Interim Core Map Documentation for the Large-fruited Sand-verbena

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

Species Summary

The large-fruited sand-verbena (*Abronia macrocarpa*, Entity ID 872) is an endangered terrestrial plant (dicot). The U.S. Fish and Wildlife Service (FWS) has not designated a critical habitat for the large-fruited sand-verbena. This species grows in openings or disturbed areas in acidic, deeply sandy soils (occurrences are reported in soils containing > 90% sand, approximately 31 – 50 inches in depth). Currently, the large-fruited sand-verbena is found only in Leon, Robertson, and Freestone counties in the post oak savanna region in eastern Texas. Additional information on the species is provided in **Appendix 1**.

Description of Core Map

The core map for the large-fruited sand-verbena is biological information type and includes both wild population and the reintroduced experimental populations that are essential to the recovery. There have been no surveys conducted on any of the experimental populations since 2008. However, based on FWS documentation, there are reintroduced large-fruited sand-verbena populations in these sites. As there is no further information available on the experimental locations, habitat information and iNaturalist information are used to develop the experimental population sites. Appendix 1 includes more information on the experimental populations. The wild population occurrences are based on data from the Texas Parks and Wildlife Department (TPWD) and FWS. EPA initially considered the species range described by FWS; however, that range spans three eastern Texas counties. Given that the range is too broad, and, since there is sufficient known location data, the agency determined that the known locations of the species presented a more refined option for the core map. **Figure 1** depicts the resulting interim core map for the large-fruited sand-verbena. The size of this core map is approximately 1,460 acres. Landcover categories within the core map area are included in **Table 1**. Landcover is predominantly pasture/hay areas.

The core map developed for the large-fruited sand-verbena is considered interim. This core map will be used to develop pesticide use limitation areas (PULAs) that include the large-fruited sand-verbena. 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 species expert feedback from FWS. This interim core map has an "average" (3) best professional judgment classification to describe major uncertainties/limitations. The core map is based on the biological information, including occupied locations and species habitat. This core map does not replace or revise any range or designated critical habitat developed by FWS for this species.

