Expert-based Model Guidance and Documentation (Version 1)

Project Information

- Species: eastern black rail (*Laterallus jamaicensis jamaicensis*)
- Lead modeler: Adam Efird, Three Oaks Engineering (adam.efird@threeoaksengineering.com), 919-407-8461
- Date started: February 2021
- Date completed: July 2023

Species Information

NCDOT NRTR Habitat Description

USFWS Optimal Survey Window: April 1 – June 30

The eastern black rail is one of the four recognized subspecies of black rail and is the only subspecies that occurs along the Atlantic coast of the United States. Habitats used by the eastern black rail along the southern Atlantic coast includes impounded and unimpounded marshes, which can be tidally or non-tidally influenced and range in salinity from salt to fresh. Nests may be built within the marsh or along the edge and hidden within dense vegetation. Black rails are extremely secretive and seldom seen. While some vocalizations occur at dusk, they are often only heard calling at night, when they vocalize at all. Eastern black rails are year-round residents in North Carolina.

Additional Species Information

There were 14 black rail NHP records listed as current in the January 2018 NHP data.

County Information

- NHP listed counties: Carteret, Craven, Currituck, Dare, Hyde, New Hanover, Onslow, Pamlico
- FWS current listed counties: Brunswick, Beaufort, Camden, Carteret, Craven, Currituck, Dare, Duplin, Hyde, Jones, Lenoir, New Hanover, Onslow, Pamlico, Pender, Pitt, Tyrrell
- Additions proposed by reviewers: NA

Environmental Data Information

All spatial data are in NAD 1983 StatePlane North Carolina FIPS 3200 (US feet).

Layer 1

- Layer name: CountyBoundaryShoreline
- Layer description:
  - Selected listed counties for black rail.
- Layer selection justification:
  - Layer is used for county boundaries and shoreline area.
- "Habitat" versus "Nonhabitat" designations:
  - Layer is used to delineate counties with black rail presence and is not used for habitat determinations. The layer was also used to create an area of low potential habitat within the county boundary but outside of the high potential habitat area.

Layer 2

- Layer name: NLCD Landcover Data 2019
- Layer description:
  - NLCD 2019 landcover data.
- Layer selection justification:
  - The NLCD 2019 data was used to select areas of habitat and exclude other non-habitat types.
- "Habitat" versus "Nonhabitat" designations:
  - Habitat designations for black rail – emergent wetland. All other landcover types excluded for including the model.

Layer 3

- Layer name: nheo_tier2/Data_NHP_Counties
- Layer description:
  - Tier 2 data acquired from NC Natural Heritage Program (EO records from 2022 data). Data_NHP_Counties is a NHP-created layer with appropriate natural community records [Brackish Marsh (Needlerush Subtype), Brackish Marsh (Salt Meadow Cordgrass Subtype), Brackish Marsh (Smooth Cordgrass Subtype), Salt Marsh (Carolinian Subtype), Tidal Freshwater Marsh (Cattail Subtype), Tidal Freshwater Marsh (Giant Cordgrass Subtype), Tidal Freshwater Marsh (Mixed Freshwater Subtype), Tidal Freshwater Marsh (Needlerush Subtype), and Tidal Freshwater Marsh (Sawgrass Subtype)] from the Tier 2 nheo data (2022) were used to add appropriate natural communities for black rail to the model (used for areas of high potential habitat). The layer was generated by NHP to maintain NHPs control over the data and was provided to ATLAS specifically for modeling.
- Layer selection justification:
  - 2018 EO records from the nheo layer was incorporated into model with any current black rail records selected and included in final merged output file.
  - In addition, (2022) nheo natural community layers with appropriate natural communities (Data_NHP_Counties) for black rail were added to the model.

Layer 4

- Layer name: TIZ_2023_complete
- Layer description:
  - Tidal influence zone area data acquired from NCDOT ATLAS Sweeping Team. A previous version was used in variations of the model during development. An updated version was produced in 2022 that provides a more accurate and higher level of detail than the previous version. The data consisted of approximately 10 sets of localized data that were merged into one overall layer and utilized in the model.
- Layer selection justification:
  - The layer was used to clip all areas of NLCD emergent marsh and appropriate potential habitat NHP natural community data to an area that is influenced by tides, providing a more accurate range of potential habitat for the black rail model. No areas of "high" potential habitat are included in areas outside of this tidal influence zone.

