

Interim Core Map Documentation for Saint Francis' Satyr Butterfly

Date Posted to EPA's GeoPlatform: July 2025

Draft Interim Core Map Developer: US Environmental Protection Agency, Office of Pesticide Programs.

Species Summary

The Saint Francis' satyr butterfly (*Neonympha mitchelii francisci*, Entity ID 455) is an endangered terrestrial invertebrate. The U.S. Fish and Wildlife Service (FWS) has not designated a critical habitat for the Saint Francis' satyr butterfly. St. Francis' satyr butterflies occur in several colonies in open habitats along streams dominated by sedges (*Carex* spp.) and other graminoids. The butterfly's habitats include herbaceous wetlands along small riparian corridors which are typically short-lived in space and time across the landscape. The butterfly has never been detected outside of Fort Bragg, NC.

Description of Core Map

The core map for the Saint Francis' satyr butterfly is based on biological information. The outer extent of this core map is defined by the perimeter of Fort Bragg, NC, because the butterfly has never been detected elsewhere (Five Year Review, 2020).

Figure 1 depicts the resulting interim core map for the Saint Francis' satyr butterfly. The size of this core map is approximately 162,998 acres. Landcover categories within the core map area are included in Table 1. Landcover is predominantly evergreen forest, woody wetlands, barren land, scrub, and open space developed. Since this species occurs in disturbed areas, many of these areas potentially represent habitat.

The core map developed for the Saint Francis' satyr butterfly is considered interim. This core map will be used to develop pesticide use limitation areas (PULAs) that include the butterfly. 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 a "limited" (2) best professional judgment classification to describe uncertainties/limitations. The map is based on known locations described by FWS. This core map does not replace or revise any range or designated critical habitat developed by FWS for this species.

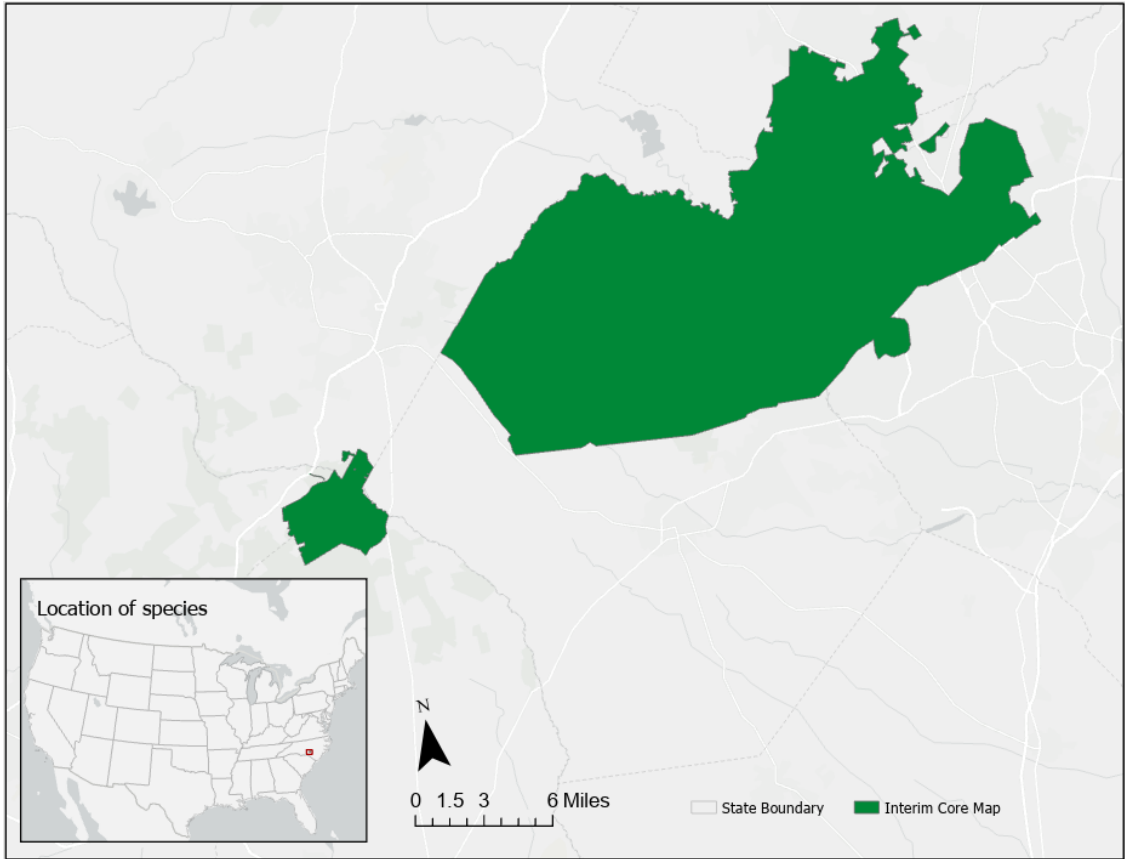


Figure 1. Interim core map for the Saint Francis' satyr butterfly.

