A Co-Benefit Approach to Prioritizing Lands for Coastal Resilience

Center for Coastal Resources Management
Virginia Institute of Marine Science

VIMS | William & Mary
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Increasing use of natural and nature-based features to build resilience to storm-driven flooding

Natural and Nature Based Features (NNBF)

Natural and Nature-Based Features (NNBFs)

- Beach
- Dune
- Forest
- Tree
- Scrub-Shrub
- Non-Tidal Forested Wetland
- Non-Tidal Scrub-Shrub Wetland
- Non-Tidal Emergent Wetland
- Tidal Marsh
- Living Shoreline: Oyster Sill
- Living Shoreline: Marsh Sill
- Living Shoreline: Breakwater

Identify NNBFs that enhance flood resilience-

Capacity of NNBFs to mitigate coastal flooding:

What are the characteristics of each NNBF that slow water movement, allow flood waters to infiltrate, and dampen wave energy?

Newsworks.org

Coastal wetlands can act like 'shag carpet' during a hurricane — NewsWorks

Living shoreline project in Gloucester. Photo: Karen Duhring

"…Because of their vegetation, the marshes act like shag carpeting, dampening the energy of a wave before it reaches land."
- Lenore Tedesco, PhD, executive director of The Wetlands Institute in Stone Harbor.

Diane Stopyra, April 30, 2016WHYY in Philadelphia
https://whyy.org/articles/coastal-wetlands-can-act-like-shag-carpet-during-a-hurricane/

Approach to increase NNBF Use

Step 1. Model flood benefits:

NNBF Capacity → Flooding Resilience

Step 2. Add water quality and socio-economic benefits

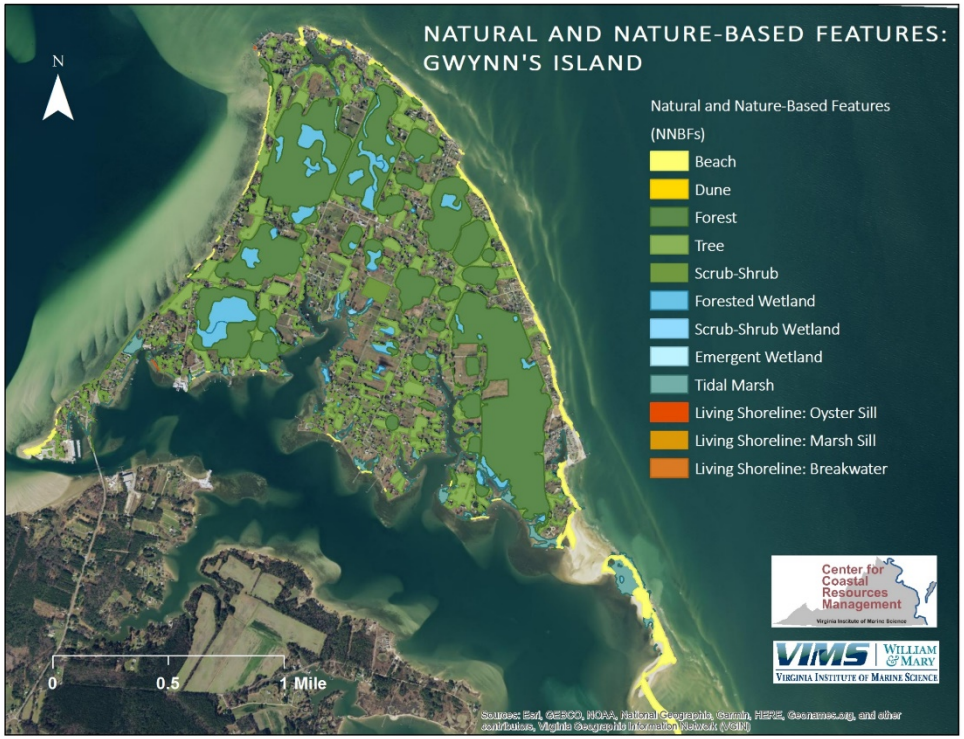
NNBF + TMDL/ Stormwater & Community Rating System/ FEMA Credits → Co-benefits

Step 3. NNBF Flood Protection + Co-Benefits = Priority land for protection

Step 4. Unprotected flood areas + Co-benefits + Priority areas for Restoration & Creation

