Tidal Marsh Adaptation Project: *Middle Peninsula, VA Regional Focus Area*

Marsh Adaptation Scenarios

The protection and restoration marsh adaptation scenarios are based on the NOAA Landscape Scale Marsh Resilience Framework marsh resilience categories and a decision matrix developed by USGS (Ganju et al. 2023), which correlates elevation and the Unvegetated to Vegetated Ratio (UVVR) in a geospatial analysis to guide marsh actions. While not shown here, the USGS is also developing a marsh lifespan calculator that will estimate how long the marsh could persist, which could inform future marsh adaptation decisions.

Protection Scenario: Use data to identify *healthy marshes* that are susceptible to sea level rise (SLR) and have the potential to migrate.

Indicator for Marsh Adaptation	Data Layers
• High Marsh Integrity – Good Condition	• UVVR (less than 0.15)
• High Vulnerability to Sea Level Rise	• Existing Tidal Marsh Layer • NOAA Sea Level Rise Scenarios (2050 and 2090 Intermediate and Intermediate High)
• High Adaptive Capacity	• Marsh Migration Corridor Envelope (MMCE) - Model synthesis indicating marsh migration potential • Protected Lands

Restoration Scenario: Use data to identify *degraded marshes* that are susceptible to SLR and have the potential to migrate.

Indicator for Marsh Adaptation	Data Layers
• Low Marsh Integrity – Degraded Condition	• UVVR (greater than 0.15)
• High Vulnerability to Sea Level Rise	• Existing Tidal Marsh Layer • NOAA Sea Level Rise Scenarios (2050 and 2090 Intermediate and Intermediate High)
• High Adaptive Capacity	• Marsh Migration Corridor Envelope (MMCE) - Model synthesis indicating marsh migration potential • Protected Lands

Guinea Marsh Complex, Middle Peninsula, VA Focus Area- Maps and Summaries

Maps were generated by Skeo to support the Chesapeake Bay Program's Goal Implementation Team (GIT)-funded project sponsored by the Climate Resiliency Workgroup (CRWG). This project is ongoing and aims to support partnership building and identification of marsh adaptation projects. Each map has a corresponding JPG file. The blue outlined polygons in the maps show areas of interest for restoration in the Guinea Marsh complex identified in the Coastal Wetland Plan for the York River, Piankatank River, and Mobjack Bay. Created maps were informed by discussions with Middle Peninsula, VA partners.

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Tidal Marsh Adaptation Project: *Middle Peninsula, VA Regional Focus Area*

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List of Maps

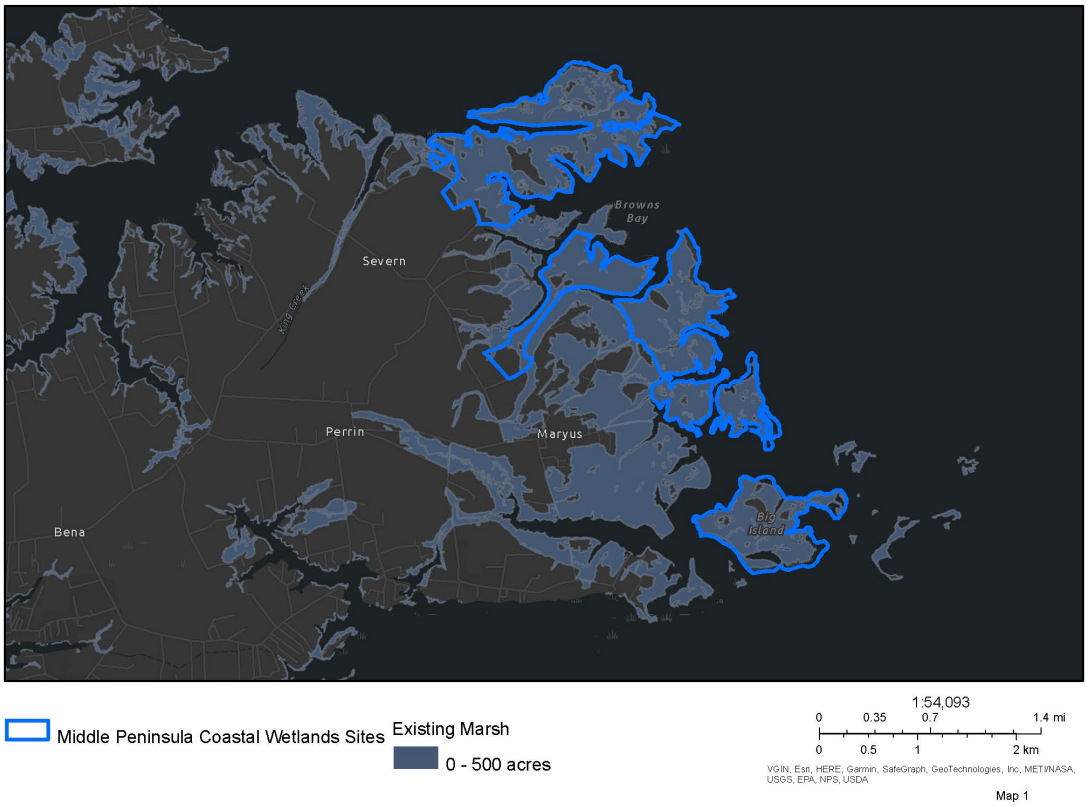
Marsh Adaptation Strategies based on Marsh Health and Potential Marsh Migration

These maps display available data related to sea level rise vulnerability, marsh health, and marsh migration potential.

Map 1—Existing Marshes and Guinea Marsh Complex
Purpose: Showcase opportunities for large-scale marsh adaptation.

Location of existing tidal marshes (blue) in the Guinea Marsh complex and Big Island from the Virginia Shoreline & Tidal Wetland Marsh Inventory.

