridge geological formation were mapped using the Florida Cooperative Land Cover (CLC) layer. This data layer was selected because it includes Florida specific habitats not found in other national landcover datasets such as the NLCD, LandFire, or GAP. The development of the CLC map included ground-truthing and review from FNAI ecologists. The inclusion of the expert review and ground truthing of information during the development ensures the GIS data is of high enough quality when mapping these highly specific habitats. FWS also references this layer in some of the Lake Wales ridge species reports (see **Appendix 1**).

Based on information found in the species documentation, this plant occurs on managed/protected lands. These protected/managed areas were added to the Florida scrub and sandhill habitat map using the data from the Florida's State Forest, Wildlife, and Environmental Areas and the Protected Lands Database (PADUS). In addition to these state managed areas, federal and NGO managed lands were added based on available information from FWS species documentation. **Appendix 2** includes additional detail on the development of the overall habitat and protected lands map.

After mapping the Lake Wale Ridge region, habitats, and protected areas, the steps to develop the individual species core map included identifying the area where the species is known to occur. When robust, the research grade points from iNaturalist were summarized to HUC-12 watersheds to identify the generalized area where the species is known to occur. HUC-12s were selected to create a generalized area around occurrence points to account for the precision of the point. The point locations have an accuracy of ~ 30 km and the average area of a HUC-12 ranges from 40 to 160 km². Given this data precision, the HUC-12 layer is a reasonable choice to identify a generalized area for use as the outer extent of the core map based on occurrences.

Florida scrub, sandhill, and recently disturbed habitat map was clipped to the generalized areas identified using the occurrence data. After creating the species core map, the Florida biodiversity matrix was used to confirm the presence of either a species occurrence or species habitat in these areas. The Florida biodiversity matrix summarizes the occurrence from the FNAI based on one square mile grids. This occurrence information is typically summarized in the FWS species documentation. These gridded areas for the occurrences are publicly available, while the individual occurrences referenced in the documentation are not. **Appendix 2** includes additional information on the development of the core map including the specific GIS tools used in development.

Discussion of approaches and data that were considered but not included in the core map

Several habitat datasets were evaluated before selecting the CLC from Florida. These sources include the NLCD, LandFire, and the Florida Statewide Land Use/Landcover map. The CLC uses the Florida Land Cover Classification System a single-statewide classification system designed to focus on conserving "Priority Habitats" throughout Florida. The classification scheme incorporates information used by Florida Natural Areas Inventory (FNAI), the water management districts (WMDs), and the Florida Fish and Wildlife Conservation Commission (FWC). The information from the Statewide Land Use/Landcover map developed by the WMDs is considered in the CLC with additional information to support

identification of these “Priority Habitats” in Florida. The additional information found in the CLC includes local or site-specific data sources based on ground-truth or local knowledge and review of high-resolution aerial photography by FNAI ecologists. Aerial photography was reviewed when other data indicated potential presence of a focal community in Florida; scrub, scrubby flatwoods, sandhill, dry prairie, pine rockland, rockland hammock, upland pine, or mesic flatwoods. Many of these focal communities represent the Florida scrub or sandhill habitats used by the plant. The NLCD does not provide enough resolution in the habitat classes to identify Florida scrub and sandhill habitat. The CLC was selected over LandFire due to specificity found in the CLC in identifying the Florida priority habitat and the additional review conducted by the FNAI.

Appendix 1. Information compiled for the Britton's beargrass

1. Recent FWS documents

- Britton's beargrass (*Nolina brittoniana*): 5-Year Review 2025: https://ecosphere-documents-production-public.s3.amazonaws.com/sams/public_docs/species_nonpublish/22650.pdf
- Recovery Plan (1/29/1990): https://ecos.fws.gov/docs/recovery_plan/960622.pdf

