A Strategic Forest Assessment of Charles County Maryland

May 2009

Performed By The Maryland Department Of Natural Resources
Forest Service
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And The Usda Forest Service

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Introduction

Forests are critical for basic needs like clean water, air, and ecological functions like wildlife habitat. They also are an important source of a sustainable local economy for a variety of forest products and recreation. Where are forests most important for water quality, wildlife habitat, and timber management? GIS analysis was used to help identify forest areas that support critical functions for clean water and air, healthy streams, and productive forests.

The conservation and restoration of forest land has become an increasingly important issue for everything from drinking water, treating stormwater runoff, and flood control to recreation, carbon sequestration, and air quality improvement. These ecosystem services would otherwise cost millions in additional tax dollars per year to provide artificially. General ecosystem service values were estimated for Cecil County forests at $12,000 per acre by the Conservation Fund, with riparian forest values over four times those values[2] Zoning is a primary driver of land preservation or development in Maryland, and is devised and enforced at the local government level. A task force formed to study the Maryland Agricultural Land Preservation Foundation (MALPF) in 2004 found that zoning will become increasingly important in determining where the greatest investment per acre is required to preserve…land.[1]

Since zoning is such an important determiner of what lands are conserved and those that are developed, it is extremely important that planners creating and implementing county-wide plans receive the best available forest information for decision making. The purpose of this assessment is to condense locally and regionally important information on habitat protection, water quality, forest sustainability, and cultural/economic importance, into a prioritization scheme for conservation and restoration of forest land. Planners can use this information to direct and prioritize forest conservation and restoration opportunities as they become available, and guide the future growth of their jurisdiction with a better understanding of the natural resources contained within it. For this analysis, areas of federal lands and incorporated municipalities were excluded because they are not under the jurisdiction of the Charles County Government.

Charles County, Maryland was a priority location for a forest analysis for several reasons:

1) Threat of development: Charles County experienced a 16.5% rate of population growth between 2000 and 2006.[2] This was second only to Calvert County for the same time period. It is also within a short commute to the Washington D.C. metro area.

2) Extent of forest resource: Charles County has extensive forest resources; according to data from the Maryland Department of Planning, in 2002 Charles County was the third most forested county by acres in Maryland.[3]

3) Regional importance: The forests in southern Charles County are important regional resources, highlighted in statewide forest targeting and prioritization, such as the Strategic Forest Lands Assessment, Forest Targeting for Water Quality, and Green Infrastructure mapping.

[1] The Conservation Fund, www.conservationfund.org/sites/default/files/CecilCounty01.22.08.pdf and www.ccgov.org/uploads/PlanningAndZoning/General/CecilCoMD_TechReport%20-%20Ecosystem%20Services.pdf.
[2]Maryland Department of Planning. Maryland's Land Preservation, Parks, and Recreation Plan, 2006. "Statewide Analysis of Rural Resource Lands: Status, Vulnerability, Threat, and Potential Return on Conservation Investment".
[3]U.S. Census Bureau. Quickfacts for Maryland Counties 2008. Available online: http://quickfacts.census.gov/qfd/states/24/24017.html

Methods

The county-specific forest analyses were built on several categories of geospatial data, including characteristics of the forest itself, location in the landscape and hydrologic setting, stressors for forest health and function, productivity for wood products, and habitat for upland and aquatic species. The forest analysis for Charles County used spatial data that, in some cases, represent on-the-ground observations, or were values mapped by other sources, like NRCS soil survey interpretations. These were compiled into a matrix where factors were assigned a score of between mostly 0 and 4, but as high as 10. These factors were weighted primarily based on the importance of the factor to the desired model goal. For example, the model designed to locate forests important for water quality and infiltration has higher weights for data layers that impact water quality directly, like soil characteristics. The weight is also a measure of the confidence of a particular data layer. Layers that are several years old, at a less desirable spatial resolution, or created from other analyses were assigned lower weights. The scores were assigned to their respective cells in an ESRI GRID—a map where information is represented by square cells that can vary in size and hold a unique value for a given attribute. The weights were then applied to the entire grid layer (raster) and added together to produce a weighted map of areas which met the desired criteria. The layers used, sources of the data, and criteria applied for weighting are presented in the appendix. The layers, category of data, and relative weighting are presented with the map product so the user can quickly see the factors making up the prioritization for the various goals.

