

Interim Core Map Documentation for Rough-Leaved Loosestrife

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Draft Interim Core Map Developer: Compliance Services International (CSI)

Species Summary

The rough-leaved loosestrife (*Lysimachia asperulaefolia*; Entity ID 967) is an endangered plant (dicot). The U.S. Fish and Wildlife Service (FWS) has not designated critical habitat for the rough-leaved loosestrife. This species is typically found growing in the ecotone between longleaf pine or oak savannas and wetter, shrubby plant communities growing on moist sand or peat (FWS 1995). Additional information is provided in **Appendix 1**.

EPA Review Notes

This core map was developed 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 the agency's process; (2) areas added to or excluded from the interim core map are consistent with the species biology and/or recovery needs; (3) data sources are documented and appropriate; and (4) the 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, consistency, or other purposes. This document may include views not held by EPA or its staff.

The core map developed in this document for this species is considered interim. This core map incorporates information developed by FWS and made available to the public. EPA reviewed the core map; 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.

Description of Core Map

The core map for the rough-leaved loosestrife is biological information type based on known location data, excluding areas of cultivated land > 25 acres (EPA undated). The outer extent of the core map is the FWS range, but unique refinements are made for each of the 10 locations in which the species occurs, based on spatial datasets created to match textual descriptions of population information in the most recent FWS 5-Year Review (FWS 2021). These are summarized in more detail in **Appendix 2**.

This interim core map spans 646,489 acres. A summary of acreage by National Landcover Database (NLCD) land use type is provided in Table 1.

Based on EPA’s best professional judgment classification system, CSI has graded this core map as “limited” (2) because it largely comprises unaltered boundaries of easily identifiable nature preserves and military bases, from trusted datasets from the U.S. Geological Survey (PAD-US) and National Conservation Easement Database. Three known locations (Bladen Lakes area, Boiling Springs Lakes, and Holly Shelter Game Lands) were delineated by CSI with high confidence according to examination of location in mapping software (ArcGIS Pro, Google Maps, Bing Maps) and a reclassification methodology producing boundaries that are qualitatively well-aligned with those boundaries. Biological information was not used for this map. More information about this classification system and its definitions can be found in the core map process document (EPA 2024).

When FWS reviews this interim core map, it may be possible to improve the confidence in this core map by revising population location information used in this analysis and may be further refined by including any other known areas that are observed from reliable and precise observational datasets. Additional refinement may include applying a filter to remove land cover types and habitats that are inconsistent with the FWS habitat descriptions for this species.

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

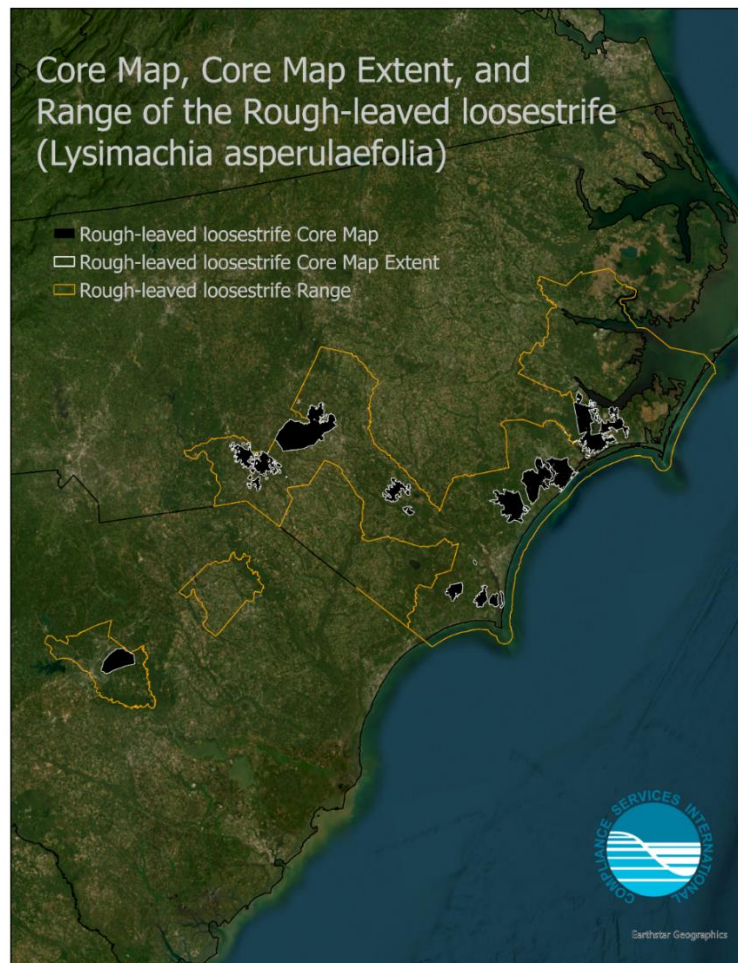


Figure 1. Interim core map for the rough-leaved loosestrife.

Example pesticide use sites/types	NLCD Landcover (Value)	% of core map represented by landcover	% of core map represented by example pesticide use
Forestry	Deciduous Forest (41)	1%	39%
Forestry	Evergreen Forest (42)	37%	39%
Forestry	Mixed Forest (43)	2%	39%
Agriculture	Pasture/Hay (81)	0%	1%
Agriculture	Cultivated Crops (82)	0%	1%
Mosquito adulticide, residential	Open space, developed (21)	3%	8%
Mosquito adulticide, residential	Developed, Low intensity (22)	2%	8%
Mosquito adulticide, residential	Developed, Medium intensity (23)	2%	8%
Mosquito adulticide, residential	Developed, High intensity (24)	1%	8%
Invasive species control	Woody Wetlands (90)	41%	51%
Invasive species control	Emergent Herbaceous Wetlands (95)	1%	51%
Invasive species control	Open water (11)	1%	51%
Invasive species control	Grassland/herbaceous (71)	2%	51%
Invasive species control	Scrub/shrub (52)	3%	51%
Invasive species control	Barren land (rock/sand/clay; 31)	2%	51%
Total Acres	Interim Core Map Acres	633,949	

Table 1. Acres by National Land cover Database (NLCD) class within the core map of the rough-leaved loosestrife. Total core map area (based on NLCD pixel count): 633,949 acres¹.

Evaluation of Known Location Information

There are four datasets with spatially delineated known location information:

- Descriptions of locations provided by FWS;
- iNaturalist;
- Global Biodiversity Information Facility (GBIF); and
- NatureServe (Explorer Pro, public version)

Compliance Services International (CSI) evaluated these four datasets before developing the core map. The

¹ This acreage is slightly different from the core map acreage (646,489) due to the pixelation of NLCD land cover. The core map is not developed from raster data.

descriptions of locations provided by FWS were generally easily identifiable and comprise a full catalogue of the known observational areas with extant populations. In general, these areas are nature preserves and military installations that can either be found in national datasets, or spatially georeferenced and delineated in GIS software.

There were 66 research grade observations found in iNaturalist². These locations were generally consistent with other datasets. **Appendices 1 and 2** include more information on the available known location information.

The public NatureServe Explorer Pro occurrences corroborated range information for the species but did not significantly improve upon the known location data that could be gleaned from descriptions of known location areas in FWS documentation. Therefore, NatureServe data were used mainly for comparison with other sources and did not factor into the spatial delineation of the core map extent.

Finally, textual descriptions by FWS of known areas of extant occupancy were spatially delineated by CSI. Details on this process are provided in **Appendix 2**.

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 FWS and their designated critical habitats² (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: Designated Critical Habitat, Range, and Biological Information. From EPA, summaries of each core map type are provided below (EPA 2024).
3. Develop the core map for the species; and
4. Document the core map.

For step 1, CSI compiled available information for the rough-leaved loosestrife from FWS, as well as observation information available from various publicly available sources (including iNaturalist, GBIF, and NatureServe). The information compiled for rough-leaved loosestrife is included in **Appendix 1**.

For step 2, CSI used the compiled information including the species range, known locations, and habitat location information to determine the core map type. CSI compared the known location data to the range and found that known locations were not only consistent with the range, but usable as an improved extent for the core map development process. Review of the available data also suggested that the species is likely located in smaller areas within the extent that was based on known observations because the species has specific habitat requirements that are not located everywhere within this extent. When weighing that

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 together, CSI selected the core map type of biological information based on known location areas within the range. CSI did not use habitat information to derive this core map although this could be considered for further refinement (further explained in the following section discussion approaches and data that were considered but not used).

For step 3, CSI used the best available data sources to generate the core map. Data sources are discussed in the process document. For this interim core map, CSI identified known location areas that were refined from species range. That extent was established using textual descriptions of population information from FWS documentation. **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

CSI considered applying a habitat or land cover-based refinement to develop the interim core map. CSI determined that the core map was sufficiently refined as-is, and that further refinements based on habitat may risk increasing uncertainty in the core map due to the types of habitats used by the species.