2. Background information

- **Status** Federally listed as endangered August 28, 1989.
- **Resiliency, redundancy, and representation** (the 3Rs)
 - “Resiliency is the ability of a species to withstand environmental stochasticity (normal, year to-year variations in environmental conditions such as temperature, rainfall), periodic disturbances within the normal range of variation (fire, floods, storms), and demographic stochasticity (normal variation in demographic rates such as mortality and fecundity). *Nolina brittoniana* is a habitat generalist that is a long-lived perennial, is subdioecious (allowing for some degree of self-fertilization or cross fertilization) and clonal. These traits provide the species the ability to maintain demographic stochasticity because it can reproduce in different ways and survive periods of suboptimal conditions. Because it is long-lived and has been seen in some locations since prior to its listing over 30 years ago it has shown resiliency to past periods of disturbances. The species occurs in multiple xeric upland communities, including scrub and sandhill indicating the species shows less specialization than some other rare endemic species sharing similar geography (Menges et al. 2001), and the species has relatively stable demography and low annual turnover. These traits allow some populations to avoid some periods of suboptimal conditions (flood/storms, see additional discussion below under Redundancy). Many of these populations are within contiguous tracts of land that provide for connectedness between populations a trait that should allow for natural recovery from disturbance events to the species, its habitats, and pollinators/seed dispersers. The species is a disturbance dependent plant and readily resprouts post fire, suggesting some level of environmental stochasticity may not be detrimental and may actually be beneficial to the species. In one study seed density in the soil of disturbed sites (i.e., site was previously disked or plowed) was closely linked to the proximity of adult plants and in other sites (e.g., undisturbed or burned sites) seed density was not related to proximity to adult plants (Hartnett and Richardson 1989). Some of these characteristics may limit the species' representation but also allow it to persist when there are few nearby plants for cross-pollination. These characteristics provide the species with resiliency.” (5-year review 2025)
 - “Redundancy is the ability of a species to withstand catastrophes. Catastrophes are stochastic events that are expected to lead to population collapse regardless of population health and for which adaptation is unlikely. *Nolina brittoniana* inhabits a large area of central peninsula Florida occurring on 37 managed conservation lands that are considered secured populations (n=53) across 12 counties range wide. In addition to known, managed populations, there are additional populations (n=13) on private or unmanaged lands. Based on the widespread distribution and nature of the species along with its general biological characteristic, a single catastrophic event is unlikely to impact

- all individuals in all populations and the species should have sufficient redundancy to be viable in the foreseeable future.” (5-year review 2025)
- “Representation is the genetic diversity found in the species allowing it to adapt to both near term and long-term changes in its physical (climate conditions, habitat conditions, habitat structure, etc.) and biological (pathogens, competitors, predators, etc.) environments. *Nolina brittoniana* has been shown to have fairly high genetic variability relative to other scrub-endemic species, which is more typical of species that are long lived, have demographic stability, outcrossing, and longer pollinator movement distances (Menges et al. 2001; 2010). These traits indicate the species may have sufficient representation. The species’ clonal nature may limit genetic diversity in places or at times; however, this enables the species to persist during times or in areas where additional plants will be unavailable for cross-pollination.” (5-year review 2025).
 - “In spite of being a peninsular Florida endemic, the species has more than two life-history traits typically associated with high genetic diversity, including long-lived plants (>10 years), outcrossing, subdioecious (most individuals have either male or female reproductive parts, and some individuals containing both male and female reproductive structures [hermaphroditic]), relatively widespread, and well dispersed (Menges et al. 2001). However, since the species is also clonal, this trait may limit genetic diversity in some populations. A more recent study of population genetics in *N. brittoniana* indicates “no evidence of recent bottlenecks or changes in genetic structure due to habitat loss and fragmentation, consistent with populations having always been small, isolated and low density” (Dolan et al. 2004).” (5-year review 2025)
 - **Habitat: (Reference: 5-year review, 2025)**
 - The Britton’s beargrass is a soil generalist and occurs on multiple xeric upland communities including scrub and sandhill.
 - Scrub and sandhill habitats are generally open habitats with low nutrient sandy soil seen in patches between the trees, shrubs, and other plants that live in the habitat. Scrub may or may not have trees. If there are trees, they tend to be widely spaced in the case of pine trees, or clustered together in clumps in the case of the shrub-like oak trees found in these habitats. Between the trees (if present) you will see a variety of shrubs, flowering plants, grasses, and lichens.
 - **Pollination:** Hymenoptera, including honey bees (*Apis mellifera*), Leucospididae: *Leucospis robertsoni*, *L. slossonae* Sphecidae: *Ammophila pictipennis*, *Bicyrtes quadrifasciata*, *Cerceris fumipennis*, *C. rufopicta*, *Sphex ichneumoneus*, Vespidae: *Pachodynerus erynnis*. Also pollinated by butterflies and moths, particularly the female yucca moth (*Tegeticula yuccasella*).
 - **Taxonomy**
 - Flowering monocot in the family Asparagaceae
 - **Relevant Pesticide Use Sites**
 - No specific pesticide use sites noted in recent FWS documentation. The 1990 Recovery Plan points out that control of exotic pest plants is important to benefit this species, particularly the Cogon grass control efforts in the Ocala National Forest.
 - **Relevant Recovery Criteria and Actions**
 - Recovery Criteria/Objectives
 - The number of populations needed to delist the Britton’s beargrass is 20 viable populations at five or more sites in four of the 12 counties where it is found: Highlands, Polk, Orange/Osceola, and Lake (5-year review, 2025).