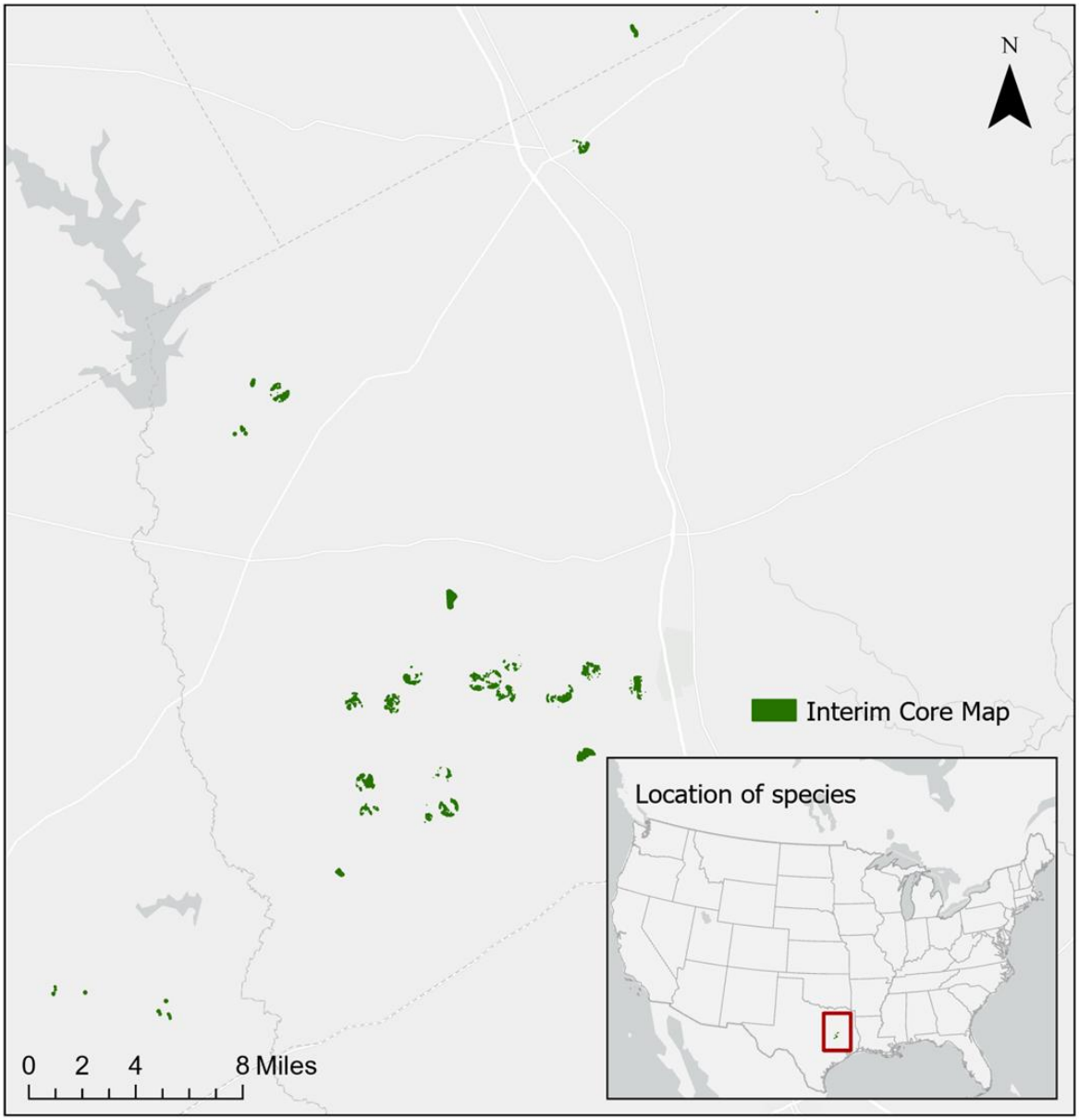

Figure 1. Interim core map for the large-fruited sand-verbena. The total acreage of the range is around 1460 acres.

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

Example pesticide use sites/types	NLCD Class/Value	% Area	Total area for landcover type
Forestry	Deciduous Forest (41)	0%	7%
Forestry	Evergreen Forest (42)	1%	7%
Forestry	Mixed Forest (43)	6%	7%
Agriculture	Pasture/Hay (81)	85%	85%
Agriculture	Cultivated Crops (82)	0%	85%
Mosquito adulticide, residential	Developed Open Space (21)	1%	4%
Mosquito adulticide, residential	Developed Low Intensity (22)	2%	4%
Mosquito adulticide, residential	Developed Medium Intensity (23)	1%	4%
Mosquito adulticide, residential	Developed High Intensity (24)	0%	4%
Invasive species control	Woody Wetlands (90)	0%	4%
Invasive species control	Emergent Herbaceous Wetlands (95)	0%	4%
Invasive species control	Open Water (11)	0%	4%
Invasive species control	Grassland/Herbaceous (71)	1%	4%
Invasive species control	Shrub/Scrub (52)	2%	4%
Invasive species control	Barren Land (31)	0%	4%
Total Acres	Interim Core Map Acres	**~ 1460**	

Evaluation of Known Location Information

There are four datasets with known location information:

1. Descriptions of locations provided by TPWD and FWS;
2. Occurrence locations in iNaturalist;
3. Occurrence locations in NatureServe; and
4. Occurrence locations in the Global Biodiversity Information Facility (GBIF).

EPA evaluated these four sets of data before selecting the type of and developing the core map. TPWD appeared to have the finest resolution of the wild populations' location information, providing a map that depicted the current known locations all within Leon, Robertson, and Freestone counties in eastern Texas (**Figure 1**). Recent research grade occurrences in iNaturalist were used to display the reintroduced

experimental populations. However, occurrences in iNaturalist, GBIF, and NatureServe did not support expanding the core map outside of these three counties. **Appendix 1** includes more information on the available known location information.

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"[1] (referred to as "the process"). EPA developed the core map using the 4 steps described in the process document:

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

For step 1, EPA compiled available information for the large-fruited sand-verbena from FWS, as well as observation information available from various publicly available sources (including iNaturalist, NatureServe, and GBIF). The information compiled for the large-fruited sand-verbena is included in **Appendix 1**. Influential information that impacted the development of the core map included:

- There are 10 distinct and known wild populations of the large-fruited sand-verbena that occur in three eastern Texas counties (Freestone, Leon, Robertson);
- There were also nine experimental populations established in Leon and Freestone counties;
- This species grows in openings or disturbed areas along sandy geologic formations (Carrizo, Sparta, Queen City) where soil content is >90% sand.