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)	2%	60%
Forestry	Evergreen Forest (42)	57%	60%
Forestry	Mixed Forest (43)	1%	60%
Agriculture	Pasture/Hay (81)	0%	1%
Agriculture	Cultivated Crops (82)	1%	1%
Mosquito adulticide, residential	Open space, developed (21)	6%	13%
Mosquito adulticide, residential	Developed, Low intensity (22)	4%	13%
Mosquito adulticide, residential	Developed, Medium intensity (23)	2%	13%
Mosquito adulticide, residential	Developed, High intensity (24)	1%	13%
Invasive species control	Woody Wetlands (90)	10%	26%
Invasive species control	Emergent Herbaceous Wetlands (95)	0%	26%
Invasive species control	Open water (11)	1%	26%
Invasive species control	Grassland/herbaceous (71)	4%	26%
Invasive species control	Scrub/shrub (52)	5%	26%
Invasive species control	Barren land (rock/sand/clay; 31)	6%	26%
Total Acres	Interim Core Map Acres	~ 162,998 acres	

Evaluation of Known Location Information

There are four datasets with known location information for this species:

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

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 Habitats³” (referred to as “the process”). This core map was developed by EPA 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 Saint Francis’ satyr butterfly from FWS, as well as observation information available from various publicly available sources (including iNaturalist, GBIF and NatureServe). The information compiled for the Saint Francis’ satyr butterfly is included in **Appendix 1**. Influential information that impacted the development of the core map included:

- “Despite extensive survey efforts, the SFS has never been detected outside of Ft. Bragg. The current distribution is much reduced from the proposed historic range.” (5-year review 2020, 16)
- “Most active sites are found in duded impact areas that are restricted in access.” (5-year review 2020, 5)
 - It is not feasible to know where within Ft. Bragg the populations all reside as some areas are not able to be accessed due to undetonated explosives.
- Restoration efforts at Ft. Bragg and release of captive reared butterflies has been successful and thus a larger area than just the duded impact areas at Ft. Bragg may now host populations (see information in **Appendix 1**).

For step 2, EPA used the compiled information to identify the core map type. EPA compared known location data to the range and found that these known locations are consistent with the species range but encompass a smaller footprint than the range. The entire range of the species was not used as the core map because the range contains areas where the species does not occur. Thus, EPA selected the perimeter of Ft. Bragg to use as the species core map.

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 perimeter of Ft. Bragg to create the core map. **Appendix 2** provides more details on the GIS analysis and data used to generate the core map.

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

EPA considered refinement of the core map’s Ft. Bragg boundary through selection for the butterfly’s preferred habitat. However, ultimately EPA did not take this approach due to the mobility of the butterfly allowing it access to non-preferred habitat, as well as the fact that it is not feasible to know where within Ft. Bragg the butterfly populations reside as some areas are not able to be accessed due to undetonated explosives.

Appendix 1. Information Compiled for Species

1. Recent FWS Documents

- [1996 Recovery plan](#)
- [2013 5-year review](#)
- [2020 5-year review](#)

