Wetlands Adaptation for Resilience

Envision the Choptank

Oct 22, 2024

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Virginia Coastal Zone
MANAGEMENT PROGRAM

VIMS | WILLIAM & MARY
VIRGINIA INSTITUTE OF MARINE SCIENCE
CENTER FOR COASTAL RESOURCES MANAGEMENT

Adaptation Overview

1. Marsh Migration Modeling
    1. Model potential tidal wetlands for each decade from 2030 to 2100
    2. Consider Land use / Land cover
2. Marsh Adaptation Approaches
3. Multi-Habitat = Multi-Benefits

Model Output

- Wetland tidal envelopes per decade from 2030 – 2100
  - Upper: 1.5X intertidal range from MLW
  - Lower: MLW
- Land use/land cover within tidal envelope on a decadal interval
- Locality and PDC-level summaries

Modeling “Marsh”

1. Extracted the potential areal footprint of marshes for each decade from 2030 to 2100 from the USGS CoNED Topobathymetric Elevation Model of Chesapeake Bay (CBTBDEM) in R version 4.1.2 using the “terra” and “foreach” packages.

2. Upper and lower extents for marshes in each decade were identified using contours also executed using the “terra” package in R.

NOTE: The mean low water locations are conservative estimates due to the absence of erosion and drowning as dynamic processes through time

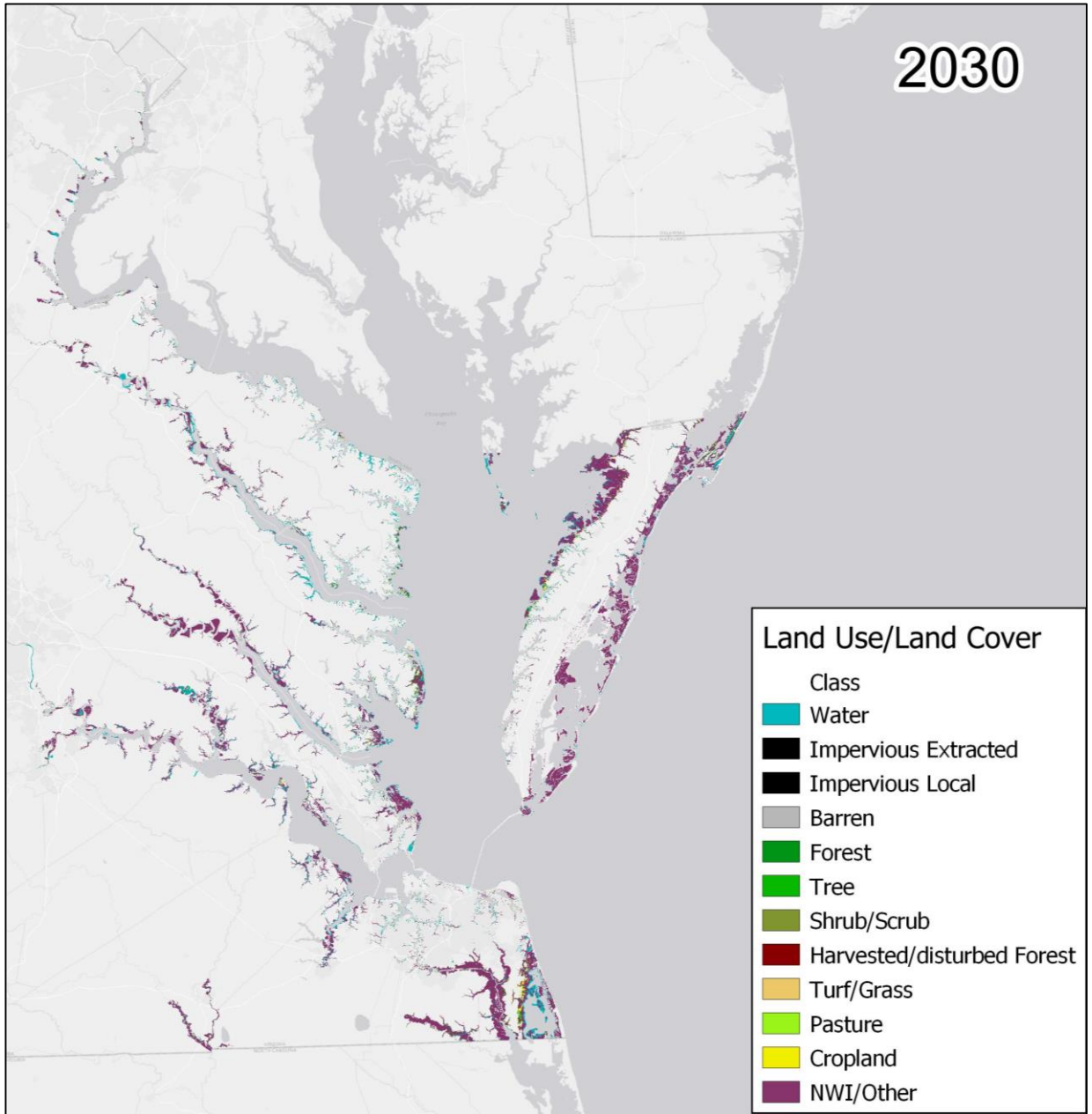
Year	RSL	MLW	Upper
2020	0.051	-0.323	0.787
2030	0.151	-0.223	0.887
2040	0.251	-0.123	0.987
2050	0.361	-0.013	1.097
2060	0.481	0.107	1.217
2070	0.621	0.247	1.357
2080	0.781	0.407	1.517
2090	0.981	0.607	1.717
2100	1.201	0.827	1.937