For step 2, EPA used the compiled information to identify the core map type including species range and known location information. The extant populations are located in openings or disturbed areas, characterized by high sand content (> 90%). These populations were identified by FWS and TPWD with the species' range. Therefore, EPA based the core map on the known locations identified by FWS, TPWD and iNaturalist along with habitat information. The entire range of the species was not used as the core map because the range contains areas where the species does not occur.

For step 3, EPA used the best available data sources to generate the core map. Data sources are discussed in the process document. For this core map, EPA used the known location information identified by FWS and TPWD. **Appendix 2** provides more details on the GIS analysis and data used to generate the core map.

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

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

EPA explored using GIS datasets that described canopy cover and soil composition since the large-fruited sand-verbena grows in open/disturbed areas comprised of 90% or greater sand content. However, this approached was not used because adding in these datasets would have increased uncertainty in the results (i.e., add areas that are unsuitable habitat for the large-fruited sand-verbena).

Appendix 1. Information Compiled for the Large-fruited Sand-verbena During Step 1

1. **Recent FWS documents/links and other data sources**
   - Five Year Review (2022) (https://ecosphere-documents-production-public.s3.amazonaws.com/sams/public_docs/species_nonpublish/3934.pdf)
   - Five Year Review (2010) (https://ecosphere-documents-production-public.s3.amazonaws.com/sams/public_docs/species_nonpublish/1694.pdf)
   - Recovery Plan (1992) (https://ecos.fws.gov/docs/recovery_plan/920930d.pdf)
   - Biological Opinion for Oncor Electric Delivery Company LLC's Habitat Conservation Plan – Permit TE-40918A (2012) (https://ecos.fws.gov/docs/plan_documents/bobs/bobs_2512.pdf)
   - Final Habitat Conservation Plan for Maintenance and Construction Activities for the Oncor Electric Delivery Company LLC (2011) (https://ecos.fws.gov/docs/plan_documents/thcp/thcp_2517.pdf)

2. **Background information**
   - **Status**: Federally listed as endangered in 1988
   - **Resiliency, redundancy, and representation** (the 3Rs)
     - Resiliency: There are ten wild populations and nine experimental populations for this species. Species' recovery priority number is 2 (high degree of threat, high recovery potential). Species' resiliency is currently not known.
     - Redundancy: Consistent monitoring is not established, making it difficult to determine redundancy. Seeds are banked with partners of the Center for Plant Conservation, but the FWS recommend that additional seed banks be established in the future (Five Year Review 2022).
     - Representation: FWS recommends establishing management guidelines to determine the species' genetic representation (Five Year Review 2022)
   - **Habitat**
     - Open or disturbed areas of post oak woodlands in three eastern Texas counties (Leon, Robertson, Freestone).
     - Deep sandy soils (> 90% sand content).
     - Species is not known to occur on cultivated fields.
   - **Pollinator/reproduction**
     - Flowering occurs between February and May.
     - Flowers open in the mid-afternoon and close by late morning, producing a strong honeysuckle aroma that is commonly associated with moth pollination.

    - Pollinators include Sphynx and Noctuid moths (black alder or pawpaw sphynx, lettered sphynx, obscure sphynx, and large necklace moth). Bees may also incidentally pollinate these flowers.
    - Self-pollinating but self-incompatible.
- **Taxonomy**
    - Terrestrial Dicot Plant
- **Relevant Pesticide Use Sites**
    - Maintenance herbicide spray applications (October to April) for linear projects.
    - Broad-scale insecticide use, which could impact pollinators.
- **Recommendations for Future Actions (Five Year Review 2022)**
    - Establish protected sites.
    - Work with LO to manage sites for existing populations.
    - Monitor known populations for general condition and reproductive success.
    - Maintain a reserve germ bank/seed bank and cultivated populations.
    - Continue with cultivation of the large-fruited sand-verbena for restoration and reintroduction efforts.
    - Determine habitat requirements.
    - Assess the demographic needs and conditions for populations.
    - Characterize phenology.
    - Investigate the pollination biology.
    - Investigate seed biology.
    - Conducting searches for existing populations.
    - Monitor existing reintroduction populations to understand effectiveness and feasibility of techniques.
    - Continue to promote public support for the conservation and recovery of the species.
    - Determine response to disturbance, agricultural practices, and other land uses.