Existing Marshes and Guinea Marsh Complex

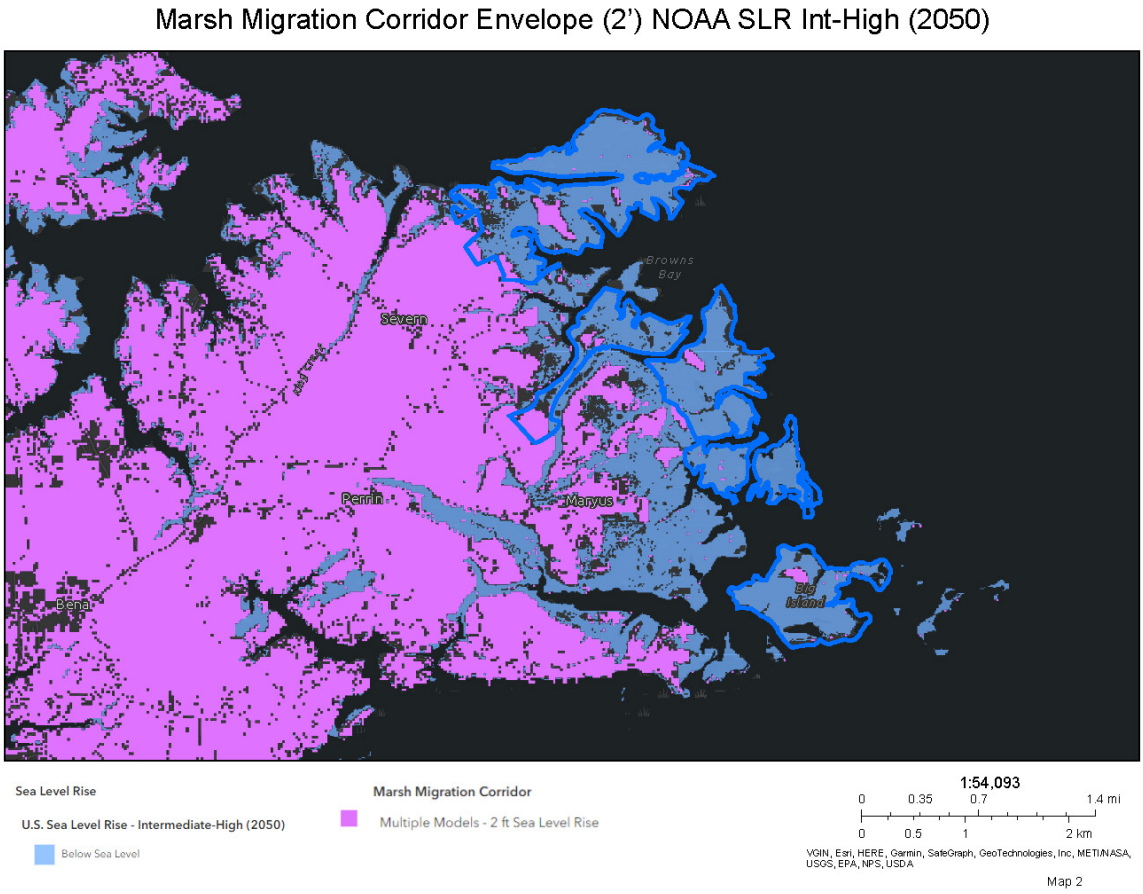


JPG File Name: Map_01_Guinea Marsh Complex_Existing Marsh

Map 2—Marsh Migration Corridor Envelope (2') NOAA SLR Int-High (2050)
Purpose: Identify protection needs to facilitate marsh migration

The Marsh Migration Corridor Envelope (MMCE) combines outputs from three marsh migration models to determine areas of potential marsh migration to future sea level rise (SLR) scenarios in Chesapeake Bay based on the methodology developed by the Virginia Institute of Marine Science (VIMS). Models included are the Sea Level Affecting Marshes Model 5.0 (SLAMM), a modified Integrated Valuation of Ecosystem Services and Tradeoffs (InVEST), and the Marsh Migration Mapping Method of the NOAA Sea Level Rise Viewer (NOAA). Existing tidal wetlands and impervious surfaces were removed from the MMCE.

Protection Scenario: The mapped data shows a significant potential for future marsh migration under various 2 ft. sea level rise scenarios (pink area; labeled as Multiple Models – 2 ft. Sea Level Rise) adjacent to land projected to be below sea level in 2050 (blue area; based on NOAA SLR Intermediate-High scenario). While the area is highly influenced by sea level rise, it also has high adaptive capacity. The marsh migration corridors (in pink) could be areas to target land conservation efforts to allow vulnerable marshes to migrate.



JPG File Name: Map_02_Guinea Marsh Complex_Marsh Migration

Map 3—Marsh Health (UVVR) and Marsh Migration Corridor Envelope (2')
Purpose: Identify restoration and/or protection potential of existing marshes

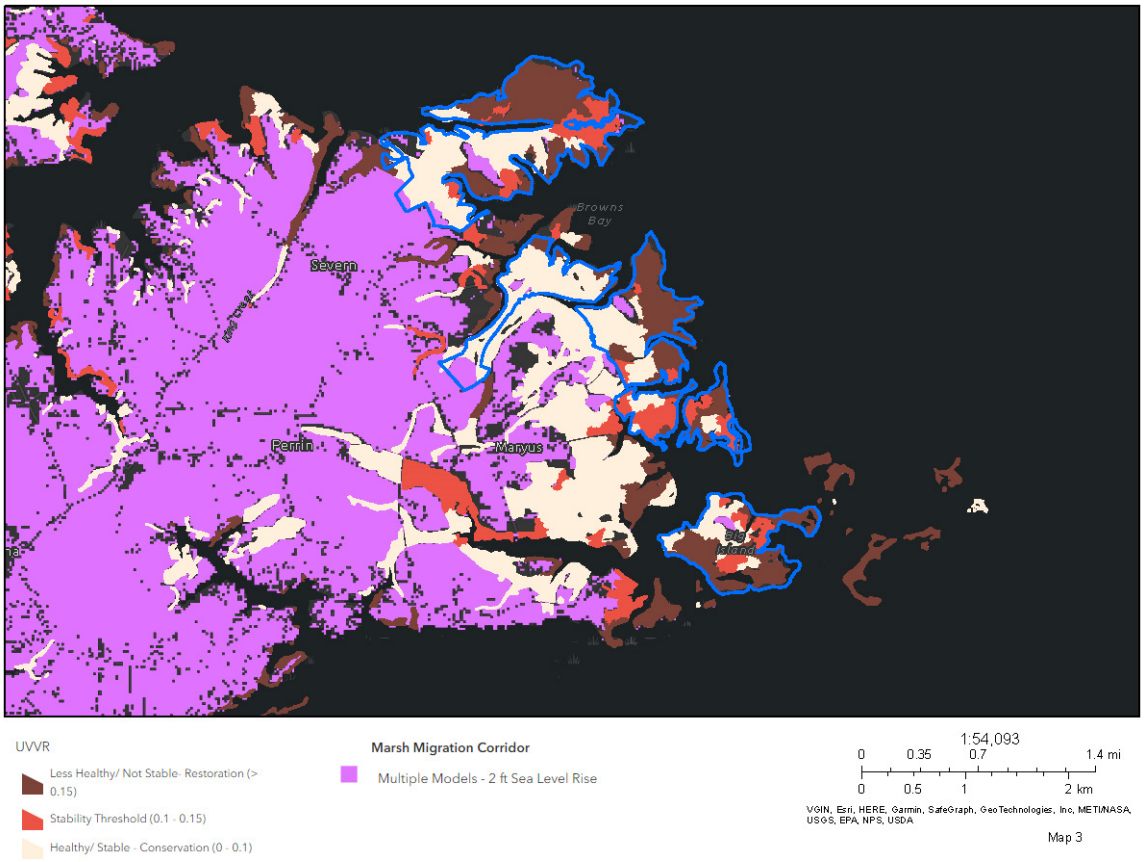
The unvegetated to vegetated ratio (UVVR) was developed by the USGS and is broadly an indicator of marsh health and stability. A smaller number indicates greater marsh stability, indicating areas for protection. A UVVR threshold greater than 0.15 indicates disintegration of the wetland complex making it less resilient to sea level rise, indicating areas for restoration. Restoration efforts that maintain a 0.15 or lower UVVR will allow for increased likelihood for marsh persistence.