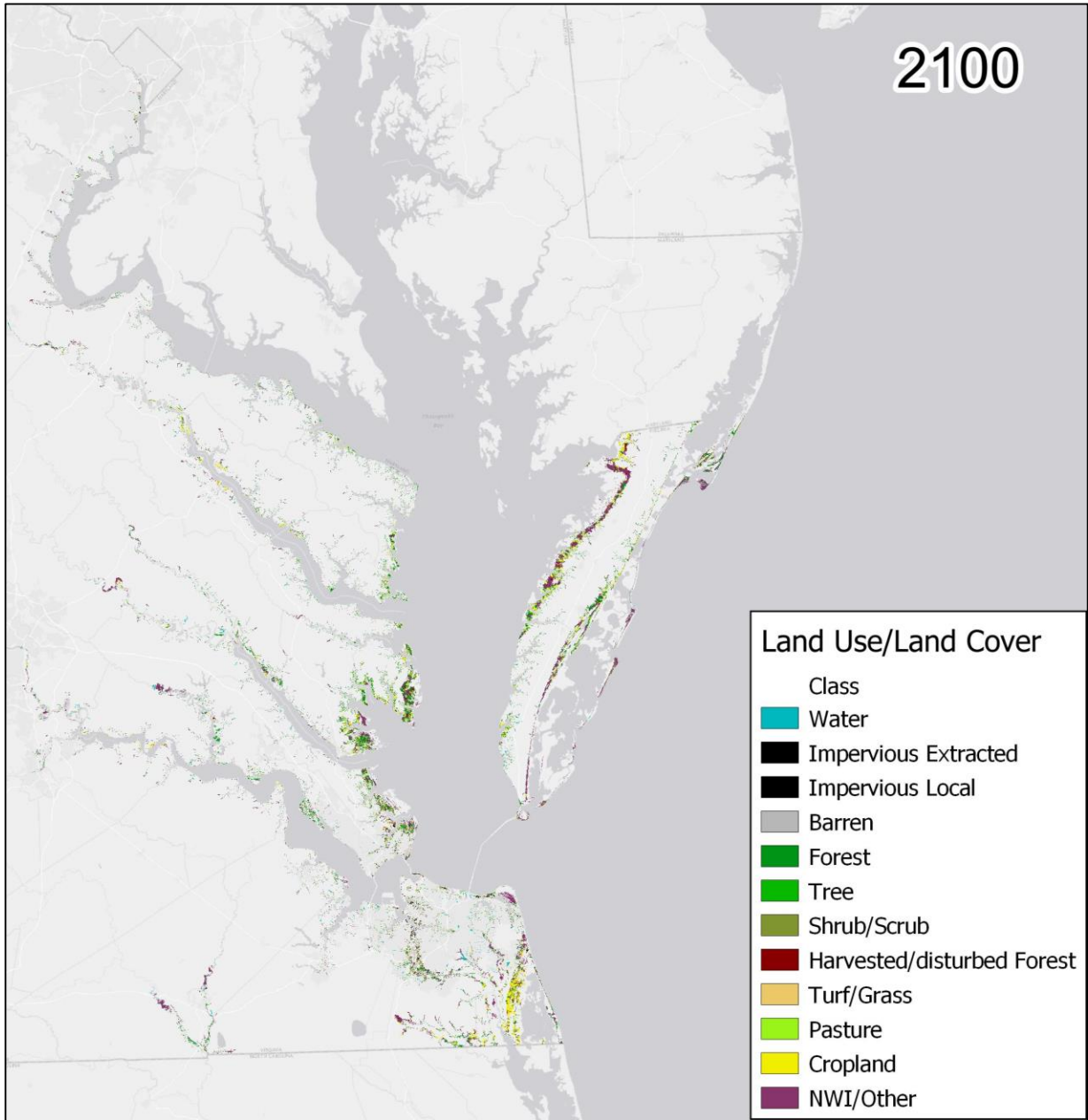
RSL: mean sea level accounting for SLR
MLW: mean low water
Upper: MLW + 1.5 * Intertidal range.

