

Interim Core Map Documentation for the White Birds-in-a-nest

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Species Summary

The white birds-in-a-nest (*Macbridea alba*; Entity ID 761) is a dicotyledonous threatened plant found in Florida. The U.S. Fish and Wildlife Service (FWS) has not assigned designated critical habitat for the white birds-in-a-nest. This species inhabits herb bog habitats (seepage bogs, deep swampy bogs, ditches, and depressions) embedded in longleaf pine savannas. Additional habitat information is provided in **Appendix 1**.

Description of Core Map

The core map for the white birds-in-a-nest is biological information type, based on known location and habitat information of the species. The most recent 5-Year Review (FWS 2024) includes a map of areas where the species is known to occur. Additional known location information from the iNaturalist, Global Biodiversity Information Facility (GBIF), and NatureServe databases corroborate these general locations but were not otherwise used in core map development.

The core map developed in this document for the white birds-in-a-nest spans 33,514 acres (**Figure 1**). A summary of acreage by National Landcover Database (NLCD 2021) land use type is provided in

Table 1.

Based on the U.S. Environmental Protection Agency's (EPA) "best professional judgment classification" system, CSI has graded this core map as "moderate" (4) because assumptions were made when connecting species life history and/or biological needs (habitat preferences) to a Geographical Information System (GIS) dataset, in this case the LANDFIRE dataset (LANDFIRE 2023). The species inhabits herb bog habitats embedded in longleaf pine savannas; the LANDFIRE Existing Vegetation Type (EVT) layer was queried for one or more of the words "bog," "flatwoods," and "savanna." Further review also added the "East Gulf Coastal Plain Wet Prairie" class. Additionally, some areas of occupancy were represented using a partly manual approach, identifying point locations before applying geoprocessing techniques. More information about this classification system and its definitions can be found in the core map process document (EPA 2024).

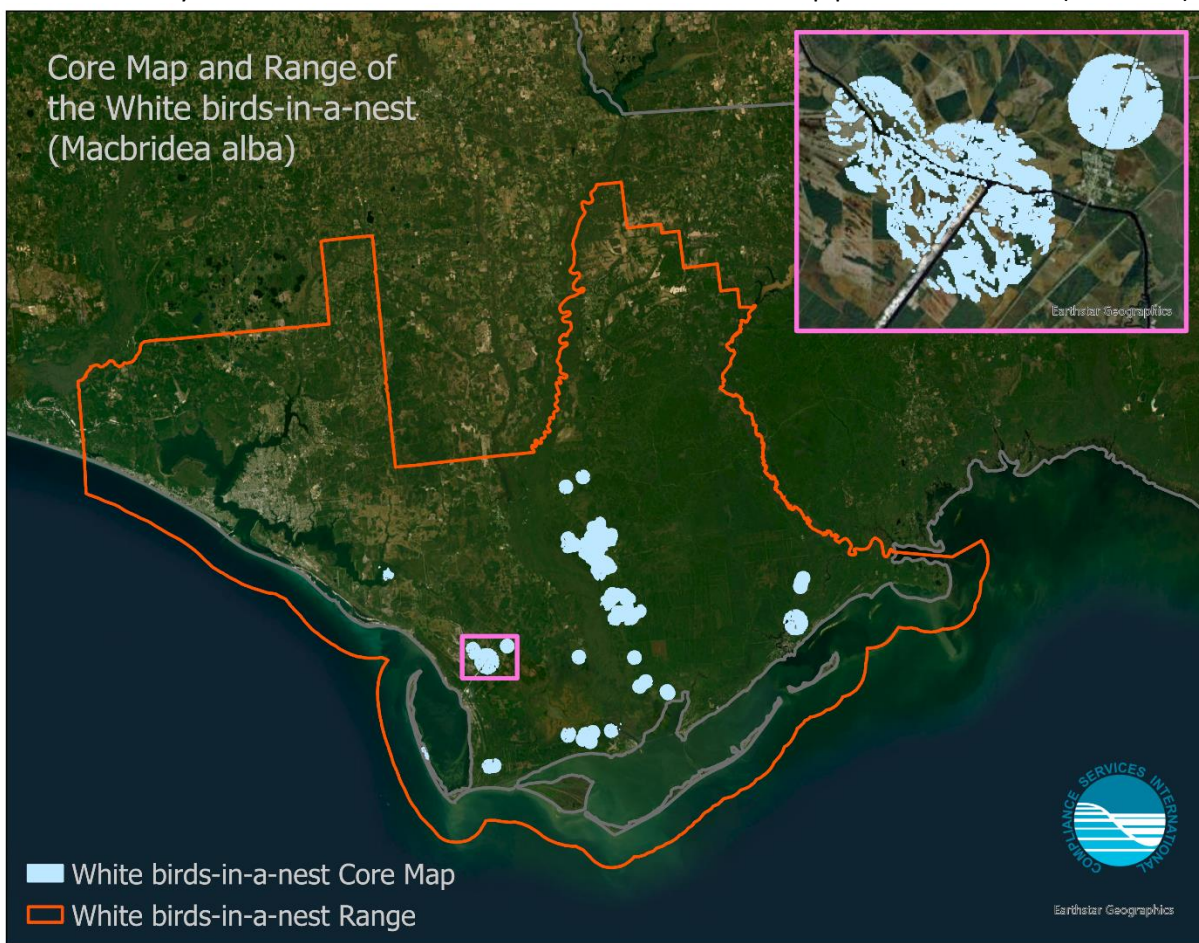


Figure 1. Interim core map for the white birds-in-a-nest (*Macbridea alba*; Entity ID 761). The core map spans 33,514 acres, while the range is 2,341,869 acres.

Table 1. Acres by National Land cover Database (NLCD 2021) class within the core map of the white birds-in-a-nest. Total core map area (based on NLCD pixel count): 33,514 acres¹.

NLCD_Land_Cover_Class	Acres
Woody Wetlands	23,521
Evergreen Forest	7,417
Emergent Herbaceous Wetlands	1,464
Developed, Open Space	395
Herbaceous	347
Shrub/Scrub	232
Developed, Low Intensity	67
Barren Land	28
Open Water	19
Deciduous Forest	12
Developed, Medium Intensity	11
Mixed Forest	1
Developed, High Intensity	-
Hay/Pasture	-

Evaluation of Known Location Information

There were four evaluated datasets with known location information:

- Depictions of locations provided by FWS;
- Occurrence locations in iNaturalist;
- Occurrence locations in GBIF; and
- Occurrence locations in NatureServe.