- “For reclassification, protect eight populations at four or more sites, with simple genetic assessment of number of individuals and demographic monitoring for 5 years” (5-year review, 2025).
- “Conserve other listed plants and animals of the central Florida scrub (including two mints, scrub jays, two lizards); also to conserve many other endemic invertebrate and plant species.” (Recovery Plan 1990)
- Recovery Actions (Recovery Plan 1990)
 - Protect habitat through purchase and other means
 - Manage protected habitats
 - Assess progress and post-recovery monitoring, including “a simple assessment of number of individuals and demographic monitoring for five years). According to the 2025 5-year review, 52 populations have been subject to simple assessments and genetic sampling.

3. Description of Range

- The range of this species is shown in **Figure A1-1**
- <https://ecos.fws.gov/ecp/species/4460#rangeInfo>

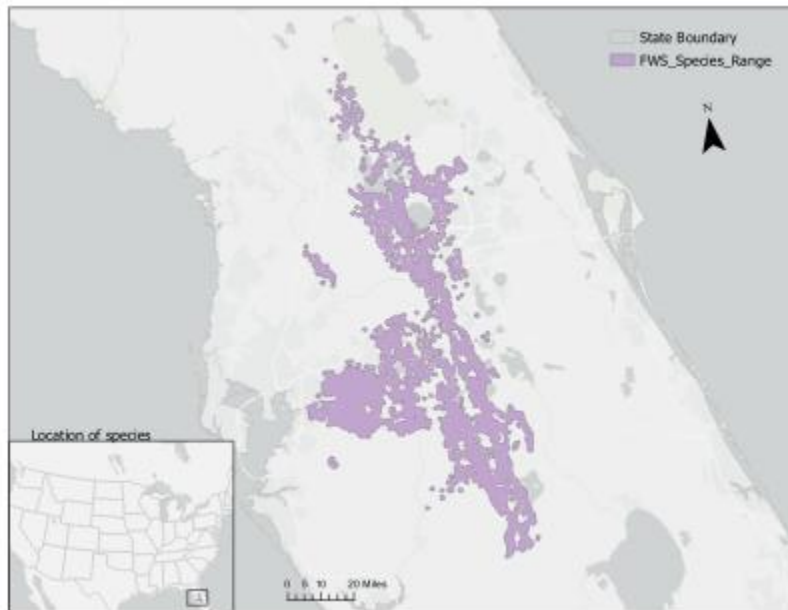


Figure A1-1. Range for the Britton’s beargrass. The total acreage of the range is approximately 1,512,131 acres.

4. Critical Habitat

- Critical Habitat has **not been designated** for the Britton’s beargrass.

