

Estuarine Blue Infrastructure: Draft Priority Conservation Areas for Chesapeake Bay and its Tidal Tributaries and Back Bay A Cumulative Resource Assessment

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Virginia Institute of Marine Science
Center for Coastal Resources Management

Final Project Report Submitted to

Virginia Coastal Zone Management Program

Virginia Department of Environmental Quality

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Executive Summary

This project is an extension of earlier efforts within the coastal zone of Virginia to build a platform for enhanced Blue and Green Infrastructure planning. This project is motivated by an interest in extending statewide conservation efforts into estuarine systems and recognition that land use decisions on the upland effect water quality and habitat health in the receiving waters.

The project in its entirety has been accomplished in distinct parts. Part one develops a Cumulative Resource Assessment to evaluate the distribution of aquatic natural resources within waters of Virginia's Chesapeake Bay waters, Back Bay of Virginia Beach, Virginia, and the seaside of the Eastern Shore of Virginia. This task mined data resources at all levels of government to bring together a comprehensive representation of information available for the study areas. The outcome of the CRA would indicate where the maximum number of resources co-exists, but not necessarily where the most important resources exist.

The second part of the project develops a process to prioritize the most ecologically valuable regions within Virginia tidal waters. Using the data output from the CRA, an Aquatic Priority Conservation Area (APCA) analysis was developed which ranks individual resources based on potential to provide important ecosystem services. A weighting function was applied and zones of good, very high, and exceptional habitat value were designated.

Phase three of the project reviewed priority conservation areas (PCAs) designated on the upland and modeled spatial relationships between terrestrial PCAs and Aquatic PCAs. Linkages established between the two could potentially elevate areas on the upland for conservation due to the geo-spatial relationship to important aquatic areas. The analysis only focused on the highest valued conservation areas within both datasets.

Finally where data was available and could support an analysis of climate change impacts, the APCA output was assessed for areas vulnerable to sea level rise impacts. The results of the analysis, which focused only within the Chesapeake Bay portion of Virginia, could indicate where APCA were unlikely to be sustained as a result of long-term impacts of rising water levels. The analysis used climate change vulnerability data derived for wetlands and beach environments as the indicator and identified APCAs adjacent to or coincident with these locations.

Introduction

This project is an extension of earlier efforts by the Virginia CZM Program to build a platform for enhanced Blue and Green Infrastructure planning. Our interest is two-fold. First, to extend the work in Blue Infrastructure (begun as FY 2003 Task 95.02 to VIMS) so we begin to develop tools to assist local governments with aquatic conservation planning, and two to initiate the process where aquatic conservation and terrestrial conservation priorities are linked. This later focus represents a truly integrated approach to conservation planning and offers a new capacity building model for local level conservation management. CZM grants to other state agencies have resulted in the identification of priority terrestrial areas that should be conserved. So combined with the results of the VIMS Blue Infrastructure projects, local governments and other planning entities will begin to have a seamless view of both land and water resources by downloading these layers into their own GIS or by simply viewing them through tools such as Coastal GEMS.

Conservation and preservation of aquatic systems in estuaries was given a boost when President Obama, in May of 2009 characterized the Chesapeake Bay as a national treasure. The executive order issued by the White House states that the government should "... identify and prioritize critical living resources of the Chesapeake Bay and its watershed" for restoration and protection. To that end, this project focuses on defining areas within the Virginia portion of the Chesapeake Bay where we find an abundance of aquatic living resources and essential habitat to support living resources. The effort is important because it paves the way for prioritizing tributaries that are considered highly valuable, potentially vulnerable to upland land use practices, and therefore targets for conservation.

While there have been efforts within the Bay to target individual or multi-species living resources habitat, there have been few efforts strategically focused on defining aquatic areas of importance for the purpose of identifying resource sensitivity and prioritizing conservation goals. Furthermore, there have been even fewer efforts that anticipate a user audience at the local level and end products that assist local governments in conservation efforts.

Objective

This project integrates various data sources to develop a cumulative assessment of aquatic living resources and habitat as a measure of estuarine resource sensitivity in Virginia waters of the Chesapeake Bay and Back Bay. The project is motivated by an interest in extending statewide conservation efforts into estuarine systems and recognition that land use decisions on the upland effect water quality and habitat health in the receiving waters. Local planners benefit from tools that can point to areas where resources are highly valued and potentially at risk. A Cumulative Resource Assessment (CRA) was developed to define where clusters of aquatic natural resources exist within the tidal tributaries. The basis for a CRA is to collect and geographically juxtapose living resource data. Secondary steps can include employing valuation systems to determine if one region is more important than another. These techniques are useful for local governments who deal with limited resources, competition for uses, and economic pressures.

