



Linking Land Change and Policy along the Chesapeake Bay Shoreline: A Case Study of Maryland and Virginia

Coastal GeoTools, Myrtle Beach, SC

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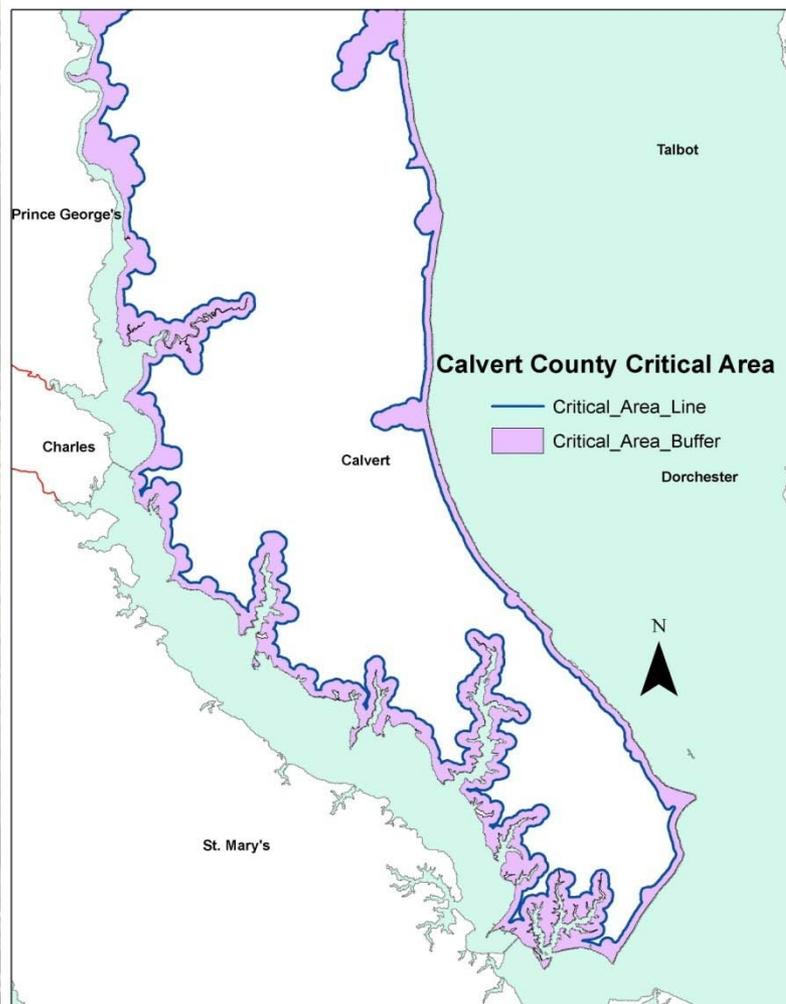
Urban Studies &
Planning



UNIVERSITY OF
MARYLAND

 **USGS**
science for a changing world

Background



Relate Changes in NOAA's Coastal Change Analysis Program (C-CAP) data to:

- Critical Area Act in Maryland
- Chesapeake Bay Preservation Act in Virginia

Maryland's Critical Area Act restricts development to varying degrees within 1000-ft of the shoreline and requires a natural buffer within 100-ft of the shoreline.

Background, Cont.