5. Known Locations

- FWS: Florida Natural Areas Inventory – Summarized from species 5-year review
 - 37 Element Occurrence Records (EORs) from the FNAI in 2023 have been recognized by Florida Natural Areas Inventory and identified in Table 1 of the 5-year review (see below Table A1-1).
 - “Range-wide there are 53 populations (EOs) on 37 conservation lands occurring in 12 counties. The majority of these population do not have current plant estimates, nor are

habitat management activities on many of these lands known that would benefit the species' viability. Even though *N. brittoniana* is a relatively long-lived perennial, habitat management is essential, especially application of fire. Of these populations occurring on conservation lands, 26 populations were reported at the last observation date to have a minimum of 50 plants. The range of plants present in populations are often in the hundreds with the largest population having over a thousand plants. These 26 populations occur on 16 conservation lands in 6 counties (Table 1). This metric alone, excluding the remaining 27 populations that updated surveys may show viability, exceeds reclassification and even possibly delisting criteria in the recovery plan (Recovery Plan above, Service 1996)" (5-year review 2025).

Table A1-1. Table of Britton’s beargrass populations from page 5 of the 2025 5-year review.

Conservation Land (EO #)	County	Last Observed	Plant Estimate
Alafia River State Park (117)	Hillsborough	3/25/2013	5
Archbold Biological Station (7, 105)	Highlands	2000	~28
Catfish Creek Preserve State Park (39, 112, 113, 114)	Polk	4/16/2008	~15
Hickory Lake Scrub County Park (78)	Polk	2003	2
Highlands Hammock State Park (19)	Highlands	3/29/2017	2
Lake June-in-Winter Scrub Preserve State Park (25, 95)	Polk	11/05/2010	~63
LWRNWR- Everglades Headwaters (130, 133, 134)	Polk	10/26/2011	157
LWRNWR- Flamingo Villas (128)	Highlands	10/24/2012	1
LWRNWR- Lake McLeod (92)	Polk	9/2/1998	2
LWRSF- Hesperides Tract and Boy Scouts (15)	Polk	3/30/2017	410
LWRSF- Lake Arbuckle Tract (98, 101)	Polk	7/11/2017	1257
LWRSF- Lake Aurora Scrub (58)	Polk	7/5/2019	5
LWRSF- Lake Livingston East Scrub (22)	Polk	11/1/2018	50-200
LWRSF- Walk-in-the-Water (100, 110, 111)	Polk	4/20/2010	890
LWR Warea Archipelago Ferndale Ridge Preserve (4, 138)	Lake	2/4/1998	~200
LWRWEA- Carter Creek (64, 97)	Highlands	1/20/2022	~224
LWRWEA- Crooked Lake West (125)	Polk	5/21/2019	8
LWRWEA- Gould Road, Horn Road Scrub (93)	Highlands	4/6/2023	~9
LWRWEA- Henscratch Road / Jack Creek (3, 87, 118, 109)	Highlands	8/23/2021	37-226
LWRWEA- Highlands Ridge (127)	Highlands	3/11/1998	2
LWRWEA- Lake Apthorpe / Holmes Avenue (30)	Highlands	3/29/2022	215
LWRWEA- Lake Blue West Scrub (96)	Polk	7/16/2018	~50
LWRWEA- Lake Placid Scrub (121)	Highlands	4/3/2014	1
LWRWEA- Mountain Lake Cutoff	Polk	9/17/2012	300+
LWRWEA- McJunkin Ranch (70, 104)	Highlands	10/21/2022	60+
LWRWEA- Royce Ranch (120)	Highlands	4/10/2014	1
LWRWEA- Silver Lake (36)	Highlands	10/20/2021	11-51
Ocala National Forest (99)	Marion	6/27/2016	7
Seminole State Forest- Warea Tract (108)	Lake	7/28/2011	35
Shadow Bay Park (139)	Orange	5/18/2017	6
South Fork State Park (Becker) (122)	Manatee	10/21/2014	10-12
SWFWMD- Chito Branch Reserve (135)	Hillsborough	12/7/2012	150
SWFWMD- Green Swamp (107)	Pasco	3/12/2008	5
Upper Lakes Basin Watershed (115)	Polk	7/26/2010	10
Wekiwa Springs State Park (136)	Orange	4/14/2020	2
Westside Conser. Easements – Lake Davenport (82)	Osceola	11/18/1997	1
Withlacoochee State Forest – Richloam Tract (106)	Pasco	11/29/2022	211