Compliance Services International evaluated these four datasets before developing the core map. Overall, there were 150 usable research-grade observations found in iNaturalist². The GBIF dataset comprised 142 georeferenced observations, 102 of which were considered usable based on the criteria described below. Both datasets were useful to identify extant population sites for the white birds-in-a-nest, but did not represent significant improvements in capturing or supplementing areas missing from FWS. The iNaturalist and GBIF datasets were somewhat redundant because the iNaturalist observations comprised all the GBIF observations.

The FWS location information provided significant refinement for mapping. These areas were converted into usable spatial data to form the extent of the core map. Further refinements to this extent were made based on the biological information/habitat needs of the species.

¹ By happenstance, this acreage is the same as the core map acreage (33,514), despite the pixelation of NLCD land cover. The core map is not developed exclusively from raster data.

² According to iNaturalist, an observation is designated as “research grade” if it 1) is verifiable with date, coordinates, photos/sounds, and not captive; 2) achieves community agreement defined as “more than 2/3 of identifiers needs to agree on the species level ID or lower;” and 3) “must pass a data quality assessment, which includes checks for accurate date and location, evidence of a wild organism, and clear evidence of the organism itself” (<https://help.inaturalist.org/en/support/solutions/articles/151000169936-what-is-the-data-quality-assessment-and-how-do-observations-qualify-to-become-research-grade->).

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

Approach Used to Create Core Map

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

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

For step 1, CSI compiled available information for the white birds-in-a-nest from FWS, as well as observation information available from various publicly available sources including iNaturalist, GBIF, and NatureServe. The information compiled for the white birds-in-a-nest is included in **Appendix 1**. Influential information that impacted the development of the core map includes a description of the species habitat from the Recovery Plan:

- Locations described in FWS documents and descriptions of its habitats. '*Macbridea alba* occurs in herb bog habitats embedded in longleaf pine savannas. Specifically, it is found between a lower elevation habitat dominated by pond cypress (*Taxodium ascendens*) overstory and a slightly higher elevation pine flatwoods dominated by an overstory of longleaf pine (*Pinus palustris*). This species inhabits seepage bogs, deep swampy bogs, ditches, and depressions in grassy pine flatwoods and savannas. It survives in open peat or sandy peat in very wet areas, in shallow standing water or sometimes even submerged for several days after a heavy rain' (FWS 1994).

For step 2, CSI used the compiled information including the species range, known locations, and habitat location information to determine the core map type. Compliance Services International compared the known location data to the range and found that known locations from FWS (polygonal mapped areas) were useful refinements of species range, identifying areas of potential occupancy within a vast range.

Review of the available data also suggested that specific landcover types could be included or excluded from the core map. To represent the species' habitat, the LANDFIRE dataset was used to identify habitat classes associated with the species habitat description above; using the "EVT_NAME" field, four unique land cover types were selected from the subset of classes falling within the core map extent: East Gulf Coastal Plain Near-Coast Pine Flatwoods, East Gulf Coastal Plain Near-Coast Pine Wet Flatwoods, East Gulf Coastal Plain Wet Prairie, and East Gulf Coastal Plain Wet Savanna. These land cover types represent the habitat inhabited by the white birds-in-a-nest. Spatial raster classes were converted to polygonal spatial data and clipped to the species extent.

For step 3, CSI used the best-available data sources to generate the core map. Data sources are discussed in UEPA's core map process document. For this interim core map, CSI followed EPA's decision framework to

arrive at a core map type of biological information. Designated critical habitat was quickly eliminated as a core map type because the white birds-in-a-nest does not have designated critical habitat. The range core map type was not selected because the species range is neither refined nor endemic.

Geographical areas known to be inhabited by the white birds-in-a-nest were identified in FWS documentation, which served as the basis for the core map and served as the outer extent for further refinements. The LANDFIRE database was clipped to this extent and reclassified to create a layer representing potential habitat for the white birds-in-a-nest; this reclassified layer was converted to a polygon layer as a usable core map. **Appendix 2** provides more details on the GIS analysis and data used to generate the core map.

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

National Wetlands Inventory (NWI)

CSI selected LANDFIRE over the National Wetlands Inventory (NWI) to represent habitat areas for a species living in bogs, flatwoods, and savannah. Since this species can be found in savannahs and flatwoods in addition to bogs, it made more sense to use a single dataset, LANDFIRE, to capture the greater diversity of landscapes it inhabits. LANDFIRE's comprehensive and detailed vegetation data provide extensive information on land cover, vegetation types, and ecological systems, which help to more accurately infer habitat types and suitability for various species. This approach also avoids the complexity of combining LANDFIRE and NWI datasets, offering a more holistic and streamlined representation of the species' habitat requirements.

Appendix 1. Information compiled for white birds-in-a-nest

1. Recent FWS documents

- 5-Year Review (2009): https://ecosphere-documents-production-public.s3.amazonaws.com/sams/public_docs/species_nonpublish/1318.pdf.
- 5-Year Review (2020): https://ecosphere-documents-production-public.s3.amazonaws.com/sams/public_docs/species_nonpublish/3070.pdf.
- 5-Year Review (2024): https://ecosphere-documents-production-public.s3.amazonaws.com/sams/public_docs/species_nonpublish/20472.pdf.
- Recovery Plan (1994): https://ecos.fws.gov/docs/recovery_plan/940622.pdf.

2. Background information

- Status: Federally listed as threatened in 1992.
- Resiliency, redundancy, and representation were not evaluated for this species.
- Habitat, Life History, and Ecology
 - Habitat: 'In general, plants are found in mesic pine flatwoods, wet savannas, seepage slopes, and ecotones between pine flatwoods and titi-swamps (Schulze et al. 2002). There are several locations within the ANF where small populations are growing on, or along, sandhill ecotones. The wettest sites occupied by these plants are grassy seepage bogs on gentle slopes at the edge of forested or shrubby wetlands. White birds-in-a-nest also occurs in drier sites with longleaf pine and runner oaks (FWS 1992), as well as along associated roadsides. The Gulf coastal lowlands near the entrance of the Apalachicola River in the Florida Panhandle provide the grassy habitat on poorly drained, infertile soils that is required by *M. alba*' (FWS 2009).
 - '*Macbridea alba* is a hermaphroditic species capable of both sexual and vegetative (via rhizomes) reproduction (Godt et al. 2004). This species is capable of both outcrossing and selfing. However, selfed seeds exhibit inbreeding depression (Godt et al. 2004). Pitts-Singer et al. (2002) studied the pollinator-plant relationship at two sites located on the ANF. Twenty inflorescences were observed for 34 hours over five days. The authors observed 70 visits of nine insect and spider species. Since only bumble bees (*Bombus* spp.) were large enough to make contact with the reproductive structures of the flowers, the authors concluded that bumble bees are the potential pollinators of *M. alba*. Thus, bumble bees are probably critical to the long-term persistence of *M. alba* because they provide a mechanism for ensuring seed set, and facilitate gene flow between plants and plant populations (Negrón-Ortiz, pers. interpretation)' (FWS 2009).
 - Pollinators: 'Since only bumble bees (*Bombus* spp.) were large enough to make contact with the reproductive structures of the flowers, the authors concluded that bumble bees are the potential pollinators of *M. alba*' (FWS 2020).
- Taxonomy
 - 'The genus *Macbridea*, which belongs to the mint family (Lamiaceae or Labiatae), consists of only two species (Kral 1983, Godfrey and Wooten 1981). *Macbridea alba* Chapman was first collected about 1860 by A. W. Chapman and a friend named Gausman (Roger Sanders, then a graduate student at University of Texas, currently at Bot. Res. Inst. of Texas, in litt. 1977), and it was named by Chapman (1860). *Macbridea alba* is an upright, usually single-

