

Accessibility of South Carolina National Wildlife Refuges

INTRODUCTION

The main mission of the National Wildlife Refuge System (NWRS) is to conserve, manage, and restore fish, wildlife, and plant resources in the United States. Additionally, one of the guiding principles behind the establishment of this network of public lands is, "Wildlife-dependent uses involving hunting, fishing, wildlife observation, photography, interpretation, and education, when compatible, are legitimate and appropriate uses of the Refuge System."¹ In order for the public to enjoy and interact with these important ecological areas, the public must be able to easily access the refuges, however there is only one entrance per

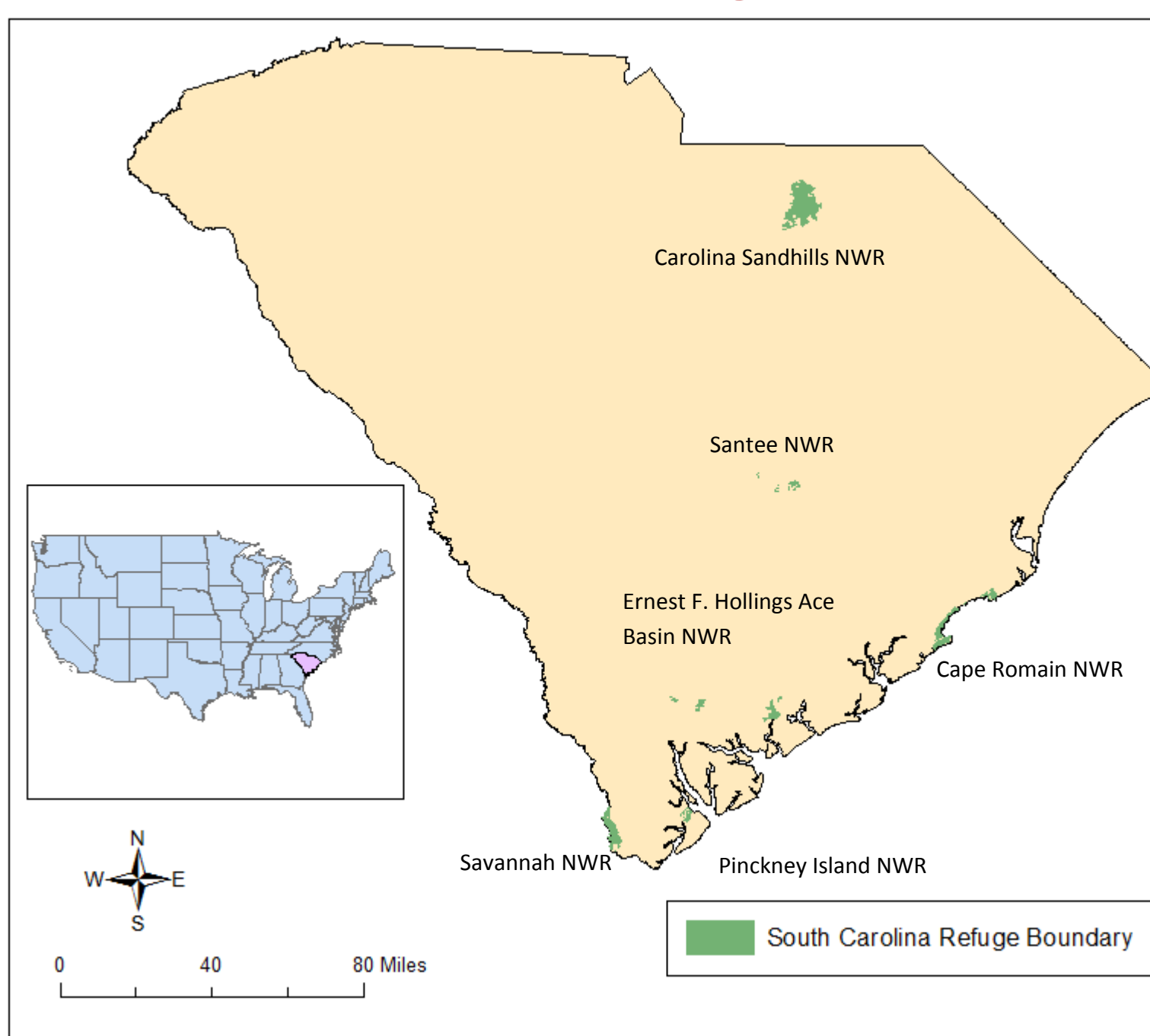
refuge. Accessibility is a large issue in land use and transportation planning. While refuges, by nature, are in isolated areas, some act as floodplains or are located on barrier islands, this does not mean that refuges should be inaccessible to visitors. National Wildlife Refuges are there for the public to engage with nature and it is important that the people are able to travel to and through these refuges. Tensions arise over public lands between public access and environmental conservation of the land; therefore it is important for sustainable transportation (roads and trails) planning on refuges.