Protection Scenario: Based on the UVVR data, significant areas of stable marsh (beige area; labeled as Healthy/Stable Conservation) exist adjacent to potential marsh migration corridors under various 2 ft. sea level rise scenarios (see description of the marsh migration corridor envelope in Map 2). Protecting those marshes can help prolong marsh persistence and facilitate migration as sea level rises.

Restoration Scenario: Smaller marshes that are less stable (red and burgundy) adjacent to potential marsh migration areas highlight opportunities for restoration and shoreline protection

efforts. Slowing down marsh degradation (i.e., decreasing the UVVR value) allows for the greater likelihood of increasing marsh persistence compared to taking no action. Additionally, increasing marsh health allows for the greater likelihood of marsh migration success in the future. Local input is imperative to ground truth mapped data.

Marsh Health (UVVR) and Marsh Migration Corridor Envelope (2')



JPG File Name: Map_03_Guinea Marsh Complex_Marsh Health & Marsh Migration

Map 4—Marsh Health (UVVR) and Marsh Migration Corridor Envelope (2') with VA Protected Lands

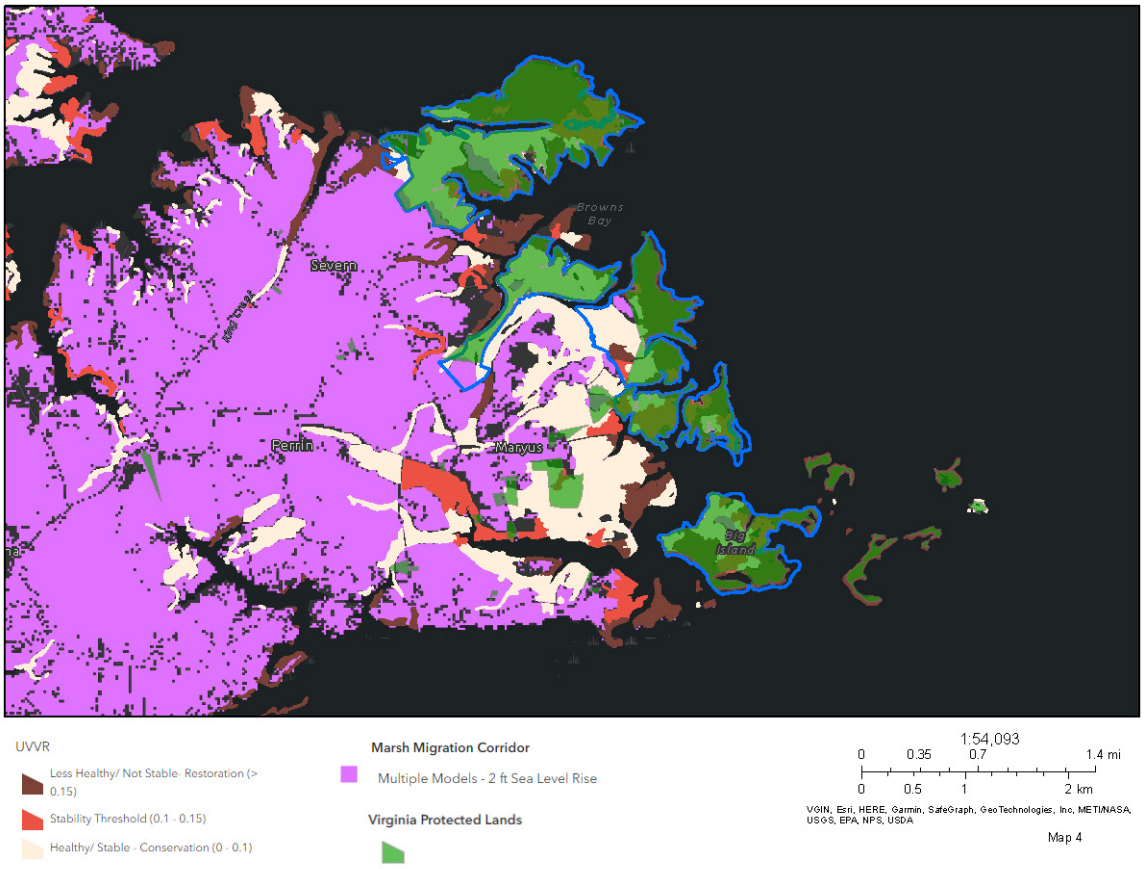
Purpose: Identify protection and restoration opportunities of existing marshes in relation to protected lands.

Marshes that are within protected lands offer opportunities for faster large-scale action in protecting and restoring marsh condition given their ownership. Though adjacent lands are privately owned, they are largely undeveloped unlike many other large-scale suitable migration corridors areas along Virginia's coastline. The opportunity to facilitate marsh migration on undeveloped tracts through easements, partnerships or land acquisition can support long-term coastal resilience.

Protection Scenario: Protected lands that adjoin areas with extensive healthy marsh and have potentially suitable migration corridors (see Map 2 for Marsh Migration Corridor Envelope description) indicate areas to protect.

Restoration Scenario: A significant amount of marsh within the protected lands (green area) is unstable or at the lower end of the stability threshold based on UVVR data (see Map 3 for UVVR description). These marshes could be targeted for restoration to enhance their likelihood to persist longer into the future.

Marsh Health (UVVR) and Marsh Migration Corridor Envelope (2') with VA Protected Lands



JPG File Name: Map_04_Guinea Marsh Complex_Marsh Health, Migration & Protected Areas

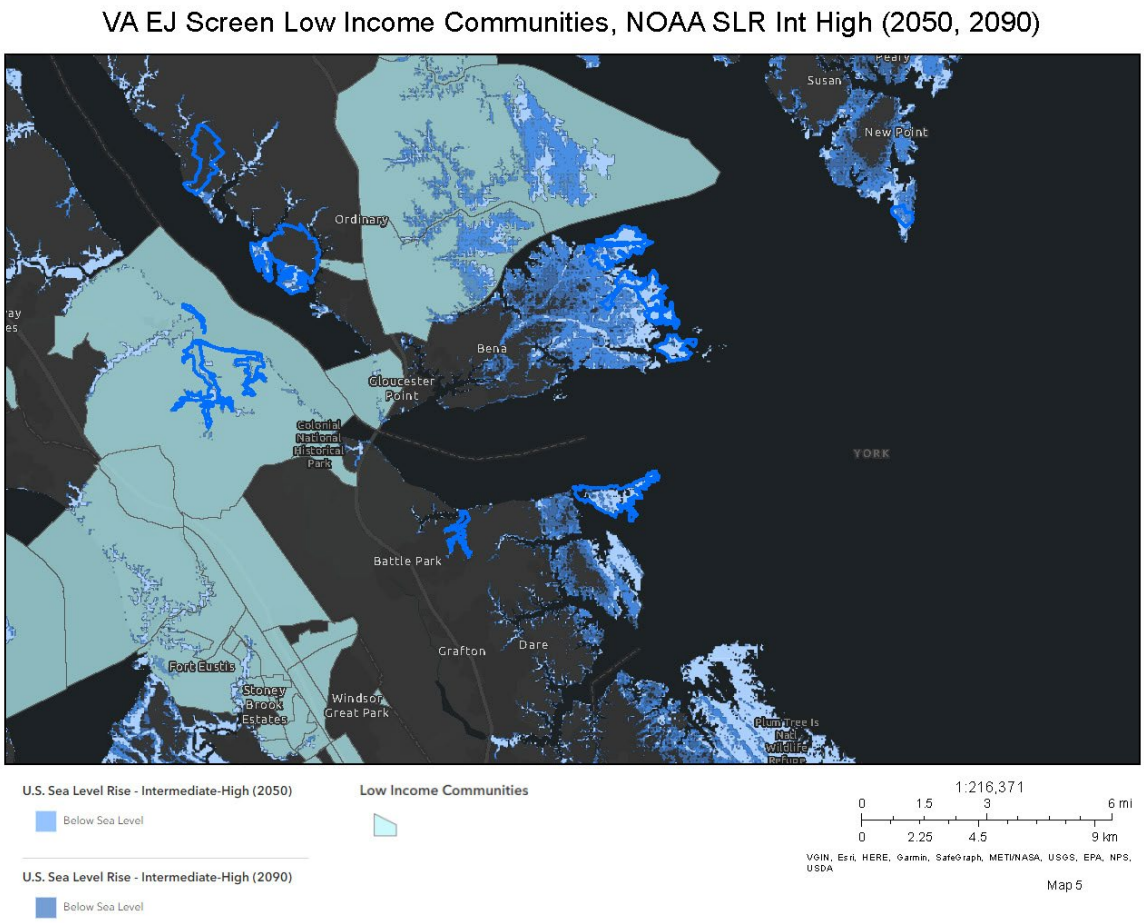
Marsh Adaptation—Land Use and Community Social Vulnerability Considerations