stemmed, odorless perennial herb with fleshy rhizomes. It is about 30-40 cm (1 ft) tall with opposite leaves up to 10 cm (4 in) long, 1-2 cm (0.5-1 in) broad, with winged petioles. Except for one site, all the plants at a site are either smooth or hairy (L. Anderson, Florida State University, pers. comm. 1990; Anderson in FNAI 1989). The flowers are clustered at the top of the plant in a short spike with bracts. Each flower has a green calyx about 1 cm (0.5 in) long and a brilliant white corolla 3 cm (1 in) long. The corolla is two-lipped, the upper lip hoodlike. Flowering is from May into July (Kral 1983, Godfrey and Wooten 1981). In flower, *Macbridea alba* is conspicuous and unmistakable. The other species in the genus, *Macbridea caroliniana*, has pink to lavender flowers, inhabits “marshes, bogs, bottomland woodlands” from southeast North Carolina to north Florida and southern Alabama (Godfrey and Wooten 1981, p. 611). It is a candidate for Federal listing’ (FWS 1994).

- Relevant Potential Pesticide Use Sites

- ‘Herbicide. While the Recovery Plan (Service 1994) mentioned that the use of herbicide or the wrong type of herbicide is a threat when it is used to control vegetation on power line rights-of-ways, we no longer consider this a threat to *M. alba* because mowing is now the common practice to maintain transmission rights-of-ways in Florida. As discussed above, herbicide treatments along transportation rights-of-ways are still a threat to the species. Franklin County allows only “spot treatment” due to impacts concerning the Apalachicola National Forest and waters within Apalachicola Bay and River basin’ (FWS 2024).

- Relevant Recovery Criteria and Actions (FWS 2024)

- Delisting Criteria:

The Recovery Plan for four plants of the lower Apalachicola Region, Florida: *Euphorbia telephioides* (telephus spurge), *Macbridea alba* (white birds-in-a-nest), *Pinguicula ionantha* (Godfrey’s butterwort), and *Scutellaria floridana* (Florida skullcap) (Service 1994) includes a recovery objective for delisting the species as well as the criterion. The objectives are to guarantee that the populations in Apalachicola National Forest are secure, and to conserve the species outside the Apalachicola National Forest by protecting habitat through land acquisition, and changes in management practices on government land, rights-of way, and private land. For delisting the species, the goal is to adequately protect and manage 15 populations distributed throughout the species’ historical range for 10 years. The plan states that these goals are by necessity only preliminary, and they will be refined. The recovery criterion addresses factor 1. Factor 2 was addressed in the recovery plan as a threat, but recovery criteria were not stipulated. Factor 3 is not relevant to *M. alba*. Factors 4 and 5, although relevant to this species, were not addressed by the Recovery Plan.

The Service believes these criteria are appropriate and relevant; however, no criteria have currently been met.

- Recommendations for Future Actions

1. Censuses are critical for Element Occurrences found without plants. For those EOs, a comprehensive census (e.g., the total number of individuals, number of flowering vs. non-flowering plants, and whether seedling recruitment is occurring) needs to

- be completed across the current distribution to determine abundance, threats, and habitat suitability. A consistent and repeatable method should be employed.
2. Reintroduction. A reintroduction approach should be designed and executed with the assistance of the Service botanist for those sites where the habitat is present and still suitable. An annual monitoring is required to examine plant survival and reintroduction success. For consideration:
 - Tate's Hell State Forest, Franklin Co.
 - Florida Native Areas Inventory Element Occurrences # 57 & 58. No plants have been observed since 2008.
 - Florida Native Areas Inventory Element Occurrence #11 along east side of CR 67, Tate's Hell State Forest, Franklin Co. was fragmented due to rights-of-way herbicide spraying and culvert reinstallation.
 3. Conduct surveys/inventories on potentially new sites (targeting recently burned sites).
 4. Establish (or continue) frequent growing-season fire regimes to maintain optimal conditions of populations. Re-visit sites shortly after a burn event and count individuals.
- Monitoring and Research Activities
1. Monitoring
 - Implement monitoring for selected populations outside of Apalachicola National Forest in Bay, Gulf, and Franklin counties. The ABG is monitoring several documented sites in Gulf and Franklin counties (Cooperative Agreement No. # F21AC02540-00). However, it is recommended to set up more subplots and monitor abundance and survival of both flowering and nonflowering individuals over time, whether seedling recruitment is occurring, and the effect of mechanical site preparation and hurricane disturbances.
 - Continue the long-term monitoring in Apalachicola National Forest sites (FNAI 2024).
 - As sea levels rise, seawater intrusion increases in duration, frequency, and spatial extent. To assess the effect of salinity on *M. alba*, sites where intrusion of salt water occurs (or will occur) should be considered for long-term monitoring.
 2. Manage Rights-of-Ways. Continue fostering conservation practices for utility and transportation rights-of-ways with the Forest Service, Talquin Electric, the Department of Transportation, and the Service and document commitment to these conservation practices in land management plans or agreements.
 3. *Ex-situ* seed studies. Since there is a possibility that seeds in long-term storage are unlikely to remain viable, examining their viability is recommended using multiple methods.