NATIONAL WILDLIFE REFUGE SYSTEM

The National Wildlife Refuge System was founded by President Theodore Roosevelt in 1903 and was set up originally to protect wetland birds from over-hunting. Over time roads were built for resource management, primarily for the use of refuge staff. However, as it became more of a mission for the USFWS to share the environmental heritage of the nation, most wildlife refuges were opened to the public for them to engage in activities ranging from wildlife photography and bird watching to hunting and fishing. The question quickly became not whether public lands should be accessible, but rather what is the appropriate access on the land.

As the USFWS states on their Transportation Planning-Integrating Conservation website, "The Service encourages the design of transportation projects that provide the greatest value to the greatest number of people while avoiding or minimizing impacts to habitat..."² This statement has inherent tensions as roads and trails inevitably fragment areas of ecological interest. However, road congestion can also be deadly to the surrounding wildlife, so optimal road and trail density is difficult to find.

South Carolina National Wildlife Refuges



ACCESSIBILITY

The tensions from public lands and transportation planning arise from wanting to maximize accessibility. Levinson and Krizek define accessibility as, "... fundamentally a spatial concept: it is predicated on the ability to be present at some location where an activity such as shopping, education, health care, recreation, socializing or public events occur."³ Accessibility, while a well-studied concept, has remained a very challenging notion to measure.⁴ There are numerous variables that can contribute to why a place is accessible or not, some of which are challenging to actually quantify. Through public participation, transportation studies, and careful planning, the National Wildlife Refuge System has attempted to make all public wildlife refuges accessible enough to the public.

