Swanquarter National Wildlife Refuge

Habitats in Swanquarter National Wildlife Refuge consist of saltmarsh and forested wetlands. Marsh vegetation consists, principally, of *Juncus roemerianis* and *Cladium jamaicense*. Forested wetlands, located in the mainland, consist of *Pinus taeda*, *Pinus serotina* and *Taxodium distichum.* The 8,800 acres of the extensive coastal marsh are included in the National Wilderness Preservation System, which are located in Pamlico Sound in North Carolina's inner banks region. The Swanquarter Presidential Proclamation designated an additional 27,082 acres of adjacent, non-refuge open water in Pamlico Sound for the taking of migratory birds. Also, the lands contiguous to the refuge in the north side of the mainland are designated agricultural areas.

Model Implementation

The A1B greenhouse gas emission scenario was selected to run SLAMM 4.1 for this analysis. This scenario is described in the Special Report on Emissions Scenarios (IPCC, 2000) and in SLAMM technical report (Clough & Park 2006) as a trend of very rapid economic growth, population growth that peaks in mid-century and declines thereafter, and rapid introduction of alternative sources of energy that includes a balance across all fossil and non-fossil sources. The A1B scenario includes minimum, mean and max estimates of global average sea level rise.

Projections of sea level rise in meters for the A1B scenario			
	Minimum	**Mean**	**Maximum**
2025	0.03	0.08	0.13
2050	0.06	0.17	0.28
2100	0.13	0.39	0.69

The IPCC's Fourth Assessment Report (IPCC, 2007) suggests a range of 0.21 to 0.48 meters of global sea level rise by 2090-2099 for the A1B scenario, excluding "future rapid dynamical changes in ice flow". The A1B mean and maximum scenarios run for this analysis are under the IPCC 2007 estimated range of global average sea level rise by 2100.

Data Inputs

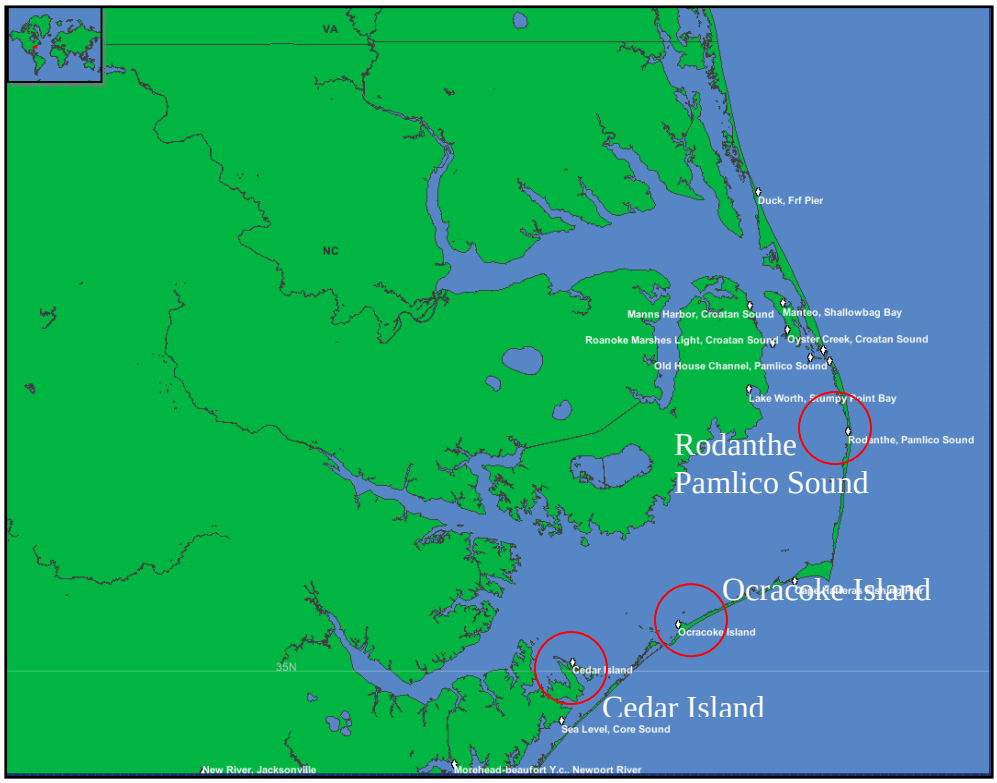
A literature survey and personal communications were conducted to parameterize the model for accretion rates, erosion rates and tide ranges.