Projected Wetlands 2050 and 2090

City of Poquoson

LULC:VA

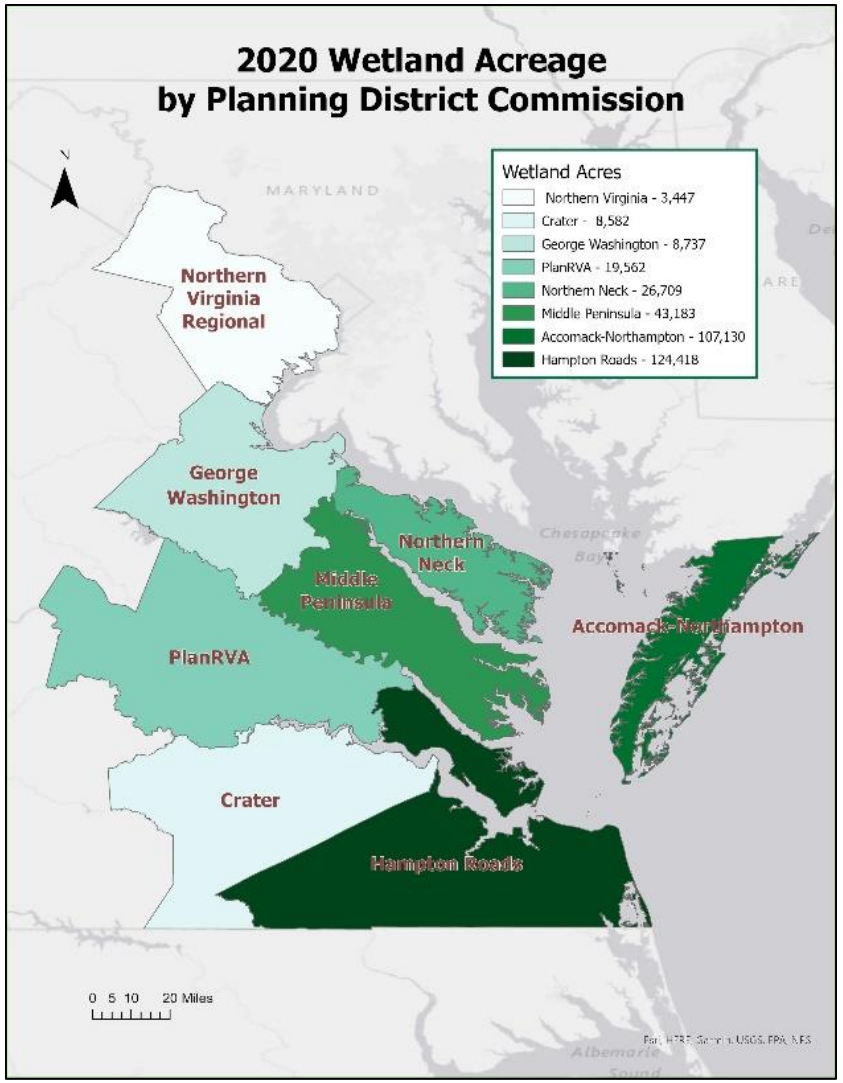

2030
Land Use/Land Cover
Class
Water
Impervious Extracted
Impervious Local
Barren
Forest
Tree
Shrub/Scrub
Harvested/disturbed Forest
Turf/Grass
Pasture
Cropland
NWI/Other

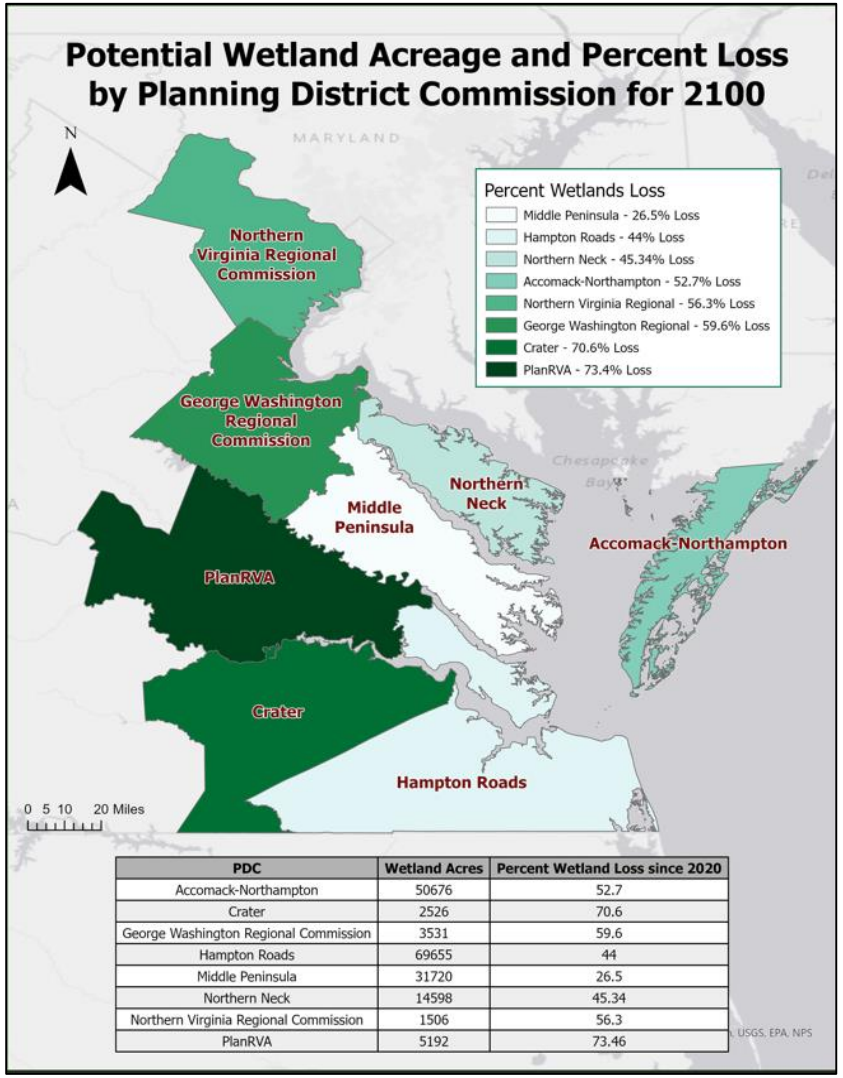

2100
Land Use/Land Cover
Class
Water
Impervious Extracted
Impervious Local
Barren
Forest
Tree
Shrub/Scrub
Harvested/disturbed Forest
Turf/Grass
Pasture
Cropland
NWI/Other

Changes in Wetland Area

Year	Acres
2020	336,896
2030	336,339
2040	335,574
2050	315,053
2060	310,576
2070	293,173
2080	249,132
2090	192,657
2100	176,292
Total Loss:	160,604