<u>Model Information</u>

- Model domain
  - This model identifies all year-round potential suitable habitat for the species.
- Model output
  - Figure 1 – Model prediction.
  - Model output is binary, and includes the USFWS species range, excluding historic counties. The species model range is split between "High" and "Low" potential habitat. "High potential habitat" represents GIS based layer areas deemed suitable habitat, and "Low potential habitat" representing areas identified as areas deemed low quality or non-habitat.
  - Shapefile covering listed counties.
- ArcGIS Model Builder
  - version ArcMap 10.4.1.
  - Model builder toolbox attached as deliverable.
  - Selected tidal and brackish marsh natural communities from NHP data, added current NHP records for black rail occurrences, selected counties from the NC counties layer that align with the current USFWS range for black rail. Included 2019 NLCD landcover class that could be potential black rail habitats (emergent marsh) along with NHP records to create an area of "high" potential habitat. Merged and clipped to black rail counties that align with USFWS range for black rail. Erased the combined model "high" potential habitat area from the rest of the black rail county boundaries to create an area of "high" and "low" potential habitat.
- ArcGIS Online (AGOL) Review
  - A model prediction file was shared with select reviewers on ArcGIS Online. Points were placed within the USFWS potential habitat as well as the model potential

habitat in order to solicit feedback. Reviewers could place additional comments for consideration by modeler.
    - AGOL review was completed in November 2022 for the draft version of this model (See Appendix 2).
- Independent Data Review
    - Describe data sources –natural heritage element occurrence data, natural heritage natural community data, tidal influence zone data
    - Describe methods – Current aerial imagery was used to determine likelihood of habitat.