3. Range

- Size: 2,341,869 acres
- Historical Range
 - See current range.
- Current Range (FWS 2024)
 - '*Macbridea alba* is endemic to the Florida Panhandle, and occurs in Bay, Gulf, Franklin, and Liberty counties (Fig. 1). In those counties, plants are found in mesic pine flatwoods, wet savannas, seepage slopes, and ecotones between pine flatwoods and titi-swamps (Schulze et. al 2002). Consistently, it has been observed in longleaf pine savannas and in transitional habitats with associative species including wiregrass (*Astrida stricta*), saw palmetto (*Serenoa repens*), meadow beauties (*Rhexia* spp.), and toothache grass (*Ctenium aromaticum*) (FWS 2020).'
 - Between 2021 and 2024 several *M. alba* surveys and stem counts were conducted by Florida Native Plant Inventory (FNAI 2024), Florida Department of Agriculture and Consumer Services (FDAC 2024) and Atlanta Botanical Garden (ABG 2024) (**Table 1**). A summary is presented here:
 - *Bay County, Lathrop Bayou Tract (LB):*
 - 2023: 1,155 stems
 - 2024: 2,172 stems in 2024 (**Table 1**). The increase seen from 2023 to 2024 likely because of a prescribed burn in 2024.
 - *Gulf County:*
 - 2023: 124 vegetative and 78 reproductive individuals in St. Joseph Bay State Buffer Preserve.
 - 2023: new population was documented in T.H. Stone Memorial St. Joseph Peninsula State Park (Gulf Co., Fig. 1) with 19 vegetative plants.
 - *Liberty & Franklin Counties, Apalachicola National Forest:*
 - 2023: 2,246 stems
 - 2024: 2,811 stems (increase of 565 stems from 2023; FNAI 2024 and H. RosnerKatz, pers. comm. 2024).
 - *Franklin County:*
 - Tate's Hell State Forest 2024: Of the three occurrences, no plants were found in two (FDAC 2024). Counts since 2008 in these two occurrences have shown similar results. Two of the larger populations on the east side of CR 69 were destroyed by rights-of-way herbicide application and a culvert reinstallation / improvement.
 - Box-R Wildlife Management Area populations between 2022 and 2023: around 440 reproductive individuals in 4 populations (ABG 2024).
 - Box-R Wildlife Management Area 2024 partial counts show fewer reproductive individuals for two populations (ABG 2024).'

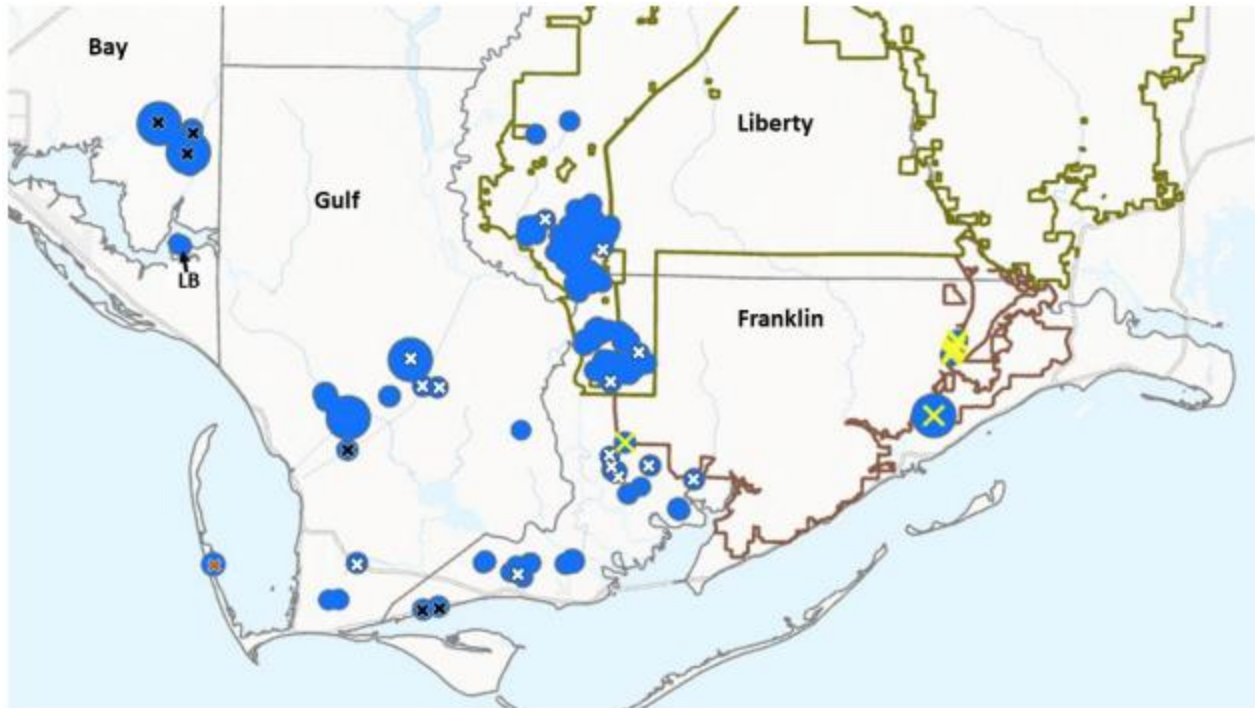


Figure 2. Map showing *Macbridea alba* (white birds-in-a-nest) historical geographical range, calculated range extent is about 2,281.357 km². Blue: buffer zone analysis of adjacent source features determined by 1km distance; represents where the species is present according to surveys, unless specified by symbols. White: Element Occurrences (EOs) without/absent of plants; yellow: EOs potentially extirpated / fragmented with some habitat present; black: EOs and habitat completely extirpated; and brown: new population, T.H. Stone Memorial St. Joseph Peninsula State Park (THMSP); LB: Lathrop Bayou. Brown border: Tate's Hell State Forest, Franklin Co; Green border: Apalachicola National Forest, Liberty County. Copied from Figure 1 of the most recent 5-Year Review (FWS 2024).