Total Area of Potential Tidal Wetlands by Decade 2020-2100

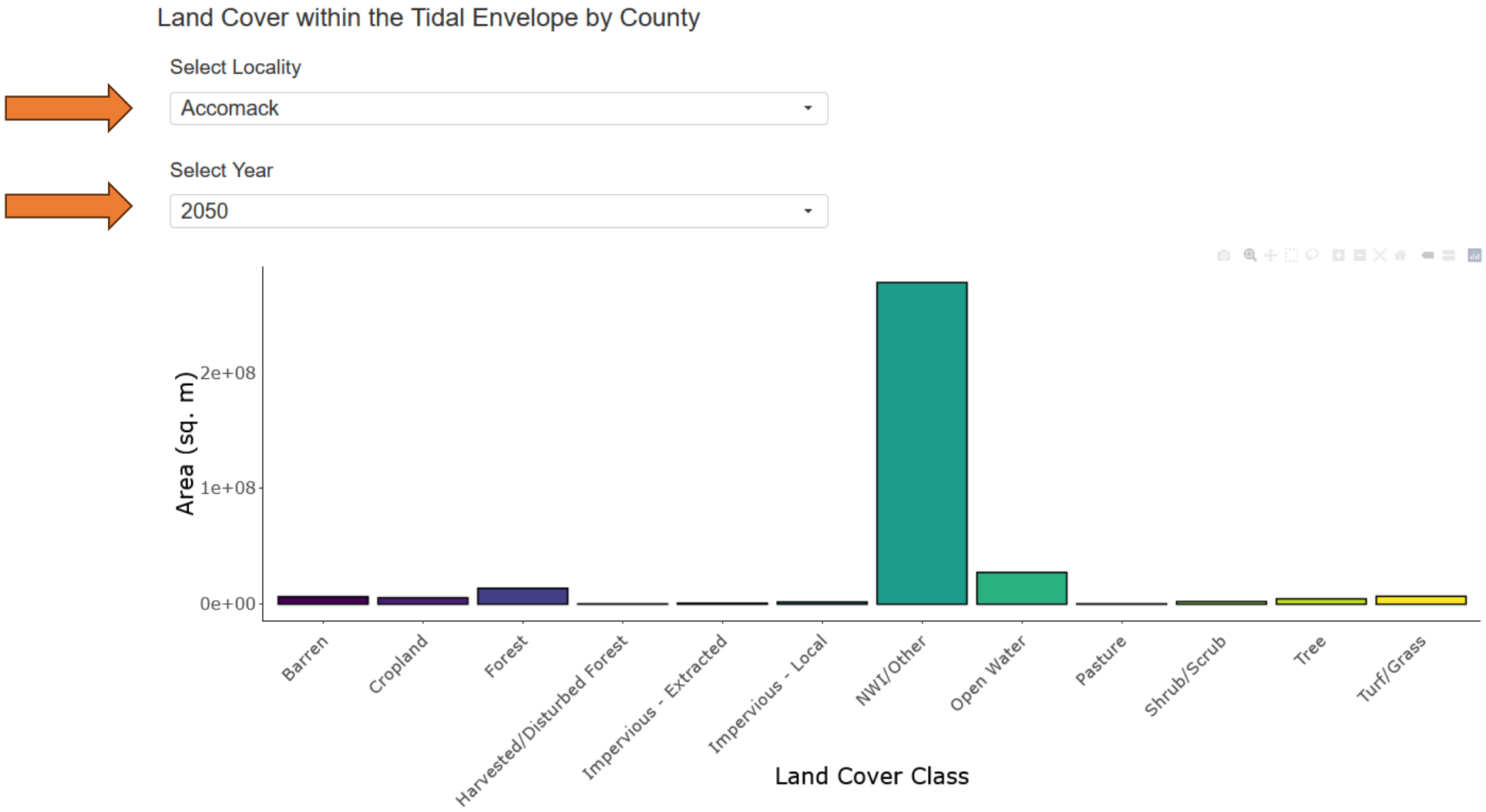




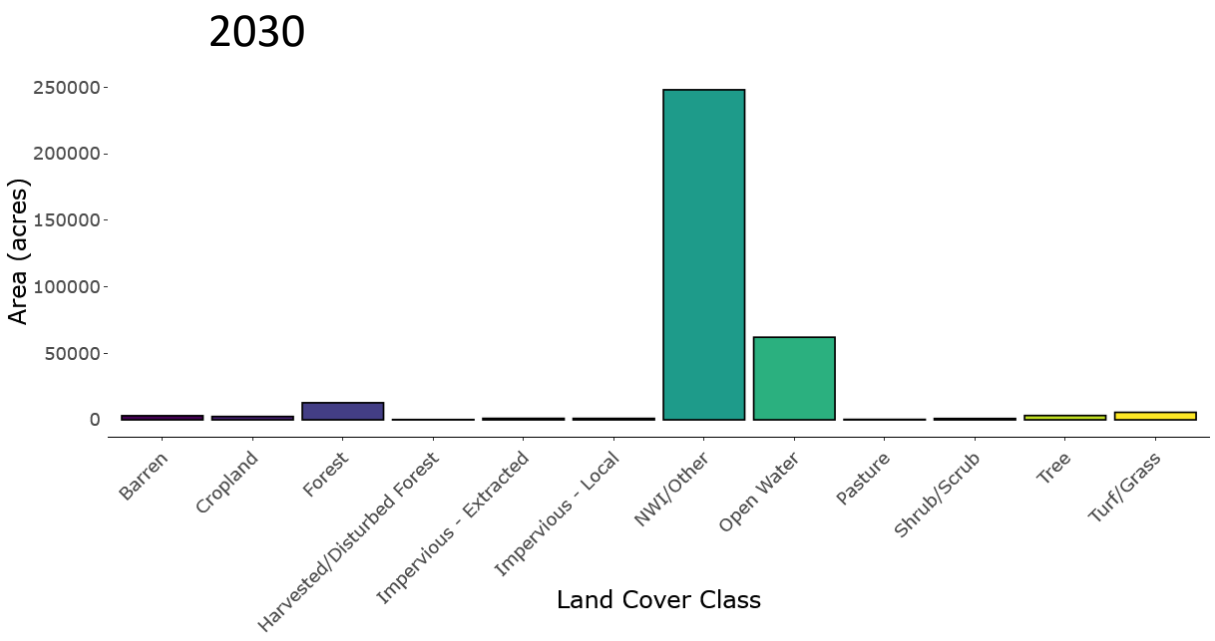
PDC	Wetland Acres	Percent Wetland Loss since 2020
Accomack-Northampton	50676	52.7
Crater	2526	70.6
George Washington Regional Commission	3531	59.6
Hampton Roads	69655	44
Middle Peninsula	31720	26.5
Northern Neck	14598	45.34
Northern Virginia Regional Commission	1506	56.3
PlanRVA	5192	73.46

