The Hampton Roads Conservation Corridor Study

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HAMPTON ROADS
PLANNING DISTRICT COMMISSION

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HAMPTON ROADS CONSERVATION CORRIDOR STUDY

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ABSTRACT

The Hampton Roads Conservation Corridor Study (HRCCS) final report summarizes a green infrastructure based approach to identifying important natural resources in the Hampton Roads region. A combination of geographic information systems (GIS) analysis and stakeholder involvement was used to identify areas where conservation efforts would support multiple benefits as well as to identify opportunities for developing a linked corridor system throughout Hampton Roads. The report provides a synopsis of the process of creating the corridor system, a discussion of the stakeholder involvement process, a description of associated educational materials, and a conclusions section that addresses implementation issues.

CREDIT

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INTRODUCTION

The Hampton Roads Conservation Corridor Study (HRCCS) is an effort to identify critical natural resources in Hampton Roads using a green infrastructure based approach. The Conservation Fund as defines green infrastructure as:

> "…our Nation's natural life support system - an interconnected network of protected land and water that supports native species, maintains natural ecological processes, sustains air and water resources and contributes to the health and quality of life for America's communities and people" (Benedict 7)

By identifying these resources now, a linked network of conservation corridors will remain protected as the Hampton Roads region grows. The HRCCS demonstrates how green infrastructure works on a regional level, which will help Hampton Roads localities, state and federal agencies, non-profit conservation groups, and the general public to make the most of their conservation investments.

A combination of geographic information systems (GIS) analysis and stakeholder involvement was used to identify areas where conservation efforts would support multiple benefits as well as to identify opportunities for developing a linked corridor system throughout Hampton Roads. The resulting maps and supporting information will be made available to the Hampton Roads localities and the state and federal agencies working in Hampton Roads for use in their planning processes.

This report provides a synopsis of the process of creating the corridor system, a discussion of the stakeholder involvement process, a description of associated educational materials, and a conclusions section that addresses implementation issues.

BACKGROUND

Through the Southern Watershed Area Management Program (SWAMP), a set of conservation corridors was identified in the Southern Watershed Area (SWA). The corridor system has proven to be a valuable planning tool for the cities of Chesapeake and Virginia Beach and the state and federal agencies working in the SWA. The corridor system has been utilized in comprehensive planning efforts, the creation of a Purchase of Development Rights program in Chesapeake, and is the target area for wetlands mitigation as outlined in the Multiple Benefits Conservation Program Memorandum of Agreement. The HRCCS expands the identification of conservation corridors to the remainder of the Hampton Roads Planning District.

The number of households in Hampton Roads is projected to increase approximately 32% between 2000 and 2030. During the same period, total employment in the region is projected to increase by 27% (HRPDC). This growth has the potential to exacerbate habitat fragmentation and adversely impact water quality. Habitat fragmentation results in the loss of interior habitat areas. Many species of plants and animals require interior habitat areas for continued viability. Continued loss of riparian forest increases the

transport of pollutants in stormwater runoff to receiving waters. Against this backdrop, it is essential that natural resource conservation and water quality protection strategies be designed to maximize the benefits obtained for the money and effort expended. The corridor system has been intentionally designed to include areas where it may be possible to achieve multiple benefits, such as the overlap of habitat protection and water quality protection. By outlining a linked corridor system, opportunities to minimize habitat fragmentation and protect contiguous riparian buffers are identified. Specifically, the following criteria were used in the identification of lands for inclusion in the corridor system:

- Habitat value
- Contiguous undeveloped areas
- Potential for water quality protection
- Potential for wetlands mitigation
- Opportunities for flood hazard mitigation
- Opportunities for storm water management
- Opportunities for parks and trails
- Opportunities for contiguous riparian corridor areas
- Opportunities for linkage across locality and state boundaries

FOCUS ON RIPARIAN AREAS

The goal of the analytic process was the identification of areas of high ecological value and high water quality protection value. In Hampton Roads, these high value areas are often in and adjacent to riparian corridors. Riparian areas can be defined as follows:

> "Riparian areas are transitional between terrestrial and aquatic ecosystems and are distinguished by gradients in biophysical conditions, ecological processes, and biota. They are areas through which surface and subsurface hydrology connect water bodies with their adjacent uplands. They include those portions of terrestrial ecosystems that significantly influence exchanges of energy and matter with aquatic ecosystems (i.e. a zone of influence). Riparian areas are adjacent to perennial, intermittent, and ephemeral streams, lakes, and estuarine-marine shorelines." *Riparian Areas: Functions and Strategies for Management*, National Research Council, National Academy Press, page 33, 2002 (Committee 3).

The National Research Council (NRC) undertook a comprehensive study of riparian areas in 1999. One of the initial observations offered in the resulting report is quoted below:

> "The federal Clean Water Act requires that wetlands be protected from degradation because of their multiple, important ecological roles including maintenance of high water quality and provision of habitat for fish and wildlife. For the last 15 years, this protection has slowed the precipitous decline in wetland acreage observed in the United States since European settlement. However, protection of wetlands generally does not encompass riparian areas – the lands bordering water bodies such as rivers, lakes, and estuaries – even though they often provide many of the same functions as wetlands."

Riparian Areas: Functions and Strategies for Management, National Research Council, National Academy Press, page 1, 2002 (Committee 2).

The NRC committee reached several overarching conclusions and recommendations intended to heighten awareness of riparian areas commensurate with their ecological and societal values:

- Restoration of riparian functions along America's water bodies should be a national goal.
- Protection should be the goal for riparian areas in the best ecological condition, while restoration is needed for degraded riparian areas.
- Patience and persistence in riparian management is needed.
- Although many riparian areas can be restored and managed to provide many of their functions, they are not immune to the effects of poor management in adjacent uplands.

In addition to the intrinsic habitat and water quality protection value, riparian areas are a focus of the HRCCS due to the opportunities they provide for creation of a linked corridor system. Urban development patterns, particularly in the older central city areas, have fragmented habitat to the extent that the riparian areas provide the only opportunity for a linked system in these areas.

PROCESS DESCRIPTION

The HRPDC staff created a set of draft maps using these criteria and subjected them to stakeholder review. Natural resource professionals reviewed the maps and provided recommendations from a resource management perspective. Local government staff reviewed draft maps of the corridor system in an effort to maximize the utility of the network and to minimize conflict with each locality's future land use plans. The draft maps were edited and finalized based on the stakeholder input. The following sections of this report provide a detailed description of the analytic process and the stakeholder involvement process.

ANALYTIC PROCESS

ESTABLISHMENT OF GOALS

The primary goal of the analytic process was to use GIS techniques and stakeholder input in order to identify areas that are highly suitable for conservation based on habitat protection and water quality protection perspectives. The secondary goal was to identify opportunities for connectivity between these areas. Riparian and bay front areas provide the most logical path for making these connections. These areas provide opportunities for the achievement of multiple ecological benefits due to their inherently high biodiversity, prevalence of wetlands, and potential for water quality protection.