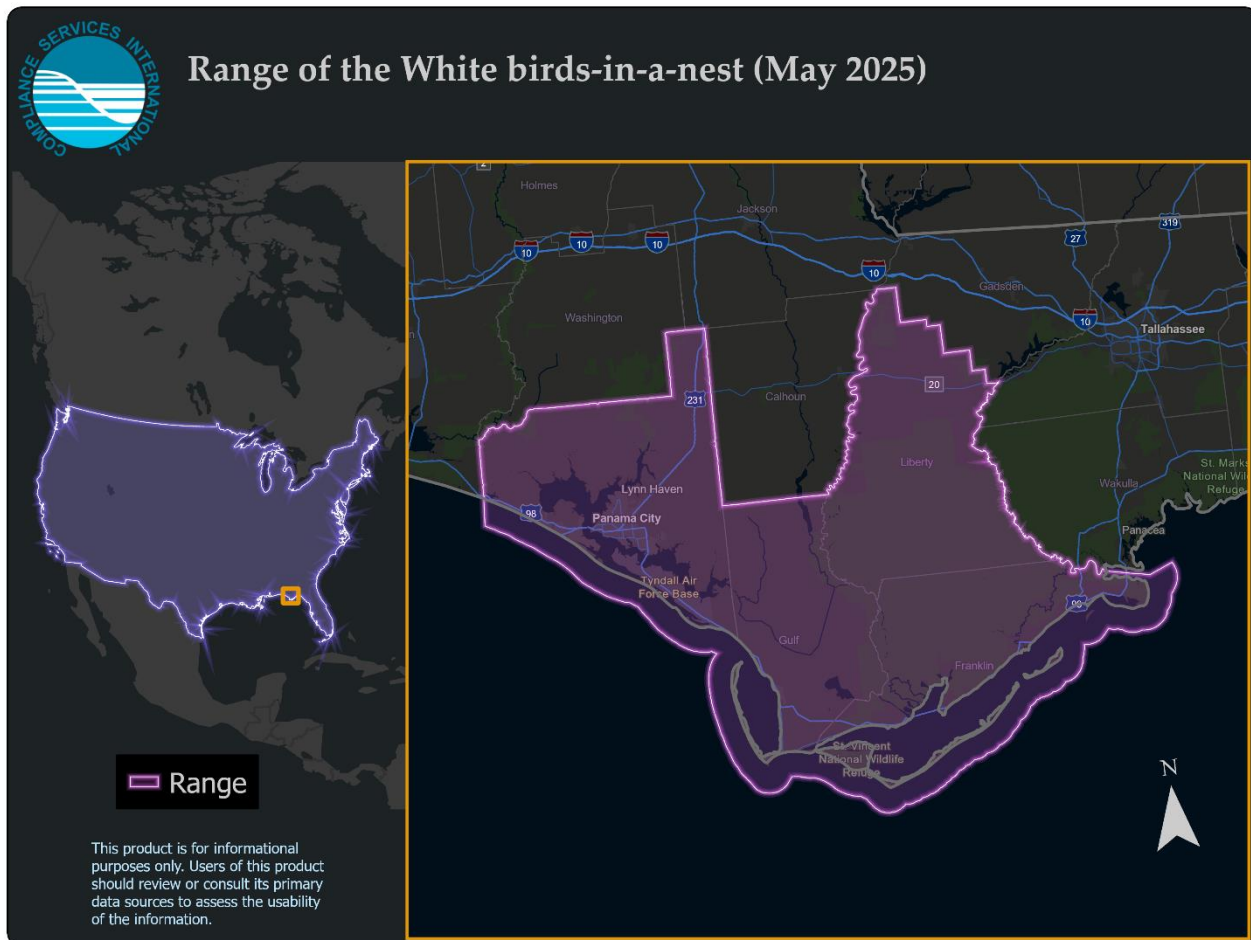


Figure 3. Range of the white birds-in-a-nest (FWS 2025).

4. Description of Critical Habitat

This species does not have a designated critical habitat.

5. Known Locations

- FWS (2024)
 - ‘Protected Occurrences. There are currently 25 protected occurrences (H. Rosner-Katz, pers. comm. 2024), and about 13 occurrences with good viability (NatureServe 2024). Ten of the 25 protected occurrences are found in the Apalachicola National Forest (Fig. 1), and 15 occurrences have been protected outside the National Forest.’
 - *Macbridea alba* is almost continuously spread throughout large sections of the ANF, Liberty Co. (Figure 2).
 - Currently, there are six extirpated EOs in Bay, Gulf, & Franklin counties (Table 1, Fig. 1). Of the 35 EOs remaining, plants were not observed (during the most recent surveys) for 13 EOs (

- **Table 2, Figure 2).**

Table 2. Estimated *Macbridea alba* occurrences and stems per county and years. Apalachicola National Forest (ANF), Box-R Wildlife Management Area (Box-R), Lathrop Bayou (LB), St. Joseph Bay State Buffer Preserve (SJSBP), T.H. Stone Memorial St. Joseph Peninsula State Park (THMSP). Copied from Table 1 of the most recent 5-Year Review (FWS 2024).

County	1963-2008 #occurrences (stems)	2010-2020 #occurrences (stems)	2021-2024 (stems)	#occurrences A: Absence E: Extirpated
Bay	3 (26-41)	3 (LB: 168)	LB (2,174)	3E
Gulf	10 (956-1,176)	2 (66)	THMSP & SJSBP (221)	4A; 1E
Franklin	16 (1,335 to 1,784)	11 (2,062 to 2,122)	Box-R & THSF (471)	8A; 2E
Liberty	3 (5,429 to 5,970+)	4 (5,390 to 7,110+)	ANF (2,811)	2A
Total	32 (7,746 to 8,971)	20 (7,686 to 9,466)	(5,677)	6E; 13A

- GBIF: <https://www.gbif.org/species/5341489>
 - GBIF includes 236 occurrence records; 62 of which are georeferenced. Thirty-five of these had usable coordinate data based on these criteria:
 - U.S. only (excludes Canada)
 - Latitude and longitude precision were both 3+ decimal places.
 - Coordinate uncertainty values no greater than 30 km.
 - Relative recency (2010-present)
 - Must include date information.
 - No “preserved specimen” observations; only “human observation.”
 - The 35 usable coordinates were mapped against the species range to evaluate their utility in representing species extent (**Figure 5**). It was observed that all the usable GBIF coordinates are originally sourced from iNaturalist, which also had more records. Therefore, the GBIF dataset was not used for core map development.

62 GEOREFERENCED RECORDS



Figure 4. GBIF occurrences for the white birds-in-a-nest (GBIF 2025).