3. Description of Species Range

- **Figure A1-1** depicts the FWS range. The range was last updated on August 28, 2024. Total acreage of the range is around 860,000 acres.

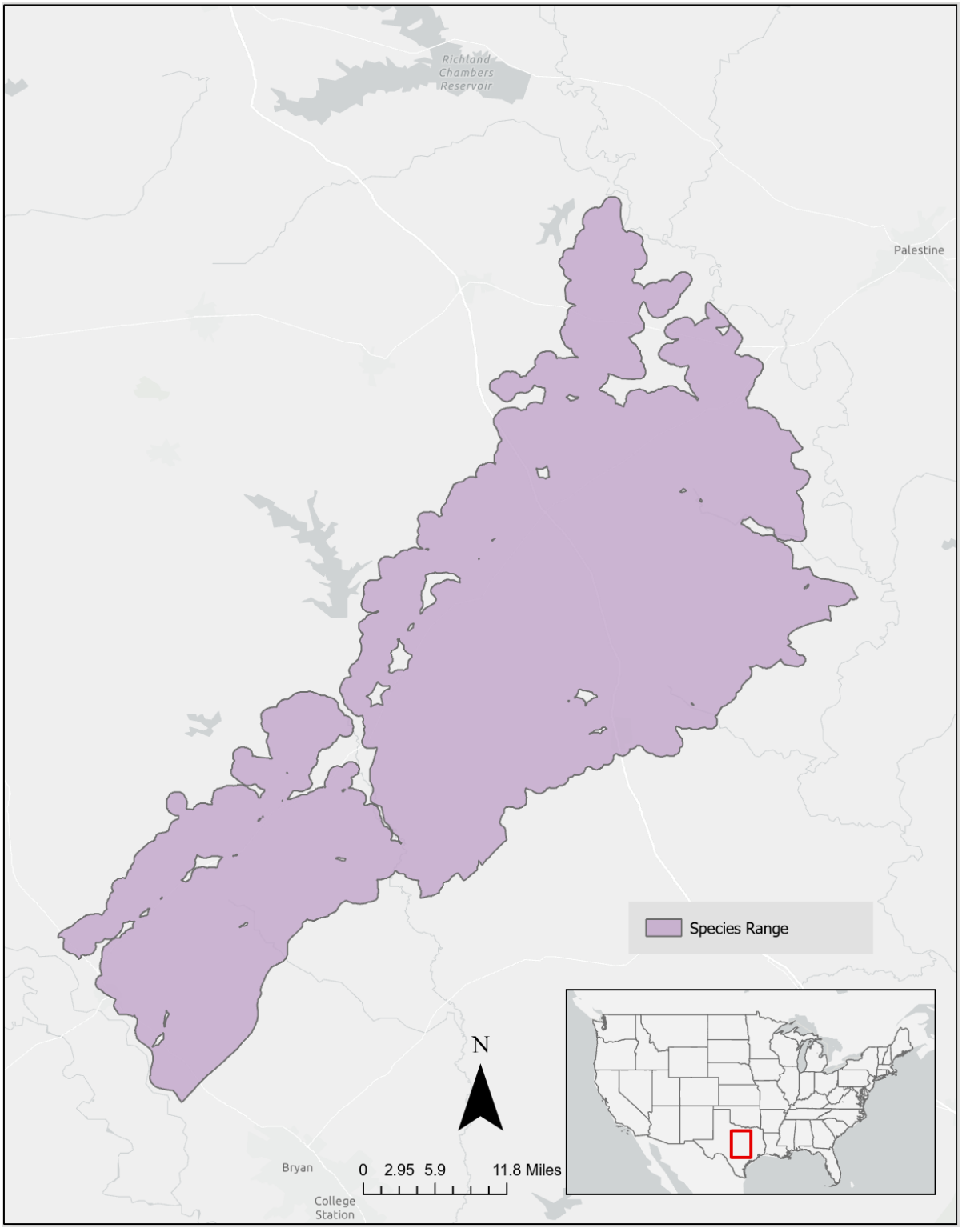

Figure A1-1. FWS range for the large-fruited sand-verbena. Total acreage of range is around 860,000 acres.