Appendix 1. Information compiled for Rough-Leaved Loosestrife

1. Recent FWS documents

- 5 Year Review (2021) https://ecosphere-documents-production-public.s3.amazonaws.com/sams/public_docs/species_nonpublish/3423.pdf
- Recovery Plan (1995) https://ecos.fws.gov/docs/recovery_plan/950419b.pdf

2. Background information

- Status: Federally listed as threatened in 1987.
- Resiliency, redundancy, and representation (the 3Rs)
 - The 3 Rs were not specifically described in the species recovery plan or most recent 5-year review for this species and there is no species status assessment.
- Habitat, Life History, and Ecology
 - Habitat: “typically found growing in the ecotone between longleaf pine or oak savannas and wetter, shrubby plant communities growing on moist sand or peat. The open character of the habitat is maintained by periodic fires.” (FWS 1995).
 - “Both fire and appropriate hydrologic conditions are critical for this species.” (FWS 1995).
 - Pollinators: “pollinated by solitary bees: most of the pollinators are in the genus *Dialictus*” (FWS 1995).
- Taxonomy
 - Wetland plant – *Lysimachia asperulaefolia* was described by Jean Louis Marie Poiret in 1814. Since listing as endangered in 1987, there have been no changes to the nomenclature of the species, however some references now spell the specific epithet as “*asperulifolia*” an orthographic variant of “*asperulaefolia*.” In addition, in the listing documents and the Recovery Plan, the common name is referred to as rough-leaved loosestrife; however, some references use the common name rough-leaf loosestrife. Ironically, the leaves are actually smooth in texture. The genus *Lysimachia* is now considered to be part of the Myrsinaceae family and not the Primulaceae family (FWS 2021)
- Relevant Potential Pesticide Use Sites
 - “*Lysimachia asperulaefolia* sites located within utility rights-of-way are threatened by herbicide use or mowing during critical growth periods” (FWS 2021)

- Relevant Recovery Criteria and Actions
 - 5-Year Review (FWS 2021) – Downlisting Criteria (downlisting will be considered when the following have been met)
 1. Management plans have been prepared and are being implemented for all publicly owned population centers and those owned by The Nature Conservancy, and [Status: partially complete].
 2. Populations at these centers have been monitored for at least five years and are determined to be stable. [Status: partially complete].
 - Recovery Criteria (FWS 2021)
 1. The rough-leaved loosestrife may be considered for delisting when the above conditions are met and a binding management agreement for each population center is in place:
 - There are 10 metapopulations that are publicly owned or in conservation ownership: Bladen Lakes Area, Boiling Springs Lakes, Camp Lejeune, Croatan National Forest, Fort Bragg/Camp Mackall, Green Swamp Nature Preserve, Holly Shelter Game Lands, Sandhills Gamelands, South Carolina Sandhills (Fort Jackson) and Military Ocean Terminal Sunny Point. These sites roughly coincide with the population centers listed in the Recovery Plan. The one exception to this is the Pamlico and Beaufort counties population center where *Lysimachia asperulaefolia* plants haven't been seen since 1990.
 - Criterion 1 is only partially complete because management plans that meet the Recovery Plan criteria have been prepared for only 5 of the 10 metapopulations: Camp Lejeune, Croatan National Forest, Fort Bragg/Camp Mackall, Green Swamp Nature Preserve and Military Ocean Terminal Sunny Point. Criterion 2 is also only partially complete because monitoring data has been collected for more than five years at nine of the 10 population centers, the exception being the Bladen Lakes Area. Further, many of the population centers have been monitored for 10 years or more. A Population Viability Analysis was prepared for this species based on this long-term monitoring data. The results of this analysis indicate that the trends at only two population centers are stable and two are increasing. The trends at five population centers are believed to be declining and the trend at the remaining site is unknown because insufficient monitoring has been conducted (Robinson and Buchanan 2014). FWS has encouraged land managers to continue monitoring in order to better understand population trends and guide management actions that will benefit the species.

3. Range

- Size: 7,376,112 acres

4. Description of Critical Habitat

- This species does not have designated critical habitat.

5. Known Locations

“When the Recovery Plan was written in 1995, *Lysimachia asperulaefolia*, was reported from 13

counties in the coastal plain and sandhills of North Carolina (NC) and two counties in the sandhills of South Carolina (SC). Since then, the species has been extirpated in Beaufort and Richmond counties in NC and Darlington County in SC; however, new populations have been found in New Hanover and Craven Counties in NC. Currently, the species is believed to be extant in 12 NC counties. Despite intensive surveys throughout the coastal plain and sandhills of SC, this species is only known from Fort Jackson Army Base in Richmond County. A total of 148 Element Occurrences (populations or subpopulations) are currently extant in NC and 19 more EOs in NC are currently ranked F, indicating that botanists have “Failed to Find” this species at sites where it was previously known (Suzanne Mason, NCNHP, pers. comm., 2013)” “Currently, state natural heritage programs recognize 53 extant populations or principal EOs (52 in NC and one in SC). “(FWS 2021).

- Known locations described in FWS 5-Year Review (FWS 2021)
 - Figure 2 is a reproduction of a map from FWS documents that illustrates occurrence data described in those documents. The following is information for extant populations and/or EOs that are protected or partially protected. Census counts by population are given in Table 2.
 - North Carolina: The nine metapopulations publicly owned or in conservation ownership are “Bladen Lakes Area, Boiling Springs Lakes, Camp Lejeune, Croatan National Forest, Fort Bragg/Camp Mackall, Green Swamp Nature Preserve, Holly Shelter Game Lands, Sandhills Gamelands, and Military Ocean Terminal Sunny Point.”
 - South Carolina: The one known metapopulation in South Carolina is found on public lands in the South Carolina Sandhills (Fort Jackson).

Land Manager	Level 1	Level 2	Level 3
Holly Shelter Game Land	3	1	1
Sandhill Game Land	2	1	1
Nature Conservancy	3	1	1
Camp McKall	0	1	0
Sunny Point	0	0	1
Fort Bragg	9	14	0
Croatan Ntl Forest	4	1	1
Camp Lejeune	6	1	1
Fort Jackson	0	0	1 (their current protocol)
TOTALS	42	7	8

Table 2. Table from the FWS 2021 5-year review that includes the census counts for the rough-leaved loosestrife.

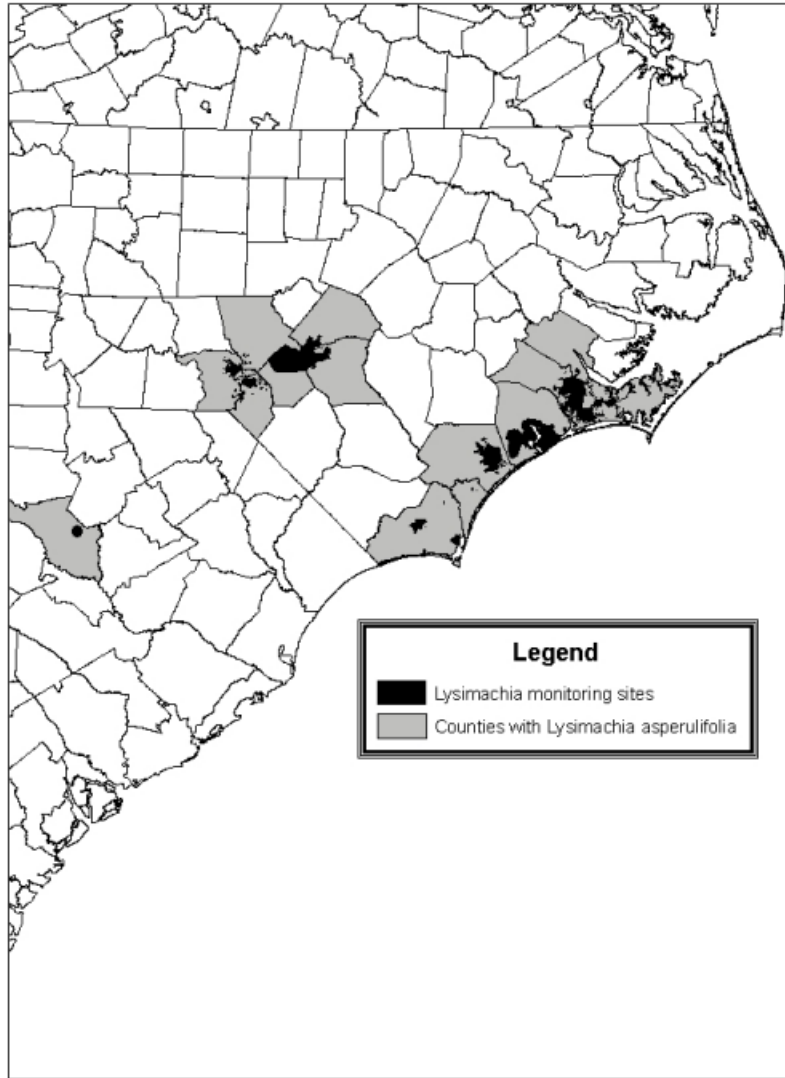


Figure 2. Monitoring sites and counties with the rough-leaved loosestrife. Reproduced from Figure A1-1 in source document (FWS 2021).

- iNaturalist: https://www.inaturalist.org/observations?taxon_id=164992
 - 66 research-grade observations, none of which had public coordinate data (Figure 3).