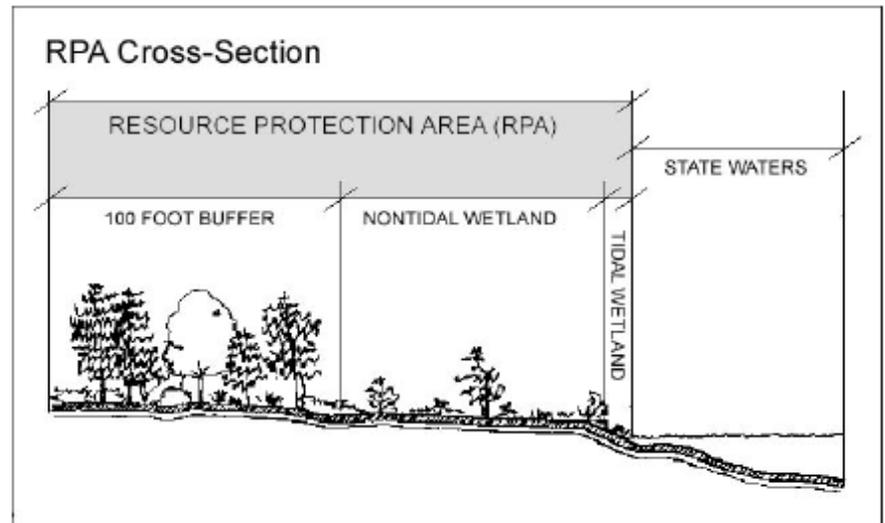


Chesapeake Bay Preservation Act Localities with Jurisdiction-wide or Bay watershed-wide RMAs



- | | | | | |
|-----------------------|------------------------|--------------------|----------------------|---------------------|
| Town of Ashland | Town of Colonial Beach | Town of Kilmarnock | Town of Parksley | Town of Urbanna |
| Town of Belle Haven | Town of Dumfries | Town of Melfa | Town of Port Royal | Town of Vienna |
| Town of Bloxom | Town of Eastville | Town of Montross | Town of Quantico | Town of Warsaw |
| Town of Bowling Green | Town of Exmore | Town of Nassawadox | Town of Saxis | Town of West Point |
| Town of Cape Charles | Town of Hallwood | Town of Ocoquan | Town of Smithfield | Town of White Stone |
| Town of Cheriton | Town of Haymarket | Town of Onancock | Town of Surry | Town of Windsor |
| Town of Clarendon | Town of Herndon | Town of Onley | Town of Tangier | |
| Town of Clifton | Town of Irvington | Town of Painter | Town of Tappahannock | |
- Localities with jurisdiction-wide, or Bay watershed-wide RMAs
 Localities with defined RMAs

The Virginia Chesapeake Bay Preservation Act requires local governments to designate and protect areas along the shoreline.



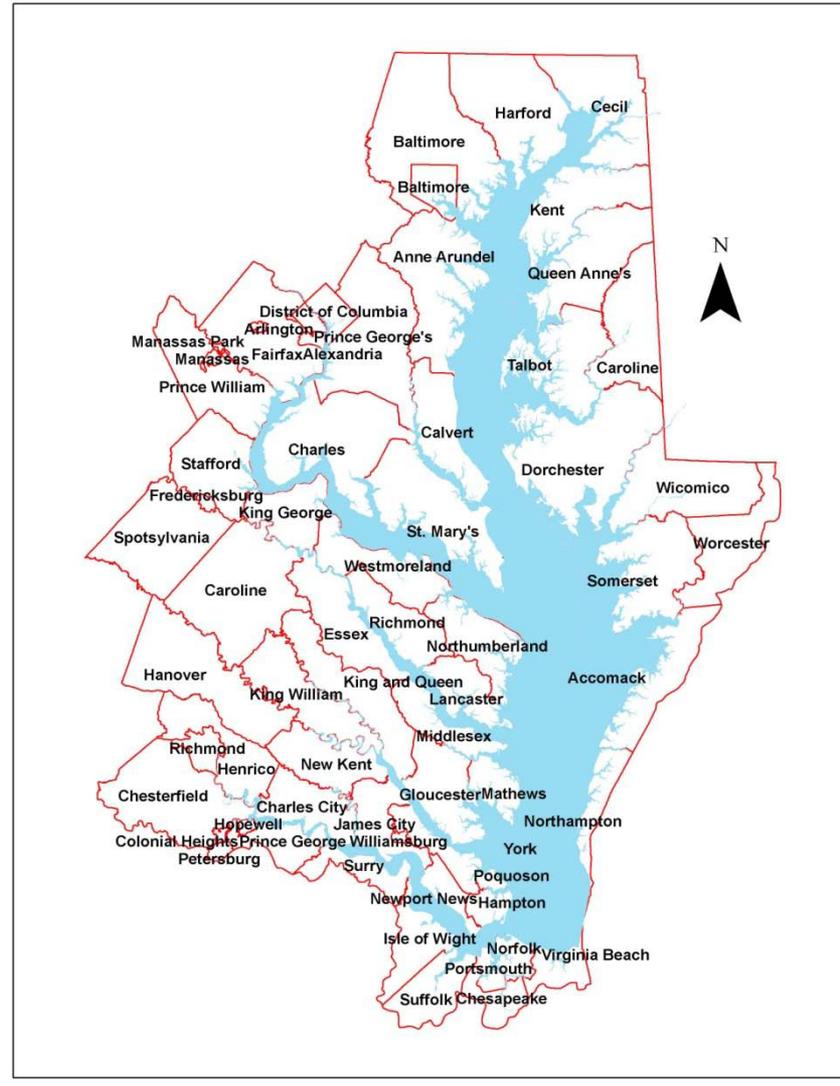
Source: Chesapeake Bay Preservation Act Handbook for the Eastern Shore of Virginia