4. **Critical Habitat**
   - FWS has not designated a critical habitat for this species (https://ecos.fws.gov/ecp/species/1882)

5. **Known Locations**
   - Known Locations described in FWS Recovery Documents
     - Currently found only in three eastern Texas counties (Leon, Robertson, Freestone) (Five Year Review 2022).
     - **Figure A1-2** depicts the currently known wild populations from FWS.
     - **Figure A1-3** depicts the currently known experimental populations from FWS. As of 2022, it is unknown how many of the nine planted EPs remain because no surveys have been conducted on any of the EPs since 2008. Based on the FWS Recovery Document, there were considerable numbers of the species reported at many of the experimental populations' locations. However, a site visit in 2022 was cut short due to inclement weather so the abundance data reported is likely more than the reported amount (5 Year Review of Large-fruited sand-verbena T2).

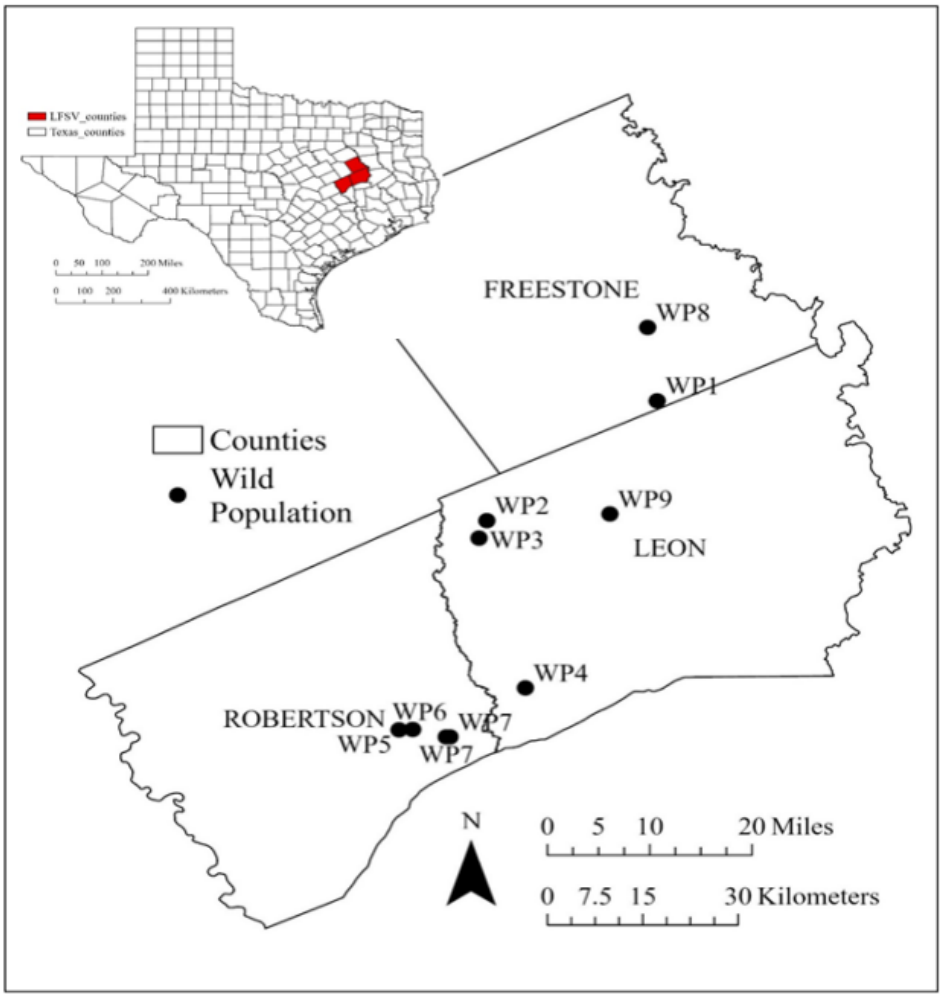

Figure A1-2. Known wild populations from FWS. Map reproduced from most recent FWS 5-year review (2022).