Linkage with local land use plans was also a key focus in the analysis. Ideally, the identified corridor system will be integrated and utilized in the future comprehensive plans of Hampton Roads localities.

BACKGROUND RESEARCH

Many successful green infrastructure projects have been completed in other areas of the country by various organizations. A wide variety of these projects were reviewed to aid in choosing the best methodology and data layers to include in the HRCCS. Some of the projects that were analyzed include the United States Environmental Protection Agency's (EPA) Southeastern Ecological Framework, The Triangle GreenPrint Project in Durham, North Carolina, Maryland's GreenPrint Program, and the Chesapeake Bay Program's Resource Lands Assessment.

While the data layers used for each project varied based on availability and project goals, there is a common theme for the methodology. Most of these projects incorporate the "hub and corridor" theory of green infrastructure, which aims to identify larger unfragmented areas of land with high ecological value and connect them together via corridors. The hubs function as anchors in the system, thereby acting as origins or destinations for wildlife migrations and other ecological processes. Hubs include areas such as wildlife preserves, state parks, community parks, working lands, and state forests. The corridors act as connectors between the hubs. Examples of corridors include riparian areas and greenbelts. These corridors are key to supporting the system.

DATA ACQUISITION AND PREPARATION

One of the challenges of choosing the data layers to include in the HRCCS model was finding data that both encompasses the entire Hampton Roads region and is consistent in quality and scale across jurisdictional boundaries. The goal of the HRCCS was a broad, generalized corridor system so only four datasets that met these criteria were ultimately chosen for the model. These datasets are: National Wetlands Inventory, National Land Cover Dataset, VCLNA Natural Landscape Assessment Cores, and Riparian Corridors. Other datasets of interest, such as flood zones and soils were not

available digitally for the entire Hampton Roads Planning District at the time of the project.

National Wetlands Inventory

The National Wetlands Inventory (NWI) is a dataset that is produced by the U.S. Fish and Wildlife Service. Wetlands in this dataset were extracted from interpretation of various years of aerial photography and classified into numerous categories. The NWI was chosen for this model because it is the most comprehensive wetlands data layer that is available for all jurisdictions in Hampton Roads. The dataset was created with a 30-meter resolution.

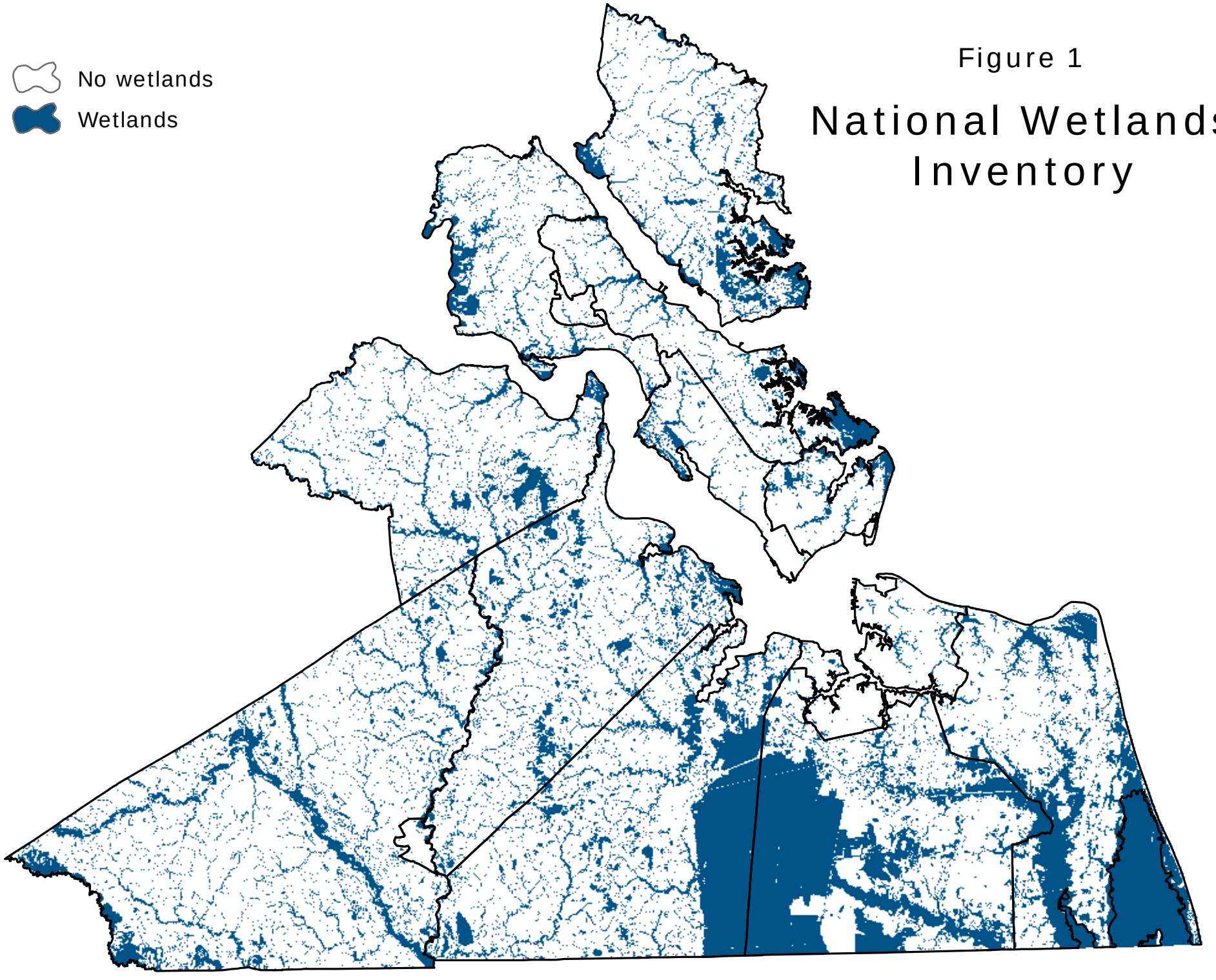
For the purposes of this project, a data layer was derived from the original that depicts simply whether an area is classified as a wetland or not, as shown in Figure 1.