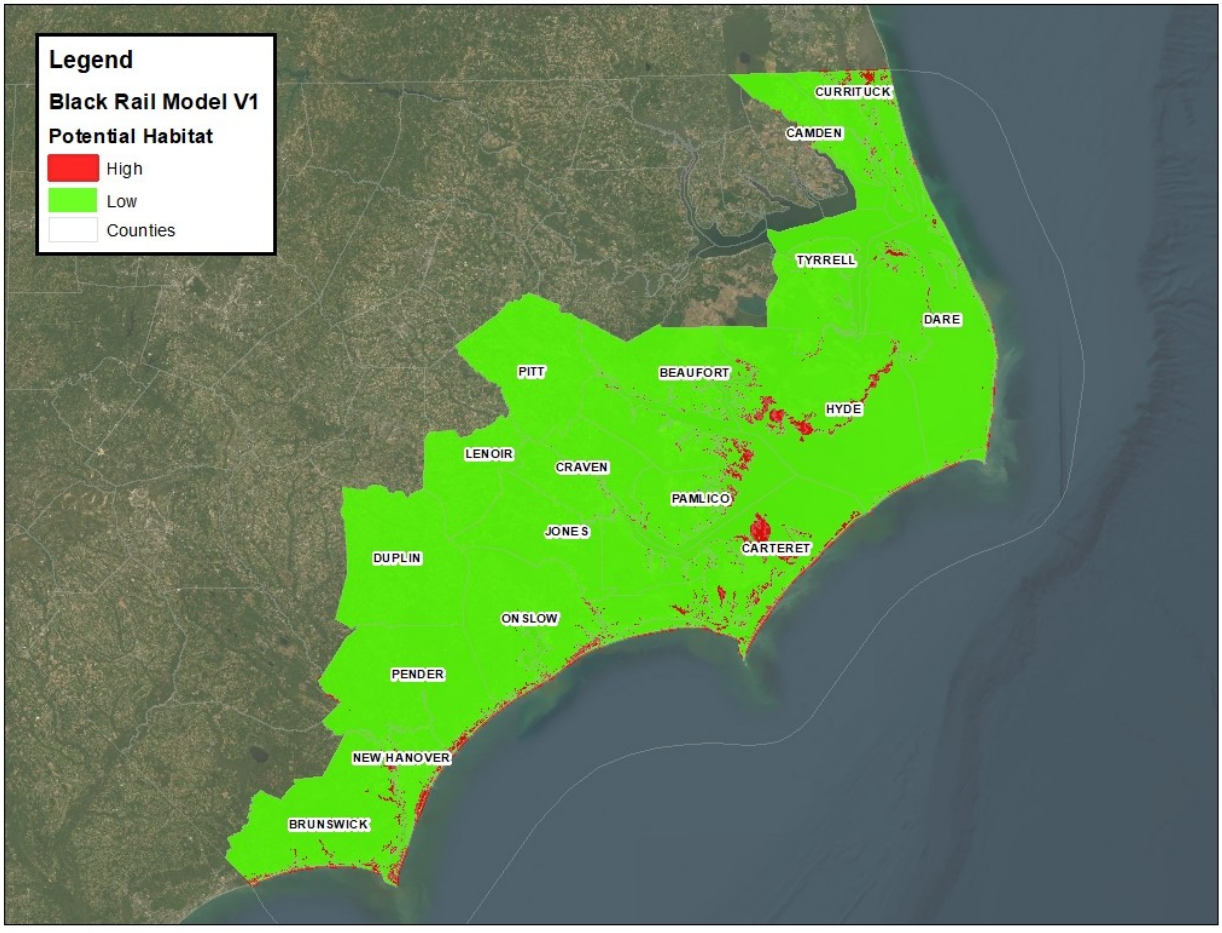


Figure 1. High and Low Potential Habitat (V1)

Previous Model Versions (Draft)

The previous version of this model was developed in August 2022. An updated tidal influence zone layer was used to refine the model to improve the “high” potential habitat areas. The V1 model was finalized in July 2023.

List of Delivered Model Products

- *This summary document.*
- *Version 1 Model builder toolbox and model screenshot (Appendix 1)*
- *Reviewer documentation (Appendix 2) – summary of comments and general model recommendations*
- *Version 1 Model prediction file(s) (shapefile)*
- *Desktop AGOL reviewer comments (shapefile)*

References

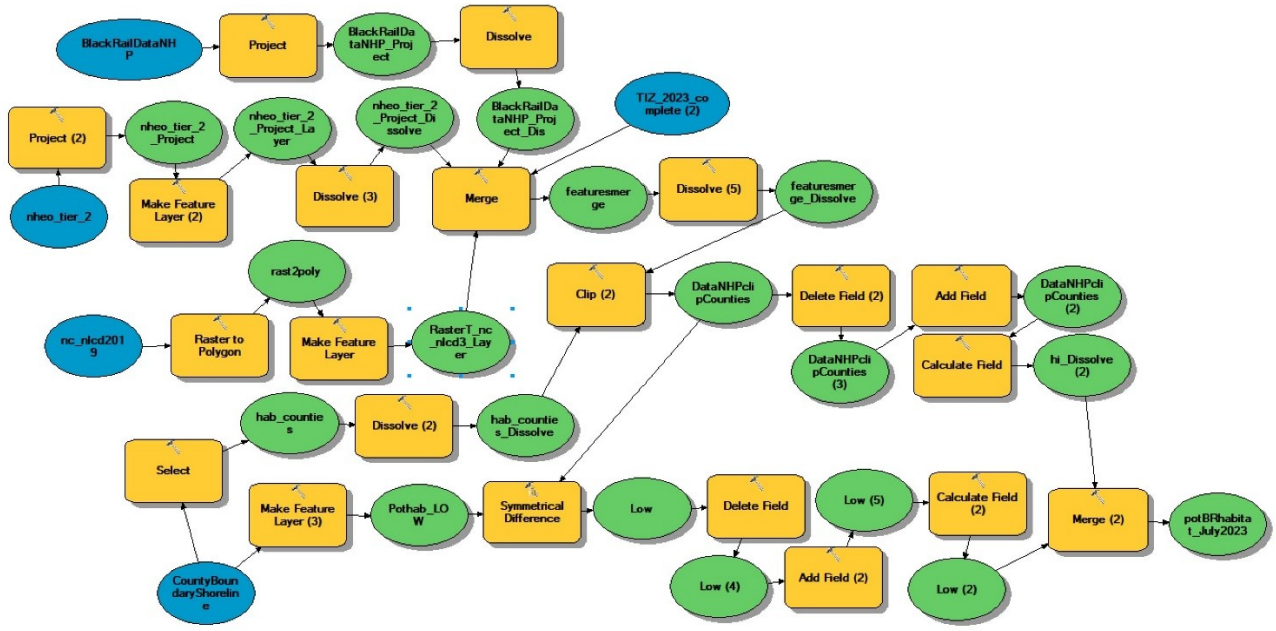
[USFWS] Eastern black rail Eastern black rail | U.S. Fish & Wildlife Service (fws.gov) (Accessed; December 3, 2020)

NatureServe. 2020. NatureServe Explorer [web application]. NatureServe, Arlington, Virginia. Available https://explorer.natureserve.org/. (Accessed: December 7, 2020).