Maps 5-8
Purpose: Illustrate the vulnerability of communities adjacent to the Guinea Marsh complex as sea level rise leads to potential changes in land use, protection, infrastructure, and habitat.

Although the Guinea Marsh complex area is shown as low risk with the FEMA Risk Index (mainly due to low population present), projected SLR data to 2050 and 2090 shows that westward areas from the Guinea Marsh complex are at high risk (Map 6). As SLR extends westward from the Guinea Marsh complex, communities with higher populations, in addition to some low income areas (Map 5), will be exposed more to coastal climate change impacts (Map 7 and 8). Enhancing the longevity of the Guinea Marsh complex could slow down the displacement of people and support coastal protection for highly vulnerable communities.

Marsh migration corridors adjacent to the Guinea Marsh complex present potential opportunity to increase protection for adjacent communities particularly as sea level rises. Land use of the area adjacent to Guinea Marsh complex also indicates a unique opportunity to consider marsh migration strategies in an undeveloped area to increase coastal protection of nearby population centers (Map 8).

Map 5—VA EJ Screen Low Income Communities, NOAA SLR Int High (2050, 2090)

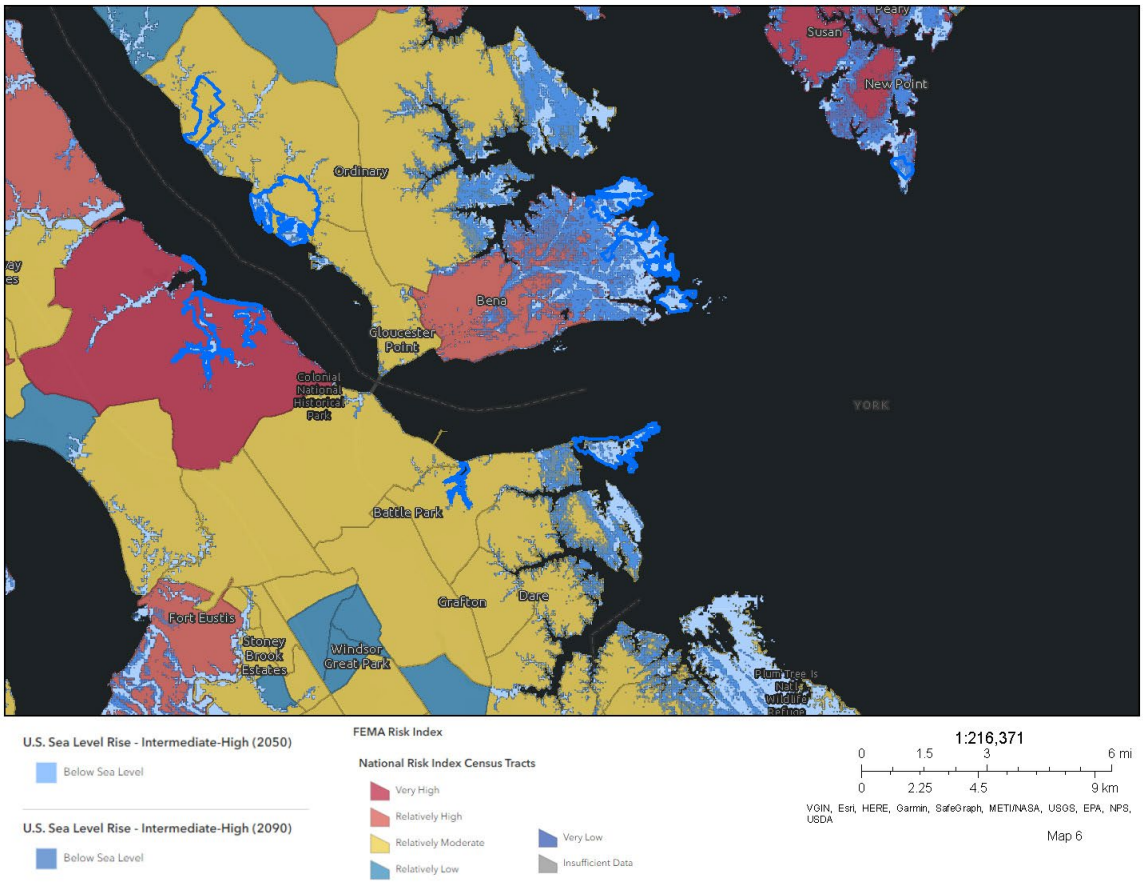


JPG File Name: Map_05_Guinea Marsh Complex_Low Income, SLR

Map 6—FEMA Risk Index, NOAA SLR Int High (2050, 2090)

The FEMA Risk Index looks at natural hazard and community risk factors at the census tract level. In the National Risk Index, risk is defined as the potential for negative impacts because of a natural hazard. The risk equation behind the Risk Index includes three components: a natural hazards component (Expected Annual Loss), a consequence-enhancing component (Social Vulnerability), and a consequence-reduction component (Community Resilience). Map shows both the NOAA SLR Intermediate-High scenario for 2050 (light blue) and 2090 (dark blue).