Accretion rates for saltmarsh habitat were set to 3.7mm/yr in Swanquarter NWR based on Cahoon et. Al (1998) who measured accretion rates of saltmarshes in Cedar Island NWR. No accretion rates were found for brackish or freshwater marshes. However, rates for brackish and freshwater marshes were estimated by adding, respectively, a 10 and 20 percent increase to the saltmarsh accretion rate. The estimated increase for brackish and freshwater accretion rates at Swanquarter was based on accretion rates measured at other marshes in the east coast of United States. Slightly higher accretion rates are typically observed for brackish and freshwater marshes than saltmarsh habitats.

Erosion rates for saltmarshes and swamp were set to 0.88 meters and 0.61 meters, respectively, based on Riggs and Ames (2001) short-term erosion rates. A default erosion rate of 0.5 meters was set for tidal flats based on default values from Clough and Park (2006).

Local tide stations are not presently installed in Swanquarter NWR or in the proximity of the estuary. Tides ranges were estimated from stations in Pamlico Sound.

Tide stations for Swanquarter NWR



Results

SLAMM 4.1 calculates relative sea level rise based on the site historic eustatic trend, change of coastal elevation and the accelerated rise of sea level from the A1B scenarios.

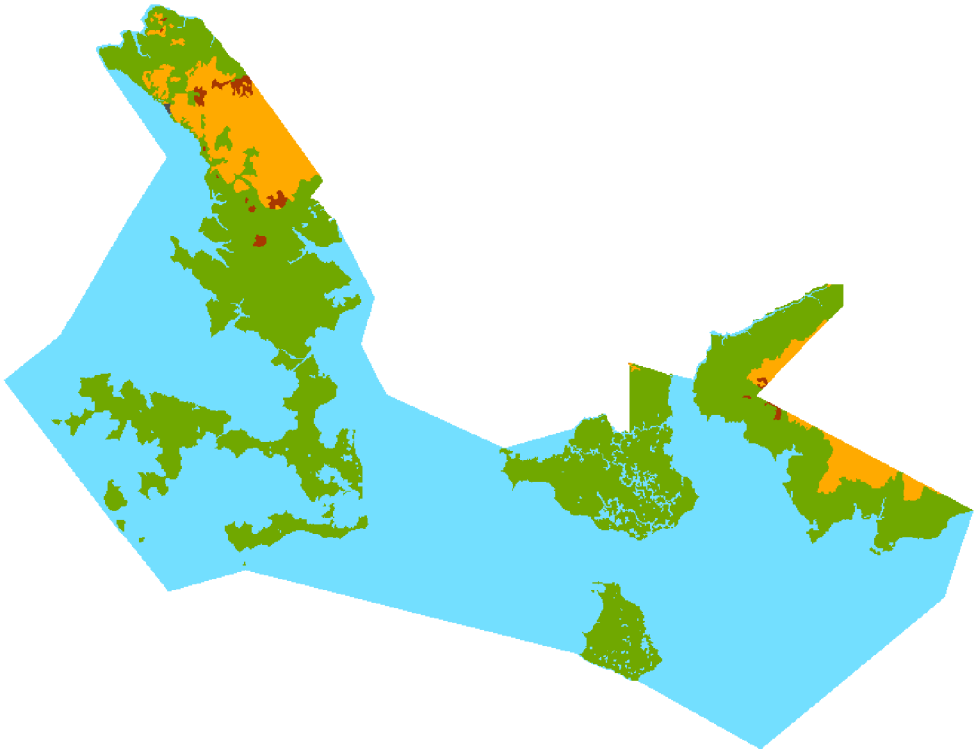
Relative sea level rise in meters			
	Minimum	**Mean**	**Maximum**
2025	0.11	0.15	0.21
2050	0.20	0.30	0.42
2100	0.37	0.63	0.94