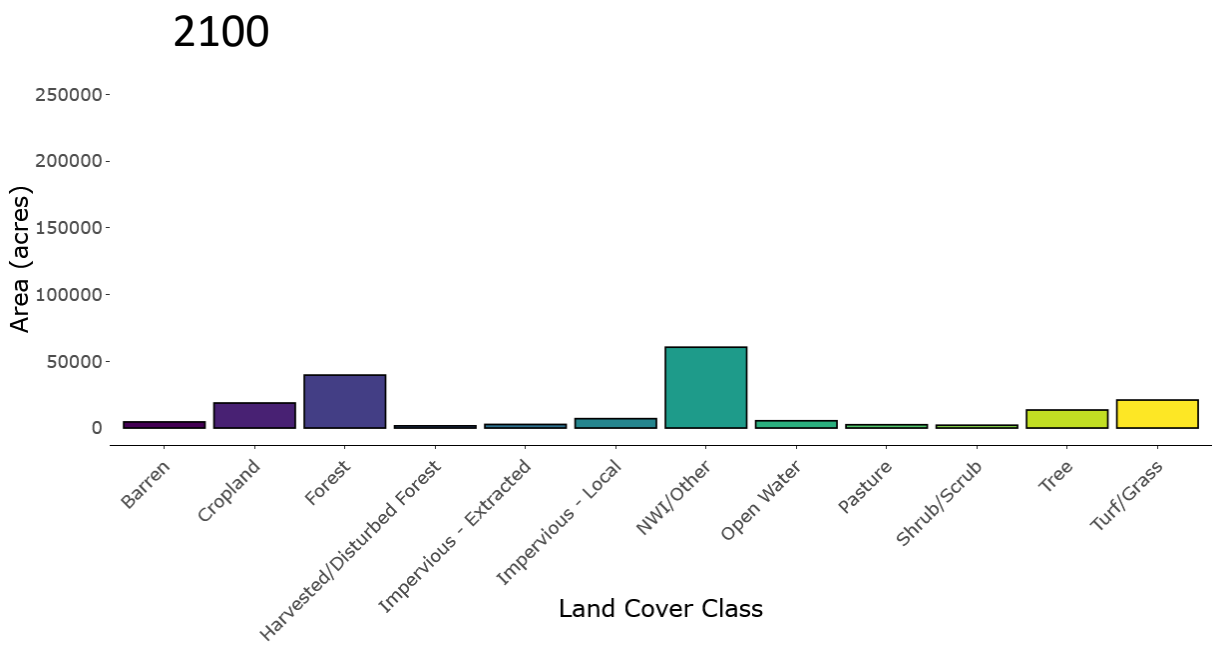
Land Use Land Cover Data Application for Coastal Zone

https://risdell.shinyapps.io/LandUseImpacts/



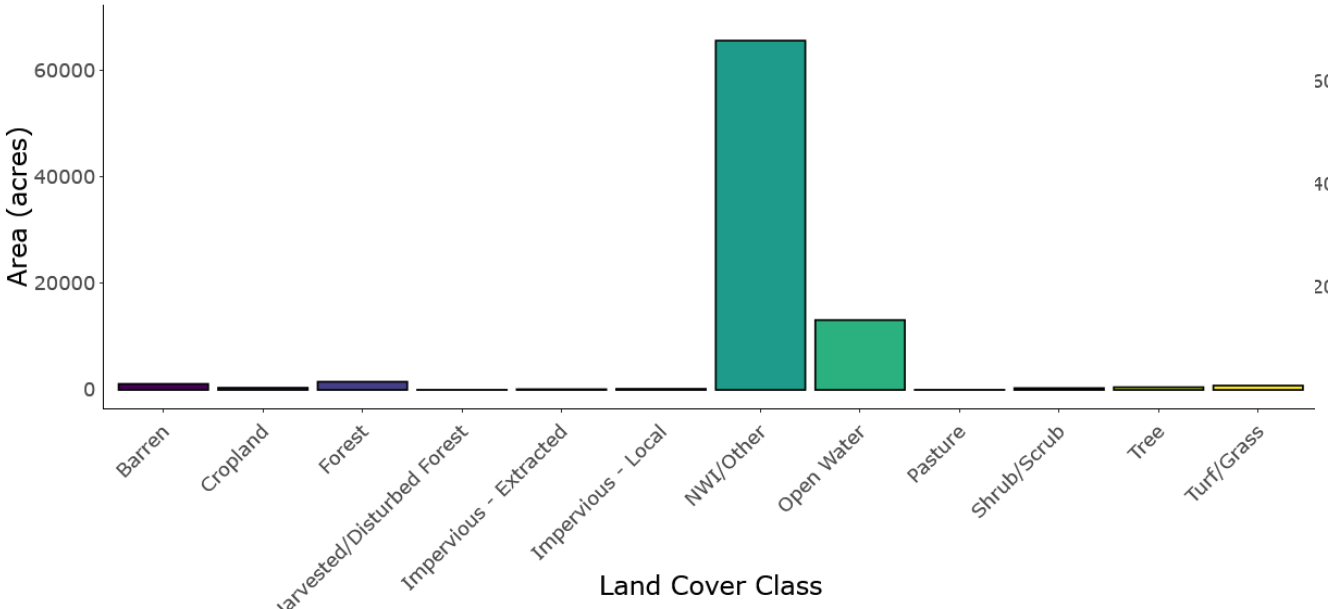
Land Use Land Cover Data Application for Virginia Coastal Zone