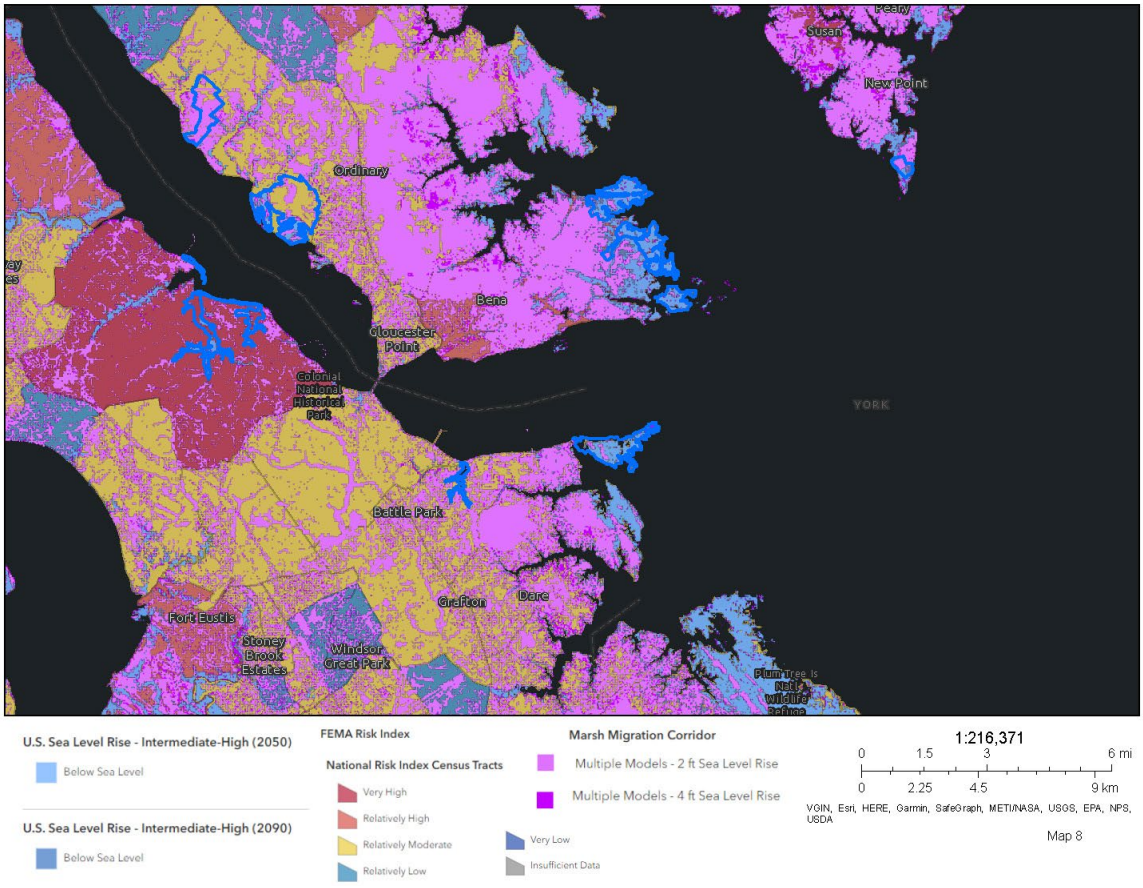
FEMA Risk Index, NOAA SLR Int High (2050, 2090)



JPG File Name: Map_06_Guinea Marsh Complex_FEMA Risk, SLR

Map 7—Marsh Migration Corridor Envelope (2', 4'), FEMA Risk Index, NOAA SLR Int High (2050, 2090)

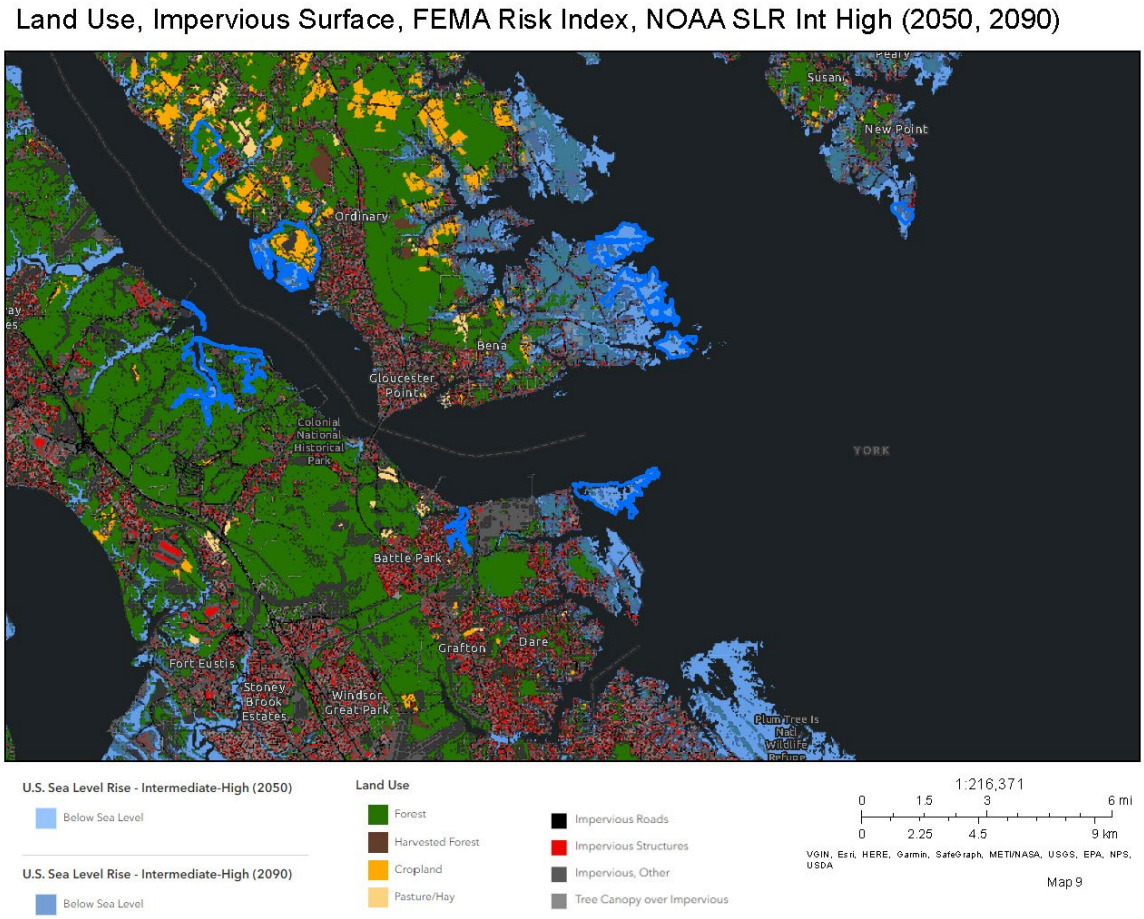
Marsh Migration Corridor Envelope (2', 4'), FEMA Risk Index, NOAA SLR Int High (2050, 2090)



JPG File Name: Map_07_Guinea Marsh Complex_Migration, FEMA, SLR

Note: The Marsh Migration Corridor Envelope (MMCE) is described above in Map 3. This map shows both the 2 ft. and 4 ft. MMCE, representative of predicted marsh migration for the mid-21st century (~2050) and end of 21st century (~2090), respectively.

Map 8—Land Use, Impervious Surface (red), FEMA Risk Index, NOAA SLR Int High (2050, 2090)



JPG File Name: Map_08_Guinea Marsh Complex_Landuse, FEMA, SLR

Note: Land use and impervious surface layers are from the Chesapeake Bay Land Use and Land Cover (LULC) Database 2022 Edition.