Projections of Habitat Changes (A1B minimum scenario)								
	Area of habitat change in hectares				**Percentage of habitat change** (+) habitat gain, (-) habitat loss			
	Initial Condition	**2025**	**2050**	**2100**	**Initial Condition**	**2025**	**2050**	**2100**
Dry Land	3	3	3	2	0%	-12%	-13%	-32%
Swamp	864	677	541	330	5%	-22%	-37%	-62%
Transitional Salt Marsh	68	885	539	842	0%	+1198%	+691%	+1135%
Saltmarsh	4813	4184	4666	4566	-28%	-13%	-3%	-5%
Tidal Flat	0	0	0	7	0%	N/A	N/A	N/A
Estuarine Open Water	11461	11461	11461	11463	67%	0%	0%	0%

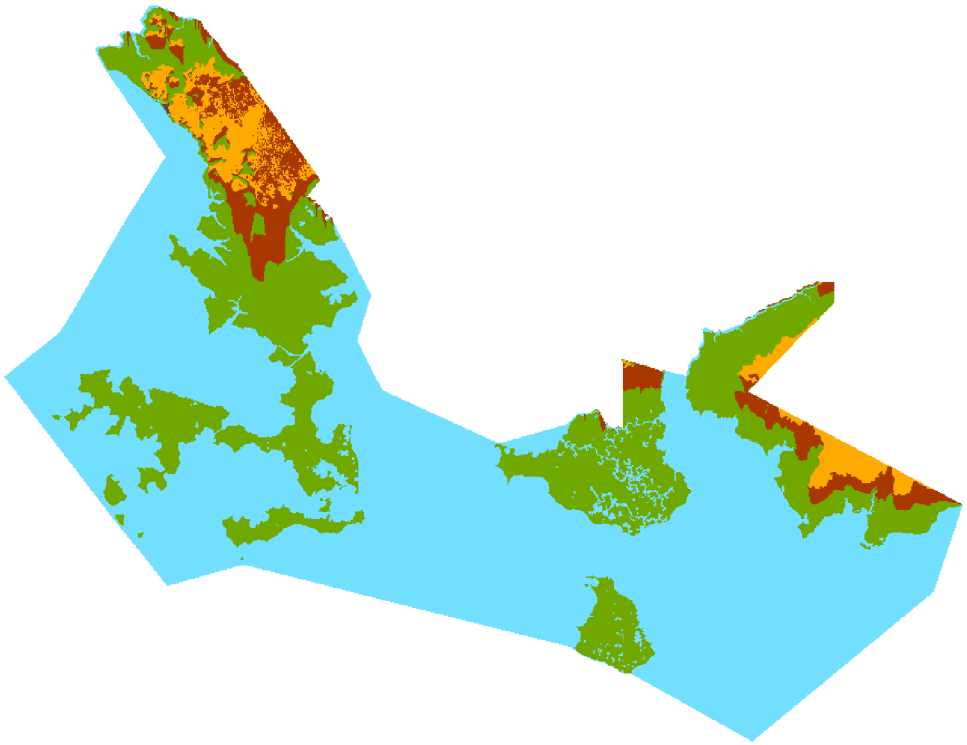
Projections of Habitat Changes (A1B mean scenario)								
	Area of habitat change in hectares				**Percentage of habitat change** (+) habitat gain, (-) habitat loss			
	Initial Condition	**2025**	**2050**	**2100**	**Initial Condition**	**2025**	**2050**	**2100**
Dry Land	3	3	2	0	0%	-15%	-33%	-99%
Swamp	864	603	414	150	5%	-30%	-52%	-83%
Transitional Salt Marsh	68	345	233	97	0%	+407%	+242%	+42%
Saltmarsh	4813	4798	1720	234	28%	0%	-64%	-95%
Tidal Flat	0	0	3380	280	0%	N/A	N/A	N/A
Estuarine Open Water	11461	11461	11461	16449	67%	0%	0%	+44%

Projections of Habitat Changes (A1B maximum scenario)								
	Area of habitat change in hectares				**Percentage of habitat change** (+) habitat gain, (-) habitat loss			
	Initial Condition	**2025**	**2050**	**2100**	**Initial Condition**	**2025**	**2050**	**2100**
Dry Land	3	3	1	0	0%	-20%	-56%	-100%
Swamp	864	528	288	54	5%	-39%	-67%	-94%
Transitional Salt Marsh	68	367	241	64	0%	+438%	+253%	+6%
Saltmarsh	4813	1587	375	161	28%	-67%	-92%	-97%
Tidal Flat	0	3265	1578	252	0	N/A	N/A	N/A
Estuarine Open Water	11461	11461	14725	16679	67	0	+28	+46