METHODOLOGY

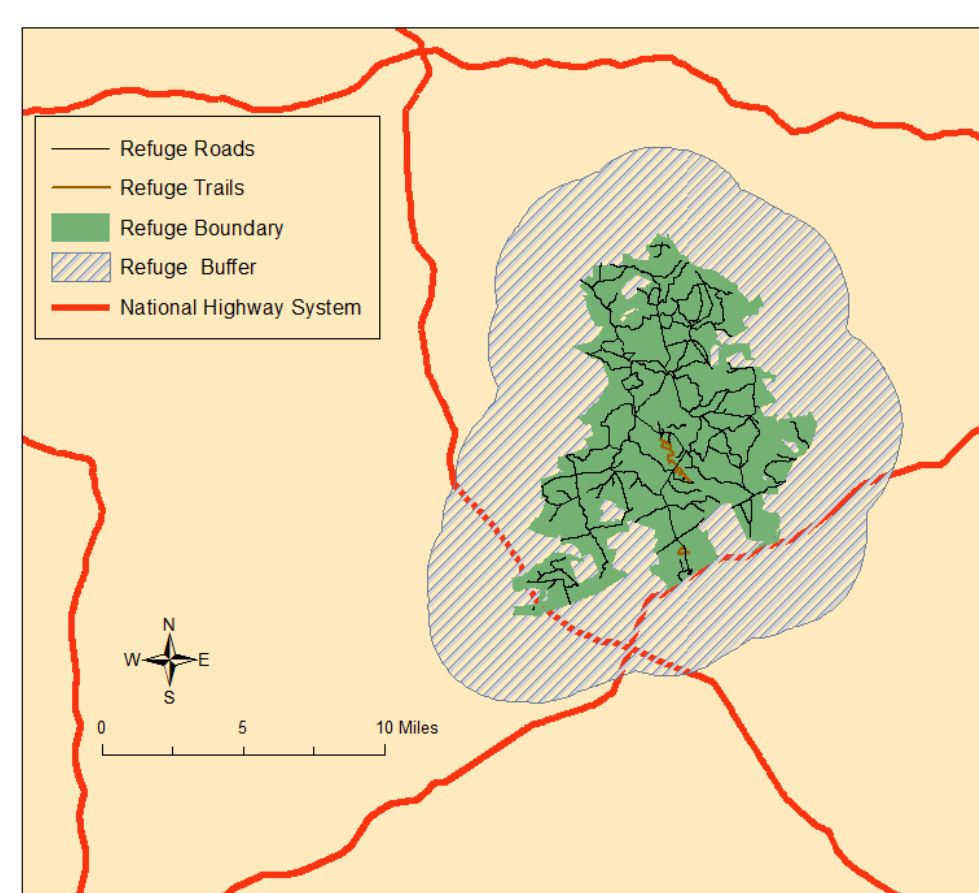
I am taking a place-based approach to examining accessibility of wildlife refuges. This means I am looking at the function of locations and opportunities on the wildlife refuge and the spatial separation of these activities. Additionally, it factors opportunities and deterrence as part of the function of accessibility.⁵

On the six South Carolinian refuges, I will look at road density, trail density, and distance from a major highway as my three independent variables to measure accessibility. My study ranks each of the refuges for each variable from 1 being least and 6 being most accessible. Then I total the trail density, road density, and distance from the National Highway System (NHS) scores to determine the most and least accessible refuges in South Carolina.