LWR- Lake Wales Ridge Ecosystem

LWRSF- Lake Wales Ridge State Forest

LWRWEA- Lake Wales Ridge Wildlife and Environmental Area

LWRNWR- Lake Wales Ridge National Wildlife Refuge

SWFWMD- Southwest Florida Water Management District

- iNaturalist (https://www.inaturalist.org/observations?subview=map&taxon_id=165720)
 - 207 research grade observations (out of 233 total observations) of occurrences as of October 2025 dated from March 2017 to October 2025. All research grade observations fall within the species' known range.
- GBIF (<https://www.gbif.org/species/2776991>)
 - 187 georeferenced records exist in GBIF. They match what is already in iNaturalist.
- NatureServe public element occurrences (https://explorer.natureserve.org/Taxon/ELEMENT_GLOBAL.2.144304/Nolina_brittoniana)
 - General areas align with in the iNaturalist occurrence points within the range. These occurrences were accounted after generalizing the iNaturalist points to the HUC-12 watersheds.

Appendix 2. GIS data review and methods to develop core map

The core map is based on species biological information including: the Lake Wales Ridge geomorphic formation, habitat type, named locations of protected/managed lands, and known occurrences associated with HUC-12⁴ watersheds or the species range. The core map includes habitats that are representative of Florida scrub, sandhill, and recently disturbed areas in addition to any protected/managed land where the species is known to occur. Florida scrub, sandhill, and recently disturbed habitats were identified using the Florida Cooperative Land Cover (CLC) map. To support the development of the core map, first a habitat map representing Florida scrub, sandhill, and recently disturbed habitat found within the Lake Wales Ridge region and the selected protected/managed land areas was created. The habitat map was then clipped using the species-specific outer extent to create the individual core map.

1. References and Software

- Florida Geomorphology Province Layer:
<https://www.arcgis.com/home/item.html?id=1d65bb89c1da450cb0845e2004871cf3>
 - Managed by the Florida Department of Environmental Protection
- EPA/ORD Ecoregions for Florida:
<https://gaftp.epa.gov/EPADDataCommons/ORD/Ecoregions/fl/>
 - Managed by EPA
 - Lake Wales Ridge:
https://gaftp.epa.gov/EPADDataCommons/ORD/Ecoregions/fl/fl_lkreg96.zip
- Wildlife Management Areas Florida:
<https://www.arcgis.com/home/item.html?id=d7f8470d9df1451d8e950cdd409bee66>
 - Managed by Florida Fish and Wildlife Conservation Commission
- PAD-US 3.0 Manager Name:
<https://www.arcgis.com/home/item.html?id=ff6f75a7f4b148cb97e9d755299edded>
 - Managed by: USGS
- Florida Cooperative Land Cover Map (CLC) Version 3.7 (polygons)
 - Managed by Florida Fish and Wildlife Conservation Commission
 - <https://myfwc.com/research/gis/wildlife/cooperative-land-cover/>
- USA Soils:
<https://www.arcgis.com/home/item.html?id=06e5fd61bdb6453fb16534c676e1c9b9>
 - Managed by ESRI – Living Atlas, created from SSURGO dataset
 - Published November 2023
 - Data from the [gSSURGO database](#) was used to create this layer.
- Software used: ArcGIS Pro 3.5