Swanquarter National Wildlife Refuge



A1B Minimum Sea Level Rise - Intial Condition



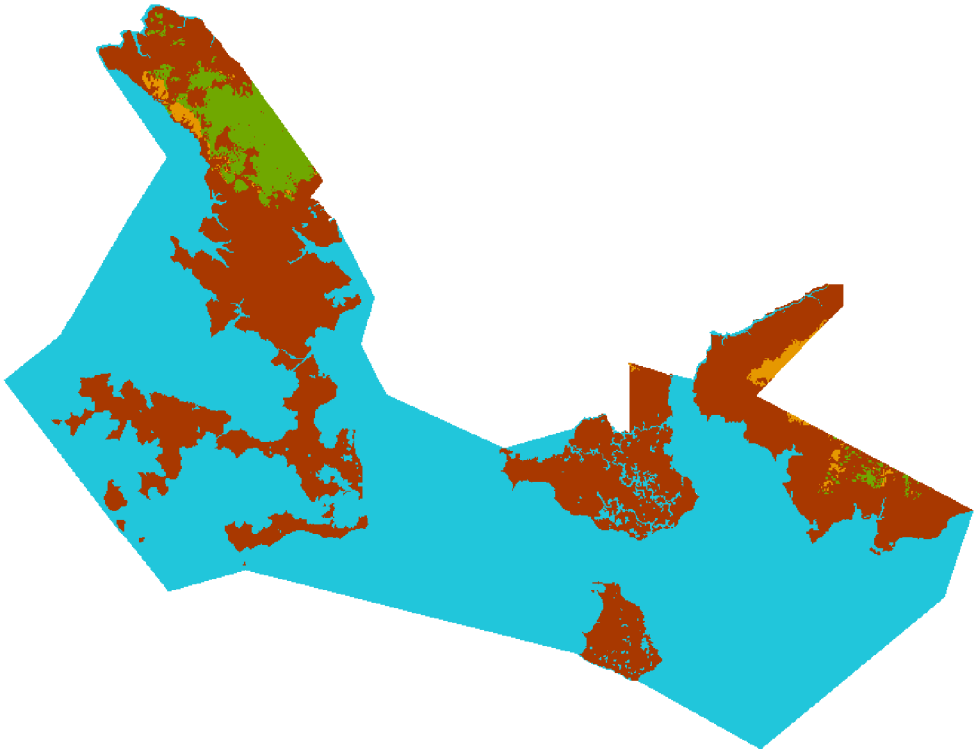
A1B Minimum Sea Level Rise - 2025

Legend

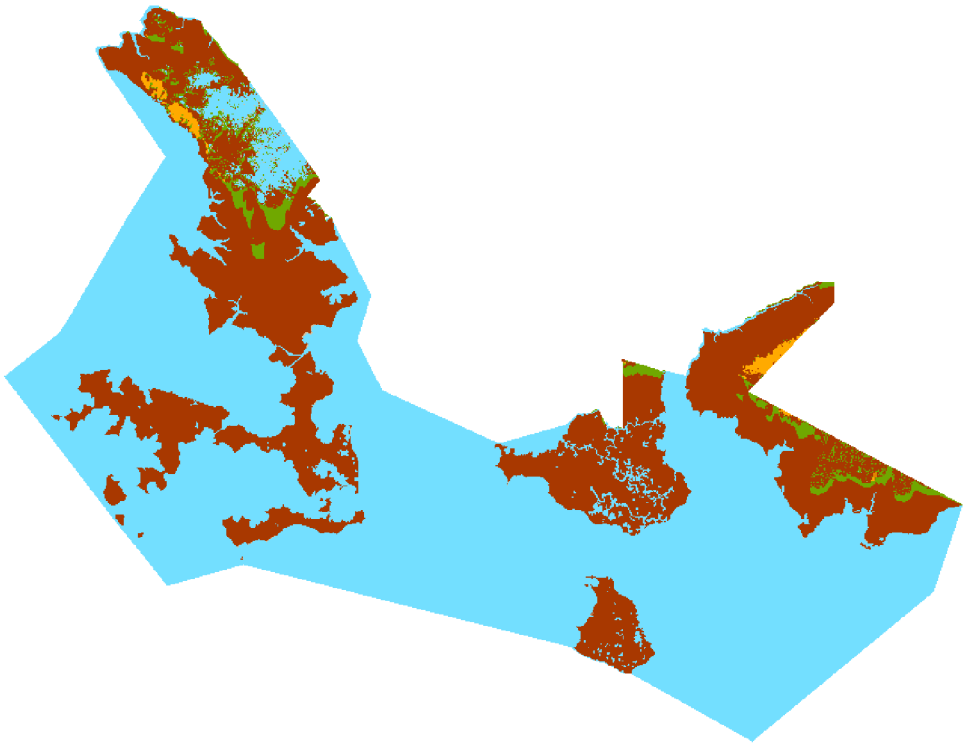
- Upland
- Saltmarsh
- Swamp
- Estuarine Open Water
- Transitional Saltmarsh