Research Question



Is the NOAA C-CAP data a good screening tool for assessing land use change along the shoreline?

Study Area: VA and MD Shoreline and Tidal Tributaries



Data and Methodology



GIS based analysis

land use/land cover –

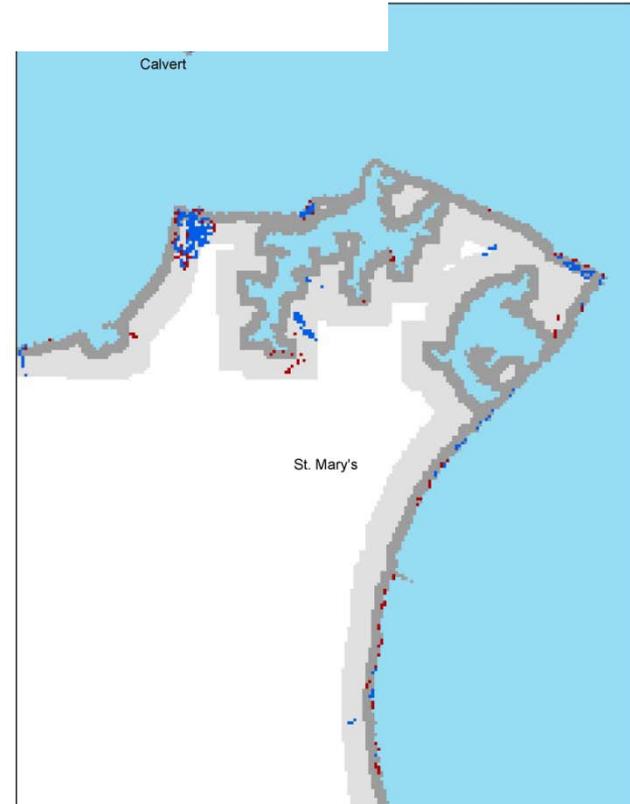
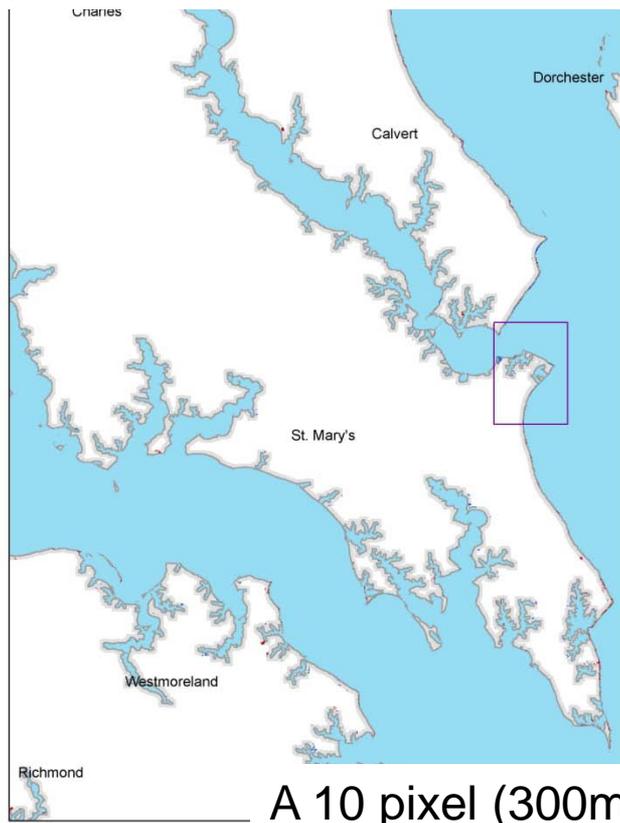
NOAA's Coastal Change Analysis Program (C-CAP)
1996, 2001, 2005