2. Datasets and Processes Used in Core Map Development

2.1. Identification of the Lake Wales Ridge geomorphic regions

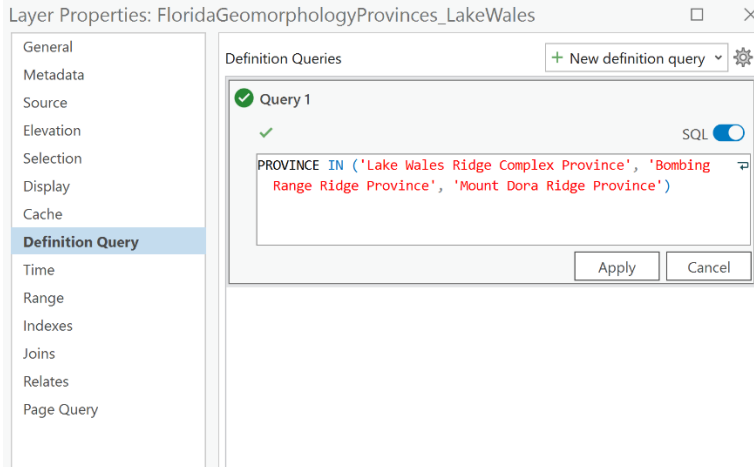
The purpose of this step is to identify the area that make up the Lake Wales Ridge region of Florida. Multiple datasets were used including the Florida Geomorphology Province Layer and EPA/ORD Ecoregions for Florida.

- 1) FWS species experts identified the Lake Wales Ridge, Bombing Range Ridge, Winter Haven Ridge, and Mount Dora Ridges as the geomorphic formations important for these plants. Most of these

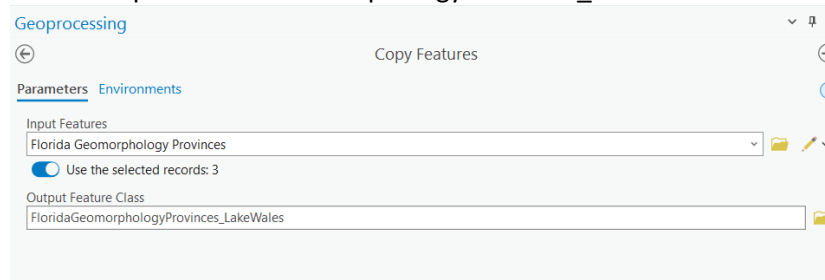
⁴ At the 12-digit Hydrologic Unit Code (HUC12). HUC12 watersheds represent areas ranging 10-40 thousand acres.

areas can be found in the Florida Geomorphology Province Layer and can be extracted using the select by attribute then the copy feature tool.

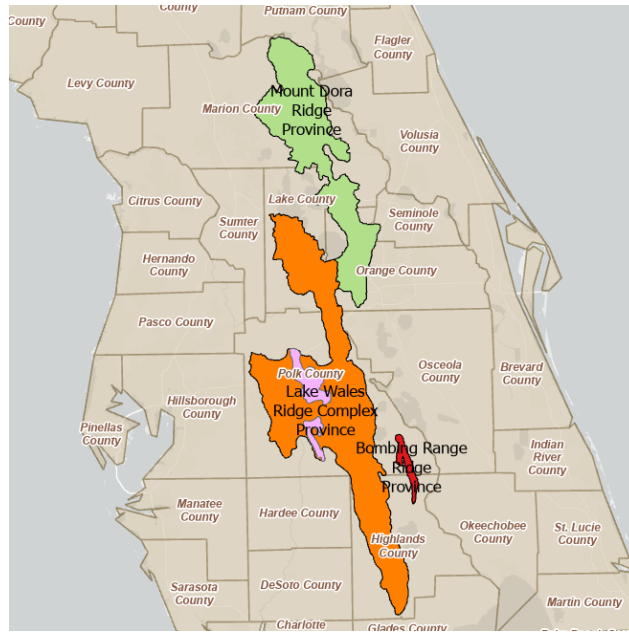
- a. Select by attribute on the "PROVINCE" column
 - i. SQL" PROVINCE IN ('Lake Wales Ridge Complex Province', 'Bombing Range Ridge Province', 'Mount Dora Ridge Province')



- ii. Note: Winter Haven Ridge is not named in this dataset
- b. After making the selection use the copy feature tool to create a new feature class
 - i. Input: selected Florida Geomorphology Province layer
 - ii. Output: FloridaGeomorphologyProvinces_LakeWales



- c. Winter Haven Ridge was not found in the Florida Geomorphology Province Layer, but it is named in the EPA Ecoregions layer for Florida. The Winter Haven Ridge is completely contained within the Lake Wale Ridge Complex found in the Florida Geomorphology Province Layer. The map below includes these geomorphic formations from the Florida Geomorphology Province Layer and the EPA Ecoregions. Winter Haven is the area in pink in the map below.