Project Scope

A Cumulative Resources Assessment (CRA) was developed for the tidal waters of the Virginia portion of the Chesapeake Bay as well as the Back Bay region located in Virginia Beach, Virginia. In a separate activity (Task Task 96.01, FY 07) the assessment was expanded to include the seaside of the Eastern Shore of Virginia. The tasks to be accomplished in developing the CRA include:

- 1) Collect and review all relevant data sources. Specifically this includes a review of data within the current Coastal GEMS application, NOAA's 2004 Environmental Sensitivity Index Atlas for Virginia, products developed by the Virginia Department of Conservation and Recreation, the Virginia Department of Game and Inland Fisheries (DGIF), the Virginia Marine Resources Commission (VMRC), Virginia Commonwealth University (VCU), The Nature Conservancy, and others. Estuarine data found in the Center for Coastal Resources Management's (CCRM) Blue Infrastructure tool was also reviewed for currency and inclusion.
- 2) Use Geographic Information Systems (GIS) and available data to create estuarine overlay districts of high sensitivity within the Chesapeake Bay and its tidal tributaries and Back Bay.

These regions will represent a varying degree of sensitivity based on the number of estuarine living resources identified within a given place.

3) Generate maps to illustrate the outcome of the CRA and prepare data and metadata for Coastal GEMS

Method and Approach to Developing the Cumulative Resource Assessment

The first task to developing the CRA was to review available data sources. We began with Blue Infrastructure, an archive representing aquatic resource information for Virginia's tidal waters of the Chesapeake Bay. The datasets comprising Blue Infrastructure were reviewed for currency and updated if deemed appropriate for inclusion in the CRA. Since the CRA would extend into intertidal habitat regions not included in Blue Infrastructure, additional data sources such as the National Wetlands Inventory and the Environmental Sensitivity Index Atlas were consulted. In addition, there have been a number of recent activities that support strategic conservation planning in Virginia which utilized some unique attributes.

In 2009, the Virginia Department of Game and Inland Fisheries released, *"Sustainable Communities: Assessment of Priority Conservation Areas and their Vulnerability to Development"* (DGIF, 2009). This project combined extensive statewide data sets and several spatial models to define priority conservation areas (PCAs) on the upland and within waters of Virginia. These data would be valuable for the anticipated aquatic CRA. After extensive review, a combination of baseline and modeled output data were acquired from the partners involved in the PCA project for use in the CRA. In all steps following, extreme care was used to insure duplication of data was not occurring. Table 1 lists the final suite of datasets used in the CRA.

The next task focused on integrating the data to perform the CRA. Corresponding shapefiles associated with each data layer were converted to a raster with a cell size of 30m. Most data sets contained large areas of no data values. To standardize the extent of each layer we set the nodata values to "0", and each raster was merged with the study area boundary specifying the resulting raster would retain the maximum cell value on each overlapping cell.

Since this was a study directed at identifying resource rich areas, datasets which included density values, numerical counts, or valuations were reviewed and selective attributes were used in the CRA. The outcome of this process eliminated resource poor areas defined by the independent datasets. For example, the data set “Shellfish Suitability” includes polygons classified as “unsuitable” or “moderately suitable” for shellfish aquaculture. For this study, only those polygons classified as “suitable” or “optimal” for shellfish aquaculture were used in this analysis. The dataset “patch reefs” classified the density of oysters ranging from none to areas that support more than 1000 oysters/m². This study used only those reefs with densities greater than 10 oysters/m².

Table 1. Baseline data for the Cumulative Resource Assessment

Dataset	Originator
1) Colonial Waterbird Database	Center for Conservation Biology, William and Mary
2) Audubon Important Bird Areas	VA Department of Game and Inland Fisheries
3) Shellfish Suitability	VIMS CCRM
4) Reef Restoration Sites	VMRC/VIMS CCRM
5) Oyster Reefs	VMRC/VIMS Eastern Shore Lab/ CCRM
6) Artificial Fishing Reef	VMRC
7) Wetlands (2009)	National Wetlands Inventory, US Fish and Wildlife
8) Sand/Mud Flats (2009)	National Wetlands Inventory, US Fish and Wildlife
9) Seed Areas	VMRC/VIMS CCRM
10) Aquaculture sites	VMRC/VIMS CCRM
11) Turtle Nest	NOAA Environmental Sensitivity Index Atlas
12) SAV (1999 – 2008)	VIMS Submerged Aquatic Vegetation Program
13) Aquatic Confirmed Habitat	VA Department of Game and Inland Fisheries
14) Aquatic Resource Integrity	Center for Environmental Studies/VCU
15) Stream Conservation Areas	VA Department of Conservation and Recreation
16) Threatened & Endangered Waters	VA Department of Game and Inland Fisheries
17) Regulated Areas	VMRC/VIMS CCRM

From the Aquatic Resource Integrity layer developed by the Center for Environmental Studies at Virginia Commonwealth University we used only areas classified as “healthy” or

“exceptional” and eliminated areas classified as “restoration potential” or “compromised”. We included only Stream Conservation Areas (Va Department of Conservation and Recreation-Division of Natural Heritage) with biodiversity rankings of “high” to “outstanding”, and only tier I and tier II ranked habitat from the Aquatic Confirmed Habitat layer developed by the Department of Game and Inland Fisheries. Each dataset was reviewed very carefully to understand the full extent of the classification before determinations were made. In some cases, data originators were consulted for clarification. Polygons eliminated from the CRA were coded “0” and those retained for the analysis were given a value of “1”.