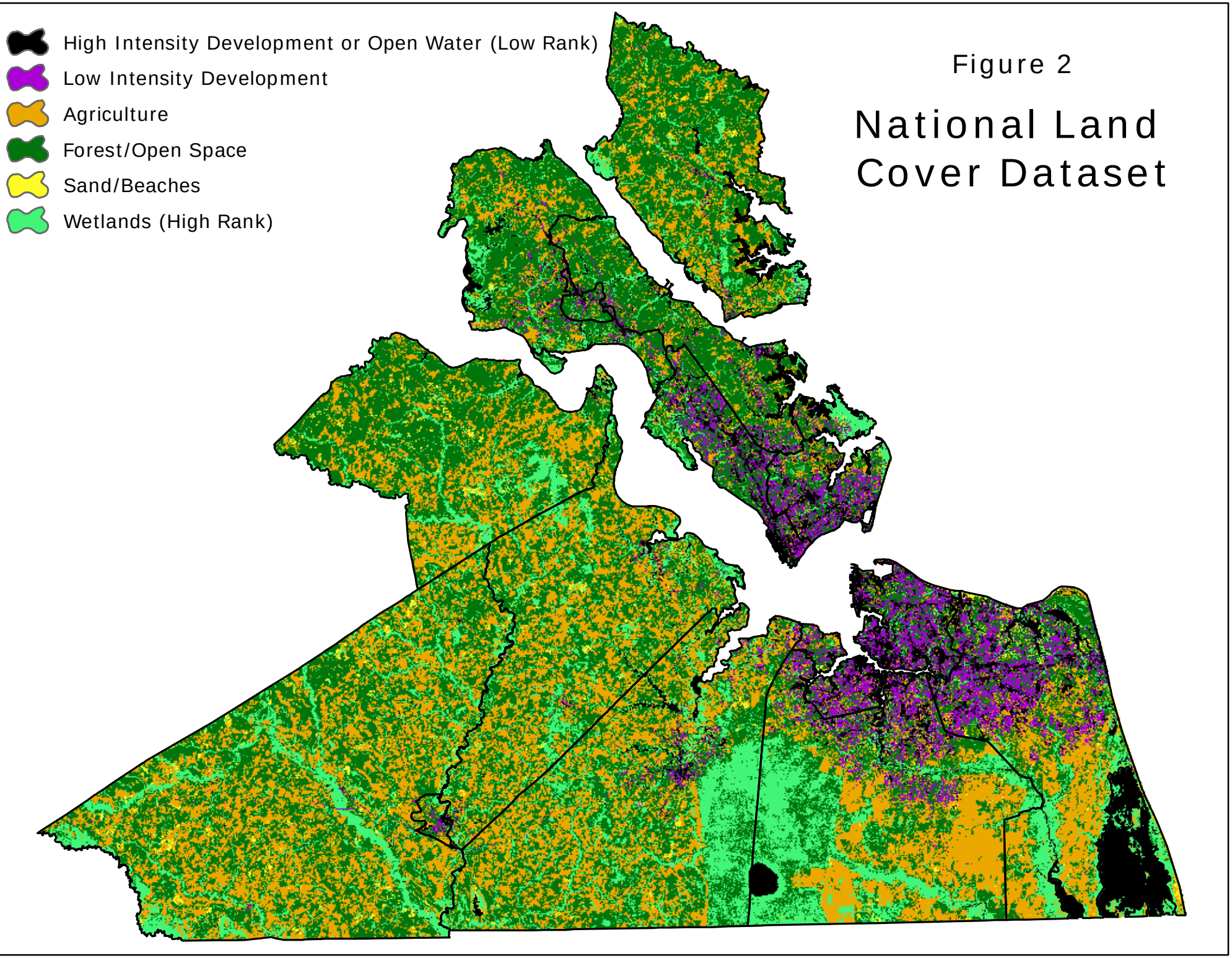
National Land Cover Dataset

The National Land Cover Dataset 2001 (NLCD) was chosen to represent land cover in the model. The NLCD was developed by the United States Geologic Survey (USGS) using Landsat Thematic Mapper satellite data. The NLCD uses a 21-class land cover classification scheme. The NLCD data was captured at a 30-meter resolution for the entire United States and therefore is the best land cover dataset available for working on a regional scale. The following land cover categories are represented in the Hampton Roads region:

- Open Water
- Developed, Open Space
- Developed, Low Intensity
- Developed, Medium Intensity
- Developed, High Intensity
- Barren Land (Rock, Soil, Clay)
- Deciduous Forest
- Evergreen Forest
- Mixed Forest
- Pasture/Hay
- Cultivated Crops
- Woody Wetlands
- Emergent Herbaceous Wetlands
- Open Water

Figure 2 shows the NLCD for the Hampton Roads region. For the HRCCS, some of the land cover categories were collapsed so that the NLCD data would work with the methodology chosen. This is discussed in the Initial Model Development section of this document.


No wetlands
Wetlands
Figure 1
National Wetlands Inventory


High Intensity Development or Open Water (Low Rank)
Low Intensity Development
Agriculture
Forest/Open Space
Sand/Beaches
Wetlands (High Rank)
Figure 2
National Land Cover Dataset

VCLNA Natural Landscape Assessment Cores

The Virginia Land Conservation Needs Assessment (VCLNA) is a project that was undertaken by the Virginia Department of Conservation and Recreation (DCR) – Division of Natural Heritage. The Natural Landscape Assessment (NLA), developed under the VCLNA, is a landscape-scale GIS analysis for identifying, prioritizing, and linking natural habitats in Virginia. The result of this analysis produced unfragmented "cores," which are interior patches of habitat (mainly forest and wetlands) that are greater than 100 acres in area. The VCLNA utilized the National Land Cover Dataset, which has a 30-meter resolution, to identify the core areas.

After the cores were identified, a Core Prioritization Model was developed to assess the ecological significance of each core based on various factors such as rare species and habitats, species diversity, and stream quality. The higher weights given to the cores reflect their higher priority for conservation. The cores were ranked on a scale of C1-C5 with C1 representing "outstanding ecological significance" and C5 representing "general ecological significance."

It should be noted that the original NLA pilot project was completed for the Coastal Zone of Virginia only, so no cores were identified for a majority of Southampton County (see Figure 3). Although Southampton County was not represented in this dataset, the VCLNA cores warranted inclusion in the model because they incorporate important ecological factors not found in other regional datasets. Since Southampton County is mainly rural, the forested and wetland features were still represented in the model through the use of the NLCD. Also, since the VCLNA will be completed for the entire state in the near future, the VCLNA data for Southampton County will be included in future revisions of the HRCCS.

Riparian Corridors

The riparian corridor data layer was derived from the hydrology dataset included in the 2002 Virginia Base Mapping Project (VBMP). This dataset was created from the VBMP aerial imagery and so is more accurate than other hydrology datasets, including the Census Bureau's TIGER data.

The original VBMP data was in CAD format and divided into tiles so several steps were undertaken to make the data compatible with GIS for input into the HRCCS model. Since there are several hundred tiles covering the Hampton Roads area, a programming script was written in the Python language to automate the data conversion from CAD into a GIS shapefiles (see Appendix A). After the conversion process, the individual shapefiles were merged into one file covering the entire region. From that layer, the hydrology features that were extracted were streams, swamps, and shorelines. Finally, multiple buffers were created in GIS for 100, 200, 300, 400, and 500 feet, as shown in Figure 4.