- d. The geomorphic formation identified from these layers are applicable for other listed animals and plants found in the Lake Wales Ridge region of Florida.

2.2. Identification of Florida scrub and sandhill habitat

The purpose of these steps is to identify the Florida scrub, sandhill and recently habitat used by these plants. The CLC map was selected to represent habitats. The CLC uses the Florida Land Cover Classification System a single-statewide classification system designed to focus on conserving “Priority Habitats” throughout Florida. This classification system includes a total of 230 habitats, 143 of which occurs in the Lake Wales Ridge region that is occupied by the listed plant. As described earlier in this document, this layer was selected because it includes Florida specific habitat not found in national habitat layers.

Florida scrub and sandhill habitats require sandy soils so the USA soil layer was used to support the identification of the habitats to extract from the CLC. All soils found within the Lake Wales region with particle type description that included a “sandy” classification were extracted, and the CLC overlap to extract all habitats found on sandy soils. All habitats that included the word scrub or sandhill in the name or description were included. For the remaining habitats found on sandy soil the descriptions were reviewed to determine if they could represent Florida scrub or sandhill, representative of dry, open areas. The following steps outline the process used to identify these 28 habitats and includes the list of habitat extracted from the CLC.

- 1) Both the Cooperative Land Cover map and the USA Soil Units map from SSURGO data were clipped using the layer defining the Lake Wales region using the Pairwise Clip Tool.
 - a. First Clip Input: LakeWalesRidgeFormations_Clippped and USA Soil Map Units
 - b. First Clip Output: USASoilsMapUnit_PairwiseClip_LWR
 - c. Second Clip Input: LakeWalesRidgeFormations_Clippped and CLC_v3_7
 - d. Second Clip Output: CLC_v3_7_PairwiseClip_LWR

- 2) From the soil layer, selected all soils with a particle size that is representative of sandy soil using the select by attribute tool and then removed all soils classified as “Farmland of unique importance” because farmland is not habitat for these species. Note: This layer is only used to

create the list of habitats from the CLC to determine which ones should be considered Florida scrub, sandhill or recently disturbed.

- a. Select by attribute SQL: taxpartsize LIKE '%sandy%' And farmlandcl <> 'Farmland of unique importance'
 - b. Generated new feature class that represents all sandy soils, not classified as farmland found within the Lake Wales Ridge extent using Copy Features Tool
 - i. Input: selected USASoilsMapUnit_PairwiseClip_LWR
 - ii. Output: USASoilsMapUnit_PairwiseClip_LWR_Sandy
- 3) Selected all habitat that occur on sandy soils using the select by location tool, indicating the relationship as “Have their center in.”
- 4) Using the description found in the Florida Land Cover Classification System⁵, each habitat type found on sandy soils type was evaluated to determine if it fits the description for Florida scrub, sandhill or disturbed area. Any habitat with the word scrub or sandhill in the name were included by default.
- a. Most of the excluded habitats were wetlands, forest with closed canopy, or habitats with high human disturbance such as agriculture and urban areas.
 - b. Communication, utilities, and transportations areas, such as roads, railroad, powerlines, and other rights of way were included because Britton’s beargrass could be found in these disturbed areas. The full list of habitats includes the following 28 habitats for Florida scrub and sandhill:
 - Bare Soil
 - Bare Soil/Clear Cut
 - Communication (recently disturbed areas)
 - Cypress
 - Cypress/Tupelo (including mixed Cypress/Tupelo)
 - Dry Prairie
 - Live Oak
 - Mesic Flatwoods
 - Mesic Hammock
 - Mixed Scrub-Shrub Wetland
 - Oak Scrub
 - Palmetto Prairie
 - Pine - Mesic Oak
 - Rails (recently disturbed areas)
 - Roads (recently disturbed areas)
 - Rural Open
 - Rural Open Forested
 - Rural Open Pine
 - Sand Pine Scrub
 - Sandhill
 - Sandhill Lake
 - Scrub
 - Scrubby Flatwoods