Other data manipulation also occurred. This study considered only vegetated wetlands, mudflats, or sand flats from the National Wetlands Inventory (NWI) coverage. We combined 10 individual years of Submerged Aquatic Vegetation (SAV) mapping data produced by the SAV Mapping Program at VIMS and used only those SAV patches that persisted for 6-10 years as an indicator of sustainability. All other polygons were eliminated from the study (assigned a value of “0”).

Buffers were also established around specific resources to represent areas within which the resource migrates (e.g. bird areas), or areas within which a resource could be affected by some impact (e.g. rare or threatened waters). Buffers were placed around points (e.g. artificial reefs) or around lines to give them a spatial platform for the analysis. In general point datasets were buffered 200m (Reef Restoration Sites, Aquaculture Sites, and Turtle Nesting Locations) or 300m (Colonial Waterbird Dataset) to provide an area for analysis. Linear datasets were generally buffered as follows; Aquatic Confirmed Habitat (300m - following criteria established by the originator), Threatened and Endangered Waters (200m), and Stream Conservation Areas (25m).

The 17 raster layers were superimposed using the Weighted Sum Tool. All layers received the same weight; overlapping cells were summed to produce the Cumulative Resource Assessment. In all cases, the analysis was performed using ESRI’s ArcMAP-ArcInfo®.

Results

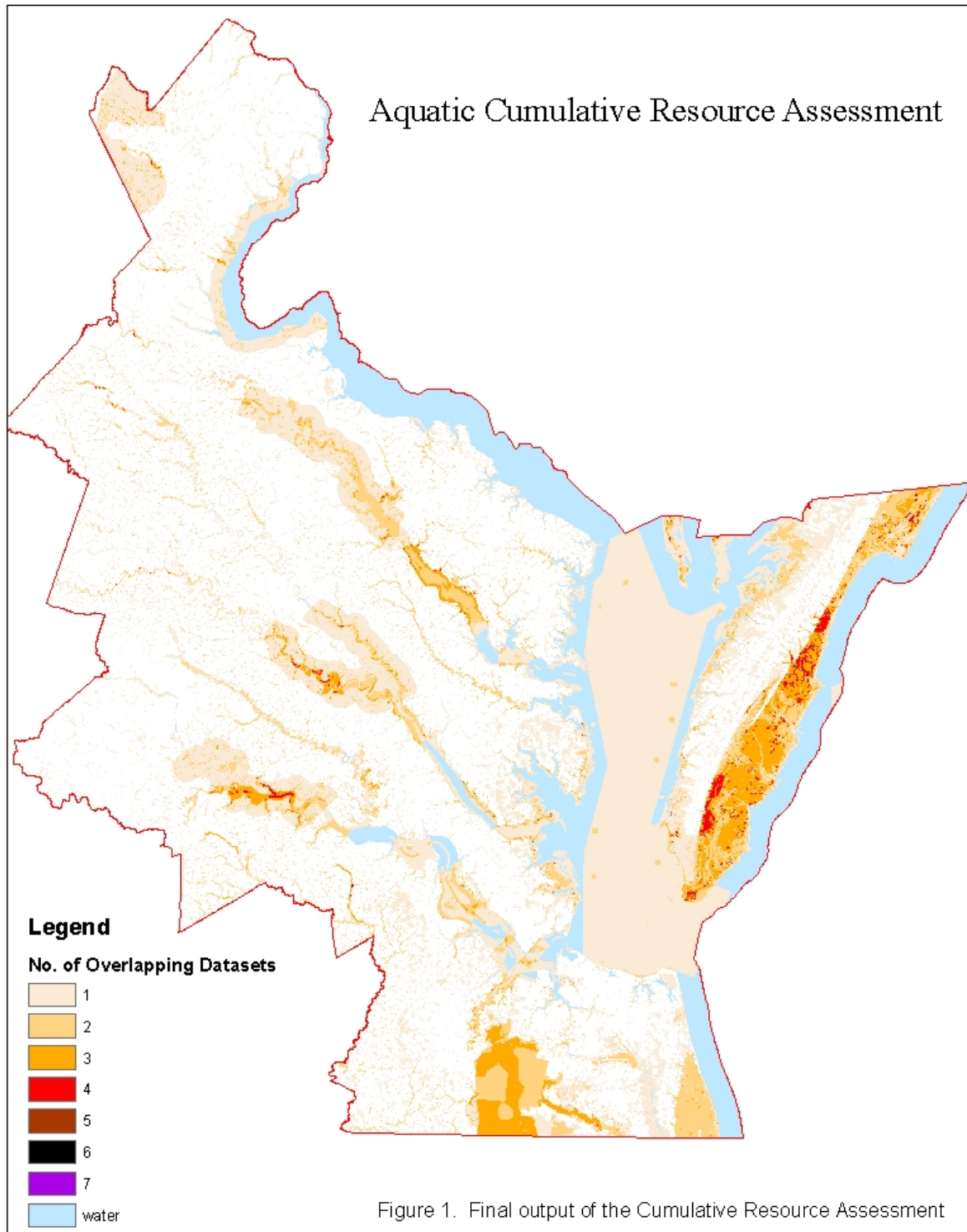
The results of the CRA are illustrated in Figure 1. The cumulative analysis used 17 different layers. Within the entire coastal region of Virginia (including the Seaside of the Eastern Shore) the maximum number of resources that were geographically co-located was equal to 7. Table 2 presents the pixel counts for each cumulative level.