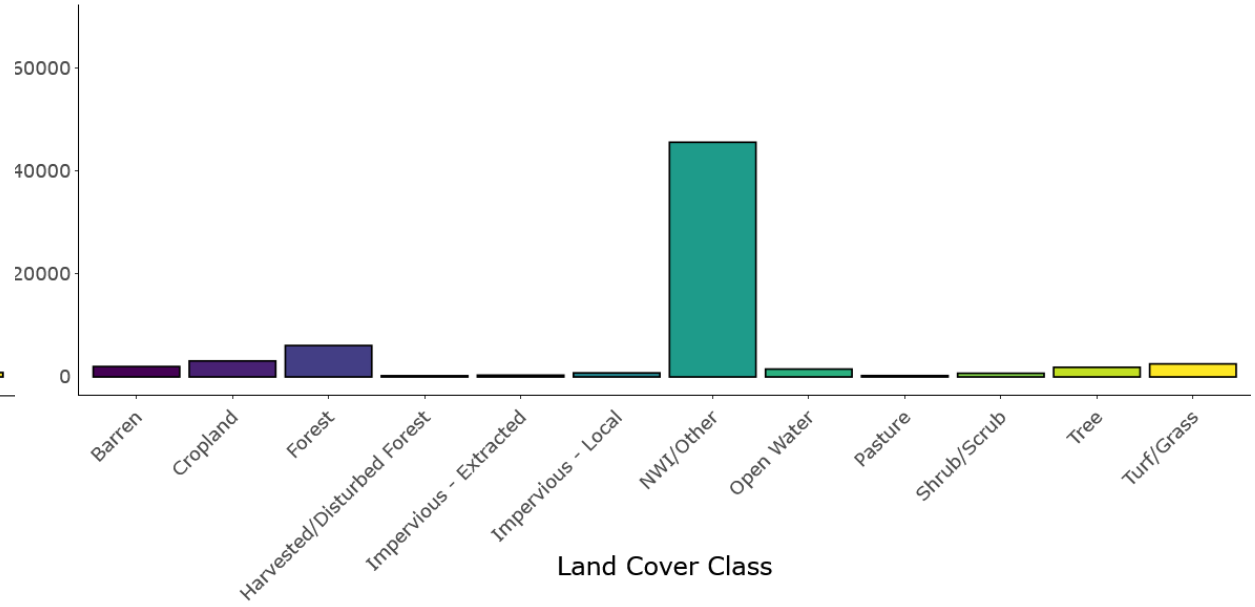




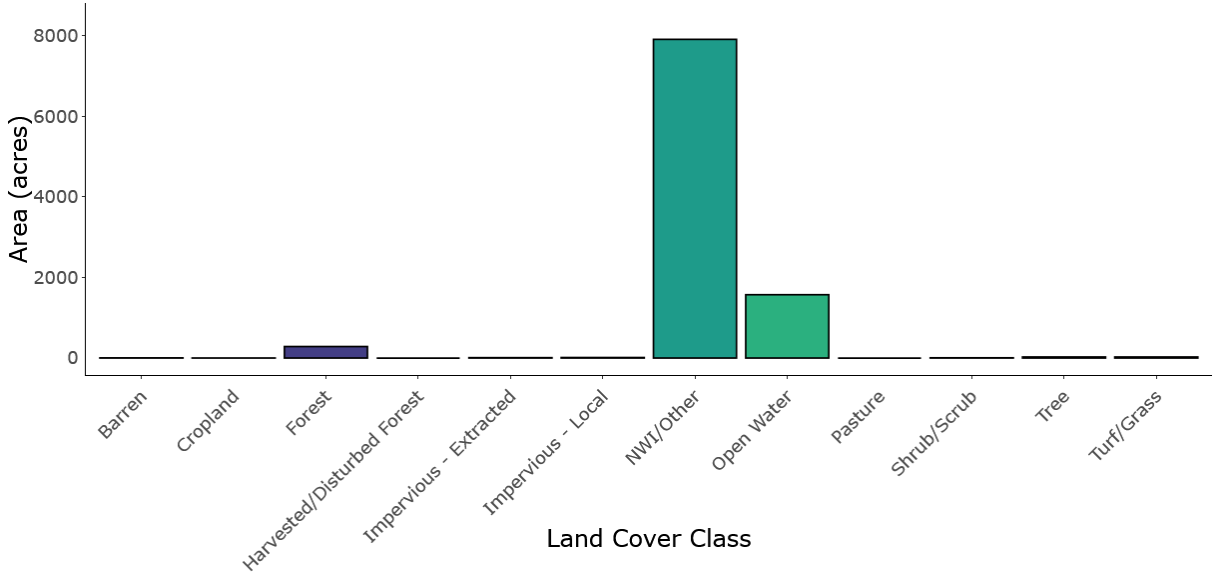
Accomack County 2020 and 2080

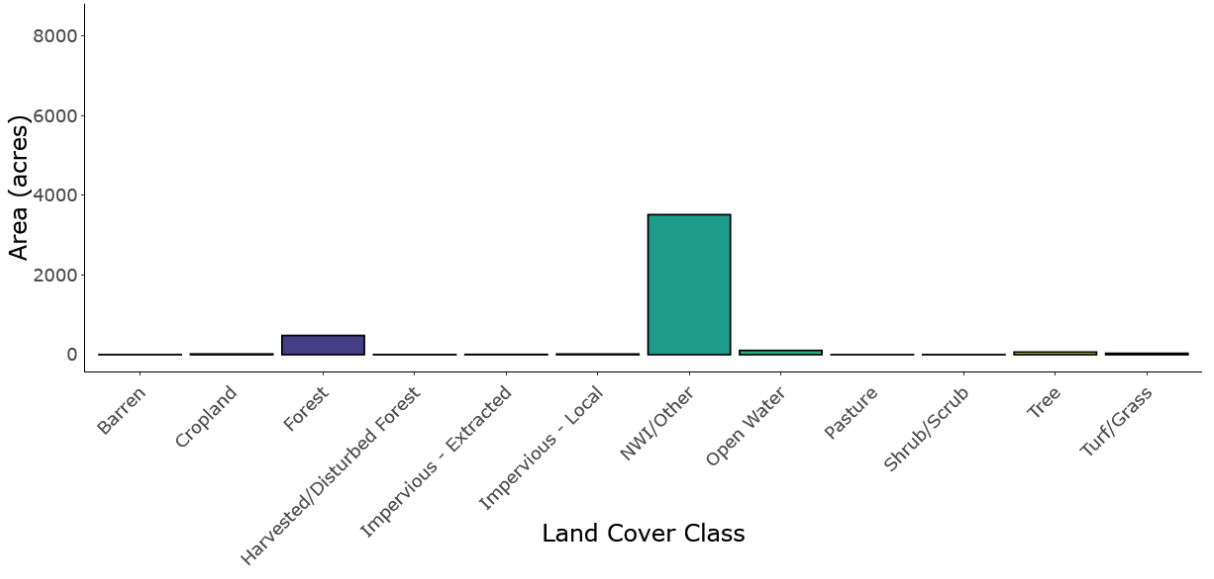
2020





New Kent County 2020 and 2080





Model Applications

- Informs wetland persistence for project planning and implementation
- Informs Comprehensive planning
- Informs Conservation planning for land acquisitions
- Locality and PDC data highlight where greater and lesser wetlands losses are anticipated
- PDC combined data enables consideration of shared marsh complexes and regional approaches to wetland projects
- Data App on existing CCRM pages
- Other?

Adaptation Projects

- Adaptable Living Shorelines
- Large scale marsh restoration/ creation
- Marsh Persistence
- Marsh Management
- Incorporate other Nature Based Solutions
  - Buffers
  - Oysters
  - SAV

Living Shorelines as the Default Approach

Living Shoreline