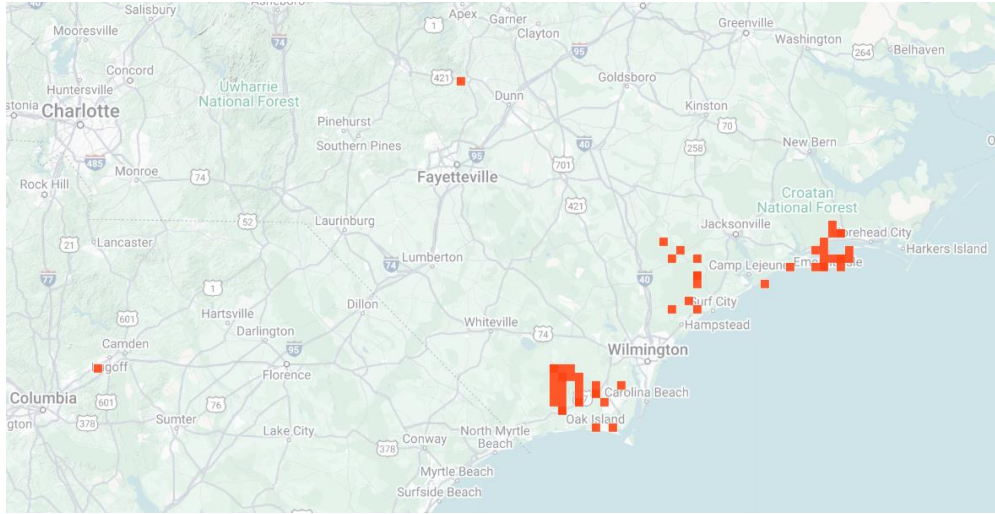


Figure 3. iNaturalist occurrences for the rough-leaved loosestrife.

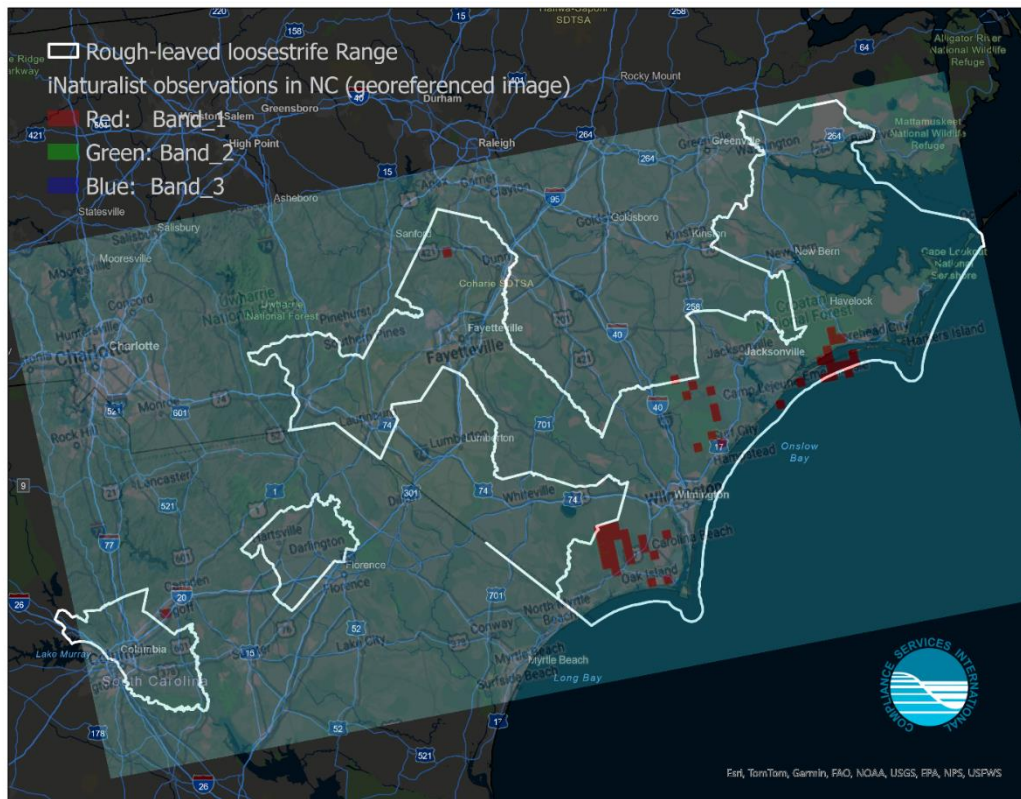


Figure 4. iNaturalist observations (red) juxtaposed against range (white) and FWS known occurrence data (purple).

iNaturalist data were compared against range and FWS known occurrence data (Figure 4) and found to be in general agreement. However, the relatively high uncertainty in point observation data precision made the iNaturalist dataset more useful as a check on other methods than a contribution to the spatial extent of the

core map.

- GBIF: <https://www.gbif.org/species/7223640>
 - GBIF includes 13 occurrences, most of which are undated. Twelve of these are “Preserved specimens” and one is a “Machine observation.”
 - None of these observations have coordinate data, even before querying for relevance.

 - NatureServe Explorer Pro:
https://explorer.natureserve.org/pro/Map?taxonUniqueId=ELEMENT_GLOBAL.2.129563
 - Available public occurrence information from NatureServe Explorer Pro aligns with the information from iNaturalist and does identify additional areas; however, its scale is too general to be considered a meaningful refinement. Given the existence of more precise location data of extant populations provided in recent (2021) FWS documentation, EOs were used as a comparison of other datasets but did not themselves contribute to the development of the core map shape.
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Appendix 2. GIS Data Review and Method to Develop Core Map

The core map for this species is based on range, with extent limited to areas of occupancy of known extant populations as of the published 2021 5-Year Review by FWS. The core map identifies all areas within the extent (described below), further refined to exclude areas of cultivated land > 25 acres.

1. References and Software

- Bing Maps: <https://www.bing.com/maps>.
- EPA Cultivated Lands > 25 acres: <https://www.epa.gov/endangered-species/process-epa-uses-develop-core-maps-pesticide-use-limitation-areas>.
- ESRI Basemaps
- Google Maps: <https://www.google.com/maps>.
- National Conservation Easement Database (NCED): <https://www.conservationaleasement.us/downloads/>.
- PAD-US: <https://www.usgs.gov/programs/gap-analysis-project/science/pad-us-data-overview>.
- Software used: ArcGIS Pro version 3.2.
- EPA Modified Cultivated Layer: <https://cdn.arcgis.com/home/item.html?id=159e70ce4c284f5b972c687037f8a668>.
- FWS Species Range: <https://www.fws.gov/species/rough-leaved-loosestrife-lysimachia-asperulaefolia>.

2. Datasets Used in Core Map Development

2.1. Range

The range for this species was last updated by FWS on September 13, 2023. A shapefile including species range for all listed species was downloaded from the FWS ECOS website on January 24, 2025. The shapefile was converted to a feature class stored in a file geodatabase and reprojected to WKID #4269 (“North America Albers Equal Area Conic”).

1. Using an ArcGIS Web Map the species was queried based on the ECOS listed “Entity ID” of 967 and exported as a feature class to a temporary file geodatabase as a standalone Entity ID-specific layer.
2. The area of the range was calculated automatically by loading it into the software (ArcGIS Pro version 3.2) 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 available known locations described in the FWS 5-year review. The known observations of extant populations in FWS documentation were judged to be sufficient for use in core map development, without addition (or subtraction) resulting from other datasets.

2.2. PAD-US

According to USGS, PAD-US is “America’s official national inventory of U.S. terrestrial and marine protected areas that are dedicated to the preservation of biological diversity and to other natural, recreation and cultural uses, managed for these purposes through legal or other effective means. PAD-US also includes the best-available aggregation of federal land and marine areas provided directly by managing agencies, coordinated through the Federal Geographic Data Committee Federal Lands Working Group.”

In the case of the rough-leaved loosestrife, where known occurrences include well-defined areas such as nature preserves and military bases, the PAD-US dataset was useful in extracting areas meant to reflect extant populations of the species. However, some locations were either partially or completely missing from this dataset, so alternate sources and methods were used when needed.

2.3. National Conservation Easement Database (NCED)

The National Conservation Easement Database (NCED) is an initiative of the U.S. Endowment for Forestry and Communities, and comprises a database of conservation easement information from land trusts and public agencies throughout the United States (<https://www.conservationeasement.us/about/>). The NCED was queried for two locations that were unavailable in the PAD-US layer. These were the Green Swamp and Sandhills locations (both in North Carolina). In these instances, attribute data were used to identify locations for these populations. Further details on this process are given in Section 3 below.

2.4. Bing Maps, Google Maps, ESRI Basemaps

For known locations that could not be identified in either PAD-US or NCED, shapes were created according to a standardized process to georeferenced image data downloaded elsewhere. In these instances, alternate mapping tools including Bing Maps, Google Maps, and ESRI basemaps were used as a starting point of a process that typically involved 1) georeferencing and saving to an ESRI file geodatabase, 2) reclassifying the data based on color scheme, 3) converting from raster to polygon, 4) filling in unwanted holes left from prior steps, and 5) dissolving into a single shape for each location. Further details on this process are given in Section 3 below.

2.5. EPA Cultivated Lands > 25 Acres

EPA has developed and published its own cultivated layer for use in core map development as a potential refinement of extent. For the rough-leaved loosestrife, extent was refined by this layer using the Pairwise Erase tool to remove significant areas of agriculture because the species habitat is not consistent with cultivated land and is therefore considered by CSI to be “off-field.” This removed relatively little area but is considered a reasonable refinement for core map development for off-field species.