Table 2. Cumulative Resource Assessment for Virginia's Coastal Zone

Total Number of Resources	Pixel Count
0	22,971,550
1	8,549,878
2	2,324,309
3	1,005,944
4	117,835
5	8,211
6	268
7	5

While the map clearly indicates the location of areas that support the maximum number of resources, this analysis does not measure the collective or independent contribution to the ecosystem as a whole. The analysis loosely indicates where there is some diversity in habitat type. However, areas that support a relatively low number of different resources (only 1 or 2) may include a resource type which performs a vast number of ecosystem services (e.g. a wetland).

The results do indicate potential hot spots for review and consideration for conservation measures. However, additional analyses are necessary to provide true direction toward an ecosystem approach for targeting aquatic conservation areas. These follow-on analyses are addressed in phase two of this work (Estuarine Blue Infrastructure: Final Priority Conservation Areas for Chesapeake Bay and its Tidal Tributaries and Back Bay).



Acknowledgements

This project was funded in part by the Virginia Coastal Zone Management Program at the Department of Environmental Quality through Grant #NA07NOS4190178, Task 93.04 of the United States Department of Commerce, National Oceanic and Atmospheric Administration, under the Coastal Zone Management Act of 1972, as amended.

The principal investigator would like to thank CCRM GIS analysts Karinna Nunez and Tamia Rudnicki for their contributions to this project. The project elements were critiqued by the Special Area Management Committee for the Seaside of the Eastern Shore and their suggestions were greatly appreciated. Special thanks to Nick Meade and Laura McKay.

Special thanks to external partners who shared data in this study: Dave Morton of the VA Department of Game and Inland Fisheries; Jason Bulluck and Joe Weber of the VA Department of Conservation and Recreation, Division of Natural Heritage; Will Shuart, Jennifer Ciminelli, and Greg Garmen of the VCU Center for Environmental Studies; Brian Watts of the William and Mary Center for Conservation Biology; and P.G. Ross and Mark Luckenbach from the Virginia Institute of Marine Science's Wachapreague Lab.

References

Department of Game and Inland Fisheries, 2009. Sustainable Communities: Assessment of Priority Conservation Areas and their Vulnerability to Development, Final Project Report, Virginia Coastal Zone Management Program, NOAA Grant # 08NOS4190466

Virginia Aquatic Priority Conservation Areas - Cumulative Analysis

Metadata:

- [Identification Information](#)
- [Data Quality Information](#)
- [Spatial Data Organization Information](#)
- [Spatial Reference Information](#)
- [Entity and Attribute Information](#)
- [Distribution Information](#)
- [Metadata Reference Information](#)

Identification_Information:

Citation:

Citation_Information:

Originator: Comprehensive Coastal Inventory, Virginia Institute of Marine Science

Publication_Date: 2010

Title:

Virginia Aquatic Priority Conservation Areas - Cumulative Analysis

Geospatial_Data_Presentation_Form: vector digital data

Publication_Information:

Publication_Place: Gloucester Point, Virginia

Publisher: Virginia Institute of Marine Science

Online_Linkage: [not available](#)

Description:

Abstract:

This data set is the result of overlaying 17 datasets representing the natural resource component of the Virginia portion of the Chesapeake Bay, the seaside lagoons on the Eastern Shore, and Back Bay in the City of Virginia Beach. The cumulative sensitivity analysis shows the areas of highest concentration of living resource features. Datasets included are Colonial Waterbirds, Audubon Important Bird Areas, Shellfish Suitability, Reef Restoration Sites, Oyster Reefs, Artificial Fishing Reefs, Wetlands, Sand/Mud Flats, Seed Areas, Aquaculture Sites, Turtle Nesting Locations, Submerged Aquatic Vegetation, Aquatic Confirmed Habitat, VCU Aquatic Resource Intergrity, Stream Conservation Areas, Threatened and Endangered Waters, and Regulated Areas.