2. Background information on Species

- **Status:** Federally listed as endangered in 1994
- **Taxonomy:** Terrestrial Invertebrate
- **Resiliency**
 - “As of 2020, only two historic sites outside the impact areas support a population, mainly as a result of active restoration activities and releases of captive-bred butterflies. One of these areas were extirpated but repopulated in 2012.” (5-year review 2020, 14)
 - “One subpopulation comprising the only population on a particular creek was extirpated in 2016 due to habitat loss and disturbance related to heavy equipment use as part of ongoing range construction activities.” (5-year review 2020, 13)
- **Redundancy**
 - “Research efforts conducted at NC State University examined genetic variation between subpopulations and found that genetic diversity was relatively high despite its restricted distribution, and that there was little evidence of population bottlenecks or extensive inbreeding within populations. They detected substantial gene flow and detectable first-generation migration, suggesting that the species is unlikely to be currently endangered by genetic factors. Despite the relatively sedentary behavior of SFS, they observed a relatively high level of gene flow and that SFS is more likely to utilize the closest riparian corridors to disperse between habitats (Milko et al. 2012).” (5-year review 2020, 16)
- **Representation**
 - “Despite extensive survey efforts, the species has never been detected outside of Ft. Bragg. The current distribution is much reduced from the proposed historic range.” (5-year review 2020, 16)
 - “The total area of occupied habitat outside the live-fire ranges is approximately 2-5 ha (4.9 to 12.3 acres). Since 2000, four additional subpopulations have been discovered, of which one is 16 large, one is small, but increasing as a result of adjacent restoration work, one is large and formerly extirpated but now repopulated, and one is unoccupied. Within impact areas, the distribution of sites has changed as described above, and there are now thought to be eight subpopulations comprising approximately 40-45 ha (98.8 to 111.1 acres).” (5-year review 2020, 16)
 - “Efforts toward releasing individuals at the restoration sites near historic subpopulations began in 2011 (Cayton et al. 2014). These long-term restoration efforts include a combination of hardwood removal and flooding using artificial dams (Cayton et al. 2015, 2019; see details in Biology and Habitat section below) and releases of captive reared butterflies.” (5-year review 2020, 9)
- **Habitat Description**
 - “St. Francis’ satyr live in highly productive wetlands that are maintained by disturbance. These wetlands occur along a stream network at Ft. Bragg that are comprised of bottomland hardwood forests with adjacent longleaf pine forest uplands. Within these successional

- systems, herbaceous meadows support numerous wetlands plants including sedges in the *Carex* family. These species include *C. mitchelliana*, which is believed to be one of the main host plants, as well as *C. atlantica* and *C. turgescens* as likely alternative host plants.” (5-year review 2020, 17)
- “In North Carolina, these herbaceous wetlands are created by beaver activities or by through fire.” (5-year review 2020, 17)
 - “The largest known subpopulations of the butterfly occur in the live-fire ranges where the lack of roads, frequent small fires, and beavers have allowed the creation and persistence of high quality habitat. Assessment of habitat dynamics and characteristics and effects on butterfly subpopulations is difficult due to the restricted access and irregular survey opportunities.” (5-year review 2020, 17)
 - “Recent efforts have included measuring egg and larval survival, and a new mark/recapture study, which allowed assessment of population size, adult survival, and dispersal. Results suggested that larval survivorship was an average of three times higher in plots with hardwood removal than those in plots without hardwood removal. (5-year review 2020, 15)
 - “Most active sites are found in duded impact areas that are restricted in access, which complicates the protection, management, monitoring and research activities aimed at furthering our understanding of this species. Dud munitions—ammunition or explosives that failed to detonate as intended—may be produced by both infantry and artillery delivery into Ft. Bragg’s live fire impact areas. Impact areas are restricted due to multiple potentially hazardous conditions including unexploded ordnance from various military activities or active training.” (5-year review 2020, 5)
 - “The butterfly cannot survive in sites that are either inundated by flooding or succeed to riparian forest.” (5-year review 2020, 6)
- **Relevant Life History Information**
 - “The St. Francis’ satyr is bivoltine, with adults emerging in May through early June and again in July through early August. The onset of each of two flight periods can vary; the first flight period is highly predictable based on climate patterns classified into growing degree days, which accounts for heat input into ecosystems. The peak activity of the second flight period is approximately 62 days after the peak of the first flight period. The last brood overwinters in a larval stage and then resumes feeding and development before pupating in the spring.” (5-year review 2020, 10)
 - “Adult lifespan is only a few days: 1.9 days during the first flight period and 3.9 days during the second flight period.” (5-year review 2020, 10)
 - “A third flight period was detected four years in a row from 2015-2018 within a restoration area. Similar to other flight periods, these vary with weather patterns. The observed third periods occurred 53-63 days after the second flight period, usually occurring in early to late September and last 9-17 days.” (5-year review 2020, 12)
 - **Ecology**
 - “Adults generally do not feed on nectar. However, there are two confirmed observations of the species nectaring on flowers of sweet pepperbush (*Clethra alnifolia*) on two occasions late in the flight period.” (5-year review 2020, 12)