0 2,950 5,900 11,800 Kilometers

Swanquarter National Wildlife Refuge



A1B Minimum Sea Level Rise - 2050



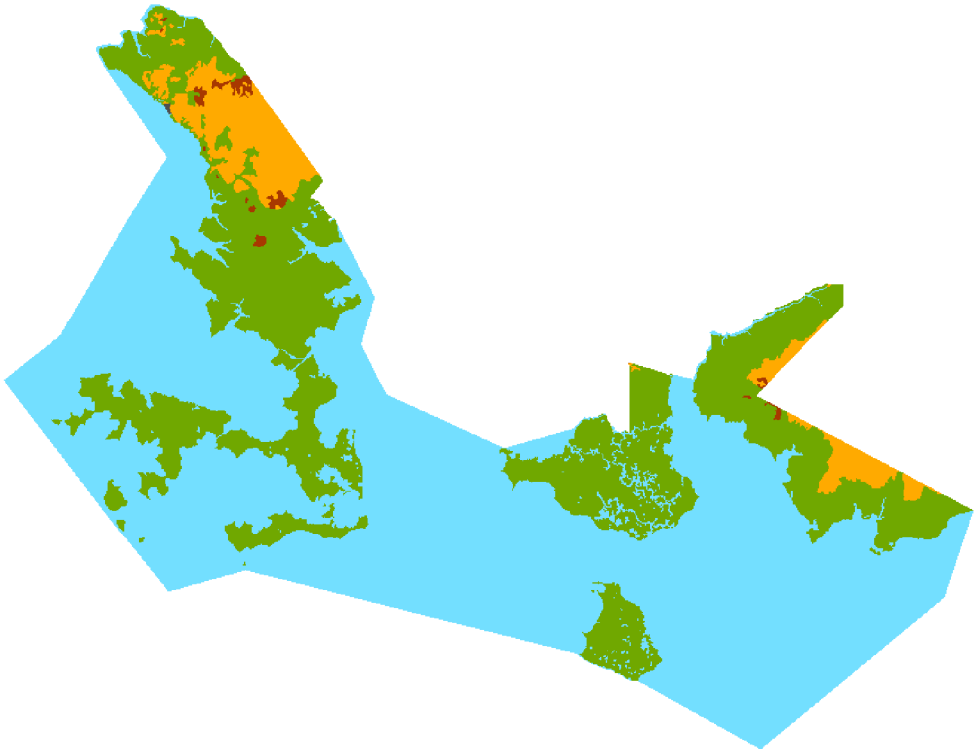
A1B Minimum Sea Level Rise - 2100

Legend

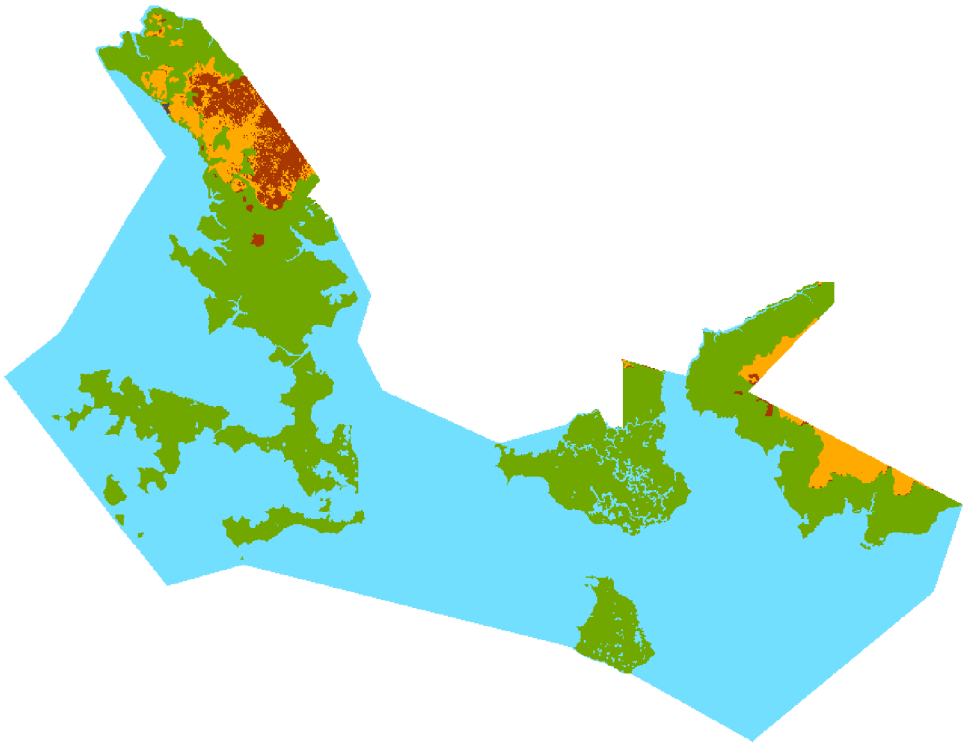
- Swamp
- Saltmarsh
- Transitional Saltmarsh
- Estuarine Open Water