Purpose:

To locate areas of high ecological importance in the Chesapeake Bay and its tidal tributaries, Back Bay, and the seaside of the Eastern Shore, by overlaying living resource datasets.

Time_Period_of_Content:

Time_Period_Information:

Range_of_Dates/Times:

Beginning_Date: 2002

Ending_Date: present

Currentness_Reference:

data of data sets used

Status:

Progress: Complete

Maintenance_and_Update_Frequency: None planned

Spatial_Domain:

Bounding_Coordinates:

West_Bounding_Coordinate: -77.992689

East_Bounding_Coordinate: -75.172544

North_Bounding_Coordinate: 39.080789

South_Bounding_Coordinate: 36.518449

Keywords:

Theme:

Theme_Keyword_Thesaurus: none

Theme_Keyword: blue infrastructure

Theme_Keyword: cumulative sensitivity analysis

Place:

Place_Keyword_Thesaurus: none

Place_Keyword: Virginia

Place_Keyword: Eastern Shore

Place_Keyword: Chesapeake Bay

Place_Keyword: Back Bay

Access_Constraints: none

Use_Constraints:

This analysis does not measure the collective or independent contribution that each dataset contributes to the ecosystem as a whole. The analysis loosely indicates where there is some diversity in habitat type. However, areas that support a relatively low number of different resources (only 1 or 2) may include a resource type which performs a vast number of ecosystem

services (e.g. a wetland) and therefore is a more important area ecologically than an area that reveals 4, 5, or 6 different layers in one location. The results do indicate potential hot spots for review and consideration for conservation measures. A clear review of the content of data within each area is necessary. However, additional analyses underway will rank areas based on the content and type of resources present for a more valuable tool for targeting of aquatic conservation areas.

Point_of_Contact:

Contact_Information:

Contact_Person_Primary:

Contact_Person: Marcia Berman

Contact_Organization: Virginia Institute of Marine Science (VIMS)

Contact_Position: Director Comprehensive Coastal Inventory Program

Contact_Address:

Address_Type: mailing address

Address:

P.O. Box 1346

City: Gloucester Point

State_or_Province: Virginia

Postal_Code: 23062

Country: USA

Contact_Voice_Telephone: (804) 684-7188

Contact_Facsimile_Telephone: (804) 684-7179

Contact_Electronic_Mail_Address: marcia@vims.edu

Native_Data_Set_Environment:

Microsoft Windows XP Version 5.1 (Build 2600) Service Pack 3; ESRI ArcCatalog 9.3.1.3000

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Data_Quality_Information:

Lineage:

Source_Information:

Source_Citation:

Citation_Information:

Originator: Comprehensive Coastal Inventory, Virginia Institute of Marine Science

Publication_Date: 2003

Title:

Hard Clam and Oyster Suitability Models

Geospatial_Data_Presentation_Form: digital data

Publication_Information:

Publication_Place: Gloucester Point, Virginia

Publisher: Virginia Institute of Marine Science

Type_of_Source_Media: digital data

Source_Time_Period_of_Content:

Time_Period_Information:

Single_Date/Time:

Calendar_Date: 2000

Source_Currentness_Reference:

dates of base data

Source_Citation_Abbreviation:

shellfish_suit

Source_Contribution:

shows suitable shallow water habitat for hard clam and oyster aquaculture (used optimal and suitable habitat rankings).

Source_Information:

Source_Citation:

Citation_Information:

Originator: Virginia Marine Resources Commission

Publication_Date: 2005/2006

Title:

Regulated Areas

Type_of_Source_Media: digital data

Source_Time_Period_of_Content:

Time_Period_Information:

Single_Date/Time:

Calendar_Date: 2005/2006

Source_Citation_Abbreviation:

regareas

Source_Contribution:

Regulated areas: broodstock management area, oyster management area, SAV sanctuary, shellfish management area, Striped Bass spawning sanctuary, harvest area, Black Drum management area, Blue Crab sanctuary.

Source_Information:

Source_Citation:

Citation_Information:

Originator: Virginia Marine Resources Commission

Publication_Date: 2009

Title:

Oyster Reef Restoration Sites

Type_of_Source_Media: digital data

Source_Time_Period_of_Content:

Time_Period_Information:

Single_Date/Time:

Calendar_Date: ongoing

Source_Citation_Abbreviation:

reefs09

Source_Contribution:

oyster reef restoration locations.

Source_Information:

Source_Citation:

Citation_Information:

Originator: U.S. Fish and Wildlife Service

Publication_Date: 20090925

Title:

National Wetlands Inventory

Publication_Information:

Publication_Place: Washington, D.C.