Figure 3

VCLNA Cores

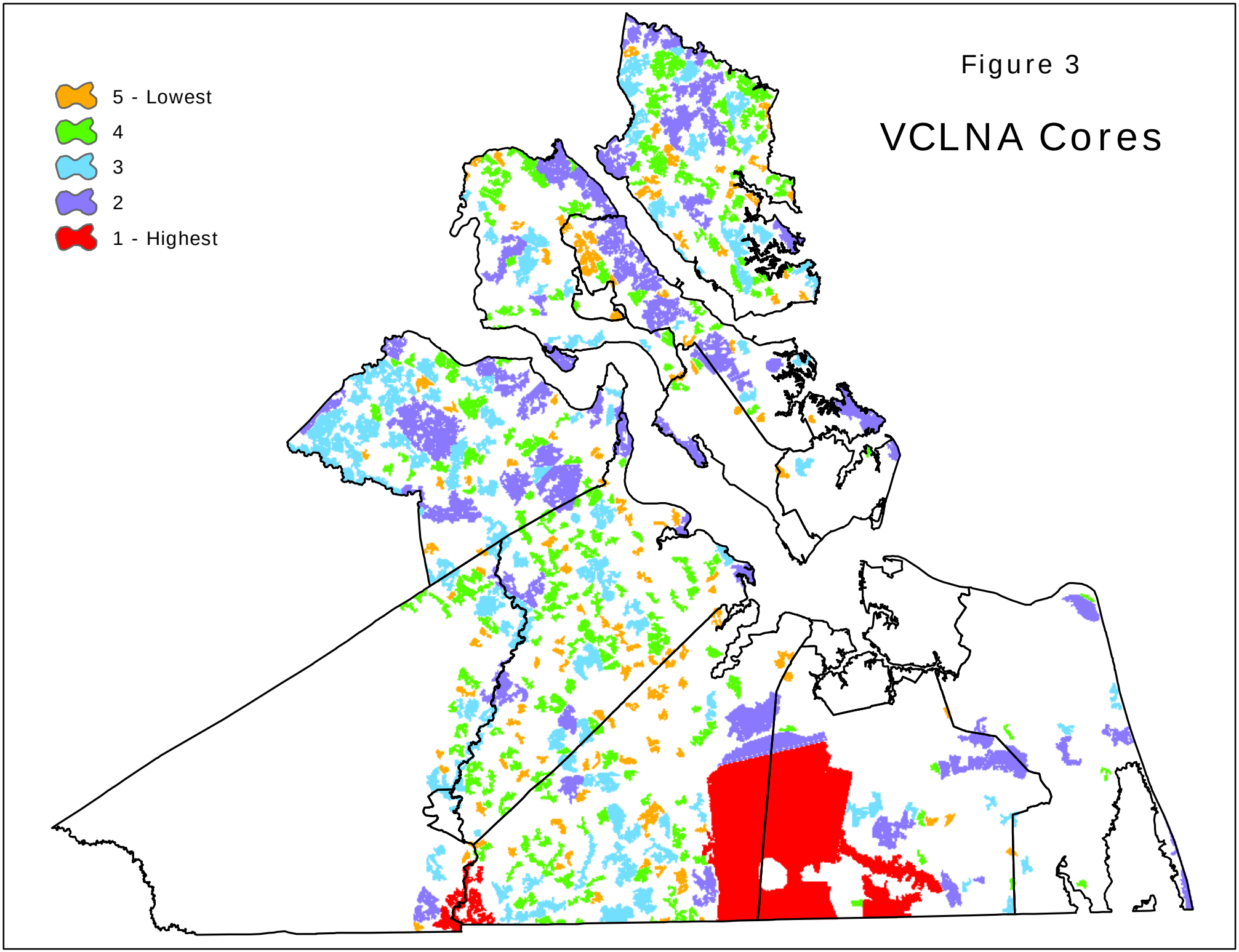
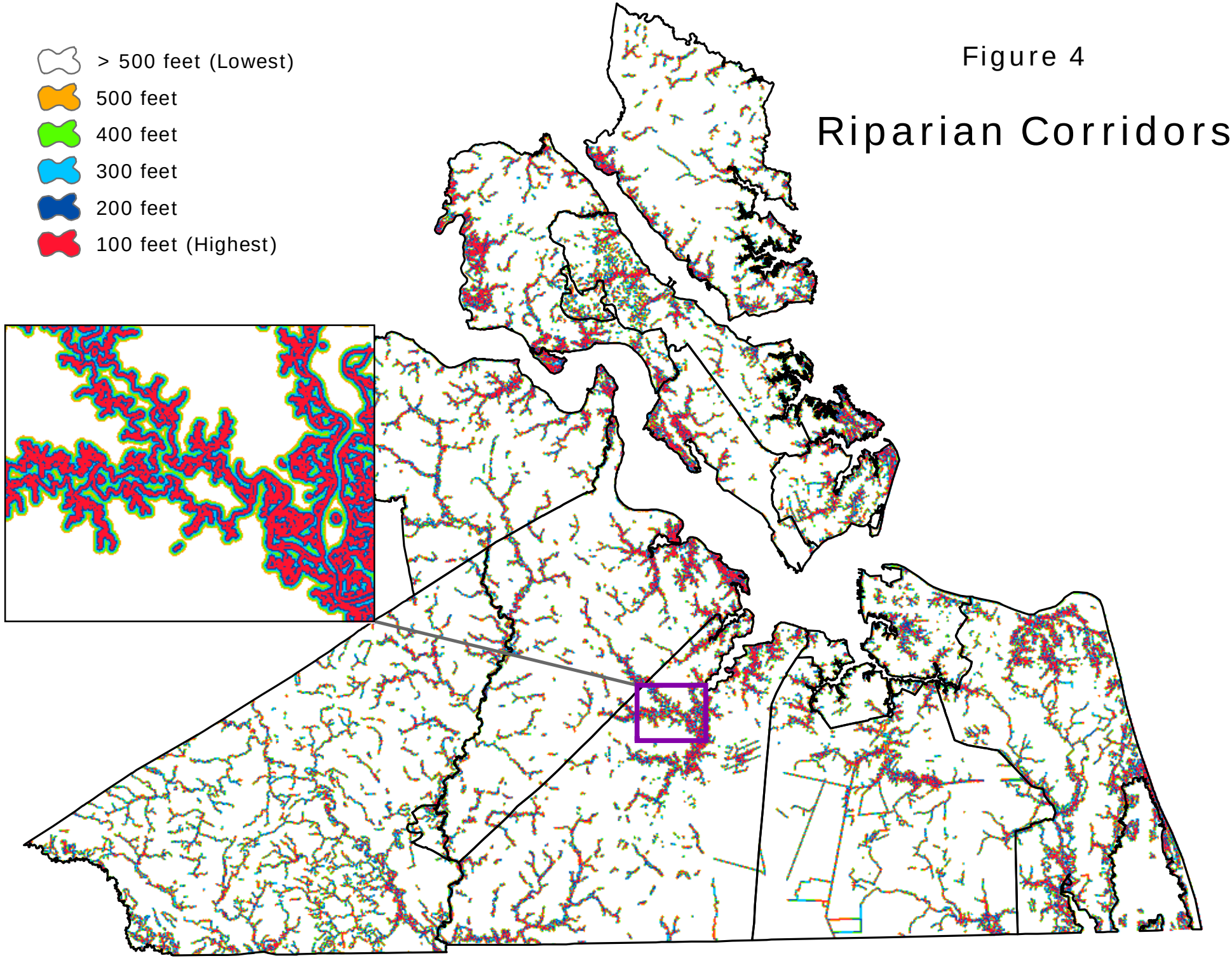


Figure 4

Riparian Corridors



The stream corridors were buffered at various distances in an effort to approximate the transitional zone of the riparian areas. The importance of this transition zone is discussed in the Introduction section of this document.