⁵ <https://myfwc.com/media/20455/land-cover-classification-revision-2018.pdf>

- Shrub and Brushland
 - Shrub Bog
 - Upland Mixed Woodland
 - Utilities (recently disturbed areas)
 - Xeric Hammock
- 5) Using Cooperative Land Cover map clipped to the Lake Wales Ridge region, joined the table of the 28 habitats based on the Name_Site column, and exported to a new feature class.
 - a. The new layer represents possible Florida scrub or sandhill habitat found in the Lake Wales Ridge region.
 - i. Input: selected CLC_v3_7_PairwiseClip_LWR
 - ii. Output: CLC_v3_7_PairwiseClip_LWR_IncludedHabitats
 - 6) Finally, the habitat map was dissolved based on habitat name to simplify the attribute table.

2.3. Adding Protected Area to the Florida Scrub and Sandhill Habitat Map

Based information found in the FWS species documentation, the Britton's beargrass occurs on managed/protected lands. These named areas were added to the Florida scrub and sandhill habitat map using the Florida State Forest, Wildlife and Environmental Areas and the Protected Lands Database (PAD-US 3.0). In addition to these state managed areas, the species often occurs on federal and NGO managed land. To capture these areas federal and NGO managed areas were extracted from the PAD-US database. These selected protected lands were added to the Florida scrub and sandhill habitat map.

- 1) Used the select by attribute tool in ArcGIS Pro to identify federal and NGO managed land based on the PAD-US 3.0 database using the "Manager Type" attribute.
- 2) Florida's State Forest, Florida's Wildlife and Environmental Areas, and the selected federal and NGO managed areas from the Protected Lands Database (PAD-US 3.0) were added to habitat layer using the merge tool in ArcGIS Pro.

2.4. Identification of HUC-12 watershed based on occurrence points

Occurrence locations from sources like research-grade iNaturalist observations were summarized to the HUC-12 watersheds to account for data precision of the point. HUC-12s were a reasonable option to create a generalized occurrence area because the point location had an accuracy of ~ 30 km and the average area of a HUC-12 ranges from 40 to 160 km². The generalized occurrence areas were used as the outer extent for the species core map.

- 1) Added the research grade points from iNaturalist to the map using the XY table to Point tool.
 - a. Filename = Brittonsbeargrass_974
- 2) HUC-12 watersheds were selected using the selection by location with an Intersect relationship between the point location and the HUC-12 watershed.
 - a. Filename = HUC12_Brittonsbeargrass

2.5. Creation of species core map using the Florida scrub and sandhill habitat maps and HUC-12 watershed extents

- 1) Using the pairwise clip tool, the Lake Wales Ridge plant habitat map was clipped to the selected outer extent for the species representative of where the species is known to occur: the HUC-12s associated with the occurrences.

- a. The resulting core map (Figure 1 of the main document) includes Florida scrub, sand hill and recently disturbed habitats in addition to the selected protected land (state, federal, and NGO) found within the species core map extent.
 - b. Pairwise clip output filename: Core_Map_beforecultivatedremoval
 - c. EPA's modified cultivated layer was then erased from the core map since this species occurs adjacent to (but not on) cultivated lands, and the smoothing process was applied as described in Appendix 3 of [EPA's core map process document](#).
 - d. Core map file can be found in "974 Brittons Beargrass.gdb"
- 2) After generating the core map for the species, the FNAI biodiversity matrix grids found within the core map extent was extracted by the species. These grids were checked using the biodiversity matrix server reports to confirm the presence of Florida scrub and sandhill habitat or a species occurrence. The FNAI occurrences were summarized in FWS species documentation by occurrence ID. However, these specific occurrence locations are not available publicly, but the information is summarized by 1 square mile grids in the FNAI biodiversity matrix. No changes were made to the species core map following this review.