Aerial Photography –

- Digital Orthophoto Quarter Quad (DOQQ) Color IR (1m) 1994-1996
 - Maryland Department of Natural Resources
 - The GIS Spatial Data Server at Radford University (VA)
- National Agriculture Imagery Program Mosaics by County (2005)
 - Geospatial Data Gateway USDA, NRCS (2005)

Zones of Study

A 3 pixel (30m) buffer was selected for zone 1
(Approximately 295ft from shoreline)



A 10 pixel (300m) buffer was selected for zone 2
(Approximately 984ft from shoreline)

C-CAP Land Cover Categories



- 0 Background
- 1 Unclassified
- 2 High Intensity Developed
- 3 Medium Intensity Developed
- 4 Low Intensity Developed
- 5 Open Spaces Developed
- 6 Cultivated Land
- 7 Pasture/Hay
- 8 Grassland
- 9 Deciduous Forest
- 10 Evergreen Forest
- 11 Mixed Forest
- 12 Scrub/Shrub
- 13 Palustrine Forested Wetland
- 14 Palustrine Scrub/Shrub Wetland
- 15 Palustrine Emergent Wetland
- 16 Estuarine Forested Wetland
- 17 Estuarine Scrub/Shrub Wetland
- 18 Estuarine Emergent Wetland
- 19 Unconsolidated Shore
- 20 Bare Land
- 21 Water
- 22 Palustrine Aquatic Bed
- 23 Estuarine Aquatic Bed

Natural Areas 8-19 and 21-23

Human Areas 2-7 and 20

Combine Raster Areas



Data Combined:

- Zone 1 and Zone 2 data sets
- A rasterized county layer
- NOAA C-CAP data for 1996, 2001, and 2005

Attributes of DataCombine

Rowid	VALUE *	COUNT	ZONES1AND2	RASTERCOUNTY	CCAP_1996_UTM	CCAP_2001_UTM	CCAP_2005_UTM
0	1	23006	1	24015	9	9	9
1	2	6257	1	24015	13	13	13
2	3	1730	1	24015	4	4	4
3	4	3443	1	24015	5	5	5
4	5	2467	1	24015	12	12	12
5	6	1525	1	24015	11	11	11
6	7	606	1	24015	3	3	3
7	8	874	1	24015	15	15	15

Counting Pixels of Change



Identify areas where:

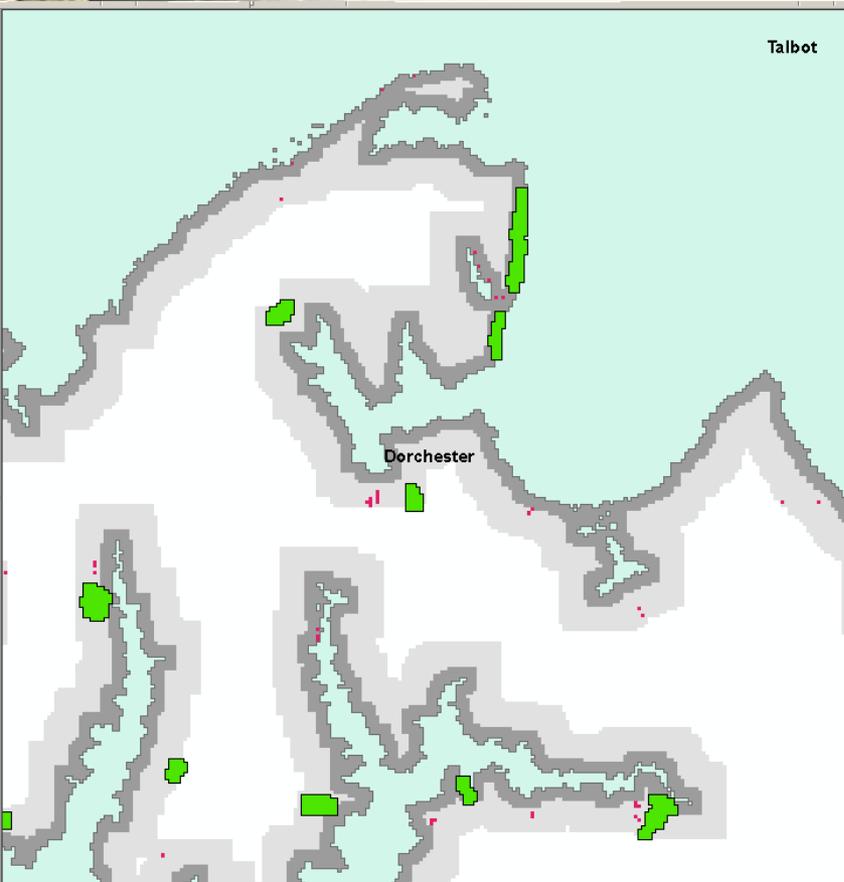
Natural Areas 8-19 and 21-23



Human Areas 2-7 and 20

1996/2005	Developed	Cultivated	Bare Land	Row Total
Forest	3388	3107	913	7408
Wetland	2532	5597	1365	9494