Step 1: NNBF for flood protection

Use of Natural and Nature-Based Features (NNBFs) to Build Resilience to Coastal Flooding



Goals of the project:

- Map/Inventory of more than 350,000 NNBFs across the coastal region
- Identify those NNBFs that enhance flood resilience to about 190,000 buildings in coastal areas
- Identify the co-benefits generated by NNBFs
  - Ecologic – water quality
  - Socio-economic – CRS FEMA
- Identify those NNBFs that provide multiple benefits for communities

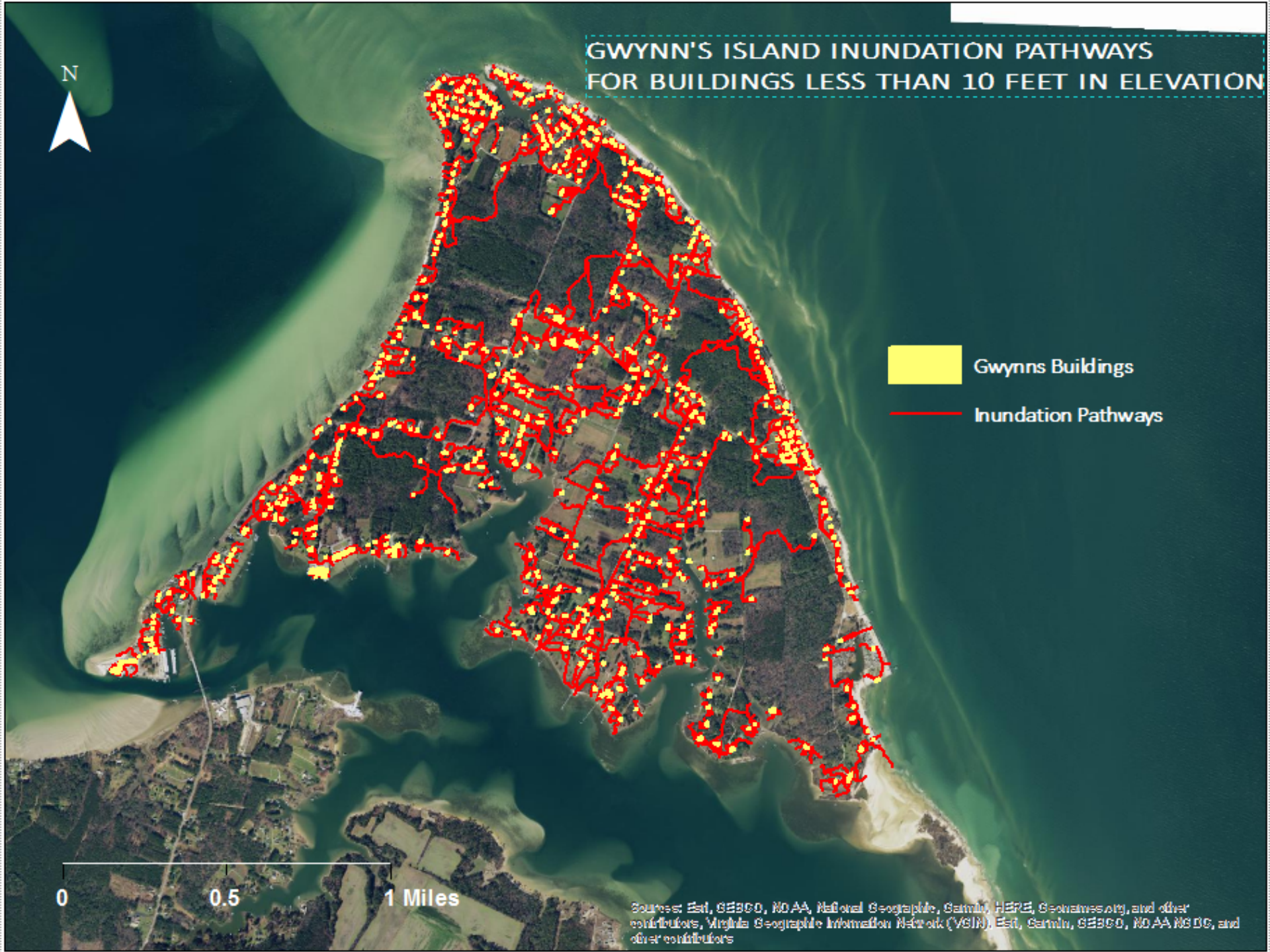
How do we link NNBFs with the buildings they protect?