North Carolina Natural Heritage Program. 2018. Biotics Database. Division of Land and Water Stewardship. Department of Natural and Cultural Resources, Raleigh, North Carolina.

United States Fish and Wildlife Service (USFWS). 2018. ECOS Environmental Conservation Online System (Accessed: May 2, 2018).

Appendix 1: Black Rail Draft Expert Model



Appendix 2: Reviewer Documentation

Project Information

- Species: Eastern black rail (*Laterallus jamaicensis*)
- Lead modeler: Adam Efird (adam.efird@threeoaksengineering.com), 919-407-8461
- Reviewer names:
  1. John Hammond (USFWS)
  2. Nicole Morgan (HDR, Inc.)
  3. Jim Mason (Three Oaks Engineering)
  - John Hammond has worked as a biologist with the U.S. Fish and Wildlife Service in Raleigh, NC since 1999. His specialty is birds and does research with the red cockaded woodpeckers in eastern NC.
  - Nicole Morgan, PhD is an environmental project manager with HDR, Inc. in Chattanooga, TN. She has previously worked on developing an eastern black rail model and is a subject matter expert on the species.
  - Jim Mason is a biologist with Three Oaks Engineering. He has been working with federally protected species since 2000, moving to North Carolina in 2001. His focus has been on threatened and endangered plant and bird species. He worked for the NCDOT Environmental Coordination and Permitting Group between 2006 and 2018 and has been with Three Oaks since then.

Range Map to Potential Habitat Draft Model

- USFWS Range 78,164,226 acres (based on last available USFWS range - 2022)
- ATLAS V1 Range 7,988,842 acres