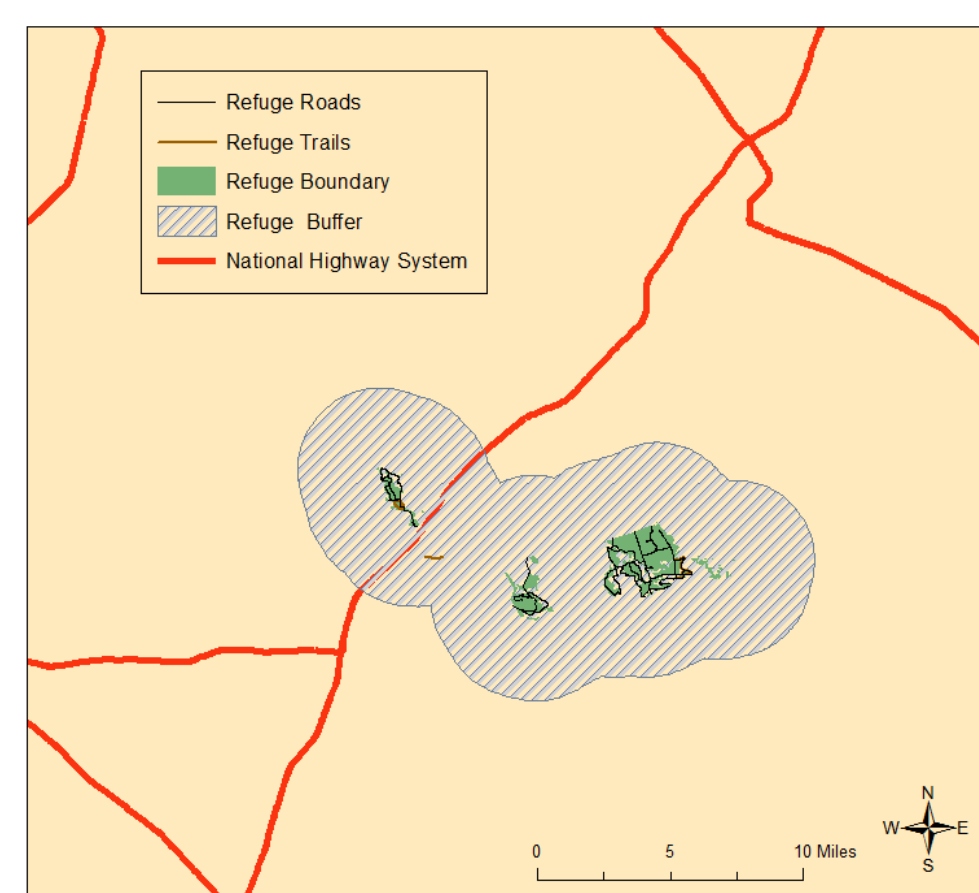
My layers are projected into NAD 1983 State Plane South Carolina FIPS 3900 feet. I started by using the clip function to make sure all my layers were clipped to South Carolina's boundaries. From there I utilized select by attribute, create layer with selection, and spatial join to gather all my analysis in the refuges attribute tables for my density calculations. In order to determine distance from the National Highway System, I created a 3-mile buffer around the perimeter of the refuges. By examining the attribute table, I was able to see how many times the buffer and NHS layer intersected.