Publisher: U.S. Fish and Wildlife Service

Type_of_Source_Media: digital data

Source_Time_Period_of_Content:

Time_Period_Information:

Range_of_Dates/Times:

Beginning_Date: 1977

Ending_Date: present

Source_Citation_Abbreviation:

NWI

Source_Contribution:

wetlands data including mud/sand flats.

Source_Information:

Source_Citation:

Citation_Information:

Originator: Watts, B.D. and B. J. Paxton, The Center for Conservation Biology

Publication_Date: 2009

Title:

Colonial Waterbirds

Publication_Information:

Publication_Place: Williamsburg, Virginia

Publisher: The Center for Conservation Biology, College of William and Mary

Type_of_Source_Media: digital data

Source_Time_Period_of_Content:

Time_Period_Information:

Range_of_Dates/Times:

Beginning_Date: 5/8/2008

Ending_Date: 7/16/2008

Source_Citation_Abbreviation:

colwtrbird

Source_Contribution:

location of waterbird nesting colonies

Source_Information:

Source_Citation:

Citation_Information:

Originator: Aimee Weldon - Virginia Audubon Society

Publication_Date: 2007

Title:

Virginia Important Bird Areas

Publication_Information:

Publication_Place: Richmond, Virginia

Publisher: Virginia Dept. of Game and Inland Fisheries

Type_of_Source_Media: digital data

Source_Time_Period_of_Content:

Time_Period_Information:

Single_Date/Time:

Calendar_Date: 1/24/2008

Source_Citation_Abbreviation:

iba

Source_Contribution:

geographic boundaries of important bird areas.

Source_Information:

Source_Citation:

Citation_Information:

Originator: Virginia Marine Resources Commission

Publication_Date: 2005/2006

Title:

Artificial Fishing Reefs

Type_of_Source_Media: digital data

Source_Time_Period_of_Content:

Time_Period_Information:

Single_Date/Time:

Calendar_Date: 2005/2006

Source_Citation_Abbreviation:

fish_reefs

Source_Contribution:

location of fishing reefs.

Source_Information:

Source_Citation:

Citation_Information:

Originator: Virginia Marine Resources Commission

Publication_Date: 2005/2006

Title:

Seed Areas

Type_of_Source_Media: digital data

Source_Time_Period_of_Content:

Time_Period_Information:

Single_Date/Time:

Calendar_Date: 2005/2006

Source_Citation_Abbreviation:

seed

Source_Contribution:

location of oyster seed areas.

Source_Information:

Source_Citation:

Citation_Information:

Originator: Ross, P.G. and Luckenbach, M.L., College of William and Mary, Virginia Institute of Marine Science, Eastern Shore Laboratory

Publication_Date: 12/31/2008

Title:

Seaside Oyster Mapping Patch Reefs

Type_of_Source_Media: digital data

Source_Time_Period_of_Content:

Time_Period_Information:

Range_of_Dates/Times:

Beginning_Date: 3/1/2007

Ending_Date: 7/1/2008

Source_Citation_Abbreviation:

patch reefs

Source_Contribution:

location of isolated patch and fringe reefs on the seaside of Virginia's Eastern Shore.

Source_Information:

Source_Citation:

Citation_Information:

Originator: Virginia Marine Resources Commission

Publication_Date: 2002

Title:

Aquaculture Sites

Type_of_Source_Media: digital data

Source_Time_Period_of_Content:

Time_Period_Information:

Single_Date/Time:

Calendar_Date: 2002

Source_Contribution:

location of aquaculture sites.

Source_Information:

Source_Citation:

Citation_Information:

Originator: Center for Environmental Studies at VCU

Publication_Date: October 2009

Title:

Aquatic Resource Layer

Publication_Information:

Publication_Place: Richmond, Virginia

Publisher: Center for Environmental Studies at VCU

Type_of_Source_Media: digital data

Source_Time_Period_of_Content:

Time_Period_Information:

Single_Date/Time:

Calendar_Date: October 2009

Source_Citation_Abbreviation:

arl

Source_Contribution:

aquatic resource integrity: location of exceptional and healthy areas.

Source_Information:

Source_Citation:

Citation_Information:

Originator: Virginia Dept. of Game and Inland Fisheries

Publication_Date: 2008

Title:

Aquatic Confirmed Habitat

Publication_Information:

Publication_Place: Richmond, Virginia

Publisher: Virginia Dept. of Game and Inland Fisheries

Type_of_Source_Media: digital data

Source_Time_Period_of_Content:

Time_Period_Information:

Single_Date/Time:

Calendar_Date: 2008

Source_Citation_Abbreviation:

aquaTier

Source_Contribution:

tiers 1 and 2 aquatic confirmed habitat.