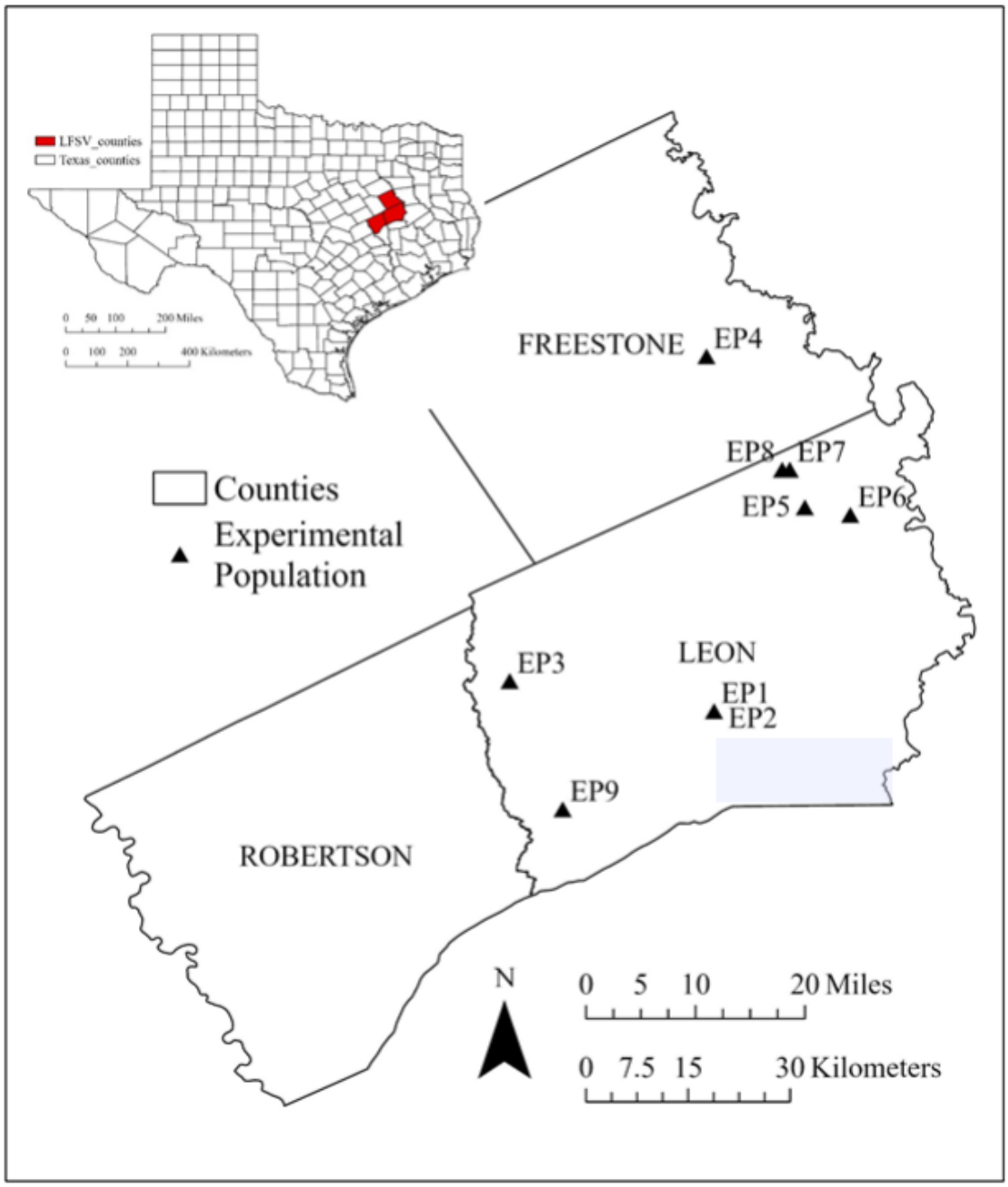

Figure A1-3. Known experimental populations from FWS. Map reproduced from most recent FWS 5-year review (2022).

- **Occurrences Included in Public Databases**
  - EPA queried iNaturalist, GBIF, and NatureServe. Occurrences in NatureServe were also consistent with other occurrence data (linked here). Collectively, the occurrence data are consistent with the three counties used to identify the core map.
  - iNaturalist (available here) had 34 research grade observations for this species, 11 of which appear to fall outside of the species range. In the current core map, EPA did not include any of the occurrences that fell outside of the species range.

- GBIF (available here) included 31 occurrences and human observations (from 2004-2024). All but 1 of these observations are also included in iNaturalist or NatureServe. GBIF points largely coincide with the species range but those that fall outside of the core map can also be accounted for by the resolution of the location data.
- Collectively, the occurrence data are consistent with the species range and known locations included in the core map.

Appendix 2. GIS Data Review and Method to Develop Core Map (Step 3)

This core map was created based on biological information, including occupied location and species habitat. EPA used the known locations provided by FWS and TPWD. The PULA consists of known locations within the species range inside of Leon, Robertson, and Freestone counties in eastern Texas.