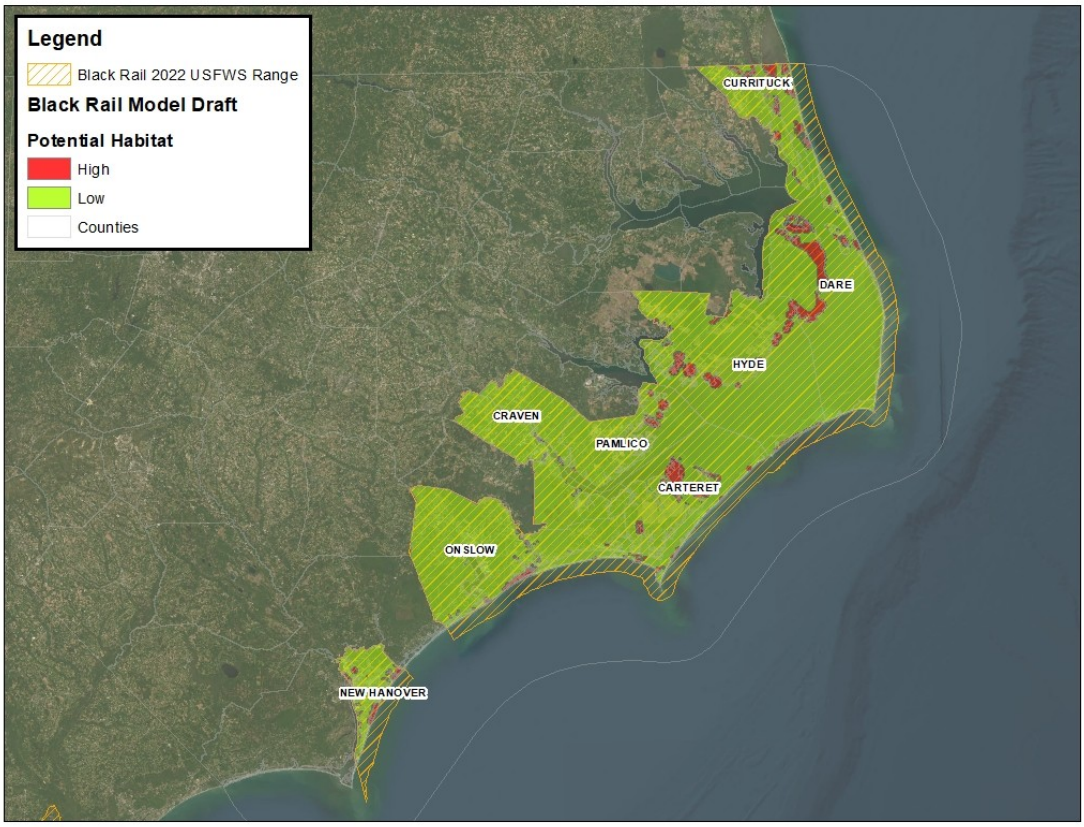


Figure 2. Range Map and Potential Habitat Draft Model (DRAFT)

Summary of Model Draft Version

- Environmental data layers remained the same between versions, except for the tidal influence zone data used to refine areas of “high” potential habitat.
- Selected all NHP element occurrence data, NHP natural communities, NLCD emergent marsh, and selected counties and merged all layers to develop “high” and “low” potential habitat areas.