Source_Information:

Source_Citation:

Citation_Information:

Originator: Division of Natural Heritage, VA DCR

Publication_Date: 2008

Title:

Stream Conservation Units

Publication_Information:

Publication_Place: Richmond, Virginia

Publisher: Division of Natural Heritage, VA DCR

Type_of_Source_Media: digital data

Source_Time_Period_of_Content:

Time_Period_Information:

Single_Date/Time:

Calendar_Date: 2008

Source_Citation_Abbreviation:

SCU

Source_Contribution:

location of stream conservation areas.

Source_Information:

Source_Citation:

Citation_Information:

Originator: National Oceanic and Atmospheric Administration (NOAA), National Ocean Service, Office of Response and Restoration, Hazardous Materials Response Division, Seattle, Washington and NOAA Chesapeake Bay Office, Gloucester Point, Virginia.

Publication_Date: 2005

Title:

Virginia ESI: Reptile Points

Publication_Information:

Publication_Place: Seattle, Washington

Publisher: National Oceanic and Atmospheric Administration (NOAA), National Ocean Service, Office of Response and Restoration, Hazardous Materials Response Division, Seattle, Washington

Type_of_Source_Media: digital data

Source_Time_Period_of_Content:

Time_Period_Information:

Range_of_Dates/Times:

Beginning_Date: 2002

Ending_Date: 2004

Source_Citation_Abbreviation:

ESI

Source_Contribution:

Sea turtle nesting locations.

Source_Information:

Source_Citation:

Citation_Information:

Originator: Virginia Institute of Marine Science

Publication_Date: 2009

Title:

Chesapeake Bay SAV Coverage

Publication_Information:

Publication_Place: Gloucester Point, Virginia

Publisher: Virginia Institute of Marine Science

Type_of_Source_Media: digital data

Source_Time_Period_of_Content:

Time_Period_Information:

Range_of_Dates/Times:

Beginning_Date: 1999

Ending_Date: 2008

Source_Citation_Abbreviation:

SAV

Source_Contribution:

location of SAV

Source_Information:

Source_Citation:

Citation_Information:

Originator: Virginia Department of Game and Inland Fisheries, Wildlife Diversity Division, Fish and Wildlife Information Services

Publication_Date: 2002

Title:

Threatened and Endangered Waters

Publication_Information:

Publication_Place: Richmond, Virginia

Publisher: Virginia Department of Game and Inland Fisheries

Type_of_Source_Media: digital data

Source_Time_Period_of_Content:

*Time_Period_Information:**Single_Date/Time:*

Calendar_Date: 2002

Source_Citation_Abbreviation:

TE waters

Source_Contribution:

location of threatened and endangered waters.

*Process_Step:**Process_Description:*

Point datasets (reef restoration sites, colonial waterbird survey points, and turtle nesting locations) were converted to polygon shapefiles by buffering each point 200 meters.

Process_Date: 2010

*Process_Step:**Process_Description:*

SAV shapefiles corresponding to the past 10 surveys (1999 – 2008) are included in the Cumulative Sensitivity Analysis. For each shapefile, SAV bed density equal to dense, moderate, or sparse was extracted and reclassified with a score value of 1 (to weight all the layers in the same manner). Each shapefile was converted to a raster with a cell size of 30m and combined (using the Mosaic Tool) with the raster of the study area. Each output displays the maximum cell value on each overlapping cell. Finally, all the rasters (10) were overlapped using the Weighted Sum Tool. Overlapping cells were summed and then the output grid was divided into 10 classes (excluding 0) using the Equal Interval classification method. For the purpose of this analysis, only classes corresponding from 6 to 10 were used in the final Cumulative Sensitivity Analysis. These classes represent those beds that have been more consistently present through the time period considered here.

Process_Date: 2010

*Process_Step:**Process_Description:*

Each shapefile data layer was converted to a raster with a cell size of 30m. Most data sets contained large areas of no data values. To standardize the extent of each layer and set the nodata values to "0", each raster was merged with the study area boundary specifying that the resulting raster would retain the maximum cell value on each overlapping cell.

Process_Date: 2010

*Process_Step:**Process_Description:*

Each of the 17 raster datasets was reclassified such that data to be counted was given a value of "1", while data not to be counted was valued at "0". The following datasets and selected attributes received a value of "1": Shellfish suitability (ranking of optimal or suitable); NWI (only used vegetated wetlands and mud/sand flats); Patch reefs (areas with >10 oysters/sq m); Aquatic resource integrity layer (ranking of healthy or exceptional); Aquatic confirmed habitat (tier I and II only); Stream conservation areas (biodiversity rankings of high to outstanding); SAV 10 year cumulative grid (only areas with 6 to 10 years of overlap).

Process_Date: 2010

*Process_Step:**Process_Description:*

The seventeen rasters were overlaid using the Weighted Sum Tool. All layers received the same weight, overlapping cells were summed to produce the Cumulative Sensitivity Analysis.