3. Creating the Core Map

3.1. Developing Extent

The core map for the rough-leaved loosestrife was developed using known location data of extant populations in North Carolina and South Carolina with specific sites enumerated by FWS as follows: Bladen Lakes Area, Boiling Springs Lakes, Camp Lejeune, Croatan National Forest, Fort Bragg/Camp Mackall, Green Swamp Nature Preserve, Holly Shelter Game Lands, Sandhills Gamelands, Military Ocean Terminal Sunny Point, and Fort Jackson. Each location was identified and converted to a polygon layer according to best available datasets, as follows.

Bladen Lakes Area

The Bladen Lakes Area was not easily identifiable with existing spatial datasets. A screenshot of the Bladen Lakes State Forest map from Bing Maps was saved to a folder, georeferenced, and converted to spatial data as follows (Figure 7):

1. Save an image of the Bladen Lakes State Forest map as an image file. Add the image to the GIS and save it to the working file geodatabase (“Bladen_Lakes”). Fit the image to a window zoomed into the vicinity of the species range, render it partially transparent (70% transparency was used) and use control points to reorient the image to be aligned with identifiable features in the background.
2. Reclassify the image to isolate the color associated with subpopulations on the original map, dark green in this case (“Bladen_Lakes_rec”).
3. Use the Raster to Polygon tool to convert the reclassified layer to a vector layer. This is done to facilitate future steps, including final delivery of a feature class representing the core map (“Bladen_Lakes_rec_r2p”). Identify polygonal shapes that are not part of the original map—largely small-area shapes in this case—and manually remove them during an edit session.
4. Use the Feature to Polygon tool to fill any holes in the polygon layer (“Bladen_Lakes_rec_r2p_f2p”).
5. Use the Pairwise Dissolve tool to dissolve the polygons from the last step into a single polygon (“Bladen_Lakes_rec_r2p_f2p_pd”).



Figure 5. Core map extent for Bladen Lakes area. An image of the Bladen Lakes area (top-left) was reclassified (top-center), converted to a polygon layer (top-right), had its holes filled in (bottom-left), and dissolved into a single shape (bottom-right).

Boiling Springs Lakes

The Boiling Springs Lakes area was not easily identifiable with existing spatial datasets. A screenshot of the Boiling Springs Lakes map from Google Maps was saved to a folder, georeferenced, and converted to spatial data as follows (Figure 8):

1. Save an image of the Boiling Springs Lakes map as an image file. Add the image to the GIS and save it to the working file geodatabase (“BS”). Fit the image to a window zoomed into the vicinity of the species range, render it partially transparent (70% transparency was used) and use control points to reorient the image to be aligned with identifiable features in the background.
2. Reclassify the image to isolate the color associated with subpopulations on the original map, light yellow in this case (“BS_rec”).
3. Use the Raster to Polygon tool to convert the reclassified layer to a vector layer. This is done to facilitate future steps, including final delivery of a feature class representing the core map (“BS_rec_r2p”). Manually edit the layer to close any unwanted breaks in the shape’s outer perimeter during an edit session.
4. Use the Feature to Polygon tool to fill any holes in the polygon layer (“BS_rec_r2p_f2p”).
5. Use the Pairwise Dissolve tool to dissolve the polygons from the last step into a single polygon (“BS_rec_r2p_f2p_pd”).



Figure 6. Core map extent for Boiling Springs Lakes. An image of the Boiling Springs area (top-left) was reclassified (top-center), converted to a polygon layer (top-right), had its holes filled in (bottom-left), and dissolved into a single shape (bottom-right).

Camp Lejeune

Two suitable polygons representing Camp Lejeune were identified in the PAD-US dataset. These records had unit names of “MCB Camp Lejeune” and “MCB Camp Lejeune West Site,” respectively. These two shapes were selected and the Pairwise Dissolve tool was run to combine them into a single shape representing the relevant area (Figure 9).

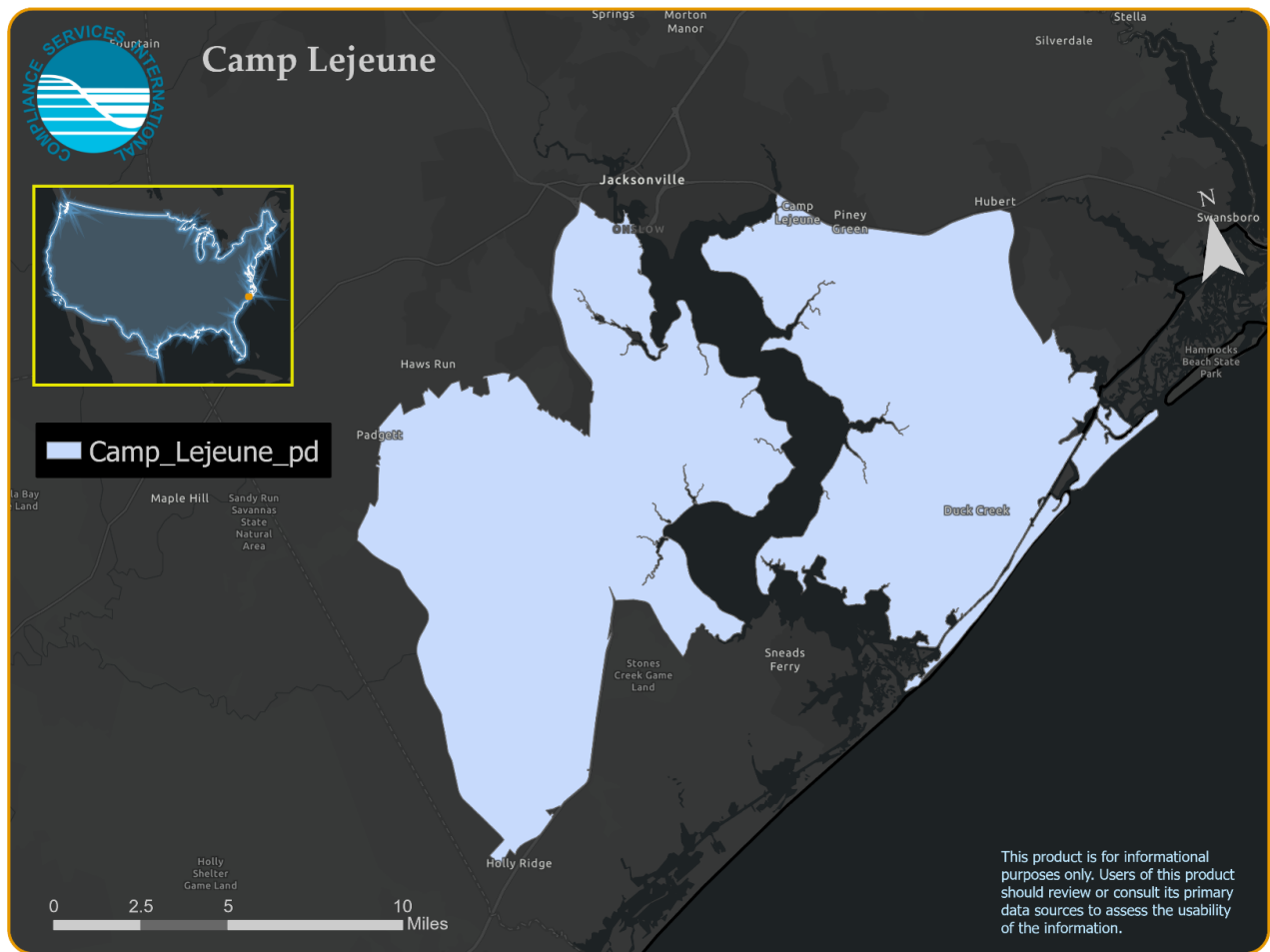


Figure 7. Core map extent for Camp Lejeune.

Croatan National Forest

The Croatan National Forest was not easily identifiable with existing spatial datasets; however, its general location was identified using a combination of Google Maps and ESRI reference data associated with one of its basemap layers. At its location, a PAD-US polygon suitably representing the forested area with Local Name = “National Forests in North Carolina” was isolated and clipped to a temporary polygon used to exclude other national forests in the state (Figure 10).