Inundation Pathways (IPs)

Gwynn's Island, Mathews

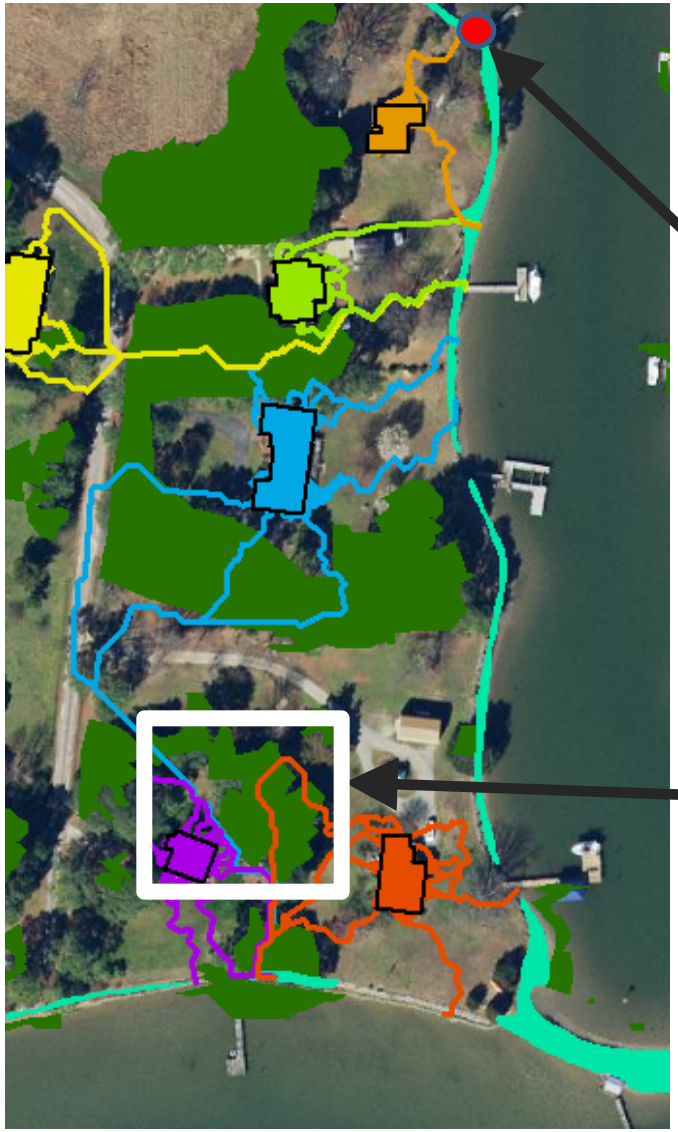
Inundation Pathways represent lowest areas where flooding waters would begin to flood onto the land and approach buildings

- for more than 190,000 primary buildings in the coastal area @ less than 10 feet in elevation
- pathways based on land elevation derived from LIDAR data


GWYNN'S ISLAND INUNDATION PATHWAYS
FOR BUILDINGS LESS THAN 10 FEET IN ELEVATION
N
Gwynns Buildings
Inundation Pathways
0
0.5
1 Miles
Sources: Esri, GEBCO, NOAA, National Geographic, Garmin, HERE, Geonames.org, and other contributors, Virginia Geographic Information Network (VGIN), Esri, Garmin, GEBCO, NOAA NGDC, and other contributors

How to we link NNBFs with the buildings they protect?

Inundation Pathways (IPs)



Gwynn's Island, Mathews

Inundation Pathways

For each building, we can count the number and types NNBFs that protect it

- *This building is protected by 1 NNBF (a tidal marsh)*

For each NNBF, we can count the number of buildings it protects

- *This tree area protects 3 buildings*

NNBF Feature Types (in this map):
- Tidal Marsh
- Tree

Relative importance of NNBF based on how many buildings it protects:

NNBF Flooding Protection Value

Flooding Protection Value

White = Zero score *Green = low score* *Red = high score*

Gwynn's Island, Mathews

Each NNBF is scored based on:

- Protection Potential
- # buildings the NNBF protects

Tidal Marsh:
Protects 32 buildings

Tree area:
Protects 0 buildings

Areas for NNBF Creation/ Restoration

Town of Cape Charles

500+ buildings.