REFUGE ACCESSIBILITY MAPS

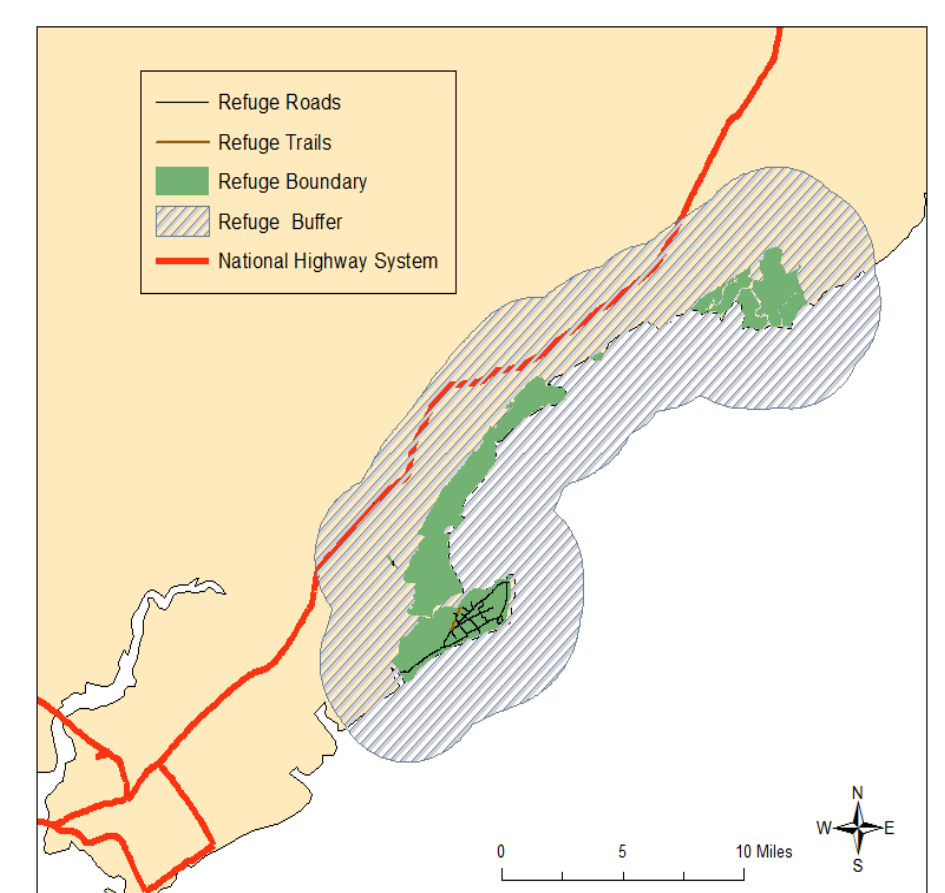
Carolina Sandhills NWR



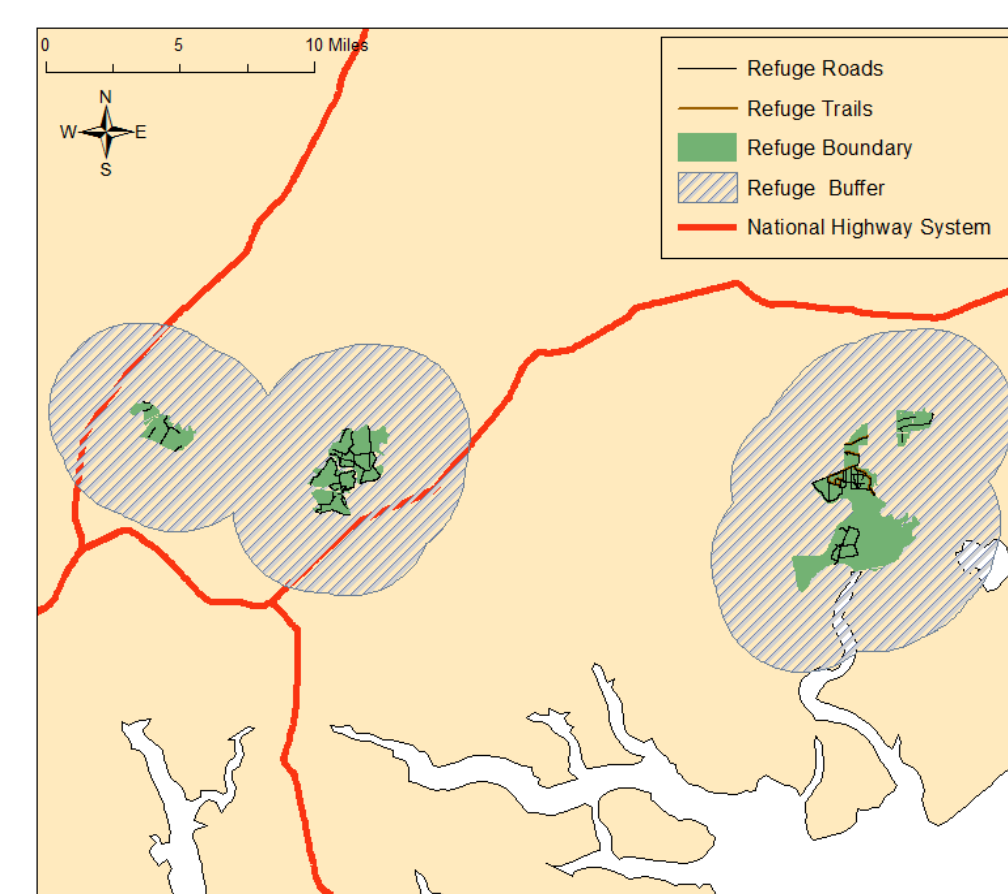
Santee NWR



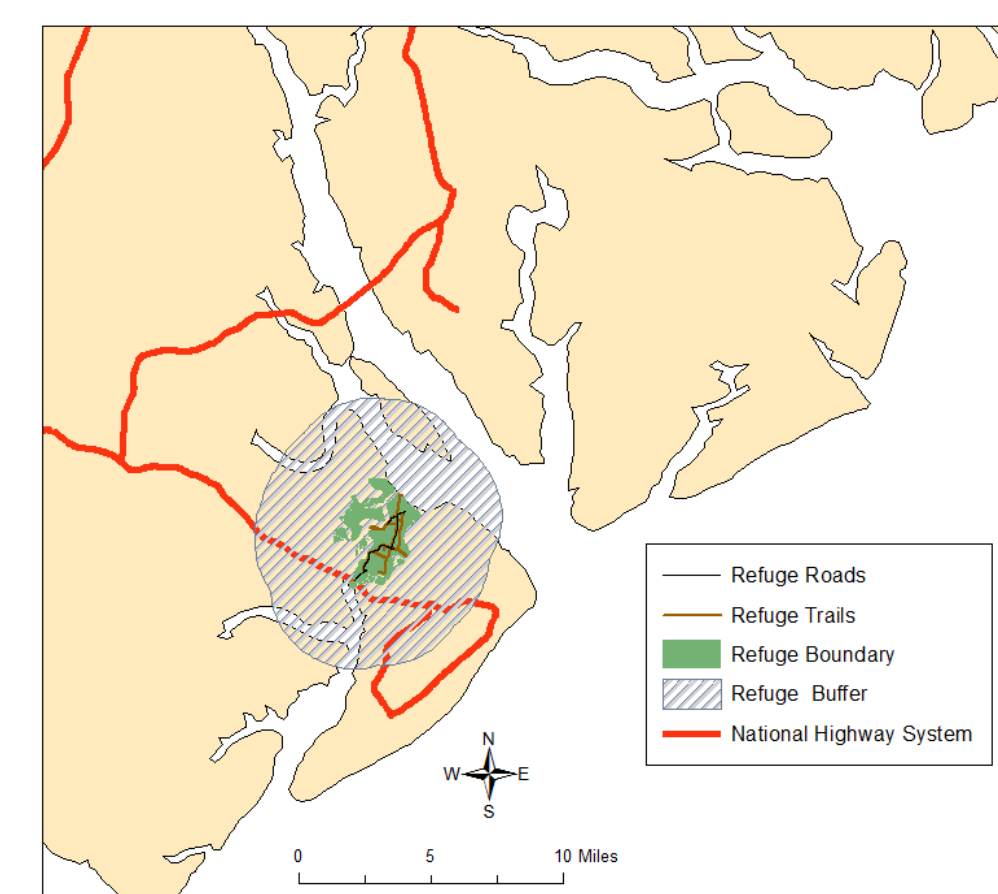
Cape Romain NWR



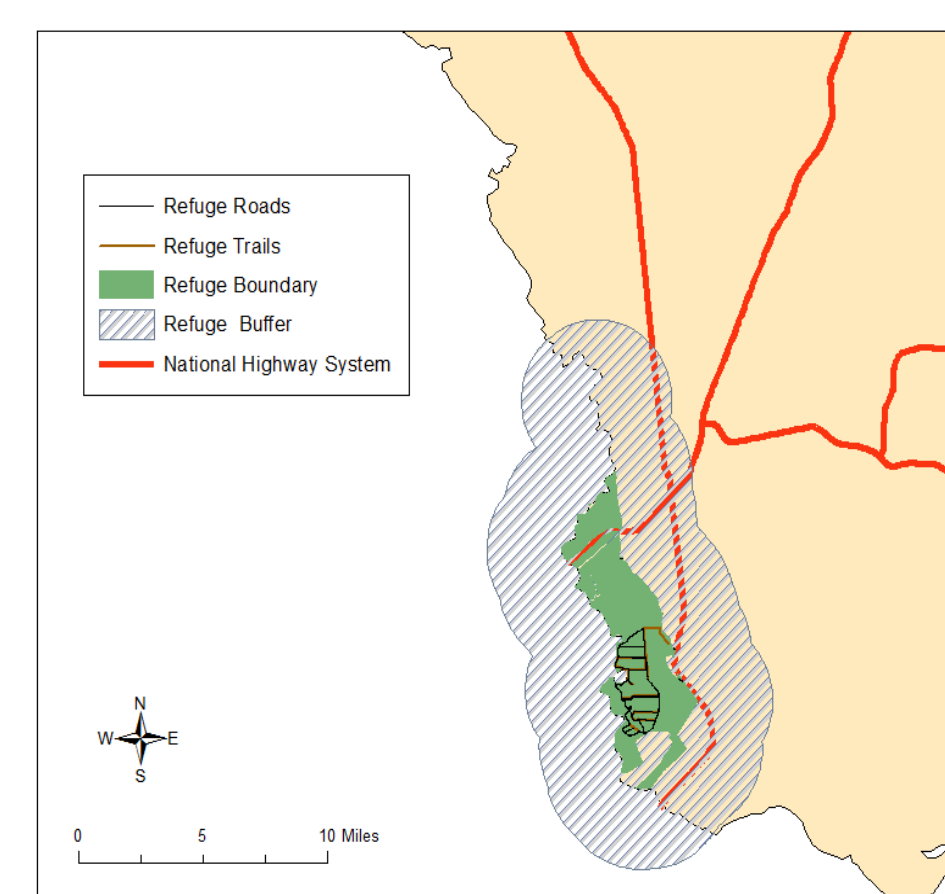
Ernest F. Hollings ACE Basin NWR



Pinckney Island NWR



Savannah NWR



RESULTS

Based on the above analysis, I was able to rank each of the public wildlife refuges in South Carolina based on their place-based accessibility. The table to the right shows the refuges' rankings and total accessibility score. My analysis is fairly accurate when measured against visitation numbers. Cape Romain is the lowest visited refuge in the area, while Pinckney Island has the highest visitation. The refuges in the middle are mixed which is most likely due to my tough processes in assigning scores. Savannah NWR has high visitation, but I gave it a low accessibility score as it is not eco-friendly to be so close to the NHS.