Other	3137	4921	3322	11380
Column Total	9057	13625	5600	28282

Grouping Change Pixels



Clustered all of the change pixels by 4

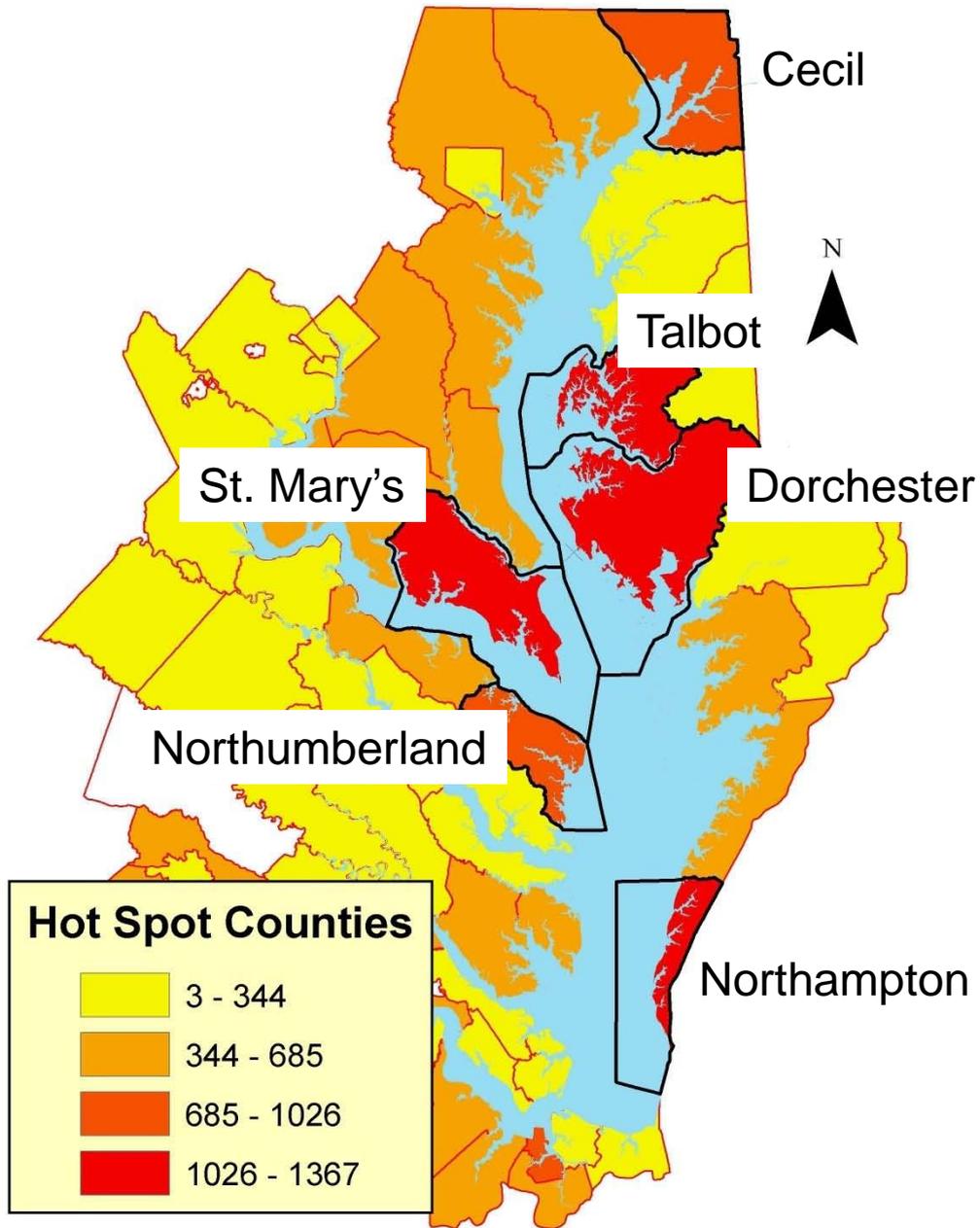
Those with adjacent pixels on 8 directions were selected