1. **Dataset References and Software**
   - Texas Natural Diversity Database. 2025. Element Occurrence data export. Wildlife Diversity Program of Texas Parks & Wildlife Department. May 7, 2025.
   - Software used: ArcGIS Pro 3.4
   - Gridded Soil Survey Geographic (gSSURGO) Database for Texas. United States Department of Agriculture, Natural Resources Conservation Service. Available online at https://gdg.sc.egov.usda.gov/. July 2, 2025
   - National Land Cover Dataset (NLCD). 2021. data service from ESRI Living Atlas https://www.arcgis.com/home/item.html?id=3ccf118ed80748909eb85c6d262b426f.
   - FWS Species Range – last updated on August 28, 2024.

2. **Datasets Used in Core Map Development**
   - All datasets used in core map development are described in EPA's process document. The Texas Natural Diversity Database was requested through https://tpwd.texas.gov/huntwild/wild/wildlife_diversity/txndd/data.phtml.

3. **Core Map Development**
   - EPA started with the species range described by FWS to set the outer extent of the core map. The map falls within three eastern Texas counties (Leon, Robertson, Freestone), which contain the known locations for the species.
   - This species requires deep, sandy soils in open or disturbed areas. Moreover, the species may be "narrowly adapted to a specific seral stage that continually shifts location" (Five Year Review 2022); therefore, this map was developed on known locations.
     - For the wild populations known location data from TPWD's Natural Diversity Database was used. This area is also consistent with other occurrence data sources.
     - See **Figure A2-1**. For comparison of FWS Species Range and the Interim Core Map based on known locations provided by TPWD.