Linking Marsh Resiliency Opportunities with Funding Priorities

In light of recent federal infrastructure funding opportunities, resulting from the Inflation Reduction Act and Bipartisan Infrastructure Law, the mapper provides a means of identifying targeted sites for marsh resilience efforts that align with funding priorities. Below are a few mapping scenarios to highlight how this mapper can assist in linking marsh resilience projects with funding priorities to bolster project proposals.

Connection to Living Resource Funding Opportunities

Example: The National Oceanic and Atmospheric Transformational Habitat Restoration and Coastal Resilience Grants

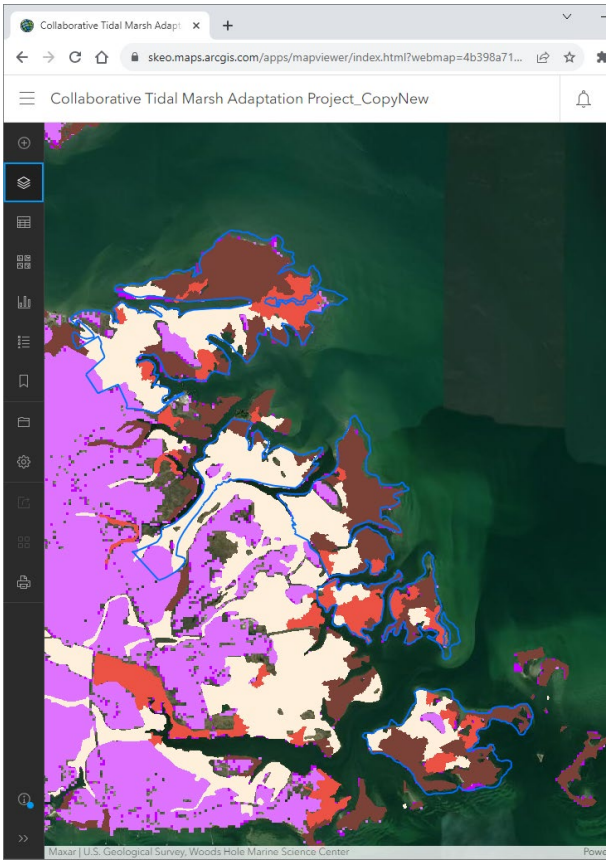
> *The principal objective of this solicitation is to support transformational habitat restoration projects that restore marine, estuarine, coastal, or Great Lakes ecosystems, using approaches that enhance community and ecosystem resilience to climate hazards. Funding will prioritize habitat restoration actions that: demonstrate significant impacts; rebuild productive and sustainable fisheries; contribute to the recovery and conservation*

of threatened and endangered species; promote climate-resilient ecosystems, especially in tribal, indigenous, and/or underserved communities; and improve economic vitality, including local employment.

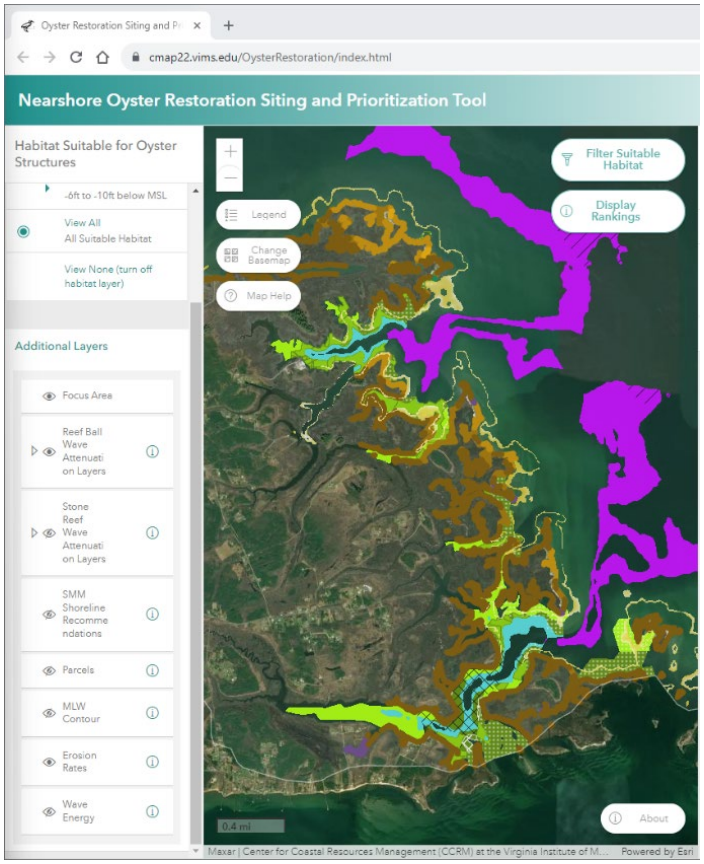
These maps demonstrate data options that could be used to identify potential opportunities to align marsh adaptation, oyster restoration, oyster structure placement, shoreline protection, and fish habitat. The marsh adaptation maps could be viewed side by side with the Nearshore Oyster Restoration Siting and Prioritization Tool from VIMS to provide insights where oyster structures could be placed to protect vulnerable marsh habitat (see Map 3 and Map 9).

Example:

Map 3 (see above for details)



Map 9



JPG File Names:

Map_03_Guinea Marsh Complex_Marsh Health & Marsh Migration

Map_09_Guinea Marsh Complex_Oyster Siting Tool

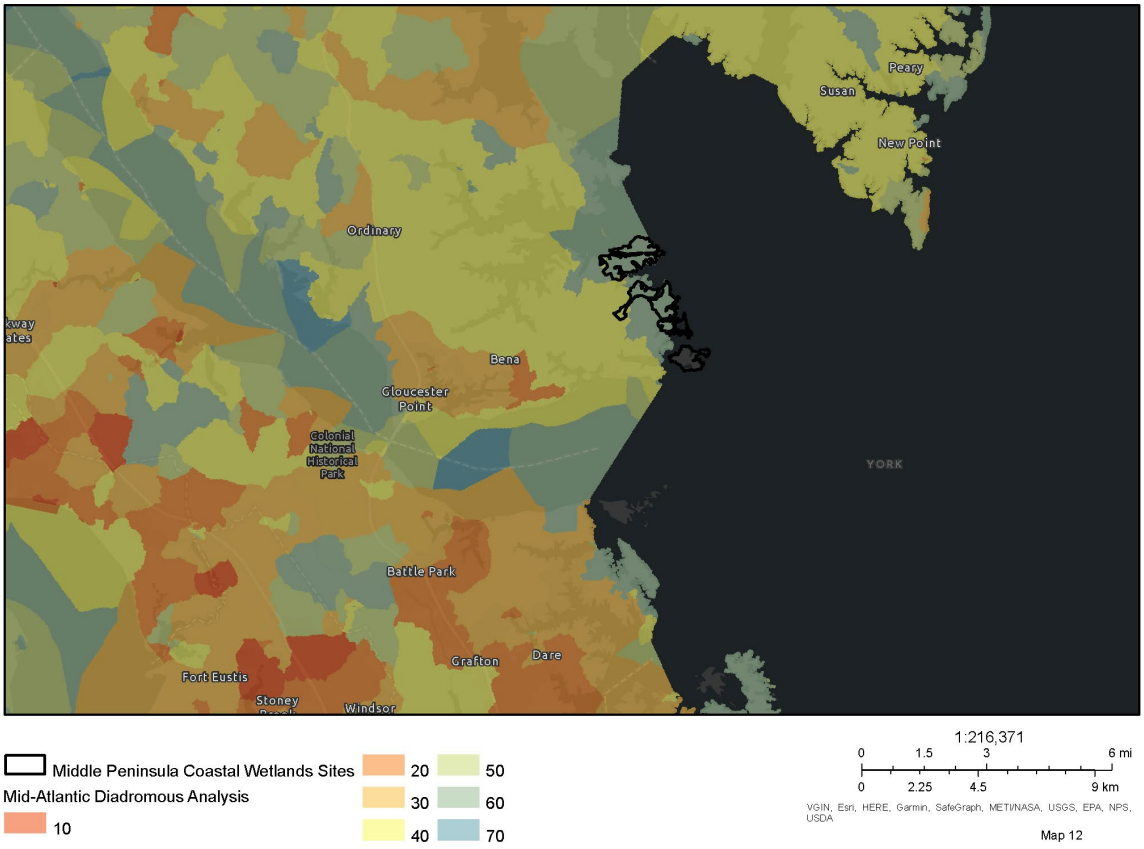
Map 10 and 11—Fish Habitat Scores

The Atlantic Coastal Fish Habitat Partnership (ACFHP) developed both the diadromous fish habitat (Map 10) and the estuarine analysis (Map 11) scores. These scores ranged from 0-80 with higher scores representing better fish habitat (e.g., exposed to less stressors). Metrics for the diadromous fish habitat scoring included impervious surface, point and nonpoint source pollution, riparian buffers, species access, flow alteration, local fragmentation, and Endangered

Species Act (ESA) critical habitat. Metrics for the estuarine analysis scoring included seagrass and oyster reef habitat, wetland habitat, water-vegetation edge, proximity to protected habitat, proximity to development, water quality, hardened shoreline, and habitat fragmentation. The suggested conservation actions are based on the final score: above 60 = area of excellent fish habitat for protection; 20-60 = restoration opportunity area for fish habitat; below 20 = degraded areas of opportunity.

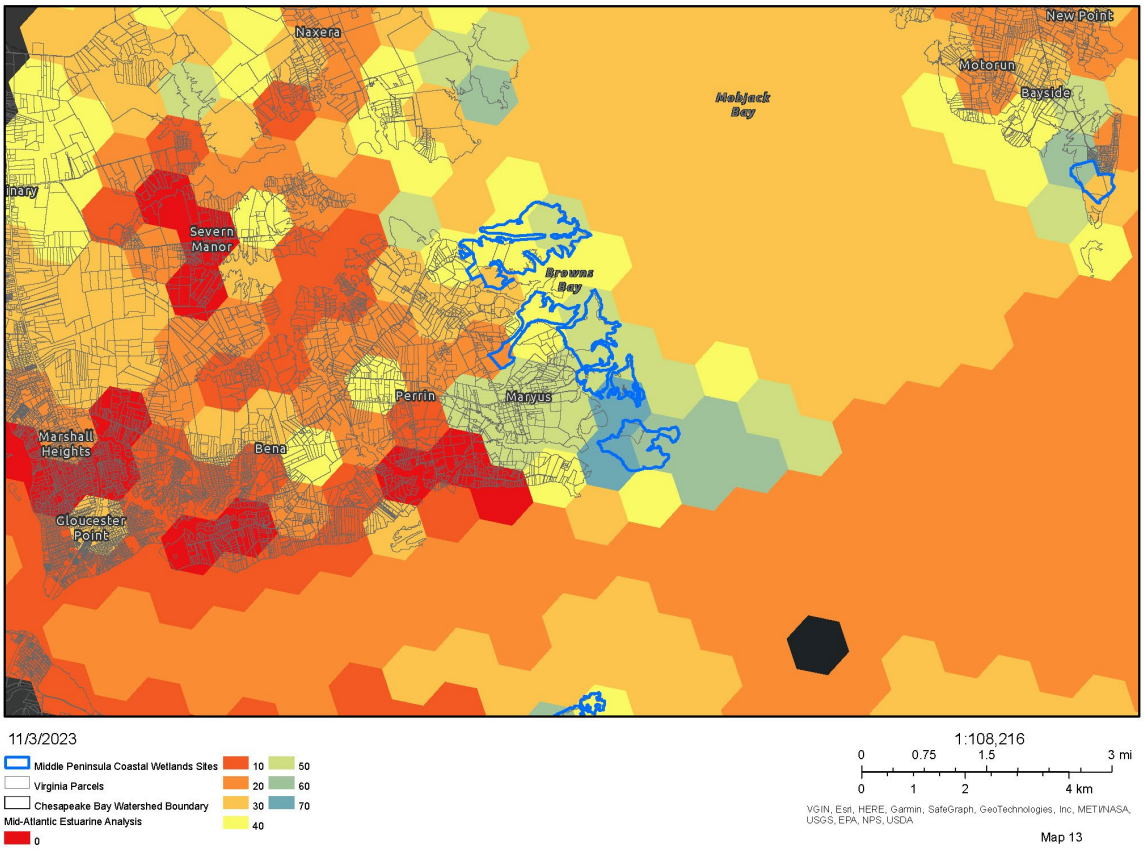
The areas of interest for restoration and protection indicated by the Middle Peninsula Coastal Wetland Sites polygons have a diadromous score of 60 across most of the areas and estuarine analysis scores ranging from 30-70 with higher scores at the southernmost sites of the Guinea Marsh complex. The highest score of 70 occur in marsh area near Big Island.