- “Caterpillars are very difficult to detect in the field and have only been observed twice since efforts began in 2002. Both detections were on or near a presumed larval host plant, Mitchell’s sedge, *Carex mitchelliana*.” (5-year review 2020, 10)
- “In 2018-2019, dispersal experiments were conducted through using mark-recapture techniques with wild individuals and by releasing captive-reared individuals during the first and second flight periods. Several individuals were observed moving >100 m from the release point, with the greatest dispersal distance recorded as 240 m. The majority of individuals stayed within 0-50 m of their release point.” (5-year review 2020, 11)
- **Taxonomy**
 - Terrestrial invertebrate
- **Relevant Pesticide Use Sites**
 - None are mentioned
- **Threats**
 - “The primary threat to the butterfly is loss of habitat due to both natural and human-caused changes.” (5-year review 2020, 20)
- **Relevant Recovery Criteria and Actions (Source: 1996 Draft Recovery Plan)**
 - Downlisting criteria include:
 - The existing metapopulation has been stable or increasing in numbers for at least 10 to 15 years.
 - A long-term protection and management plan is in place to ensure its continued survival.
 - De-listing criteria include:
 - The existing metapopulation has been protected and stabilized, as described above.
 - At least three total populations have been found or established in the sandhills region and have been stable or increasing for 10 to 15 years.
 - Recovery actions include:
 - Protect existing populations.
 - Manage for the long-term survival of existing populations.
 - Monitor existing populations.
 - Continue research into the species’ life history, ecology, and reasons for decline.
 - Conduct searches for additional populations.
 - Establish additional wild populations within historic range.
 - Develop information and education programs.

3. Description of Species Range

- The current geographic range encompasses 213,746 acres.
- **Figure A1-1** depicts the current FWS species range map (last updated 05/06/2021).

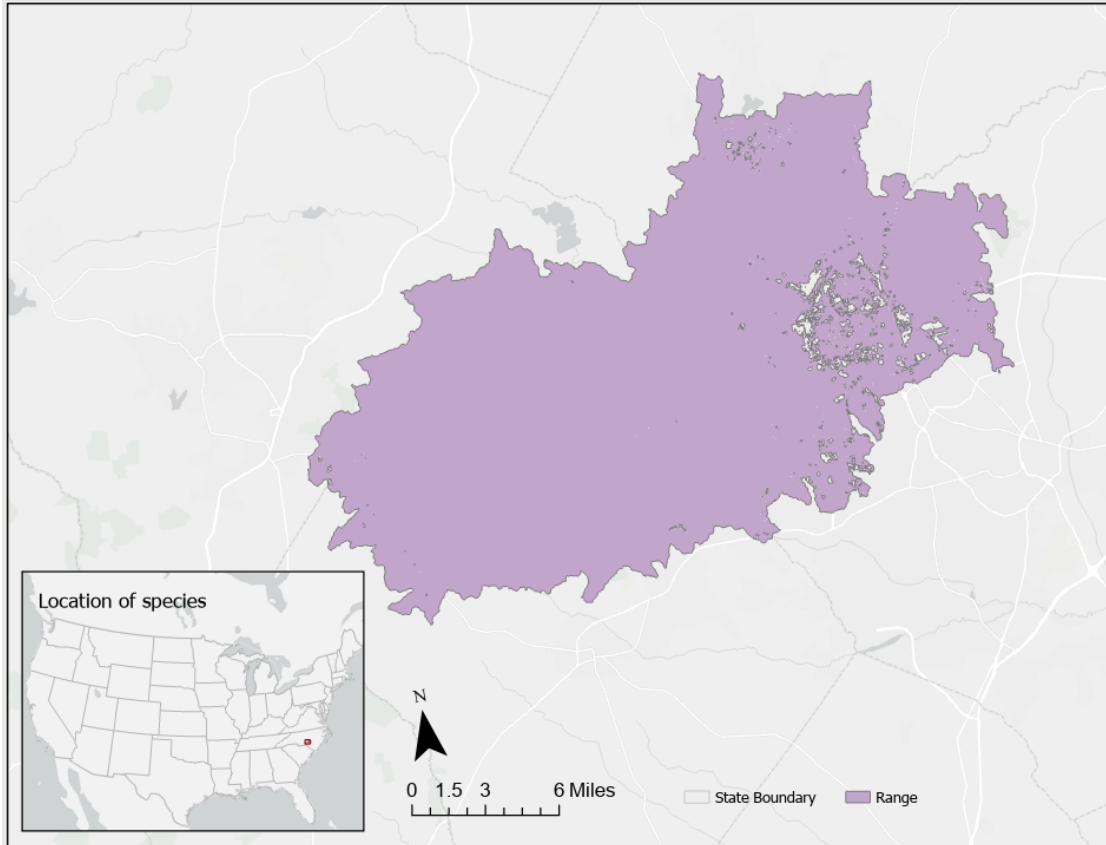


Figure A1-1. Map of Saint Francis' satyr butterfly range.