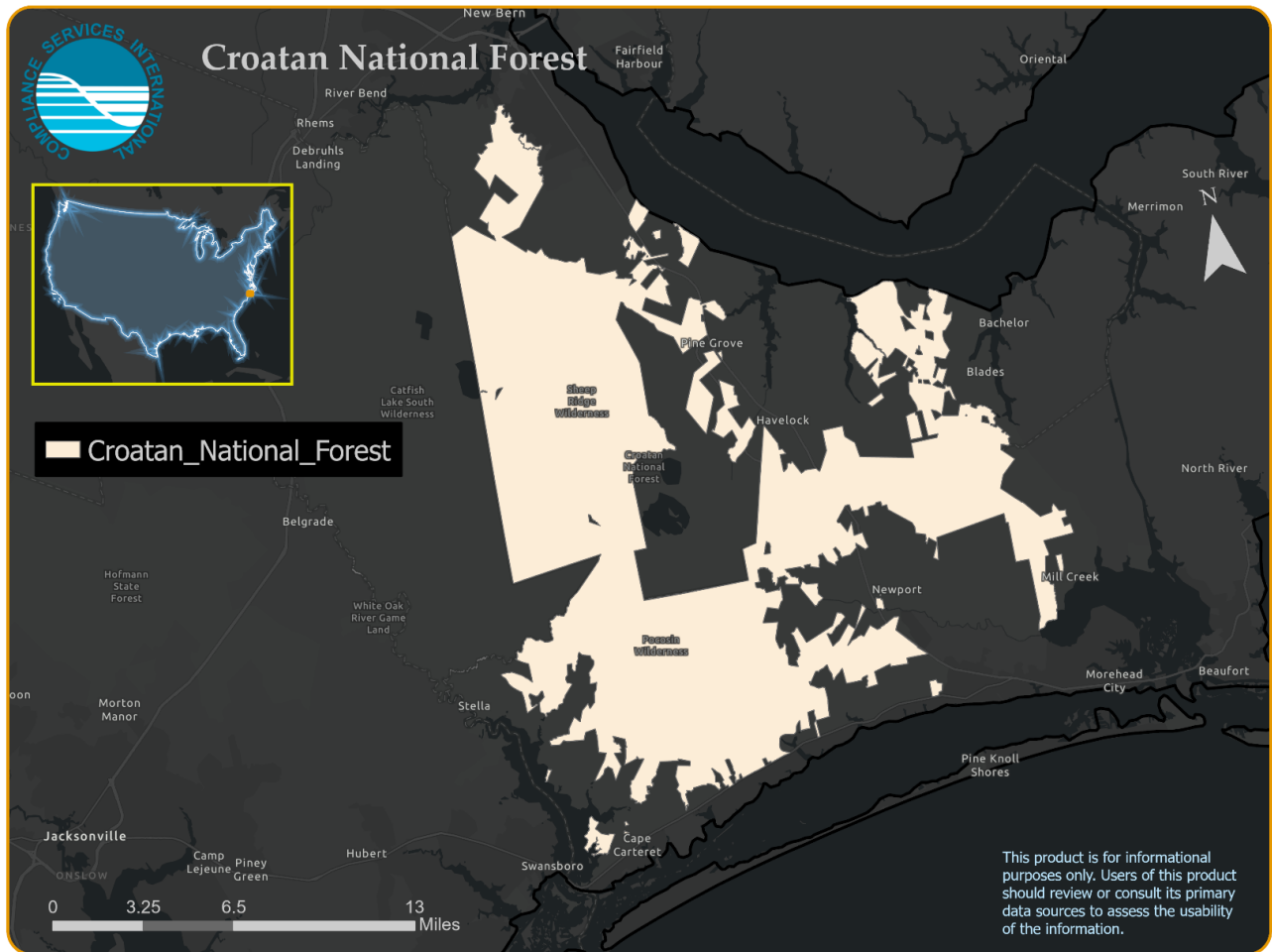


Figure 8. Core map extent for Croatan National Forest.

Fort Bragg/Camp Mackall

Both Fort Bragg and Camp Mackall were easily identifiable in the PAD-US dataset. Their shapes were selected and exported as standalone polygons “Fort_Bragg” and “Camp_Mackall,” respectively (Figure 11).

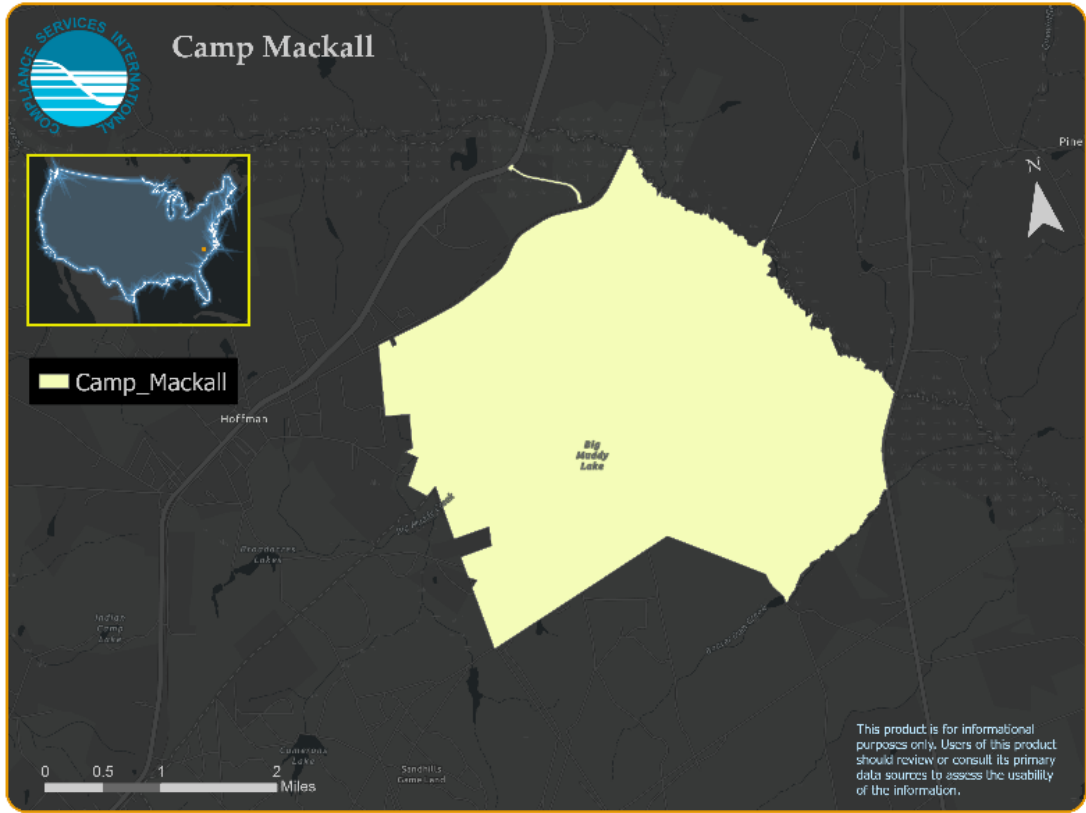
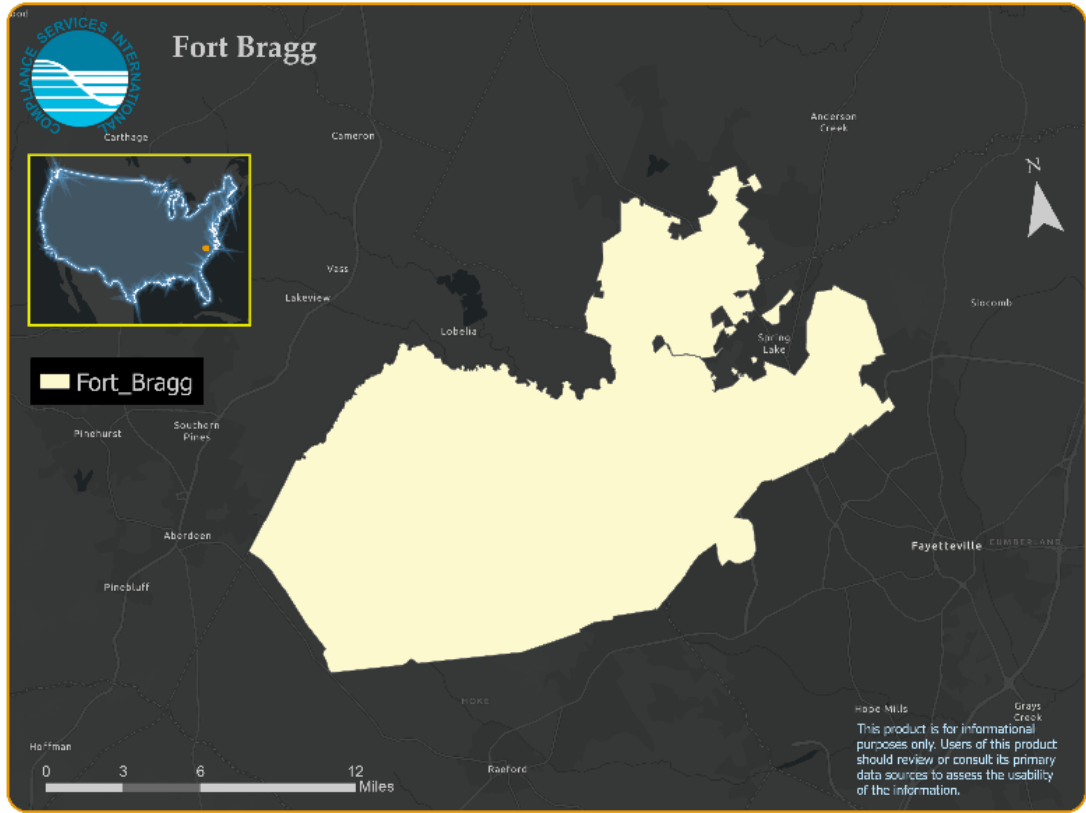


Figure 9. Core map extent for Fort Bragg/Camp Mackall.