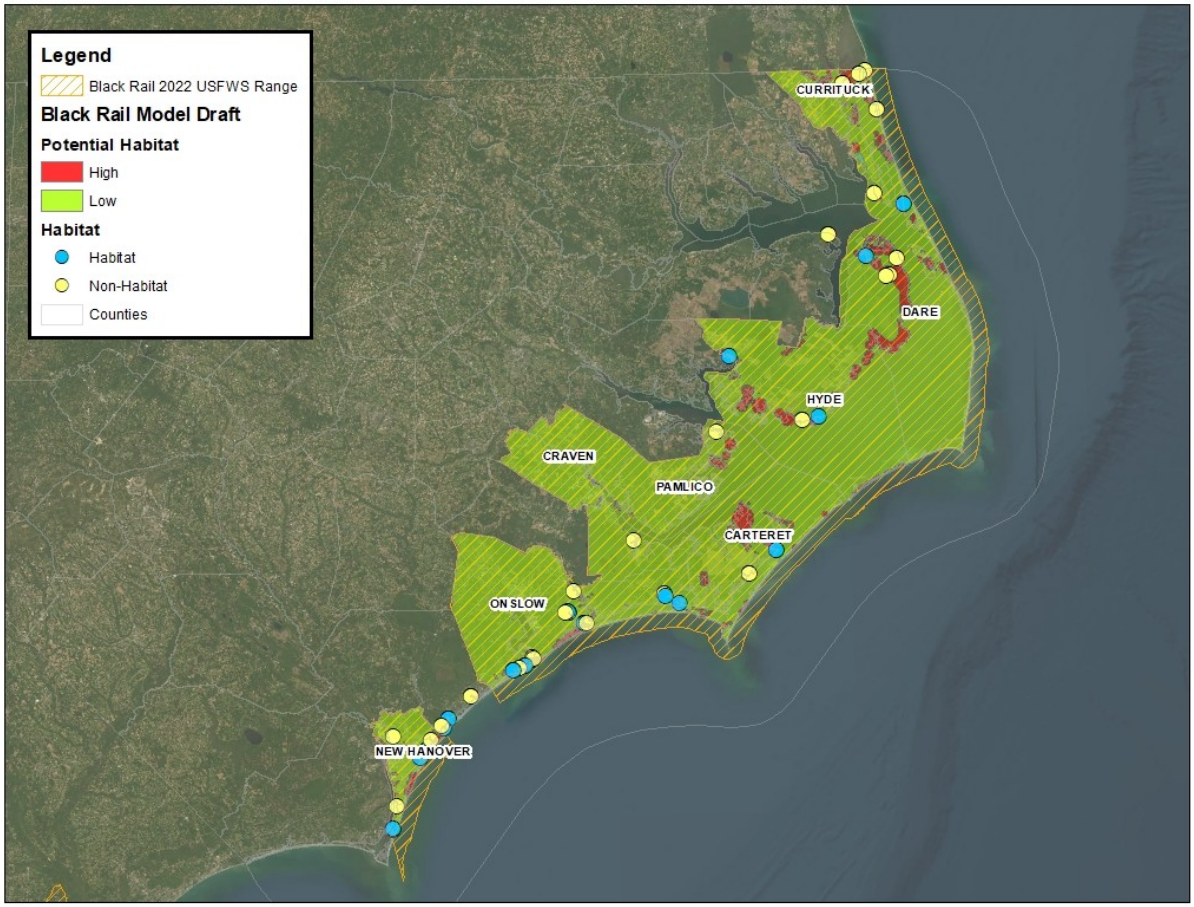


Figure 3. Desktop AGOL Reviewer Points

- Desktop Response Rate
  - AGOL Reviewer Response Rate: 100%
    - 21 reviewer points placed by modeler
  - # Additional comments (placed by reviewers): 64

<u>Reviewer Responses</u>

- Reviewers provided a complete and balanced review. Flags of non-habitat areas were primarily focused on areas where the landcover data or the marsh layers did not match what was viewable on the aerial photography. Most comments were about non-marsh habitats and upland areas showing up as habitat and needed the value to be reversed to non-habitat.
- Reviewers for the most part agreed with the potential habitat. Modelers commented that areas of non-habitat occasionally were included in the model and should be removed. Examples of non-habitat observed by reviewers: maritime forest, forested uplands, non-sandy shorelines or beaches, and developed land.

Proposed Version 1 Model

In order to address comments by reviewers, the following changes were made to the model:

- NLCD landcover data from 2019 was used to select emergent marsh and along with the NHP natural community data, was clipped to the updated tidal influence zone layer to produce a more refined area of “high” potential habitat.
- While reviewers commented on the overprediction of non-suitable habitats, potential habitat could not be further refined using landcover due to limitations and inconsistencies in data content and scale.