Expanded by 1 pixel

Converted to polygons

Hot Spot Identification

Identified counties with greatest number of change polygons



Residential



Chesapeake Bay Program
A Watershed Partnership



Cecil

Shoreline Hardening / Shifting

St. Mary's



Golf Courses

Dorchester



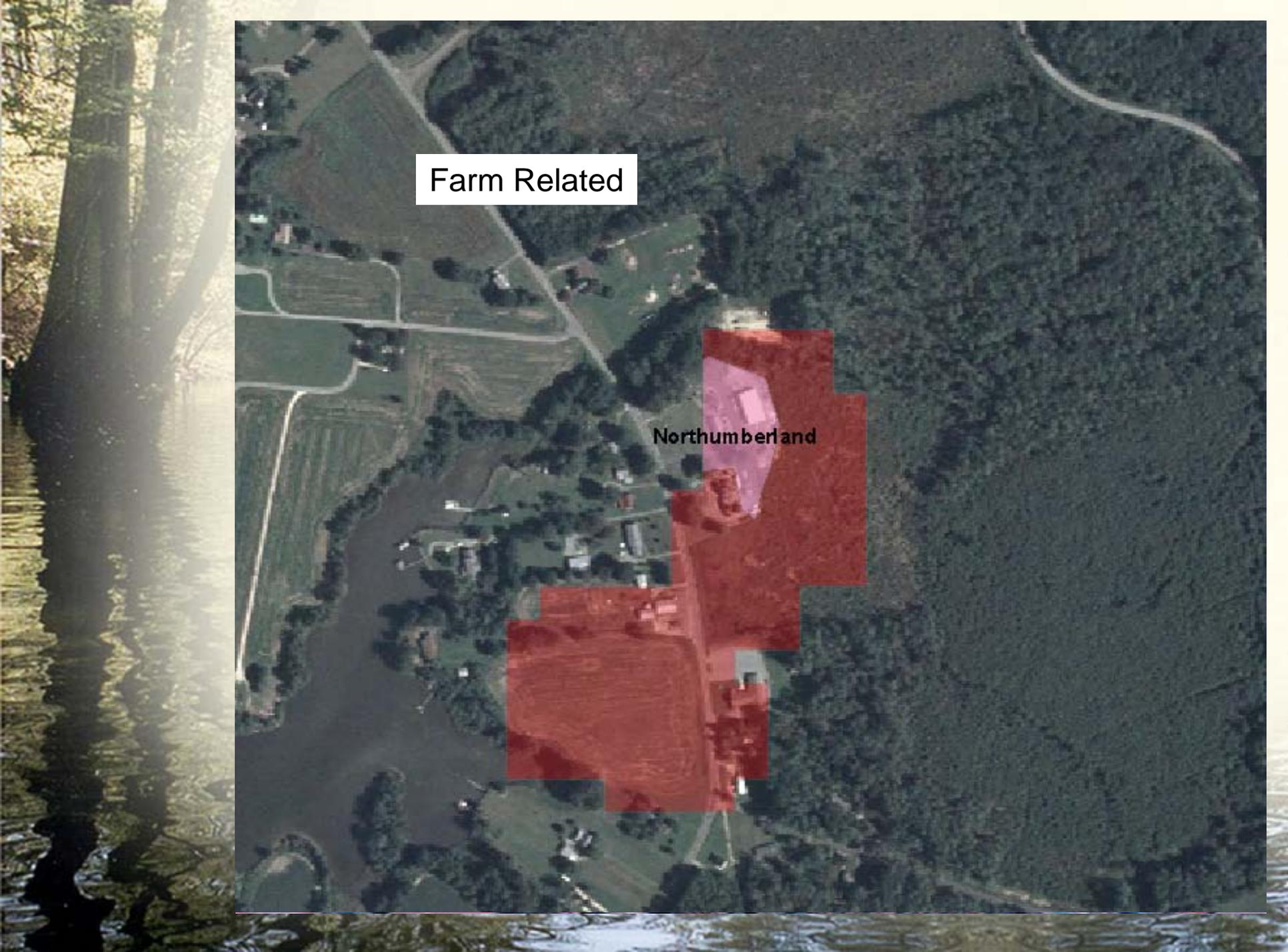


Dorchester

Docks

Farm Related

Northumberland





Northampton

Change? – No Change?



2005

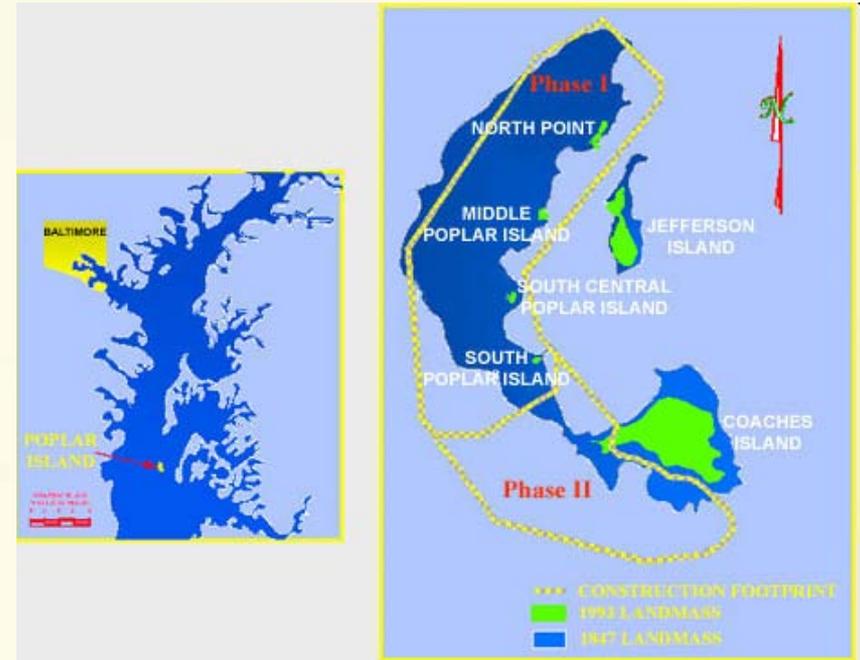


Talbot

Touching bases with local planners



Poplar Island



<http://www.nab.usace.army.mil/projects/Maryland/PoplarIsland/index.html>

USACE Project

- Restoring previously existing island
- Dredge spoils from Baltimore harbor
- Has been successful as habitat for birds and terrapins.