Fish Habitat



JPG File Name: Map_10_Guinea Marsh Complex_Fish Habitat Diadromous Scores

Estuarine Analysis



JPG File Name: Map_11_Guinea Marsh Complex_Fish Habitat Estuarine Scores

Connection to Community Resiliency Funding

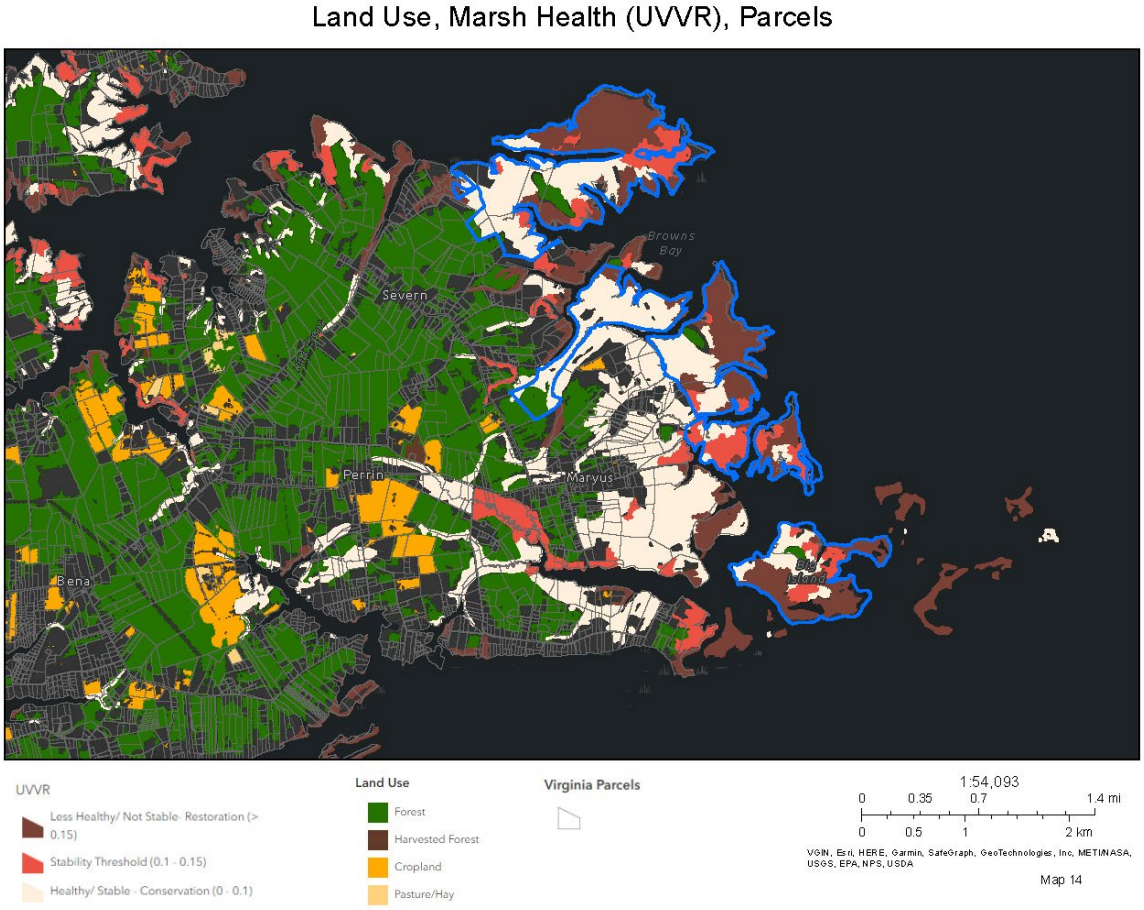
Example: NCCOS National Coastal Resilience Fund

> *The National Coastal Resilience Fund restores, increases and strengthens natural infrastructure to protect coastal communities while also enhancing habitats for fish and wildlife. Established in 2018, the National Coastal Resilience Fund invests in conservation projects that restore or expand natural features such as coastal marshes and wetlands, dune and beach systems, oyster and coral reefs, forests, coastal rivers and floodplains, and barrier islands that minimize the impacts of storms and other naturally occurring events on nearby communities.*

Property Acquisition Studies (Land Use, Marsh Migration Corridors, Projected Marsh and Habitat Transition, Ownership)

Areas where there is potential for marsh migration adjacent to publicly owned lands and healthy marshes (UVVR = 0-0.1) could be considered for acquisition to enhance coastal resilience and habitat over the long term. Reference maps showing land use, marsh health, and potential marsh migration are included below (Map 12 and 13).

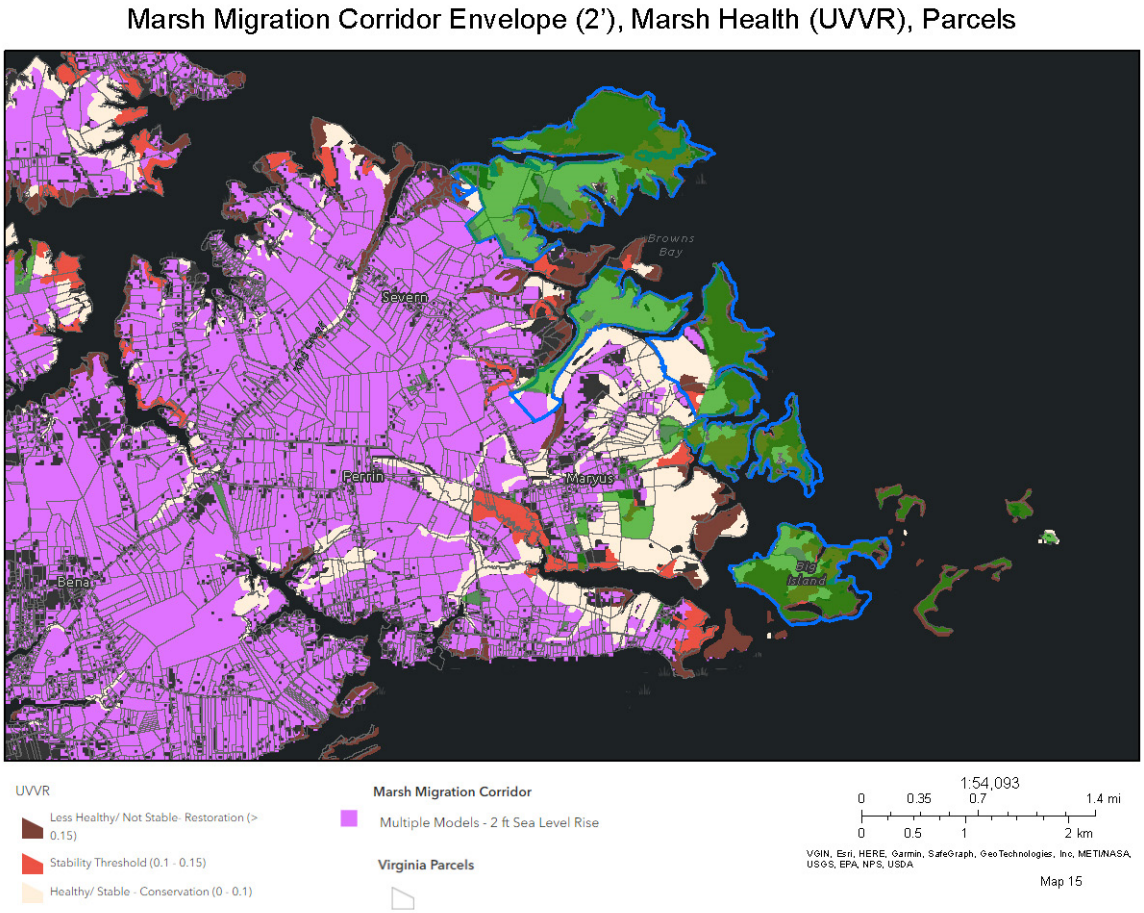
Map 12—Land Use, Marsh Health (UVVR), Parcels



JPG File Name: Map_12_Guinea Marsh Complex_Landuse, UVVR, Parcels

Note: The Land Use layer is described in Map 8 and UVVR in Map 3.

Map 13—Marsh Migration Corridor Envelope (2'), Marsh Health (UVVR), Parcels:



JPG File Name: Map_13_Guinea Marsh Complex_Migration, UVVR, Parcels

Note: The Marsh Migration Corridor Envelope layer is described in Map 2 and UVVR in Map 3.