INITIAL MODEL DEVELOPMENT

A weighted overlay analysis in GIS was used to create the corridor system for Hampton Roads. Weighted overlay analysis is a standard technique used with raster GIS data for determining the suitability of the landscape to meet the stated criteria. For this project, the VCLNA cores, NWI, NLCD, and riparian corridors were incorporated into the model to produce one final suitability dataset. The two major steps in the weighted overlay analysis process are ranking (calibrating) and weighting the data layers.

The first step is to rank the attribute values from the model input layers. A single attribute is chosen from each individual layer as the criterion. Each attribute value is given a rank of 1-9 with 9 representing “highly suitable” and 1 representing “not suitable.” Then, each cell in the raster dataset is assigned the chosen number using the reclassify function in GIS.

In order to use this ranking system, the land cover classes were condensed from the original 21 classes. The highest ranking was given to wetlands areas, followed by forests. The lowest rank was given to high and medium intensity development. For the NWI layer, there was a simple yes/no ranking of 9 and 1. For the riparian buffers, the 9 ranking was given to the 100-foot buffer, which is closest to the stream. As the buffer width increases, the ranking decreases. The VCLNA cores were ranked in five categories like the original dataset with the 9 being assigned to C1 cores. Table 1 summarizes how each of the four input layers was ranked.

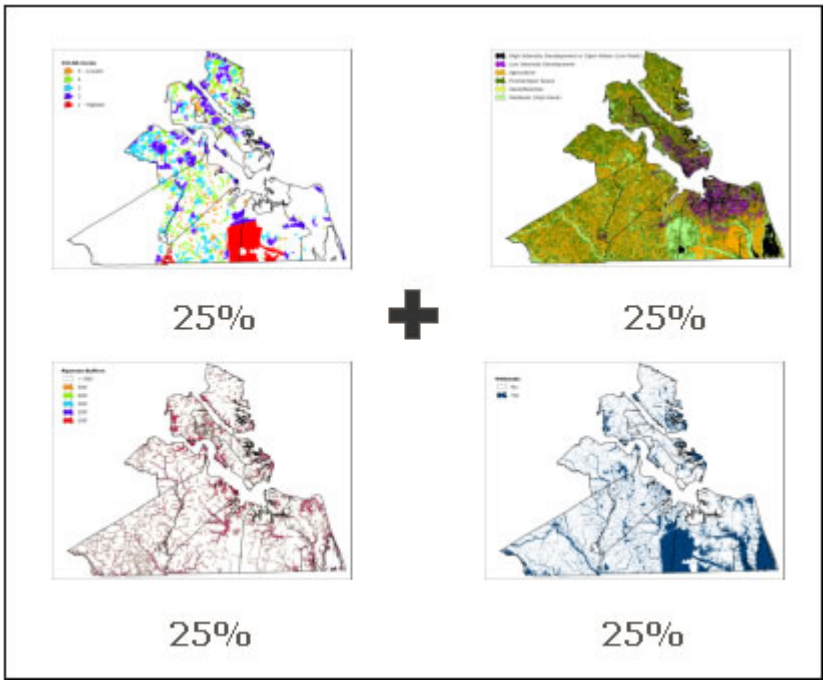
Table 1: Attribute Values and Ranks

Layer	Attribute	Original Attribute Value	Rank	Notes
NLCD	Land Cover	11	1	Open Water
		21	7	Developed, Open Space
		22	3	Developed, Low Intensity
		23	1	Developed, Medium Intensity
		24	1	Developed, High Intensity
		31	8	Barren Land (Rock, Soil, Clay)
		41	7	Deciduous Forest
		42	7	Evergreen Forest
		43	7	Mixed Forest
		81	5	Pasture/Hay
		82	5	Cultivated Crops
		90	9	Woody Wetlands
		95	9	Emergent Herbaceous Wetlands
NWI	Presence of Wetlands	Yes	9	
		No	1	
Riparian	Buffer Width	100'	9	Includes streams, swamps, & shorelines
		200'	8	
		300'	7	
		400'	6	
		500'	5	
		> 500'	1	
VCNLA Cores	Core rank	1	9	Highest
		2	8	
		3	7	
		4	6	
		5	5	Lowest
		NoData	1	

Next, each of the layers is given a weight to compare the relative importance against the other layers. For the initial run-through of the model, equal weights were given to each data layer and calculated using simple percentages. Using the map calculator functionality in GIS, each data layer was multiplied by its assigned weight and then all layers were added together. This operation is represented graphically in Figure 5 and with the map calculator equation below:

```
([VCLNA] * 0.25) + ([NLCD] * 0.25) + ([NWI] * 0.25) + ([Riparian] * 0.25)
```

Figure 5: Graphic depiction of overlay analysis



The resulting suitability surface is shown in Figure 6. This map became the baseline from which stakeholders evaluated the project and offered suggestions and input.