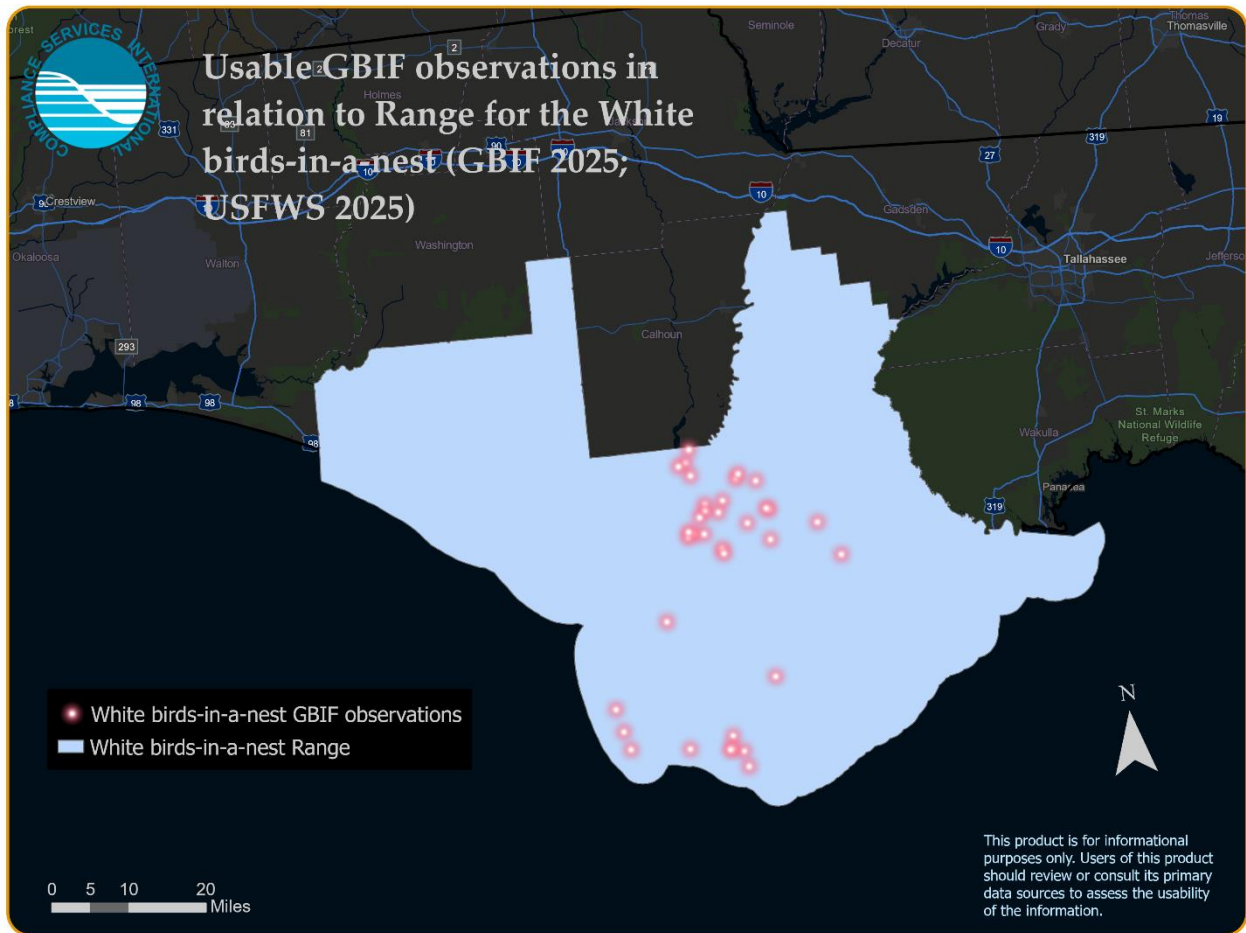


Figure 5. Usable GBIF occurrences (pink) in relation to the range of the white birds-in-a-nest (GBIF 2025; FWS 2025).

- iNaturalist: https://www.inaturalist.org/observations?taxon_id=165028
 - iNaturalist includes 56 total observations (**Figure 6**), 43 of which are research-grade with usable coordinate data based on these criteria:
 - U.S. only (excludes Canada)
 - Latitude and longitude precision were both 3+ decimal places.
 - Relative recency (2010-present)
 - Observation description did not include the text “intentionally incorrect.”
 - Public positional accuracy value no greater than 30 km
 - This resulted in the exclusion of four records.
 - The PPA value represents the positional uncertainty of the coordinate. This value was used as the buffer distance for iNaturalist points, to ensure that the actual position of the observation is captured.
 - Locations are consistent with GBIF, which is expected because all the GBIF observations are imported from iNaturalist. There are eight observations in inland areas within the range that are not represented by the GBIF dataset (**Figure 7**).
 - There are no iNaturalist locations outside of the range of the white birds-in-a-nest.
 - The iNaturalist data do not significantly improve upon or supplement the known location areas provided by FWS in the most recent 5-Year Review for the species (FWS 2024). However, these data may provide insight into where the species is more commonly found

and are a useful validation of other known location information used.

Observations

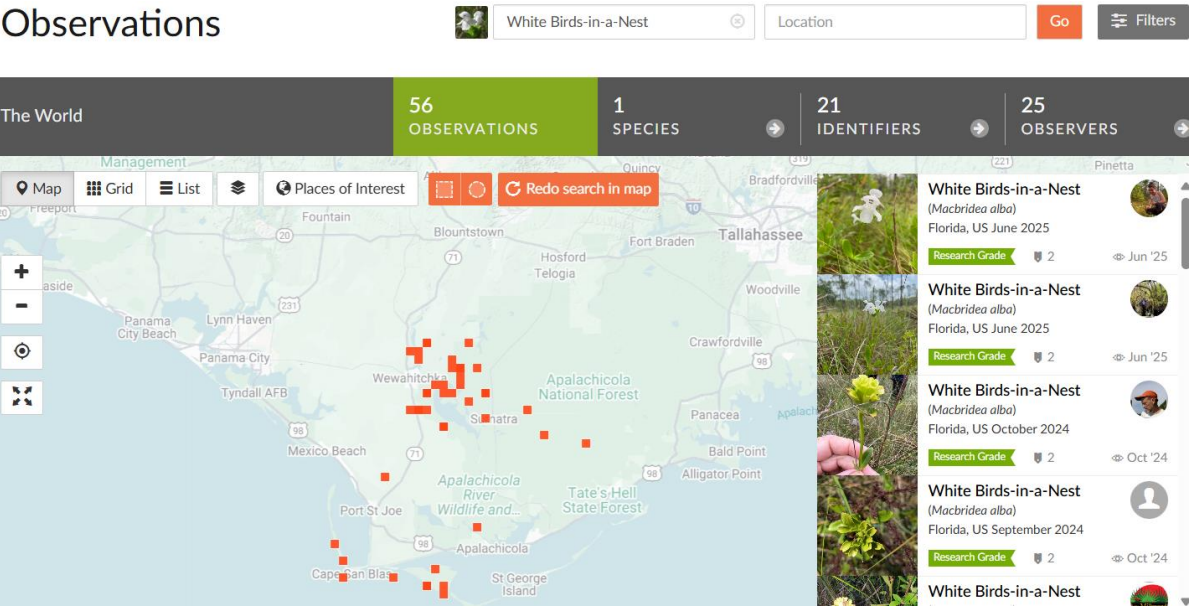


Figure 6. iNaturalist occurrences for the white birds-in-a-nest.