0 2,950 5,900 11,800 Kilometers

Swanquarter National Wildlife Refuge



A1B Mean Sea Level Rise - Intial Condition



A1B Mean Sea Level Rise - 2025

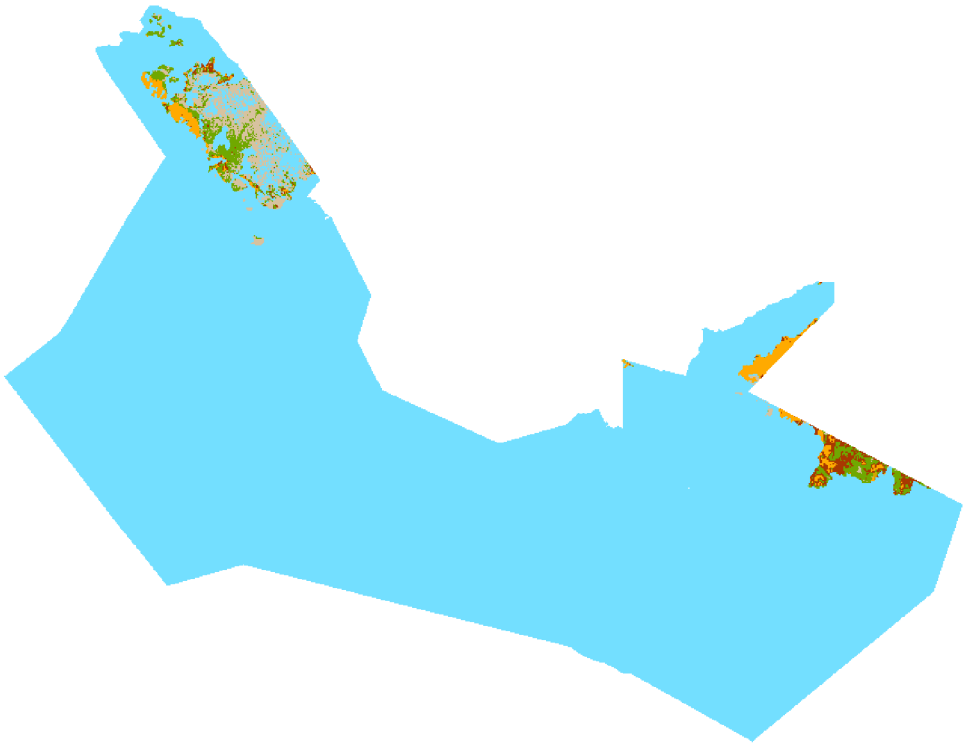
Legend

- Upland
- Swamp
- Transitional Saltmarsh
- Saltmarsh
- Estuarine Open Water

0 2,950 5,900 11,800 Kilometers

Swanquarter National Wildlife Refuge

A1B Mean Sea Level Rise - 2050



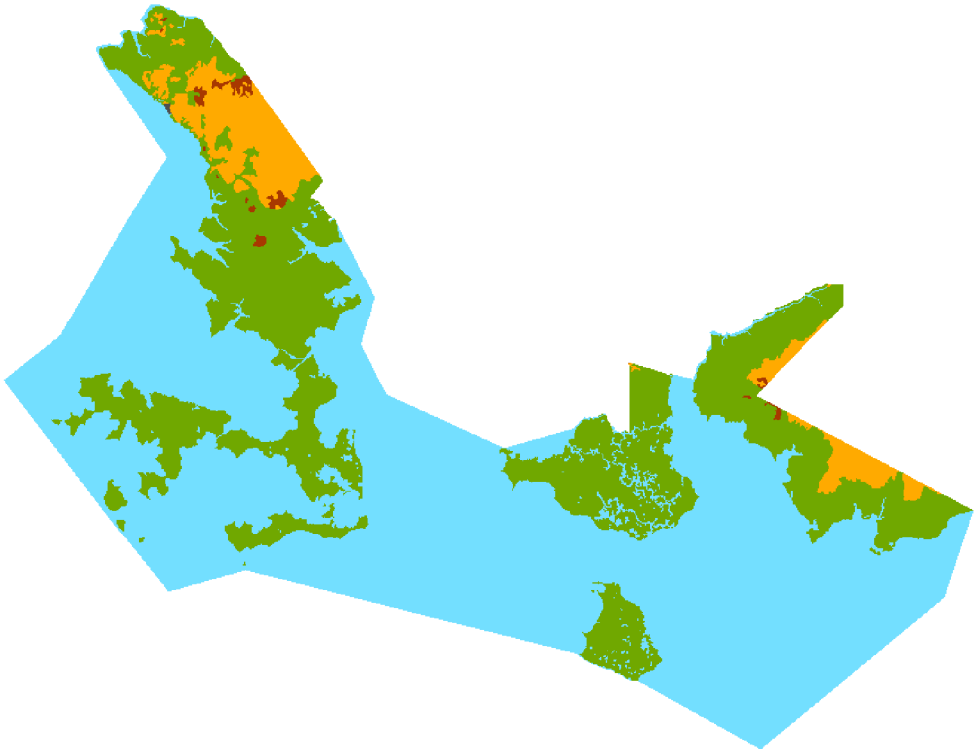
A1B Mean Sea Level Rise - 2100

Legend

- Upland
- Swamp
- Transitional Saltmarsh
- Saltmarsh
- Tidal Flat
- Estuarone Open Water