- Living Shorelines must be the primary approach to shoreline management unless best available science proves one is not suitable.

Rock

- Rock revetments are the next preferred alternative if a LS is not suitable based on best available science.

Mixed Media Shoreline

- When a LS is not suitable, living shoreline approaches should be incorporated where possible.

Living Shorelines

- **Proposed projects must allow the landward migration** of existing vegetation over the useful life of the project (2017 NOAA Intermediate-High Projection Curve).

•**Create a Wide Marsh**
  •Provides more space for wave attenuation.

•**Consider Sill Placement**
  •Place sill channelward of MLW to maximize distance between sill and bank to enhance wave break zone.

•**Consider Multiple Nature-Based Solutions**
  •Employ various solutions as lines of defense.

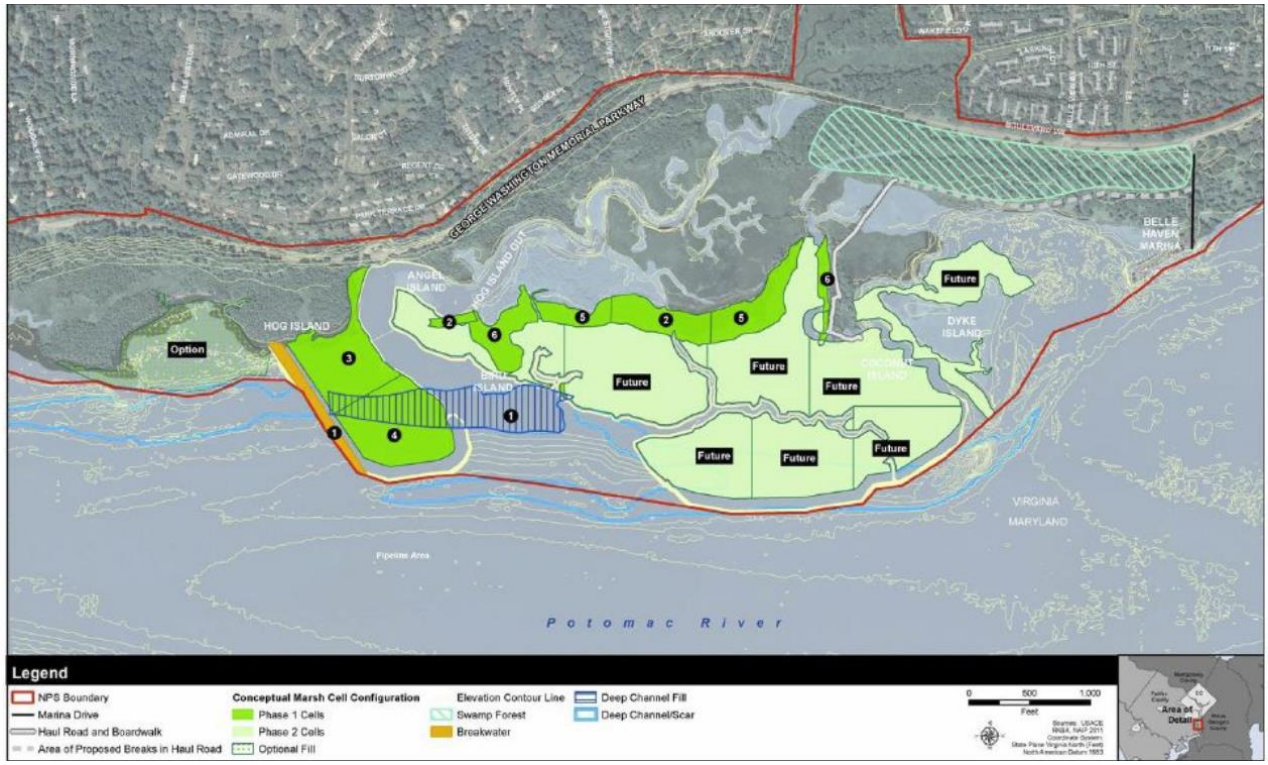
•**Restore Upland Buffer**.