REFINING THE MODEL

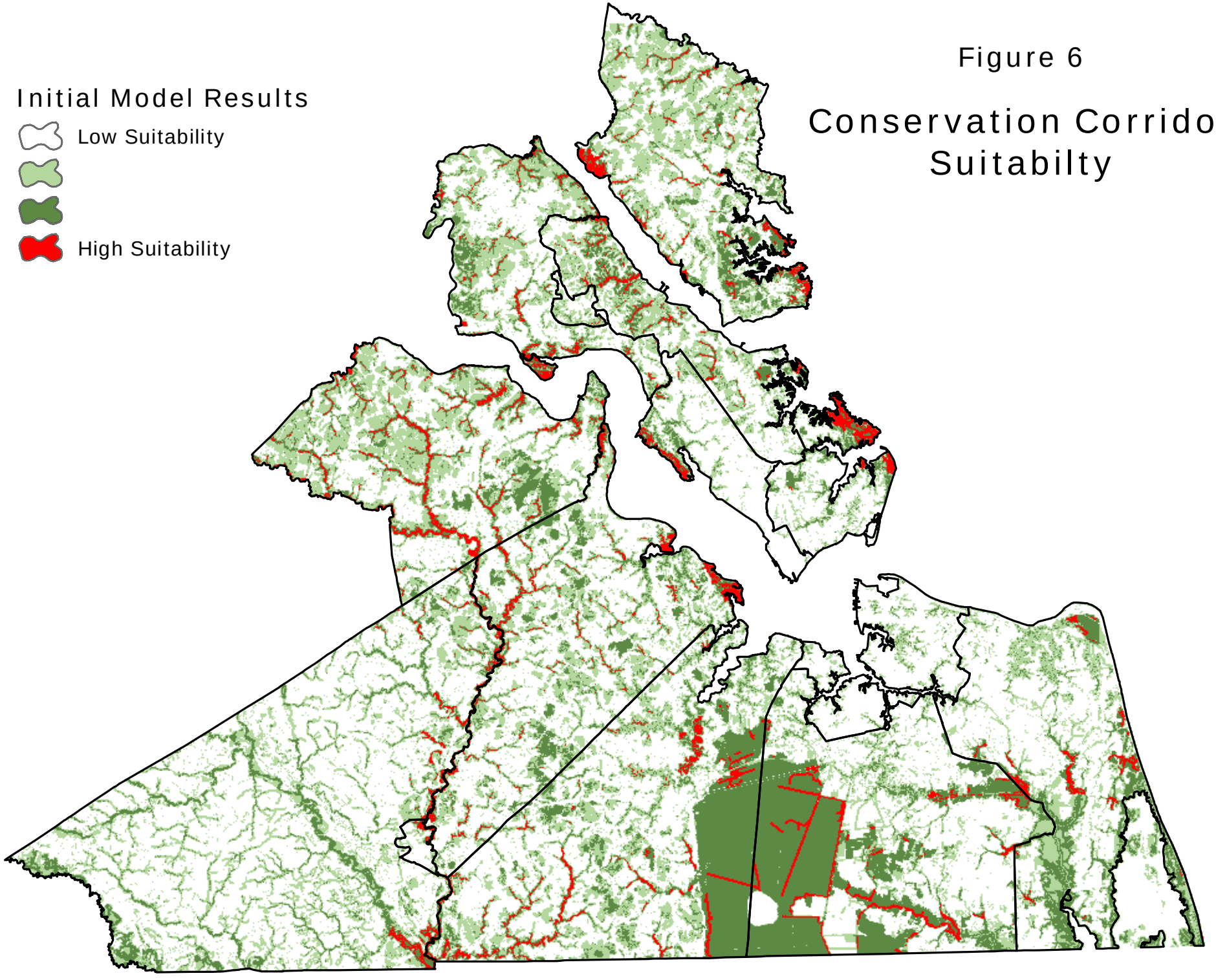
The Analytical Hierarchy Process (AHP) is a quantitative method for ranking decision alternatives by developing a numerical score to rank each alternative. The score is based on how well each alternative meets the decision makers' criteria. The AHP method is used to gain consensus on how to weigh individual data layers against each other for the suitability analysis.

The natural resources stakeholder group participated in an exercise in which each person filled out two worksheets (see Appendix B). Each worksheet allowed the stakeholder to compare the importance of each data layer to the others and score that relationship. The importance levels were ranked 1-9 according to the definitions shown in the table on the worksheet.

The information from each worksheet was then entered into a spreadsheet (see Appendix C). The spreadsheet averages the responses and calculates the relative weights for each data layer. The weighted overlay analysis was then run twice in GIS using the results of the AHP weighting exercise. Each data layer was multiplied by the weight calculated in Step 5 and divided by the sum of those weights. The following is an example of the equation used in the map calculator to compute the results:

Figure 6

Conservation Corridor Suitabilty



```
(([NLCD] * 10.42) + ([Riparian Buffers] * 1) + ([Wetlands] * 2.53)+([VCLNA
Cores] * 4.28)) / 18.22
```

The participants completed the worksheet twice. The first exercise was comparing the data layers based on a habitat preservation perspective and the second exercise was based on a water quality perspective. In both versions of the worksheet, the participants weighted the layers in the same order, however the value of the weights was different. Table 2 summarizes the results.

Table 2: Results from AHP Exercise

	Weight (Habitat)	Weight (Water quality)
Land Cover	10.42	8.03
VCLNA Cores	4.28	2.90
Wetlands	2.53	2.71
Riparian Areas	1	1

The two resulting suitability layers were then combined into one final layer depicting both outcomes (see Figure 7). The final Suitability for Conservation layer was the basis for the creation of the Opportunities for Connectivity layer.

OPPORTUNITIES FOR CONNECTIVITY

The Opportunities for Connectivity data layer highlights areas where there are opportunities to create a linked network of green infrastructure (both protected and unprotected spaces) in Hampton Roads. Since the corridor system is primarily riparian-based, most of the suitable conservation areas are connected via streams. The boundaries of this corridor layer are generalized and should be interpreted at a regional scale only – not at a neighborhood level. This map is intended as a tool to aid the regional planning process and does not necessarily reflect the actual future land use plans of individual Hampton Roads localities. The final results of the HRCCS are shown on the map in Figure 7.

FINAL STAKEHOLDER REVIEW

The HRCCS map was again sent out to planning staff in the local jurisdictions for final comments. A few edits were made to the Opportunities for Connectivity layer based on these comments.

Figure 7

STAKEHOLDER INVOLVEMENT PROCESS

Multiple opportunities have been provided for stakeholder review and comment as the conservation corridor system has been developed. The HRPDC Joint Environmental Committee process has been used throughout the project as a sounding board. A meeting with conservation specialists was used as a means of prioritizing data layers. Meetings with locality representatives provided an opportunity to discuss land use planning issues. Draft maps were circulated to the parks and recreation departments of the region's localities for review and comment. The final draft maps were circulated to the region's planning directors and associated staff. The analytic process was refined and the draft maps edited based on the stakeholder input. The following sections provide additional detail on the stakeholder involvement process.

NATURAL RESOURCE AGENCY MEETING

The Natural Resource Agency meeting held on September 19, 2005 provided an opportunity for professionals in the field of natural resource conservation to review and comment on the results of the GIS analysis from the initial model development. Representatives from the HRPDC, the Virginia Department of Conservation and Recreation, the Virginia Department of Transportation, the Virginia Department of Game and Inland Fisheries (VDGIF), the Virginia Institute of Marine Science (VIMS), the Virginia Dare Soil and Water Conservation District, the Virginia Beach Department of Agriculture and the Natural Resource Conservation Service (NRCS) participated in the meeting. The meeting included an overview of the project, general group discussion of the Corridor plan, a survey process to assist in ranking potential conservation areas and a wrap-up discussion. A detailed discussion of the survey process is contained in the section of this report on the Analytic Process.

Several issues were discussed in the course of the meeting including the following:

- The possibility of using the riparian corridor layer in a separate proximity analysis of the model results, rather than used as input into the model itself. This technique would eliminate the bias the model results have toward riparian corridors but would still allow for identifying significant conservation areas within the corridors.
- Possible availability of additional data from VIMS and VDGIF.
- The value of ranking the features within individual GIS data layers compared to the weighting of layers.
- The possibility of involving stakeholders in the ranking of the GIS layers, not just the weighting.
- Possibility of merging wetlands information from the National Wetlands Inventory and the National Land Cover Dataset.
- Differing approaches to dealing with urban and rural areas.

These options were reviewed and discussed following the Natural Resource Agency meeting. A follow-up meeting was held with VIMS staff to discuss analytic methods and data availability in detail. Opportunities for a potential cooperative effort between VIMS and HRPDC in the future were also discussed.