0 2,950 5,900 11,800 Kilometers

Swanquarter National Wildlife Refuge



A1B Maximum Sea Level Rise - Intial Condition

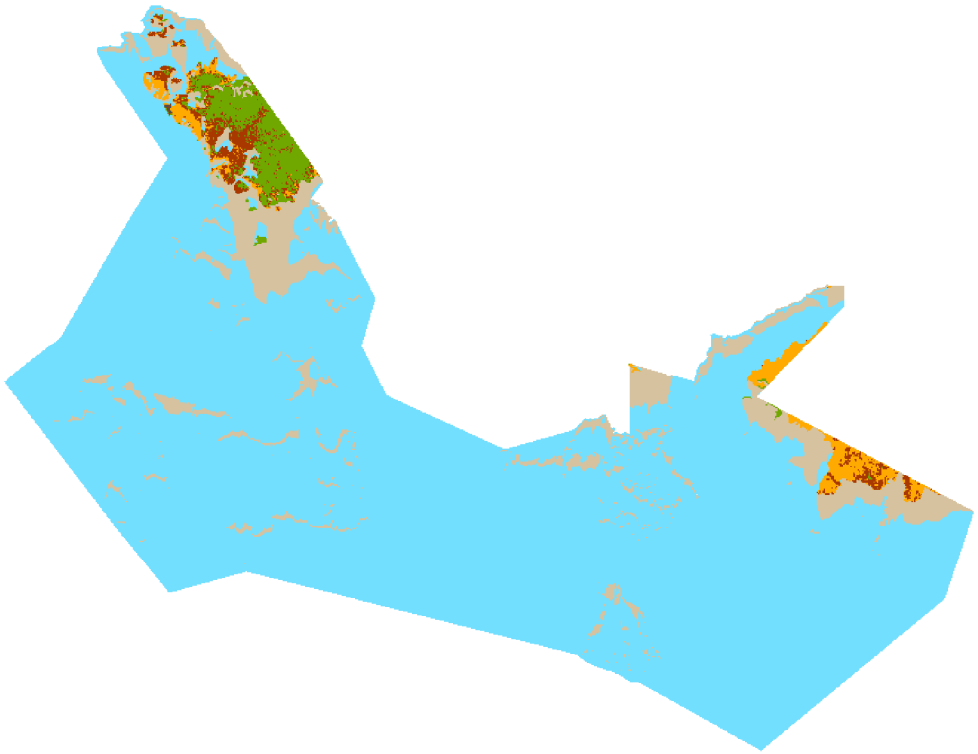
A1B Maximum Sea Level Rise - 2025

Legend

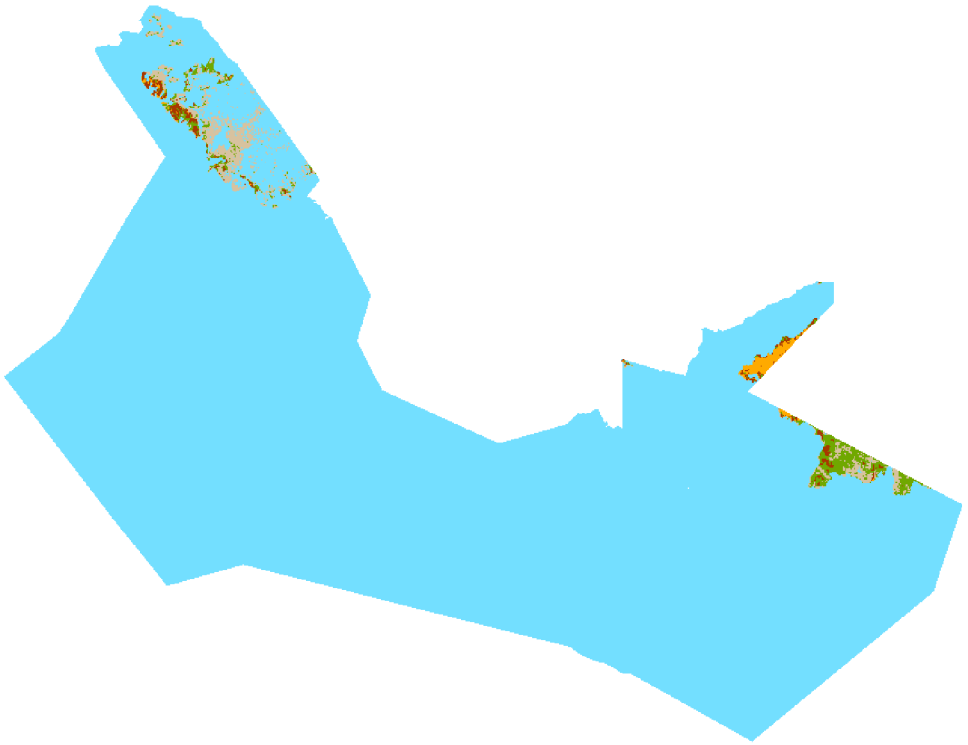
- Upland
- Swamp
- Transitional Saltmarsh
- Saltmarsh
- Estuarine Open Water

0 2,950 5,900 11,800 Kilometers

Swanquarter National Wildlife Refuge



A1B Maximum Sea Level Rise - 2050



A1B Maximum Sea Level Rise - 2100

Legend

- Upland
- Saltmarsh
- Swamp
- Tidal Flat
- Transitional Saltmarsh
- Estuarine Open Water

0 2,950 5,900 11,800 Kilometers