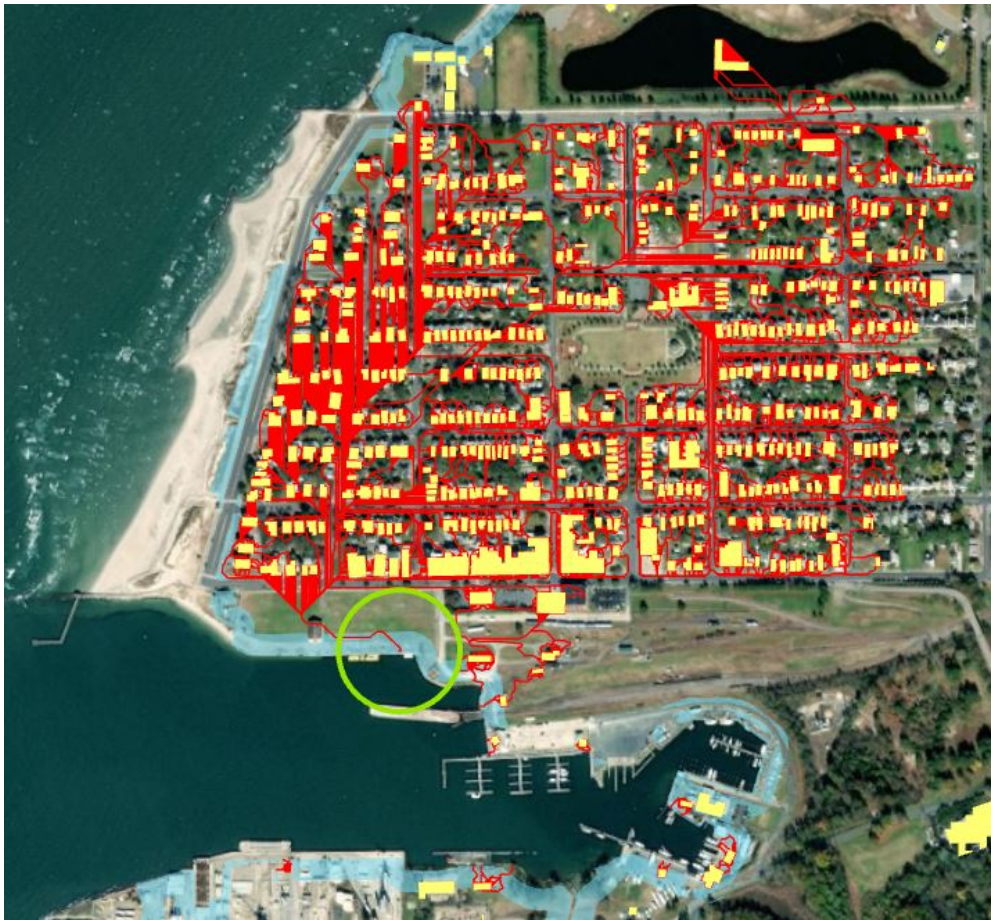
Many shared Inundation Pathways

Lowest elevation could be priority for new NNBFs

Additional NNBFs priorities can be along IPs that protect:

- Important infrastructure: Schools, Hospitals, Shelters, etc
- Clusters of buildings

Areas for NNBF Creation/ Restoration



Town of Cape Charles

Lowest elevation could be priority for new NNBFs

Areas along the shore and within the FEMA floodplain may also qualify for:

- Flood Insurance Premium reductions via the Community Rating System

AND/ OR

- TMDL/ Stormwater credits

Approach to increase NNBF Use

Step 1. Model flood benefits:

NNBF landscape position: location + elevation → Flooding Resilience

Step 2. Add water quality and socio-economic benefits

NNBF + TMDL/ Stormwater & Community Rating System/ FEMA Credits → Co-benefits

Step 3. NNBF Flood Protection + Co-Benefits = Priority land for protection

Step 4. Unprotected flood areas + Co-benefits + Priority areas for Restoration & Creation

Take Home Points

- Identifies Natural and Nature Based Features that provide flood protection benefits
- Identifies areas lacking NNBF flood protection benefits
- Incorporate water quality and flood insurance services into the assessment for existing features
- Can target locations for NNBF creation/ restoration to maximize multiple benefits
- Supports the preservation and implementation of NNBF features as a component of coastal community resilience