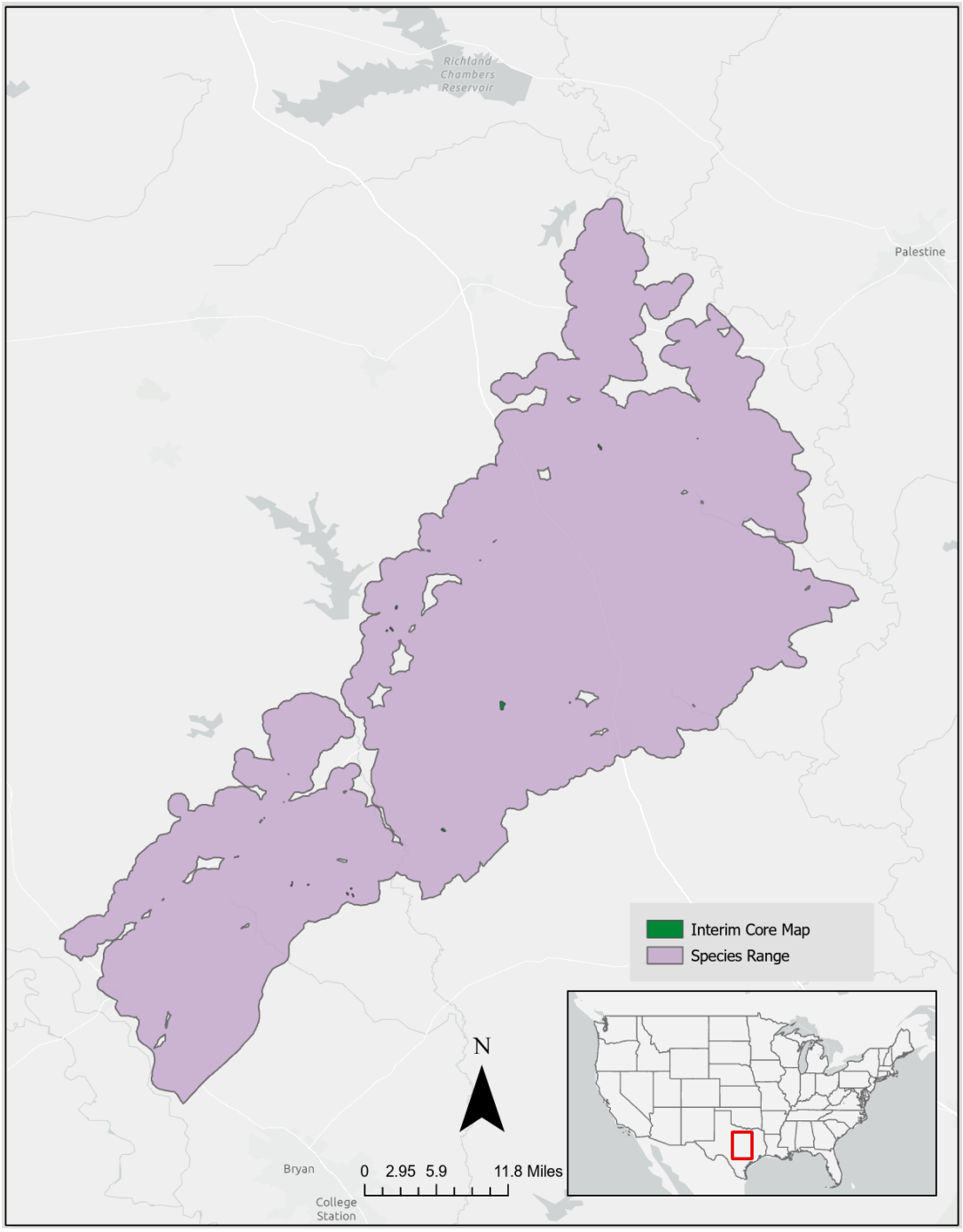

Figure A2-1. FWS Species Range and Interim Core Map of the Large-fruited Sand-verbena.

- For the experimental populations' biological information, both iNaturalist occurrence points and habitat information were used to generate potential areas.
    - The gSSURGO database for Texas map unit was clipped to the Range extent and the following tables were linked to it using appropriate join fields and clipped the map unit extent using Range.

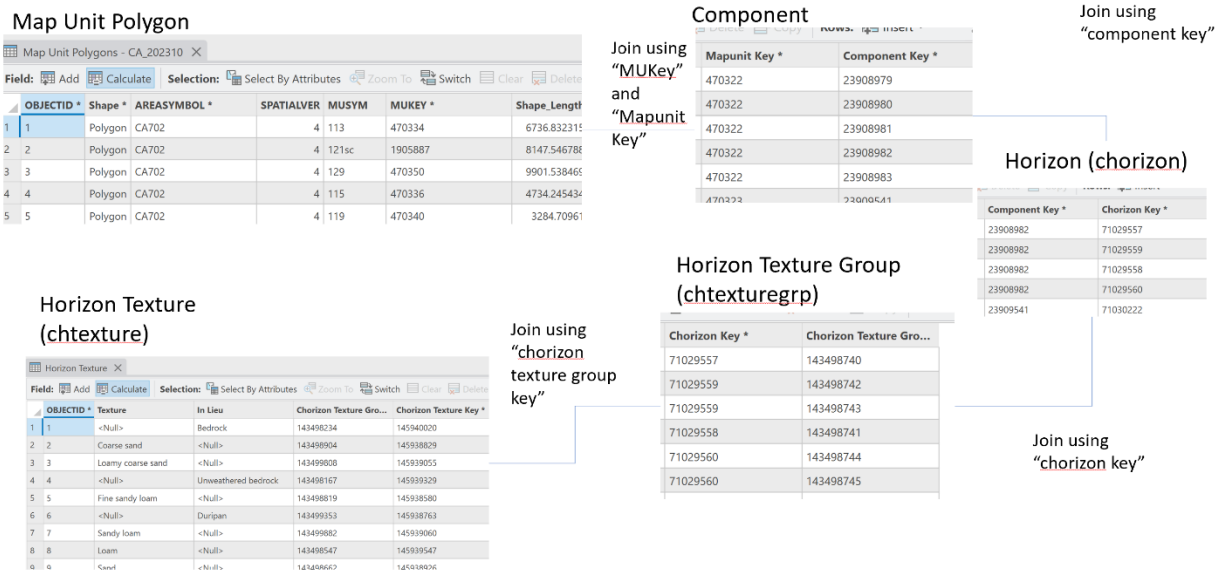

Figure A2-2. Tables were linked to the refined range using appropriate join fields.

- NLCD (2021) land cover was extracted to the range extent and the following land cover classes were identified using "extract by attribute" geoprocessing tool.
- Potential occurrence areas were created using the maximum positional accuracy value (562 m) as the buffer.
- An intersected area was created using the above three mentioned data. This area was considered as the potential experimental site area.
- Both the potential experimental populations' areas and the TPWD's Natural Diversity Database representing the wild populations' areas were merged and the final core map was developed.