Green Swamp Nature Preserve

Two shapes representing the Green Swamp Nature Preserve were easily identifiable from the National Conservation Easement Database, specifically its ESRI File Geodatabase download. The polygon layer was queried and Site Name = “Green Swamp Preserve Dedicated Nature Preserve” and “Green Swamp Game Land Dedicated Nature Preserve” were selected. The Pairwise Dissolve tool was used to dissolve the shapes into a single layer “Green_Swamp_pd” (Figure 12).

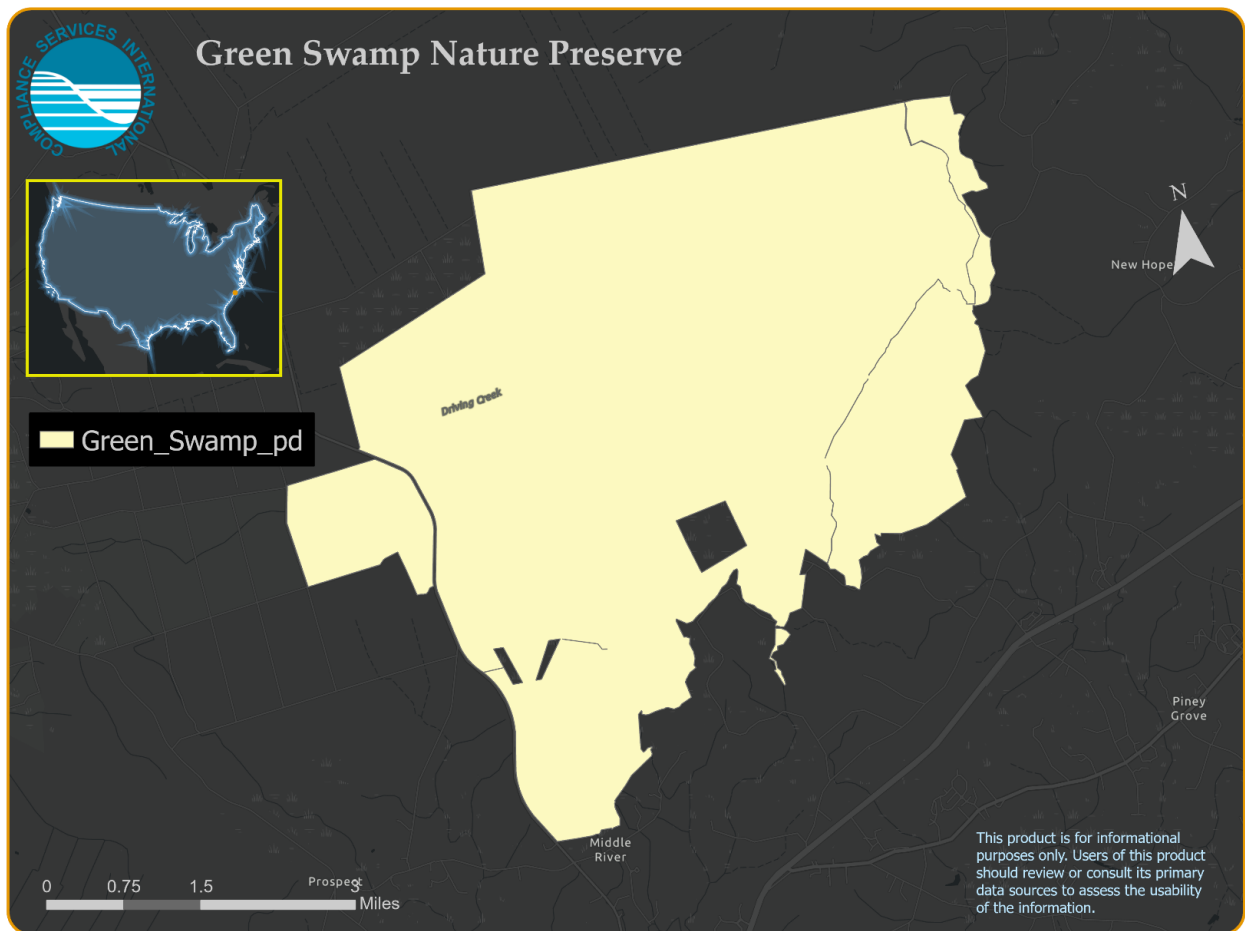


Figure 10. Core map extent for the Green Swamp Nature Preserve.

Holly Shelter Game Lands

The Holly Shelter Game Lands was not easily identifiable with existing spatial datasets. A picture of the underlying ESRI basemap layer at its location was saved to a folder, georeferenced, and converted to spatial data as follows (Figure 13):

1. Save an image of the Holly Shelter Game Lands map as an image file. Add the image to the GIS and save it to the working file geodatabase (“HS”). Fit the image to a window zoomed into the vicinity of the species range, render it partially transparent (70% transparency was used) and

use control points to reorient the image to be aligned with identifiable features in the background.

2. Reclassify the image to isolate the color associated with subpopulations on the original map, dark green in this case (“HS_rec”).
3. Use the Raster to Polygon tool to convert the reclassified layer to a vector layer. This is done to facilitate future steps, including final delivery of a feature class representing the core map (“HS_rec_r2p”).
4. Use the Feature to Polygon tool to fill any holes in the polygon layer (“HS_rec_r2p_f2p”).
5. Use the Pairwise Dissolve tool to dissolve the polygons from the last step into a single polygon (“HS_rec_r2p_f2p_pd”).



Figure 11. Core map extent for the Holly Shelter Game Lands. An image of the Holly Shelter area (top-left) was reclassified (top-center), converted to a polygon layer (top-right), had its holes filled in (bottom-left), and dissolved into a single shape (bottom-right)

Sandhills Gamelands

Seventy-four shapes representing the Sandhills Gamelands were easily identifiable from the National Conservation Easement Database, specifically its ESRI File Geodatabase download. The polygon layer was queried, and Folder Path LIKE '%Sandhills%' records were selected. The Pairwise Dissolve tool was used to dissolve the shapes into a single layer “Sandhills_only_pd” (Figure 14).

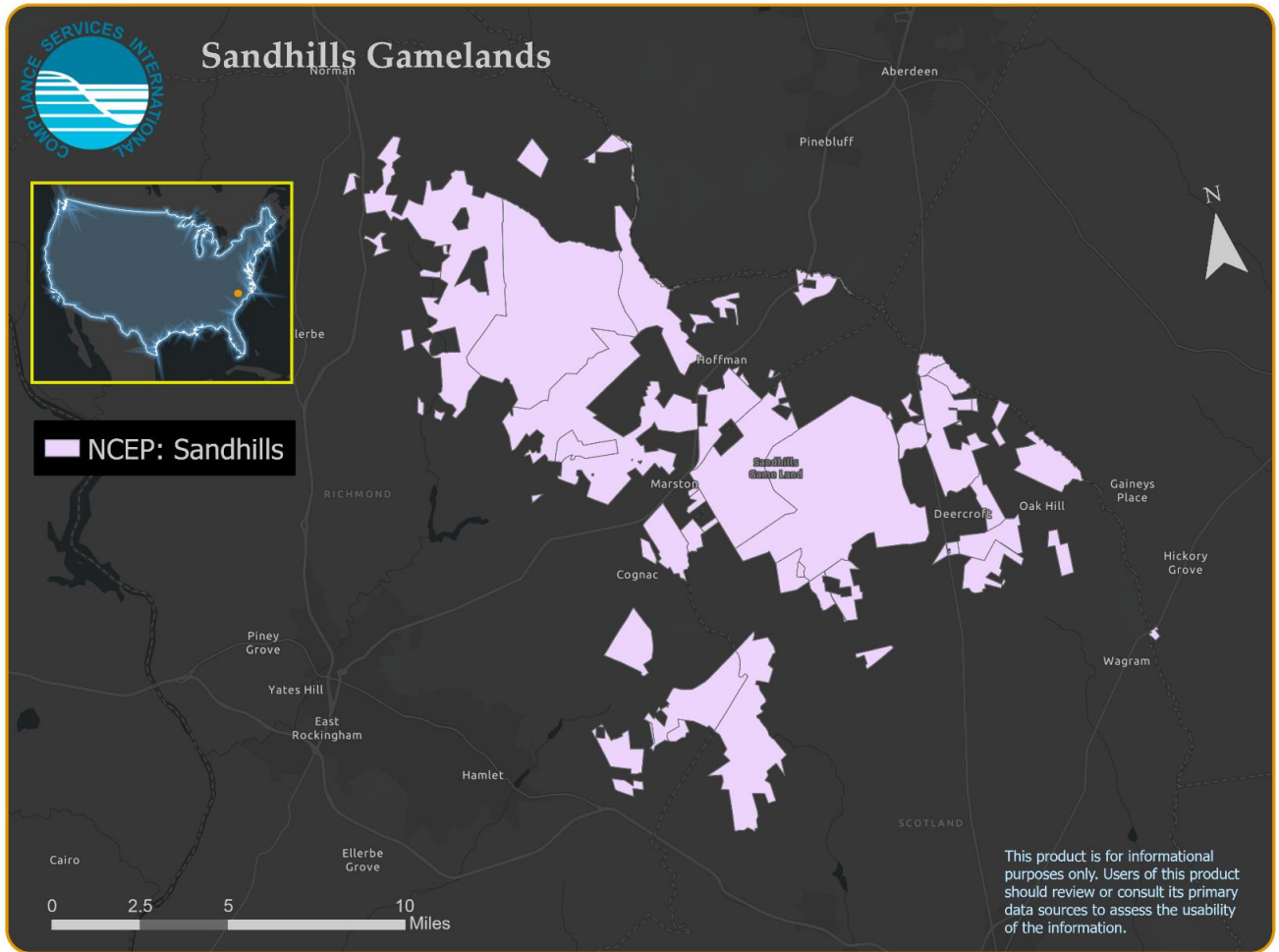


Figure 12. Core map extent for the Sandhills Gamelands.