LOCAL GOVERNMENT STAFF MEETINGS

Two meetings with local government staff provided an opportunity for planning professionals to examine draft maps of the corridor system and provide input based on future land use plans of the local governments. A meeting for the Southside Hampton Roads localities was held on September 26, 2005 and a meeting for Peninsula localities was held on September 29, 2005. Topics discussed at the meetings included possible conflicts between the draft corridor system and future land use plans, opportunities for linkage of the corridor system across locality boundaries and possible linkage of the corridor system with existing or planned parks and open space features.

Based on this input several modifications were made to the Peninsula maps to highlight opportunities for linkages among the Peninsula localities. The Southside maps were edited to reflect new existing conservation areas. There was also a discussion about the future greenways planned in the City of Virginia Beach.

JOINT ENVIRONMENTAL COMMITTEE MEETINGS

The Hampton Roads Joint Environmental Committee process has been used extensively for review and discussion of the conservation corridor system. A series of presentations has been made to the committee on various facets of the corridor system and the methodology used to create it. The Joint Environmental Committee meets monthly and is comprised of representatives of local, state and federal agencies working on a broad range of regulatory and environmental programs in Hampton Roads

In preparation for the HRCCS a series of presentations to the Joint Environmental Committee was used to provide the group with background on other projects in Virginia that help to inform a green infrastructure for Hampton Roads. Presentations included the Virginia Conservation Lands Needs Assessment (VCLNA), the Virginia Comprehensive Wildlife Conservation Strategy, Blue Infrastructure mapping efforts and the Interactive Stream Assessment Resource (INSTAR). These presentations helped to provide a framework for subsequent discussions of the evolving HRCCS.

OTHER OPPORTUNITIES FOR STAKEHOLDER REVIEW AND COMMENT

The draft HRCCS maps and associated materials were distributed to the Parks and Recreation Departments and the Planning Directors of all of the Hampton Roads localities for review and comment. Based on this final round of reviews, additional modifications were made to the corridor system in the City of Chesapeake.

EDUCATIONAL ELEMENTS

Educational materials for the HRCCS have been developed with two different target audiences in mind. A generally accessible set of materials has been developed with the goal of informing the general public about the project. A set of more technical materials has been developed with local government planners, natural resource managers and GIS professionals in mind.

GENERAL EDUCATIONAL MATERIALS

The primary educational tool developed for the general public is a video presentation of green infrastructure concepts. The video, which is titled “Make the Connection! Green Infrastructure for the Future of Hampton Roads,” contains an illustrated introduction to the reasoning behind a green infrastructure based approach to conservation and specific information on the conservation corridor work accomplished under SWAMP and the HRCCS. The primary outlet for the video will be the public-access cable TV channels in Hampton Roads. The video will also be made available to local governments in Hampton Roads for use in public forums with their citizens. In addition to the video, articles have been developed for the HRPDC quarterly newsletter. The first article provided an introduction to the project and featured a map of the initial GIS analysis. The second article contains a synopsis of the completed project and the summary map (see Appendix G).

Development of the Educational Video

Due to the fact that the educational video was developed with the general public as the primary audience, the concept of green infrastructure and the HRCCS are explained in relatively simple language. Little discussion of the underlying science and technology is presented. The imagery used is a combination of video shot around Hampton Roads specifically for this project, stock aerial imagery provided by the consultant hired to produce the video, digital orthophotography from the Virginia Base Mapping Project, GIS maps developed by the HRPDC staff, and still photography. The script was developed in consultation with the Virginia Coastal Zone Management Program. The script is structured as follows:

- Discussion of the value of open space
- Introduction of the concept of green infrastructure
- Brief overview of the Southern Watershed Area Management Program
- Overview of the HRCCS
- Discussion of land management practices that citizens can employ to contribute to the corridor network.

A copy of the script for the video is provided in Appendix D. The total running time for the video is nine minutes.

Technical Educational Materials

The second set of materials is intended for use by planning, natural resource, and GIS professionals that are interested in either applying the HRCCS in a local government context or transferring the methodology to another geographic region. These materials consist of:

- Metadata for the GIS layers used in the project.
- Sections of this report on the analytic process and the stakeholder involvement process.
- PowerPoint presentations that summarize the analytic process and the application of the corridor system to meet a diverse set of planning goals.

CONCLUSIONS AND RECOMMENDATIONS FOR IMPLEMENTATION

The Hampton Roads Conservation Corridor Study is a valuable first step towards the establishment of a green infrastructure network in Hampton Roads. The geographic information system analysis and the stakeholder involvement process have resulted in the identification of priority areas for conservation and opportunities for linkage among those areas. However, a substantial amount of work remains to be done in terms of identifying and carrying out implementation strategies for the corridor system. This conclusions section contains a discussion of the analytic process and the stakeholder involvement process. In addition, implementation strategies and transferability of the project to other geographic regions are explored.

ANALYTIC PROCESS

The analytic process was generally successful and resulted in the identification of a useful corridor system. The GIS based process is data intensive and would have benefited from additional digital information including the following:

- Consistent future land use data: Not all of the localities in Hampton Roads have digital versions of their future land use maps. Among those localities that do have digital future land use maps, significant differences exist in the land use categories and level of detail provided. A uniform digital future land use database for the entire Hampton Roads region would be valuable in critiquing the corridor system and its relationship to projected land use patterns. Production of a uniform digital future land use file was beyond the scope of this project.
- Consistent detailed soils data: The Soil Survey Geographic (SSURGO) Database was available for only a subset of the Hampton Roads localities while the analytic process was underway. Addition of this detailed soils information to the analysis could prove valuable in identifying areas for restoration of wetlands and identifying prime agricultural soils.
- Digital flood hazard data is not yet available for all Hampton Roads localities. This information would enhance the value of the corridor system as a tool for flood hazard planning.

The corridor system will need to be updated periodically to include newly available digital data (such as the update to the VCLNA), updated land use and land cover data, and updated future land use plans. In addition environmental changes such as sea level rise will eventually impact the location and viability of various habitat types. The corridor system will eventually need to be adjusted to accommodate these changes and any implementation actions such as purchase of lands within the HRCCS for conservation purposes.

STAKEHOLDER PROCESS

The stakeholder process was generally successful in involving the staff of the Hampton Roads localities and the natural resource agencies working in Hampton Roads in the process of identifying and refining the corridor system. Perhaps due to the fact that the green infrastructure approach to conservation includes aspects of several different professional disciplines, it was often difficult to communicate the importance of having a particular staff person involved in the review process. As the focus of the HRCCS shifts towards implementation it will become necessary to involve a different range of stakeholders. One important future direction will involve partnerships between localities and entities such as non-profit conservation groups that have the ability to purchase and hold conservation easements. A second important area will be the local government public involvement process as each community deals with comprehensive plan updates, development of future land use strategies and rezoning issues.

APPLICATION OF THE CORRIDOR SYSTEM

The corridor system could be applied to meet a broad range of planning and environmental goals in the Hampton Roads region. The following sections provide an overview of possible application areas.