4. Critical Habitat

- There is no critical habitat for this species.

5. Known Locations

- **Occurrences Described in FWS Documents**
 - Fort Bragg Army Installation located in central North Carolina (5-year review, 2020)
- **Occurrences in iNaturalist**
 - Searched on 4/2/2025
 - https://www.inaturalist.org/observations?subview=table&taxon_id=84170
 - There are 5 research grade observations available from 2008 to 2012.
 - **Figure A1-2** depicts the locations of these observations.
 - Three of the observations are within the Fort Bragg complex and while two are outside of it, they are obscured by 28 km so may have been inside the complex.

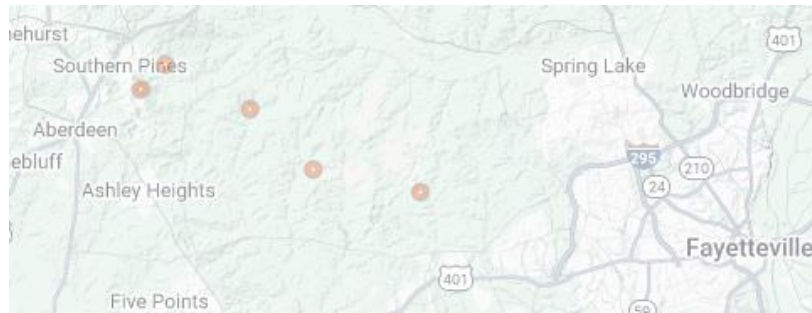


Figure A1-2. Occurrences of the Saint Francis' satyr butterfly available in iNaturalist.

- **Occurrences in GBIF**
 - Searched on 4/2/2025
 - https://www.gbif.org/occurrence/search?has_coordinate=true&has_geospatial_issue=false&taxon_key=4299786
 - There were 7 observations available for this species, only 2 of which were not included in iNaturalist and are “preserved specimens” from 1984.
 - All observations appear to be within the Fort Bragg complex. **Figure A1-3** depicts the locations of these observations.

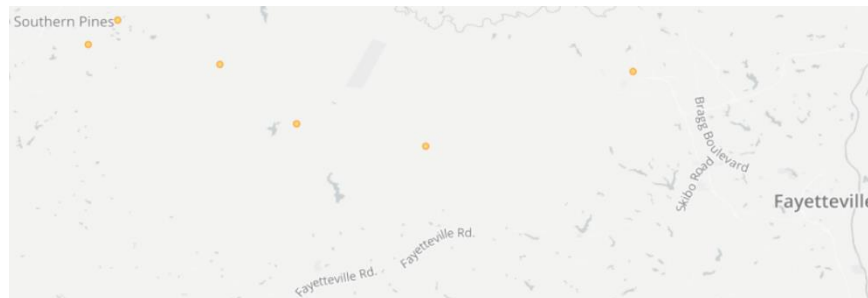


Figure A1-3. Occurrences of the Saint Francis' satyr butterfly available in GBIF.

- **Occurrences in NatureServe**
 - NatureServe was searched on 04/02/2025
 - <https://explorer.natureserve.org/pro/Welcome>
 - NatureServe did not have any additional locations.

Collectively, the occurrence data are consistent with reducing the core map to biological information, which would be the footprint of Fort Bragg.

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. EPA used the perimeter of Ft. Bragg to develop the core map.

1. Dataset References and Software

- Software used: ArcGIS Pro 3.2
- Fort Bragg Boundary
 - Raster layer provided by Cumberland County ITS-Geospatial Services Division.
 - Found at: <https://opendata.co.cumberland.nc.us/datasets/CumberlandGIS::fort-bragg-boundary/about>
- FWS Species Range (last updated 05/06/2021)
 - <https://ecos.fws.gov/ecp/species/5419>

2. Datasets Used in Core Map Development

- Datasets used are described above.

3. Core Map Development

- EPA started with the FWS species range and overlaid the Fort Bragg Boundary.
- The Fort Bragg Boundary shapefile map was smaller and encompassed the locations where the species exist so was used as the core map.