Military Ocean Terminal Sunny Point

One suitable polygon representing Military Ocean Terminal Sunny Point was identified in the PAD-US dataset. This record had Unit Name = "Military Ocean Tml Sunny Point," which was isolated and saved to the working geodatabase with a layer name "Military_Ocean" (Figure 15).

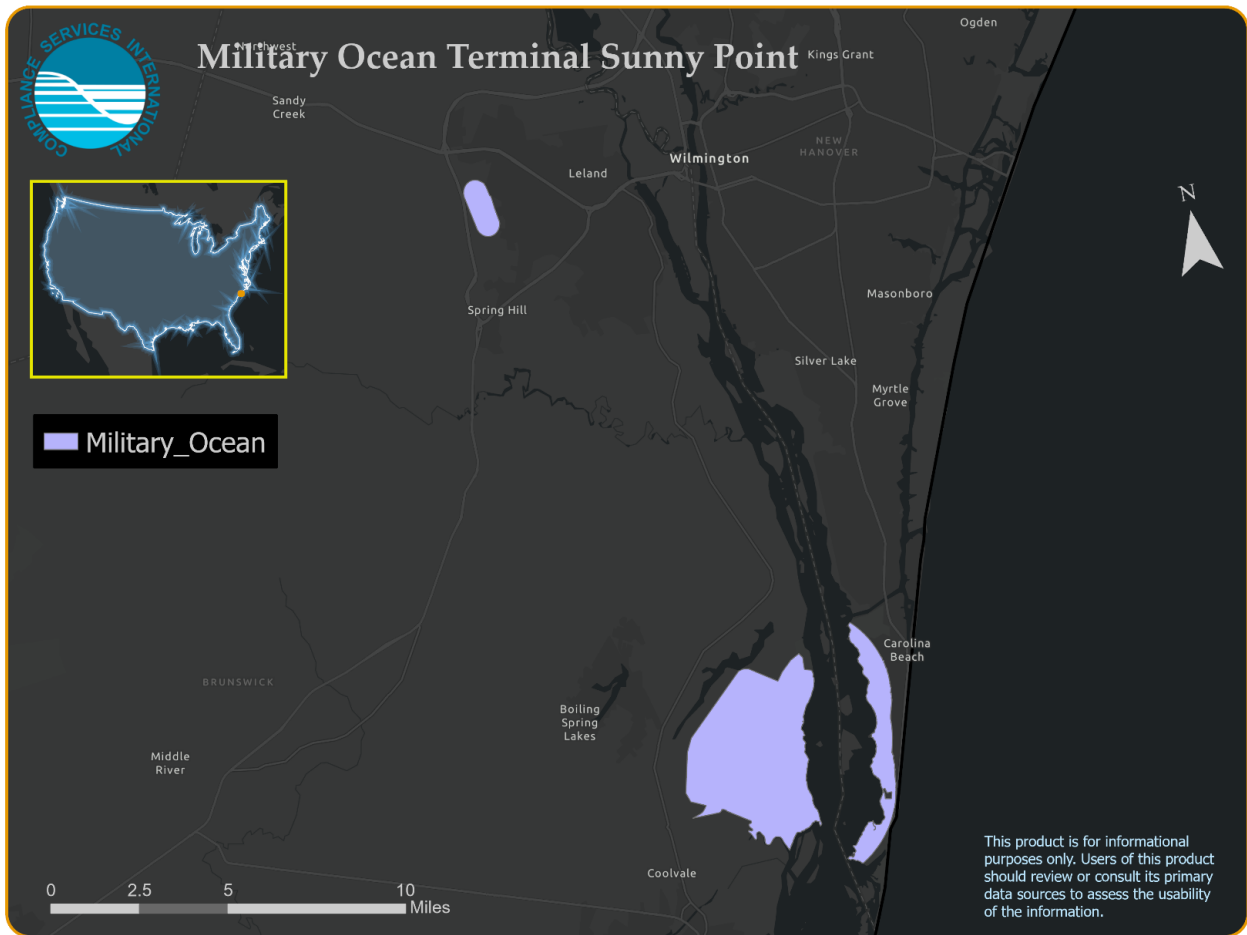


Figure 13. Core map extent for the Military Ocean Terminal Sunny Point.

Fort Jackson

One suitable polygon representing Fort Jackson was identified in the PAD-US dataset. This record had Unit Name = "Fort Jackson," which was isolated and saved to the working geodatabase with a layer name "Fort_Jackson" (Figure 16).

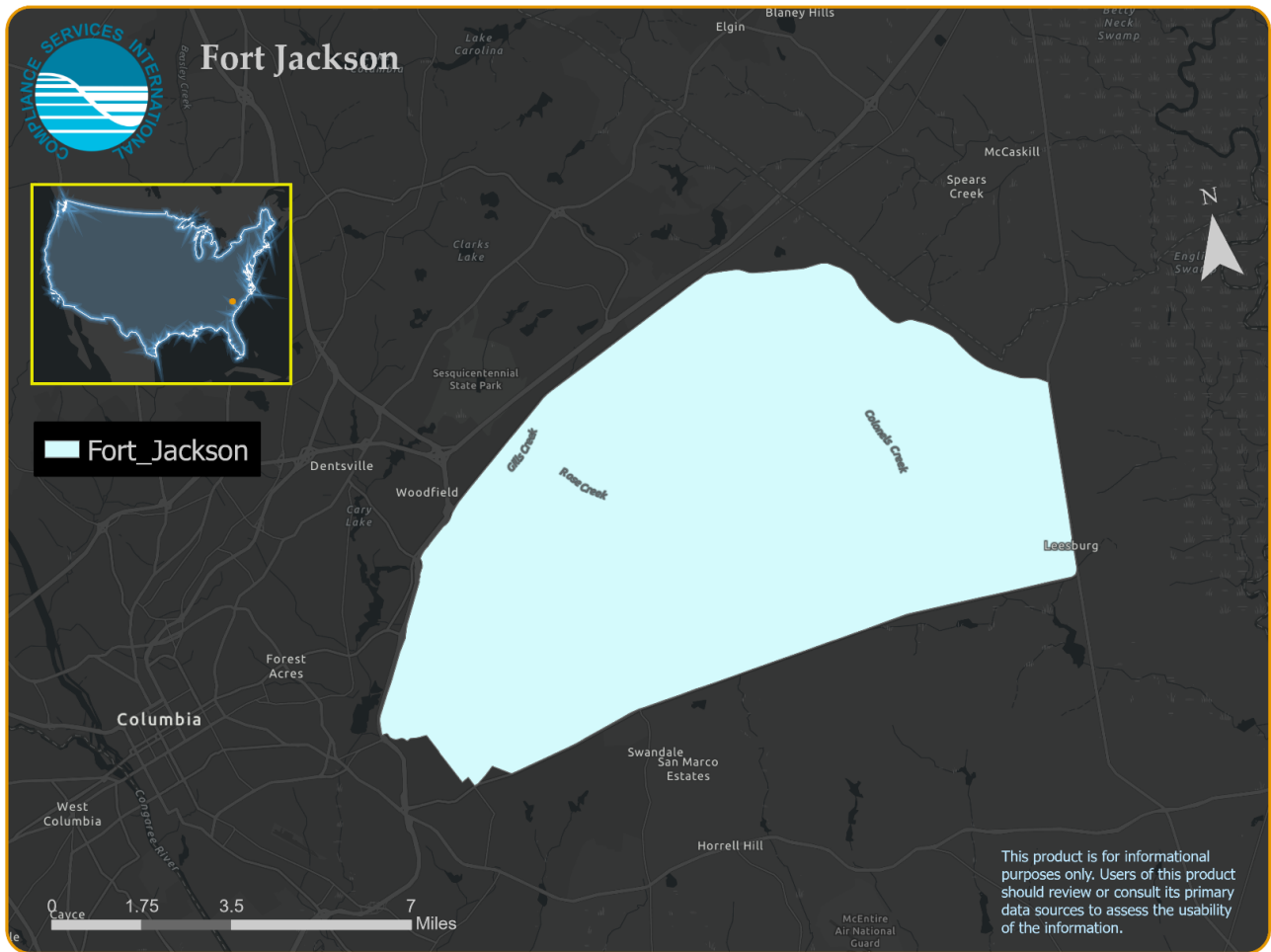


Figure 14. Core map extent for Fort Jackson.