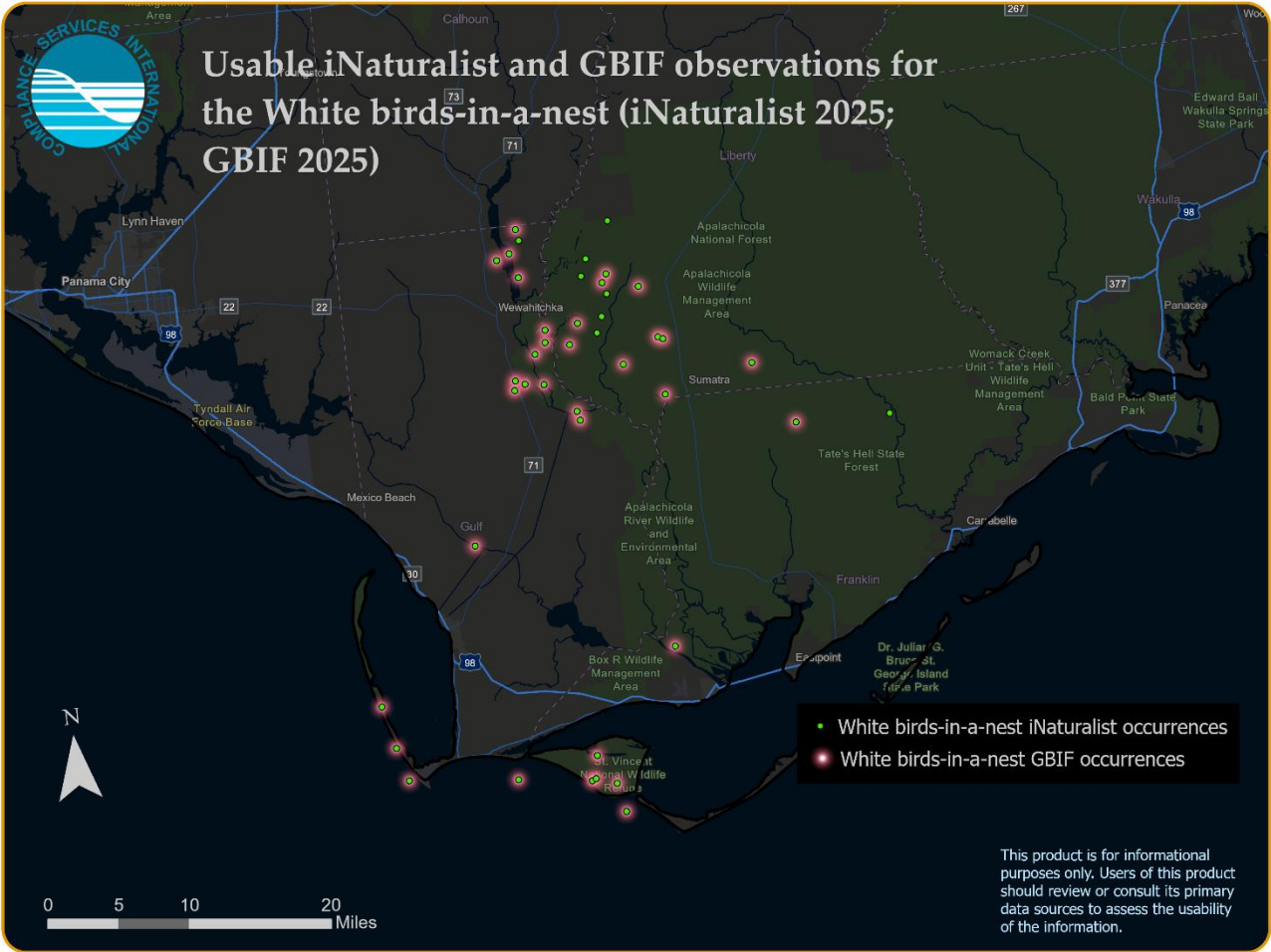


Figure 7. Usable iNaturalist and GBIF observations for the white birds-in-a-nest (iNaturalist 2025; GBIF 2025).

- NatureServe Explorer: <https://explorer.natureserve.org/>
 - Available public occurrence information from NatureServe Explorer aligns with the information from iNaturalist and GBIF.
 - EOs were used for comparison purposes with known location data from FWS to develop the core map; however, they did not provide a meaningful refinement from range (or supplement to it) and so were not used in core map development.

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

The core map for this species is based on biological information, which includes the habitat used by this species found within a spatial extent based on the known location information for extant populations of white birds-in-a-nest. The core map identifies all areas within the extent (described below) matching the species habitat description from **Appendix 1**. Professional judgment was used to match Existing Vegetation Type (EVT) classes in the LANDFIRE dataset as described below (LANDFIRE 2023). LANDFIRE is regarded as a high quality national-level dataset that is appropriate to identify vegetation types and ecosystems that are suitable habitat for plant species such as the white birds-in-a-nest.

1. References and Software

- LANDFIRE (2023): <https://landfire.gov/data/FullExtentDownloads>.
- Software used: ArcGIS Pro version 3.2.
- FWS 5-Year Review (2024): https://ecosphere-documents-production-public.s3.amazonaws.com/sams/public_docs/species_nonpublish/20472.pdf.
- FWS Species Range: <https://ecos.fws.gov/ecp/species/6291>.

2. Datasets Used in Core Map Development

2.1. Range

The range for this species was last updated by FWS on Feb. 17, 2022. A shapefile including species range for all listed species was downloaded from the FWS ECOS website on May 5, 2025. The shapefile was converted to a feature class stored in a file geodatabase and reprojected to WKID #102008 ("North America Albers Equal Area Conic").

1. Using an ArcGIS Web Map the species was queried based on the ECOS listed "Entity ID" of 761 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 known location information areas from FWS in its 5-year review (FWS 2024). The range was used to establish the outer boundary ("extent") of the core map, but did not factor into geoprocessing steps because the core map extent was entirely contained within the range.

2.2. FWS 5-Year Review

The most recent 5-Year Review includes the most up-to-date information about extant population locations of the white birds-in-a-nest (FWS 2024). These sites are catalogued in the document's **Figure 1** (**Figure 2** Error! Reference source not found. of this document), which additionally includes information about protected areas nearby. A spatial layer of these locations was created by CSI and incorporated into the development of the core map extent using the procedure detailed in Section 3.

Some of the known locations in **Figure 2** are identified as "without/absent of plants" or "EOs and habitat completely extirpated." These polygons were judged to not be reliable areas of species presence and were therefore excluded from core map development.