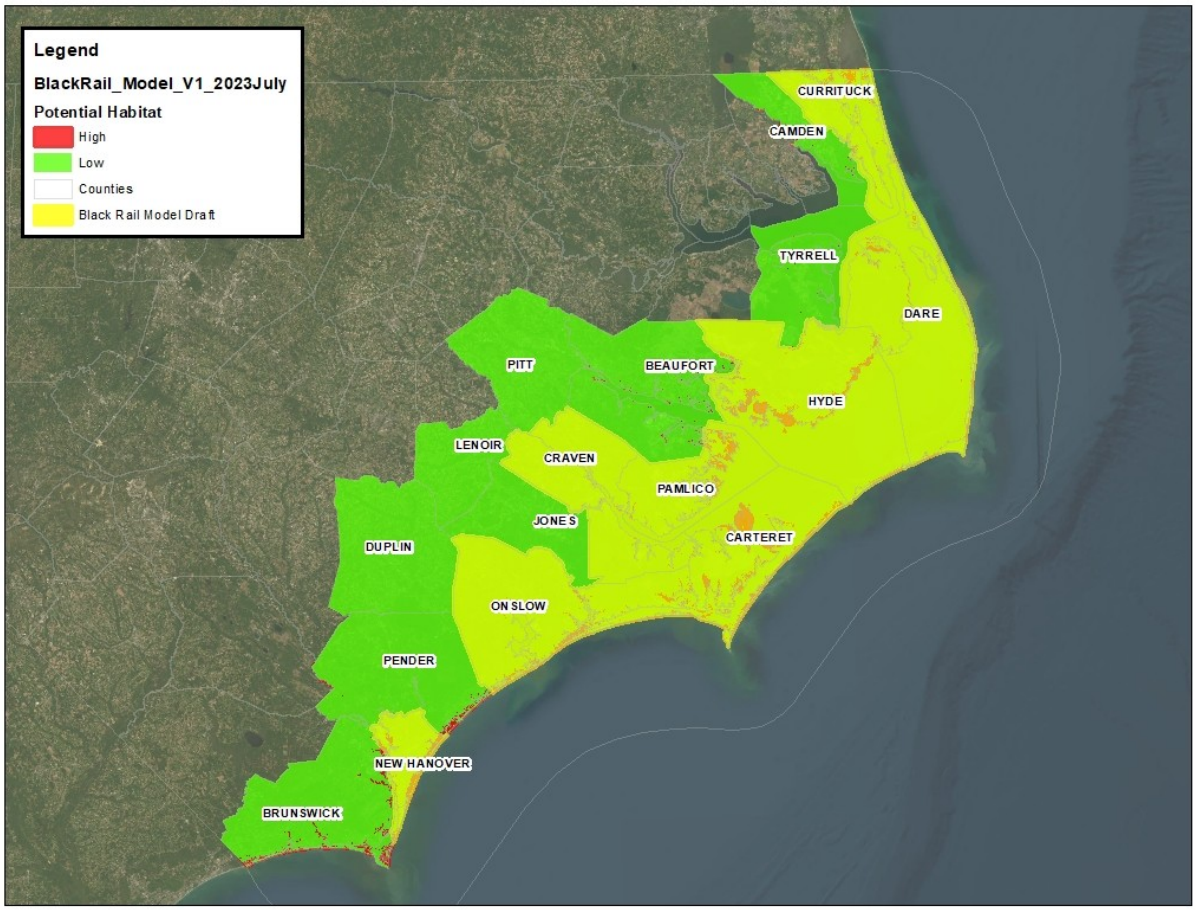


Figure 4. Potential Habitat Version 1 vs DRAFT model

Model Assessment and Accuracy Statistics

Figure 5 illustrates the accuracy statistics for the model assessment sites. The black rail potential habitat model clearly illustrates the general geographic areas along marshes, tidal areas, and edges of inland waterbodies that GIS-based layers can best predict for at a particular time period.

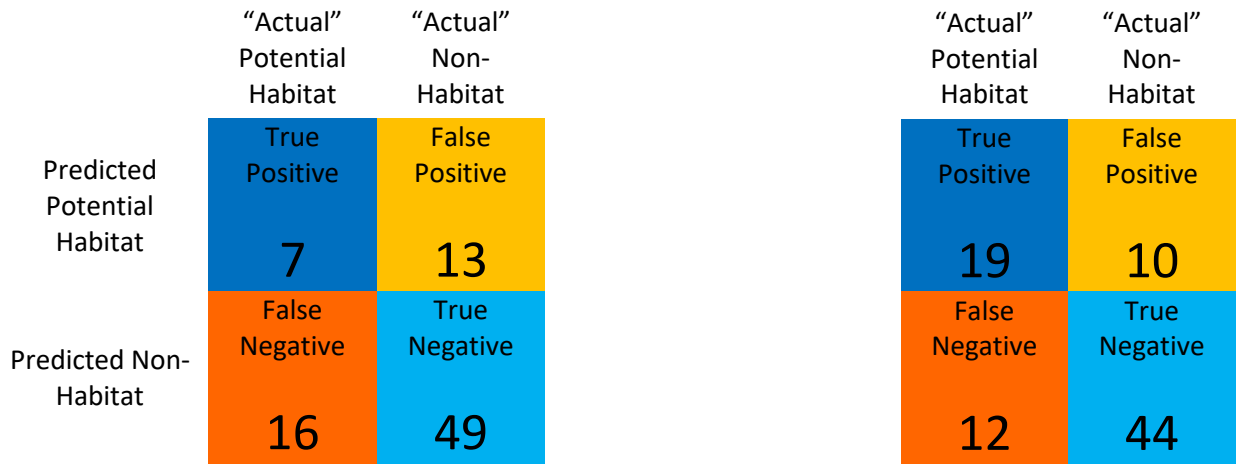


Figure 5. Accuracy summary of the desktop reviewer responses based on model assessment of Draft (left) Version and Version 1 (right) model output.

Based on the biologists' observations, accuracy of the draft binary classification model was as follows:

- Percent correctly classified was 66% (Draft), 74% (Version 1)
- Sensitivity was 0.304347826 (Draft), 0.612903226 (Version 1)
- Specificity was 0.729411765 (Draft), 0.814814815 (Version 1)

Desktop comments are summarized as follows:

- The model generally overpredicts for potential habitat and predicted false positives for developed neighborhoods, maritime forests, forested uplands, non-sandy shorelines or beaches, and canals. Due to the dynamic nature of coastal marshes, this model will capture a snapshot in time of current marsh conditions.

The model remained largely the same between draft and V1 versions except for the county range of the model V1 version being corrected as well as improvements in the tidal influence layer. This allowed for the specificity value, sensitivity, and percent correctly classified of the V1 model increasing from the draft version.