Process_Date: 2010

*Process_Step:**Process_Description:*

Metadata imported.

Source_Used_Citation_Abbreviation:

C:\DOCUME~1\tamia\LOCALS~1\Temp\xml1226.tmp

Process_Date: 20100525

Process_Time: 15532800

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Spatial_Data_Organization_Information:

Direct_Spatial_Reference_Method: Vector

Point_and_Vector_Object_Information:

SDTS_Terms_Description:

SDTS_Point_and_Vector_Object_Type: G-polygon

Point_and_Vector_Object_Count: 433731

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Spatial_Reference_Information:

Horizontal_Coordinate_System_Definition:

Planar:

Grid_Coordinate_System:

Grid_Coordinate_System_Name: Universal Transverse Mercator

Universal_Transverse_Mercator:

UTM_Zone_Number: 18

*Transverse_Mercator:**Scale_Factor_at_Central_Meridian:* 0.999600*Longitude_of_Central_Meridian:* -75.000000*Latitude_of_Projection-Origin:* 0.000000*False_Easting:* 500000.000000*False_Northing:* 0.000000*Planar_Coordinate_Information:**Planar_Coordinate_Encoding_Method:* coordinate pair*Coordinate_Representation:**Abscissa_Resolution:* 0.000000*Ordinate_Resolution:* 0.000000*Planar_Distance_Units:* meters*Geodetic_Model:**Horizontal_Datum_Name:* North American Datum of 1983*Ellipsoid_Name:* Geodetic Reference System 80*Semi-major_Axis:* 6378137.000000*Denominator_of_Flattening_Ratio:* 298.257222[Back to Top](#)

*Entity_and_Attribute_Information:**Detailed_Description:*

Entity_Type:

Entity_Type_Label: va_aquatic_pca_cumulative

Attribute:

Attribute_Label: FID

Attribute_Definition:

Internal feature number.

Attribute_Definition_Source:

ESRI

Attribute_Domain_Values:

Unrepresentable_Domain:

Sequential unique whole numbers that are automatically generated.

Attribute:

Attribute_Label: Shape

Attribute_Definition:

Feature geometry.

Attribute_Definition_Source:

ESRI

Attribute_Domain_Values:

Unrepresentable_Domain:

Coordinates defining the features.

Attribute:

Attribute_Label: FID_va_aqu

Attribute:

Attribute_Label: GRIDCODE

Attribute_Definition:

Number of overlapping resources.

Attribute:

Attribute_Label: No_Layers

Attribute_Definition:

Number of overlapping resources. Areas with no datasets have been coded as land or water.

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Distribution_Information:

Distributor:

Contact_Information:

Contact_Organization_Primary:

Contact_Organization: Virginia Institute of Marine Science (VIMS)

Contact_Position: Director Comprehensive Coastal Inventory Program

Contact_Address:

Address_Type: mailing address

Address:

P.O. Box 1346

City: Gloucester Point

State_or_Province: Virginia

Postal_Code: 23062

Country: USA

Contact_Voice_Telephone: (804) 684-7188

Contact_Electronic_Mail_Address: marcia@vims.edu

Contact_Instructions:

Contact via email

Resource_Description: Downloadable Data

Distribution_Liability:

The Comprehensive Coastal Inventory Program (CCI) at VIMS performs a service by distributing data generated by either CCI or public agencies which offer data without restriction or charge. CCI assumes no responsibility for data accuracy or precision, metadata completeness or correctness for digital information. CCI assumes no liability for misuse of any data which may arise as a result of any alteration, conversion, or combination with other data sources. As well, the timeliness and scale of these products must be considered when evaluating appropriate use.

Standard_Order_Process:

Digital_Form:

Digital_Transfer_Information:

Transfer_Size: 144.129

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Metadata_Reference_Information:

Metadata_Date: 20100526

Metadata_Contact:

Contact_Information:

Contact_Organization_Primary:

Contact_Organization: Virginia Institute of Marine Science (VIMS)

Contact_Person: Tamia Rudnicki

Contact_Position: GIS Programmer/Analyst

Contact_Address:

Address_Type: mailing address

Address:

P.O. Box 1346

City: Gloucester Point

State_or_Province: Virginia

Postal_Code: 23062

Country: USA

Contact_Voice_Telephone: (804) 684-7181

Contact_Facsimile_Telephone: (804) 684-7179

Contact_Electronic_Mail_Address: tamia@vims.edu

Metadata_Standard_Name: FGDC Content Standards for Digital Geospatial Metadata

Metadata_Standard_Version: FGDC-STD-001-1998

Metadata_Time_Convention: local time

Metadata_Extensions:

Online_Linkage: <http://www.esri.com/metadata/esriprof80.html>

Profile_Name: ESRI Metadata Profile

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