Due to surprisingly low trail densities, my only recommendation would be to increase the amount of trails on the each refuge. While road density was low, this is not necessarily a bad thing as long as refuge staff is able to access parts of the refuge as necessary. Additionally, it is difficult to give policy recommendations as it pertains to the NHS since some of the highways were built prior to the refuge being established. However, if possible re-routing the highways is the funding is available should be considered.

Calculated Road Densities

Name of National Wildlife Refuge	Road Density (mile per acre)	Road Density Score
Cape Romain	0.000474	1
Carolina Sandhills	0.003337	4
Ernest F. Hollings ACE Basin	0.004054	5
Pinckney	0.001184	3
Santee	0.017156	6
Savannah	0.000870	2

Calculated Trail Densities

Name of National Wildlife Refuge	Trail Density (mile per acre)	Trail Density Score
Cape Romain	0.000039	1
Carolina Sandhills	0.000109	2
Ernest F. Hollings ACE Basin	0.000441	3
Pinckney	0.002662	6
Santee	0.000880	5
Savannah	0.000542	4

Calculated NHS Distance

Name of National Wildlife Refuge	NHS Intersections	NHS Distance Score
Cape Romain	3	2
Carolina Sandhills	7	5
Ernest F. Hollings ACE Basin	6	6
Pinckney	6	6
Santee	3	2
Savannah	11	3

Accessibility Score

Name of NWR	Trail Density Score	Road Density Score	NHS Distance Score	Accessibility Score
Pinckney Island	6	3	6	15
Ernest F. Hollings ACE Basin	3	5	6	14
Santee	5	6	2	13
Carolina Sandhills	2	4	5	11
Savannah	4	2	3	9
Cape Romain	1	1	2	4

Citations: (1) <http://www.fws.gov/refuges/about/mission.html>, (2) <http://www.fws.gov/transportationplanning/index.html> (3) Levinson and Krizek, *Access to Destinations*, 63. (4) Levinson and Krizek, *Access to Destinations*, 86. (5) Yigitcanlar, Tan, "A GIS-based land use and public transportation accessibility indexing model," 32.

GIS Data Sources: www.fws.gov/gis, www.sc.gov/gis
 Projection: NAD 1983 State Plane South Carolina FIPS 3900 feet Scale: 1:297,500

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