Conservation Goals

The HRCCS has the potential to be a valuable component of regional and local natural resource conservation programs. As discussed previously many of the areas identified in the corridor system have high intrinsic value for protecting critical habitat and water quality. The corridor system is rich in wetlands and forested areas and many opportunities are identified to protect or establish linkages between wetland and upland areas. Undeveloped riparian corridor areas in Hampton Roads are rich in biodiversity and have the potential if properly managed to provide both important habitat and help to manage non-point source water pollution. Maintenance of existing forested riparian buffers will help to filter stormwater runoff and can provide uptake of critically important nutrients, such as nitrogen and phosphorus. In addition, these forested areas help slow the transport of sediments and other particulate matter into receiving waters.

Parks, Recreation and Open Space Goals

Linkage of parks, trails and other recreation areas to the corridor network has the potential to buffer critical habitat areas from encroachment by new development. In addition, these areas can contribute to the management of non-point source water pollution if impervious surface areas are kept to a minimum. Similarly the protection of agricultural areas adjacent to the corridor system can provide buffering of important habitat areas. Maintaining low intensity land uses adjacent to the corridor system will minimize the encroachment of new development on important habitat areas. The potential also exists to use the corridor system as a buffer between incompatible land uses such as agriculture and rural residential development. Finally the corridor system

could be used as an organizational paradigm for a purchase of development rights program.

Regulatory Compliance

The corridor system could also be used as a component of compliance with a range of regulatory programs. In the Southern Watershed Area, a Memorandum of Agreement was developed among the local, state and federal agencies involved in wetlands regulation to use the corridor system as a tool in selecting sites for off-site compensation for wetlands impacts. This type of program could either be developed for other sub-areas in Hampton Roads or be expanded to a region-wide program. In addition, compliance with regulatory programs related to water quality protection such as the NPDES stormwater program and Total Maximum Daily Load (TMDL) requirements may be aided by the inclusion of a green infrastructure component. Two of the critical factors in managing non-point source pollution are the quantity and placement of impervious surface areas in a watershed. The HRCCS identifies important riparian corridor areas that if protected or reforested, address to some extent both of these concerns. Clearly the protection and enhancement of lands within the HRCCS will be in most cases only a subset of the efforts needed to meet TMDL goals. Floodplain management and flood hazard mitigation efforts will also benefit from the proper management of riparian corridor and other shoreline areas.

Other Planning Goals

Finally, a broad range of other planning programs may benefit from the inclusion of a green infrastructure component. When used in conjunction with other planning tools, green Infrastructure can assist in limiting encroachment of new development on military bases, support of urban growth areas, control of infrastructure and service provision cost and protection of drinking water supplies. To meet these diverse goals, green infrastructure can be used both as a tool to buffer critical resources and as an element of a future land use plan to differentiate between those areas identified for future development and those areas identified for conservation. In the case of control of infrastructure and service provision costs, green infrastructure could be used as an element of a growth management plan to concentrate new development in specific areas, thereby limiting the length of water and sewer pipes and the size of service provision areas for police and fire. In the case of protection of drinking water supplies, green infrastructure can be used to buffer the shorelines of reservoirs and water supply rivers. In the Southern Watershed the conservation corridor system has been used to identify areas that if protected from development would both limit encroachment on Naval Air Station Oceana and NALF Fentress and contribute to the integrity of the corridor system.

In the near future, the HRPDC will host two workshops on green infrastructure issues. The first workshop will focus on questions associated with implementing green infrastructure across varying geographic scales. The second workshop will focus on partnerships and funding opportunities for implementing green infrastructure. These

workshops will likely result in a set of recommendations and opportunities for applying the HRCCS.

INTEGRATION WITH LOCAL GOVERNMENT PLANNING

Comprehensive plans, future land use plans, zoning ordinances, subdivision ordinances and other elements of local government land use planning and regulation are critically important in determining the future land use patterns in Hampton Roads. The extent to which the HRCCS is implemented is therefore highly dependent on the extent to which it is used in the local government planning process. To this end, the HRCCS has been designed to minimize conflict with local future land use plans. The HRPDC staff will continue to provide technical support for those communities wishing to use the corridor system as an element of their land use planning process.

INTEGRATION WITH OTHER GREEN INFRASTRUCTURE EFFORTS

The State of Virginia is currently in the initial stages of establishing a statewide green infrastructure system. The inclusion of the VCLNA data in the development of the HRCCS insures that a strong linkage exists to the evolving statewide effort. HRPDC staff will continue to work with state staff to insure compatibility with the statewide network. The Chesapeake Bay Program developed the Resource Lands Assessment (RLA), a green infrastructure network that extends across the entire Chesapeake Bay watershed. HRPDC staff is currently involved in discussions with the Chesapeake Bay program staff to provide feedback from the HRCCS to the Bay watershed wide effort. HRPDC staff is also involved in discussions with the Albemarle-Pamlico National Estuary Program (APNEP) and individual North Carolina localities on opportunities of linking the system with localities in North Carolina.

The Nature Conservancy has been very active in Hampton Roads, particularly in the Southern Watershed Area. Lands have been purchased in the North Landing River and Northwest River watersheds. In addition, TNC recently announced an agreement with International Paper and the Conservation Fund to acquire 218,000 acres across 10 states. This purchase includes more than 20,000 acres in Sussex, Surry, Isle of Wight and Southampton counties in Virginia and in Northampton and Hertford counties in North Carolina. The tracts purchased in Virginia overlap the lands identified in the HRCCS, mainly along the Nottoway, Meherrin, and Blackwater Rivers in Southampton County. This purchase adds significantly to the protection of riparian corridor lands in Hampton Roads.

Many of the existing protected lands in Hampton Roads (including federal, state, and local parks and preserves) fall into the conservation corridors as identified in the HRCCS. Figure 8 illustrates which protected lands are within the corridor and which are outside of the corridor.

Figure 8

TRANSFERABILITY

The analytic method employed in developing the HRCCS is fully transferable to other geographic areas assuming the availability of sufficient digital input data, GIS software and hardware and staff with expertise to carry out the analysis. The digital data used in the HRCCS analysis is not yet available for all of Virginia, however suitable replacement data may be available at the local or regional level in the geographic area of interest. The methodology and approach can be transferred regardless of the specific data utilized in the HRCCS. As the statewide extension of the VCLNA and associated statewide green infrastructure efforts progress, this information will become more commonly available.

IMPLEMENTATION ACTIONS

In addition to the two pending workshops on green infrastructure the staff of the HRPDC will continue to work with member localities and state and federal agencies to integrate the HRCCS with future land use and other environmental management plans. Technical assistance will be provided on both the use of the GIS products and on options for implementation of the HRCCS. The HRPDC staff will also seek to develop partnerships with agencies and organizations that can provide funding to land acquisition and purchase of development rights programs that localities may wish to implement. Following completion of the upcoming green infrastructure workshops the HRPDC staff plans to convene additional meetings with staff from the Hampton Roads localities to develop detailed strategies for implementing the HRCCS. Finally, meetings will be held with local, state and federal agencies as needed to update and adapt the HRCCS to reflect changing circumstances or the availability of additional data to enhance the system.

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