•**Create Stable Slopes**
  •Design slopes to be less susceptible to erosion from wave action.

•**Incorporate shellfish to add benfits** (oysters, ribbed mussels)

Large Scale Restoration

- Build containment cells within the historic boundary. "The location of these cells would be prioritized based on the most benefits of the specific locations could provide to the existing marsh. . . .“
- Restore emergent marsh within the area of the historic promontory;
- Restore marsh along the existing marsh to expand
- Reintroduce tidal flows west of the Haul Road to restore the swamp forest.



Dyke Marsh, Alexandria. Potomac River

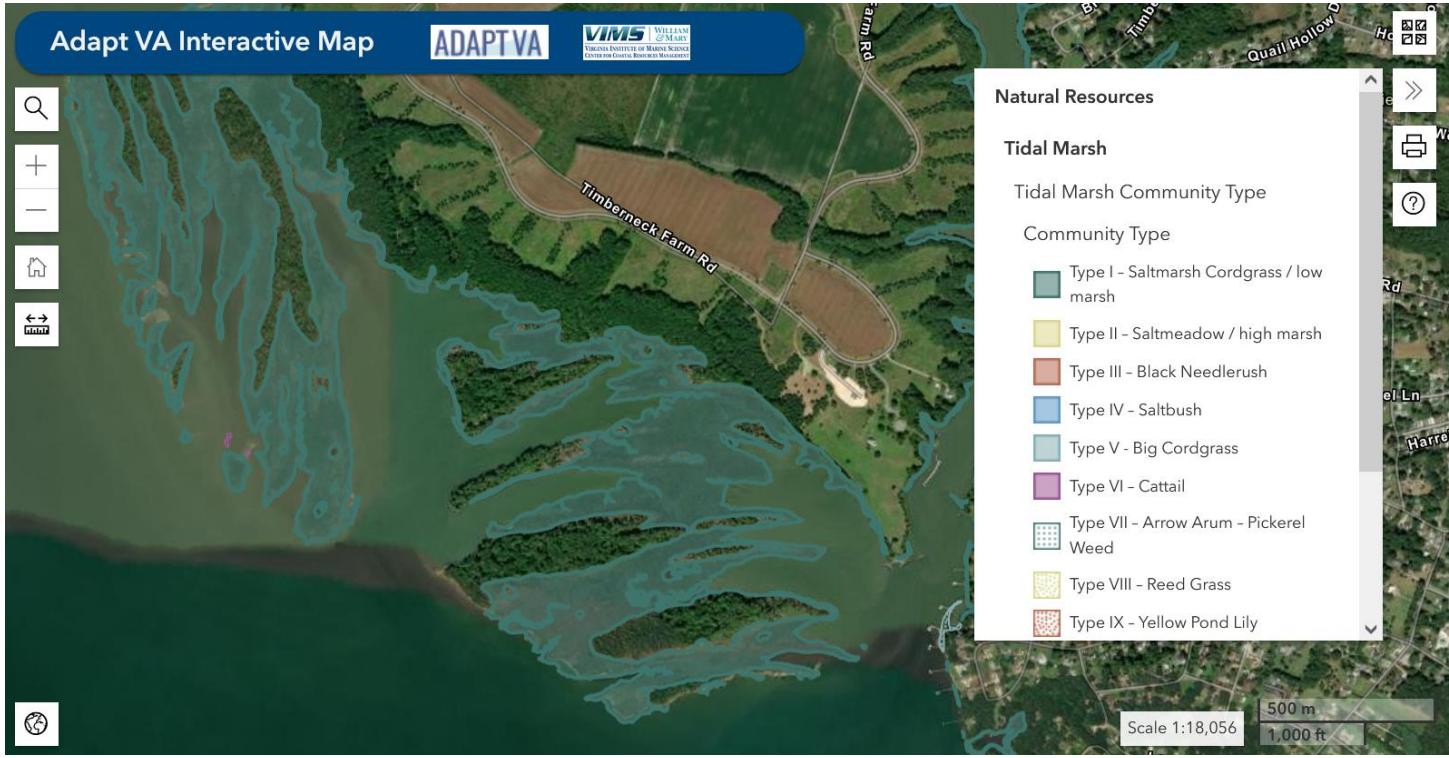
Large Scale Management

Guinea Marsh. Eastern Gloucester County Virginia

- Multiple Approaches
  - Sediment Addition
  - Edge Protection
    - Breakwaters
  - Hydrologic controls
    - Weirs
    - Ditch plugs
    - Runnels
  - Integrated Habitat
    - Oysters
    - SAV

Marsh Persistence

- Thin Layer
- Drowning / sediment starved
  - Increased elevation capital
  - May require repeated applications
- Beneficial Use of Dredged Material



Catlett Island. Chesapeake Bay NERR Virginia

Marsh Adaptation Considerations

Conservation Activity	Action	Wetland Benefit
Protect	Wetland Fee Simple Acquisition	Persistence
	Wetland Easement	Persistence
	Buffer Fee Simple/ Easement	Persistence, Migration
	Agricultural Conservation Easement/Wetland Reserve Easement Program	Persistence, Migration
	Floodplain Easement	Migration
	Coastal Resilience Easement (or other resilience instrument)	Migration
Restore	Re-establish	New wetland area and/or Expansion (in historical boundary)
Create	Build New	New wetland
Manage	Hydrology Control (Runnels, ditch plugs, tide gates)	Persistence, Expansion
	Sediment additions (i.e., TLP, BUDM)	Persistence, New wetland
	Elevation control/grading	Persistence, Expansion, New Wetland
	Erosion Control	Persistence
	Remove physical barriers (i.e., berms, impervious surface)	Persistence, Expansion, Migration
	Invasive species management (nutria, *Phragmites*, etc.)	Persistence
	Vegetation: planting and/or stabilization controls	Persistence