3.2. Combining Extent

The combined extent of the rough-leaved loosestrife was created using the Merge tool on each known location dataset, namely:

- Bladen Lakes Area: “Bladen_Lakes_rec_r2p_f2p_pd”
- Boiling Springs Lakes: “BS_rec_r2p_f2p_pd”
- Camp Lejeune: “Camp_Lejeune_pd”
- Croatan National Forest: “Croatan_National_Forest”
- Fort Bragg/Camp Mackall: “Fort_Bragg” and “Camp_Mackall”
- Green Swamp Nature Preserve: “Green_Swamp_pd”
- Holly Shelter Game Lands: “HS_rec_r2p_f2p_pd”
- Sandhills Gamelands: “Sandhills_only_pd”
- Military Ocean Terminal Sunny Point: “Military_Ocean”
- Fort Jackson: “Fort_Jackson”

The resulting layer was named “RLL_merge” and saved to the working geodatabase. Finally, this layer was dissolved using the Pairwise Dissolve tool to create a single shape representing the extent of the rough-

leaved loosestrife, named “RLL_extent” (Figure 17).

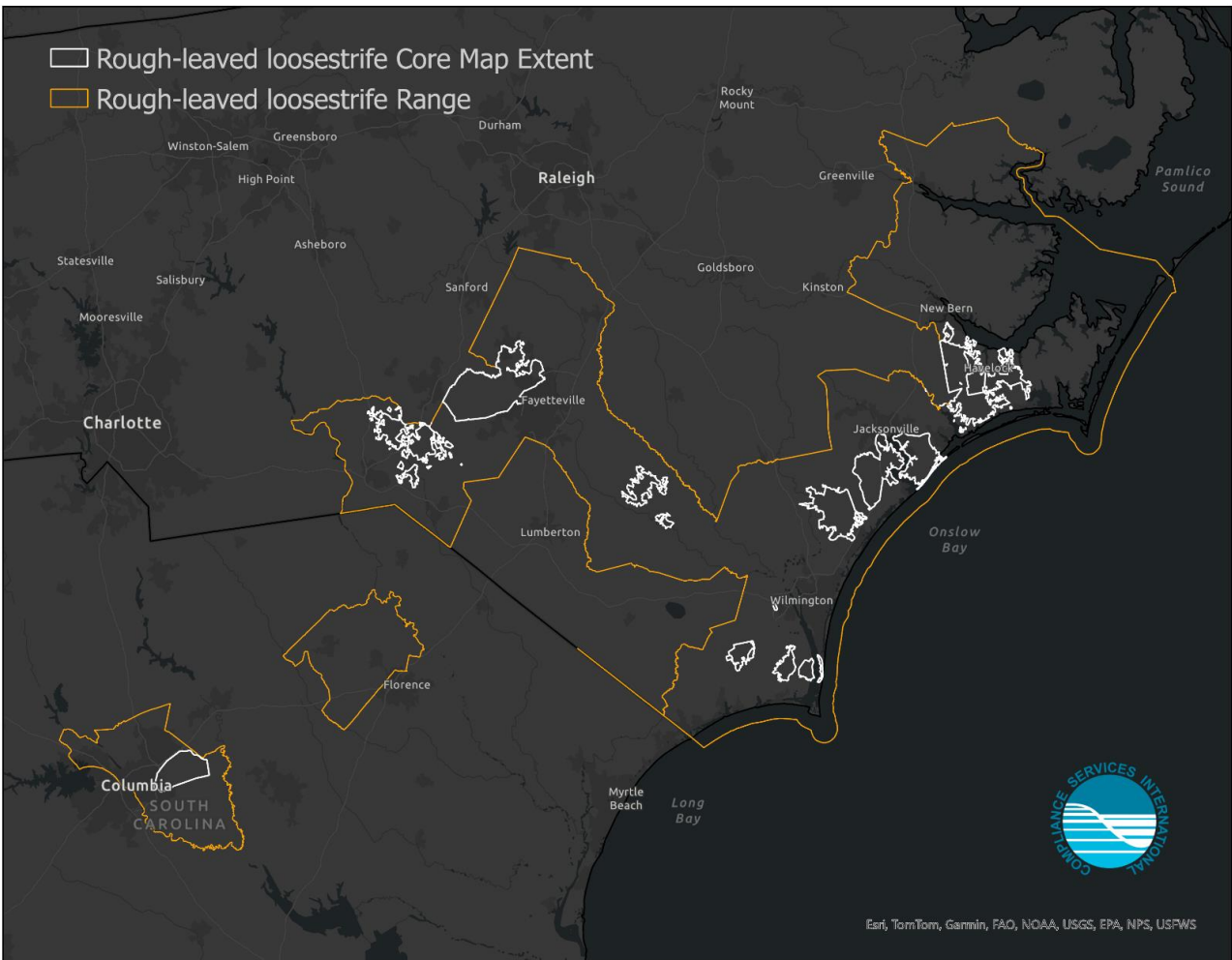


Figure 15. Range and core map extent of the rough-leaved loosestrife.

3.3. Cultivated Lands-based Refinement

The species is not considered to be “on-field.” That is, it is unlikely the species would be found in agricultural fields and its natural habitat—the ecotone between longleaf pine or oak savannas and wetter, shrubby plant communities growing on moist sand or peat (FWS 1995)—does not account for this land use type. To account for off-field species like the rough-leaved loosestrife, EPA developed and published its own cultivated layer for use in core map development as a potential refinement of extent. CSI applied this refinement by using the Pairwise Erase tool on the species extent “RLL_extent” and exporting to a file geodatabase as a finalized core map layer (“RLL_CoreMap”) (Figure 18). This step removed potential agricultural land from the core map area. The resulting core map layer spans 646,489 acres.

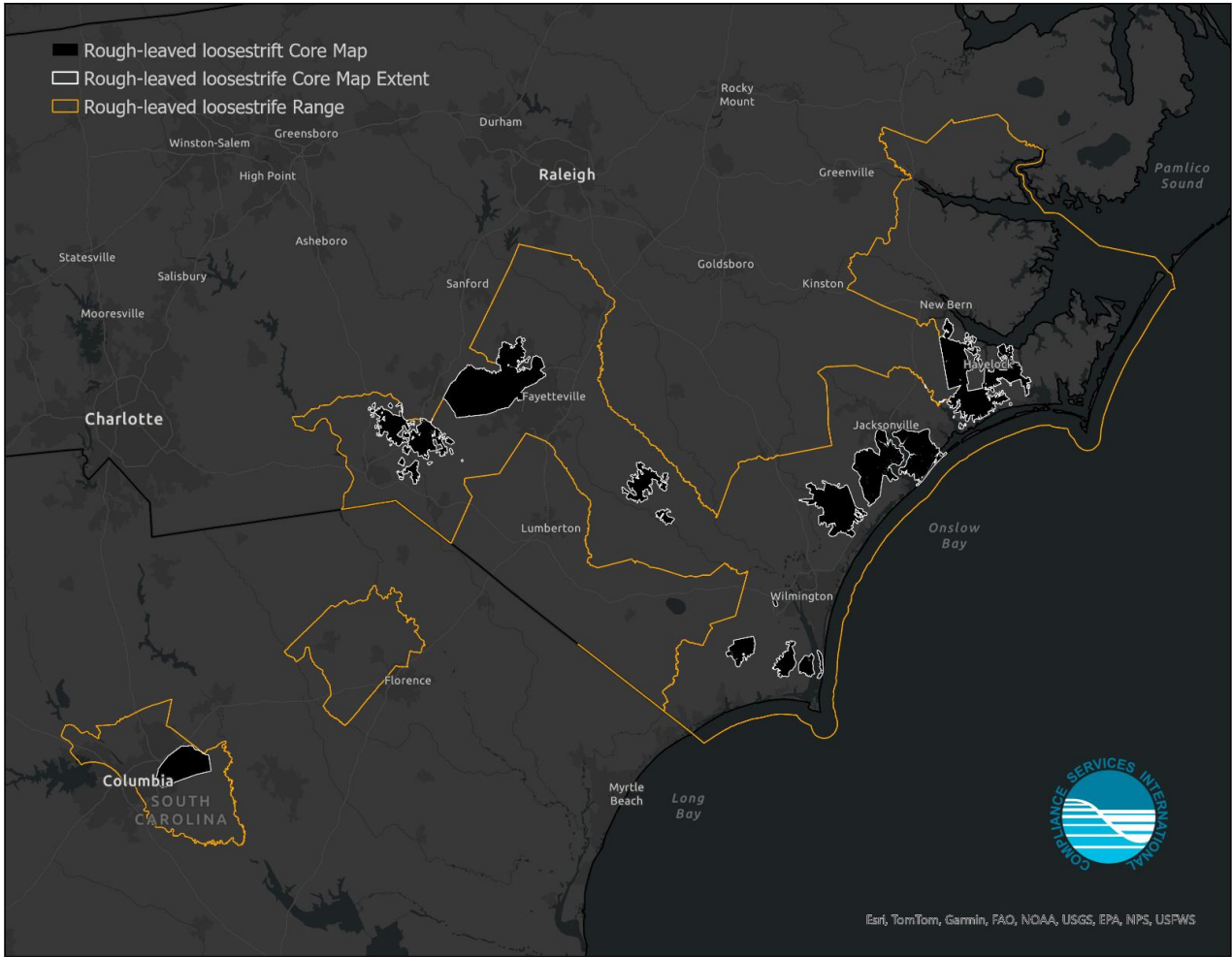


Figure 16. Range, core map extent, and core map of the rough-leaved loosestrife. Core map area: 646,489 acres.

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