Talbot County, MD



Chesapeake Bay Program
A Watershed Partnership

Bay Creek Resort and Marina Community

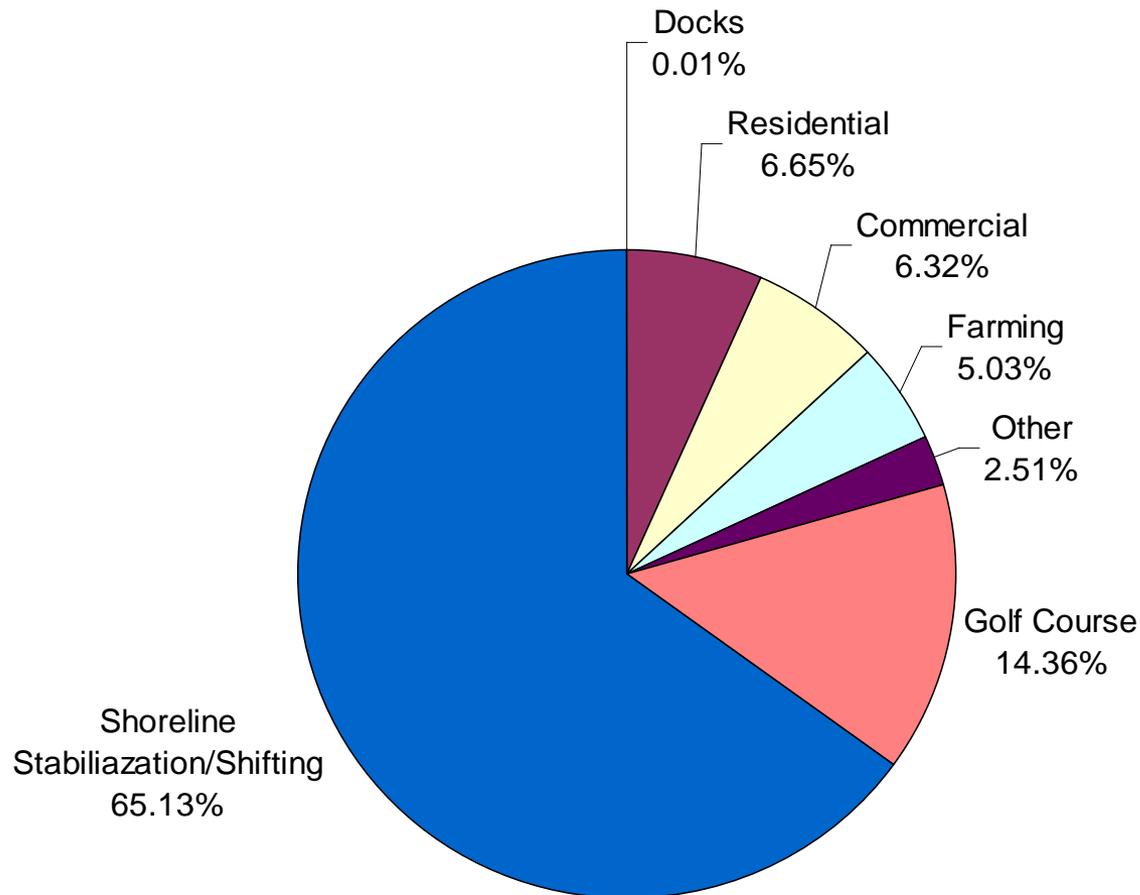
Charles City, VA



Results and Findings



682 Total Acres of Change



Results and Findings



Total Change areas in HotSpots where CCAP identified change	396
Actual change found using aerial imagery	125

Change was found in only 1/3 of the records identified

Results and Findings



	Acres change in Hotspot Counties	Total Acres in Hotspot Counties	Percent change in each zone
zone 1 (300ft)	442.4	96,275	0.460%
zone 2 (1000ft)	239.4	150,173	0.159%

Almost 3 times magnitude of change higher in zone 1 closest to the shoreline

Is NOAA C-CAP data a useful tool in identifying and qualitatively characterizing change?

- Potentially...BUT
- There may be limitations in farming areas as well as along the shoreline
- NOAA could possibly need to explore improvements along the shoreline (due to turbulence and changes along the land water interface)



Next Steps

- Look at the rest of the CB watershed
- Quantitatively characterize change
- Draft a white paper or other publishable work
- Comments, Questions and Suggestions are encouraged!!

Special Thanks



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Maryland long range planner



Peter Claggett, USGS, Mentor





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