2.3. LANDFIRE

Once the species extent was established using the most recent 5-Year Review document, the LANDFIRE 2023 database was used to identify areas within the extent corresponding to the habitat of the white birds-in-a-nest. The EVT layer was clipped to the core map extent and professional judgment was used to identify land cover types associated with the species' habitat. Land cover selections for the white birds-in-a-nest are listed in Table 3.

Table 3. LANDFIRE EVT classes associated with the habitat of the white birds-in-a-nest within its extent (LANDFIRE 2023).

EVT_NAME
East Gulf Coastal Plain Near-CoastPine Flatwoods
East Gulf Coastal Plain Near-CoastPine Wet Flatwoods
East Gulf Coastal Plain Wet Prairie
East Gulf Coastal Plain Wet Savanna

The "Value" field associated with these land cover classes was used during the reclassification process stage in Step 2 of the "Refinement based on Biological Information" procedure given in Section 3.2.

3. Creating the Core Map

3.1. Defining Extent

The core map extent for the white birds-in-a-nest was developed using known location information from FWS, using georeferencing and other techniques. During spatial data development, it was observed that the smaller shapes, circles or roughly circular shapes, can be well-approximated by estimating their center and applying a radius of 1000 m to create a circle overlapping the underlying feature. CSI additionally thought it appropriate to implement an additional 200 m to this distance (1,200 m in total) to account for uncertainty associated with manual steps taken, and display resolution. The resulting distance conservatively captures the areas represented by these roughly circular shapes.

There are some areas where the species locations are too concentrated to confidently identify the centers of circles within. For these areas, the core map extent was initially developed using raster-based tools before being converted into polygonal features. The same "additional" 200 m distance was added to these areas as a buffer, to account for uncertainty in the data development process. Finally, the layers representing roughly circular and non-circular shapes were merged into one shape as described below.

1. Save an image of **Figure 1** of the most recent 5-Year Review (FWS 2024; Error! Reference source not found. of this document) to a workspace ("WBIAN.png").
2. Use the Raster To Geodatabase tool to import the saved image ("WBIAN.png") into a file geodatabase, saved as "WBIAN".
3. In a georeferencing session, fit the previous image ("WBIAN") 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. Save edits.

Core Map extent for roughly circular areas

4. Create an empty points feature class ("WBIAN_pts") and navigate to Edit/Create to create new

points features. Use the Point tool to manually create points centered as precisely as possible on the centers of the circles identifying extant populations in the georeferenced layer. Save edits.

- Note: some features in the source image are not recognizable as circular or roughly circular shapes. These areas are captured differently, as described in Steps 6-11.
5. Use the Pairwise Buffer tool to buffer the points from the previous layer ("WBIAN_pts") by 1,200 m and save as a new feature class, "WBIAN_pts_pb1200m".

Core Map extent for roughly non-circular areas

6. Use the Reclassify tool to reclassify the previous layer ("WBIAN_pts") to isolate areas associated with the known locations of the white birds-in-a-nest. Values of 0-10 were assigned a new value of 1, while all other values were assigned as "NODATA". Save as a new raster layer, "WBIAN_rec".
7. Use the Raster To Polygon tool to convert the raster from the previous step ("WBIAN_rec") into a polygonal layer, "WBIAN_rec_r2p".
8. Use the Select tool to manually select features from the previous layer ("WBIAN_rec_r2p") that represent known location areas of the white birds-in-a-nest that were not captured by buffered points layer in Step 5. Save as a new layer, "WBIAN_rec_r2p_sel".
9. Use the Pairwise Buffer tool to buffer the previous layer (WBIAN_rec_r2p_sel") by 200 m to account for uncertainty in earlier stages of data development. Save as "WBIAN_rec_r2p_sel_pb200m".
10. Use the Feature To Polygon tool to fill "holes" in the geometries of the shapes in the previous layer ("WBIAN_rec_r2p_sel_pb200m"), and save as a new layer, "WBIAN_rec_r2p_sel_pb200m_f2p".

Combining circular and non-circular areas of species presence

11. Use the Merge tool to merge layers representing roughly circular ("WBIAN_pts_pb1200m") and non-circular ("WBIAN_rec_r2p_sel_pb200m_f2p") areas of species presence and save as "WBIAN_extent".
12. Use the Pairwise Dissolve tool to dissolve features from the previous layer ("WBIAN_extent") into a layer with a single feature, saved as "WBIAN_extent_pd".

3.2. Refinement based on Biological Information

The total extent of the white birds-in-a-nest core map, which comprises known locations, all of which are within species range, includes a significant area and number of different land cover types that do not align with descriptions of the white birds-in-a-nest habitat. To improve confidence in the core map, a refinement based on biological information was applied to the core map extent.

The best-available dataset for suitable species habitat was found to be the LANDFIRE dataset. This spatial layer was used as a refinement of the core map area as follows:

1. Load the LANDFIRE Existing Vegetation Type ("LF2023_EVT_240_CONUS") layer into a GIS.
2. Use the Clip Raster tool to clip the "LF2023_EVT_240_CONUS" layer by the species extent ("WBIAN_extent_pd"). Examine the "EVT_NAME" field to identify land cover types associated with habitat descriptions of the white birds-in-a-nest. Positive identifications are given in **Table 3**. Save as a new Layer "LF_crExtent". Choose to output this layer in the preferred projection, WKID #102008.
3. Use the Reclassify tool to reclassify the previous layer ("LF_crExtent") to identify areas of white birds-in-a-nest habitat. Assign a value of "1" for acceptable land cover types, and "NODATA" for all others. Save as a new layer, "LF_crExtent_rec".

4. Use the Raster to Polygon tool to convert the previous layer ("LF_crExtent_rec") into a polygonal spatial layer, saved as "LF_crExtent_rec_r2p".
5. Use the Pairwise Dissolve tool to dissolve the previous layer ("LF_crExtent_rec_r2p") into a feature class with a single shape, saved as "LF_crExtent_rec_r2p_pd".
6. (Optional) Export the previous layer "LF_crExtent_rec_r2p_pd" as a new layer identifiable as the species core map ("WBIAN_CoreMap").

3.3. Cultivated Lands-based Refinement

The white birds-in-a-nest is not expected to be found in agricultural areas, so a refinement to exclude areas of agriculture would have been appropriate. However, it was observed that the output from the last geoprocessing step above ("LF_crExtent_rec_r2p_pd") did not contain any cultivated areas according to NLCD 2021 (

Table 1). Therefore, the step of removing cultivated areas > 25 acres was considered unnecessary and thus was not performed.

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