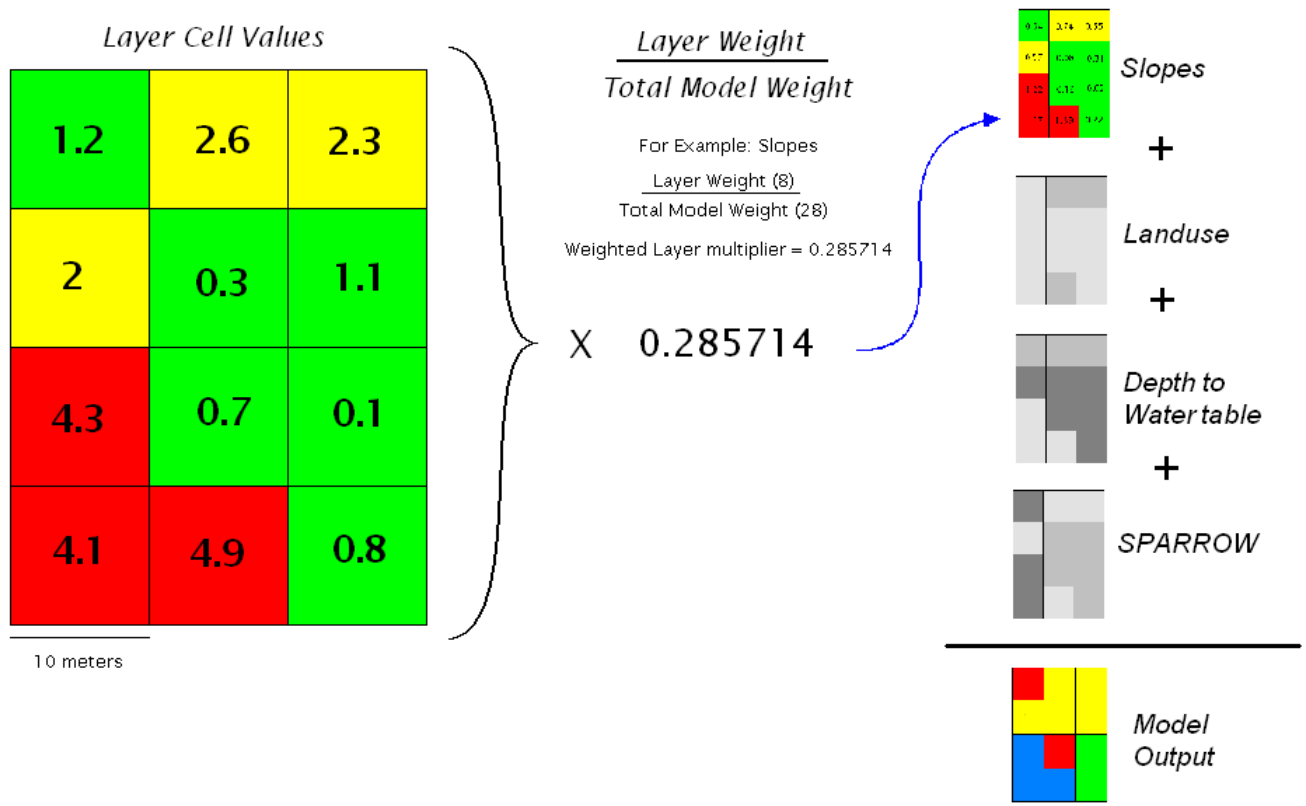


Figure 1: Raster Model Design

CHARLES COUNTY FOREST COVER - THE CONSERVATION FUND, 2007

While the project was in planning stages, the Conservation Fund—a non-profit organization dedicated to conserving America's legacy of land and water resources—had completed a revised forest cover map for Charles and a portion of Prince George's counties, Maryland. The Conservation Fund assisted the Maryland DNR Forest Service by providing the map for use in the analysis. Meanwhile The Conservation Fund was proceeding with a Green Infrastructure analysis of Charles County to support a project with the State Highway Administration. The Conservation Fund routinely supplies data, information, and analysis to government agencies and nonprofit organizations to support its goal of acquiring and conserving land across the country. This forest cover layer provided more current information at a finer scale (10m versus 30m) than other existing forest cover data. The Conservation Fund forest layer was created at a 6m resolution and aggregated to a 10m resolution to improve overlay with other data sets.

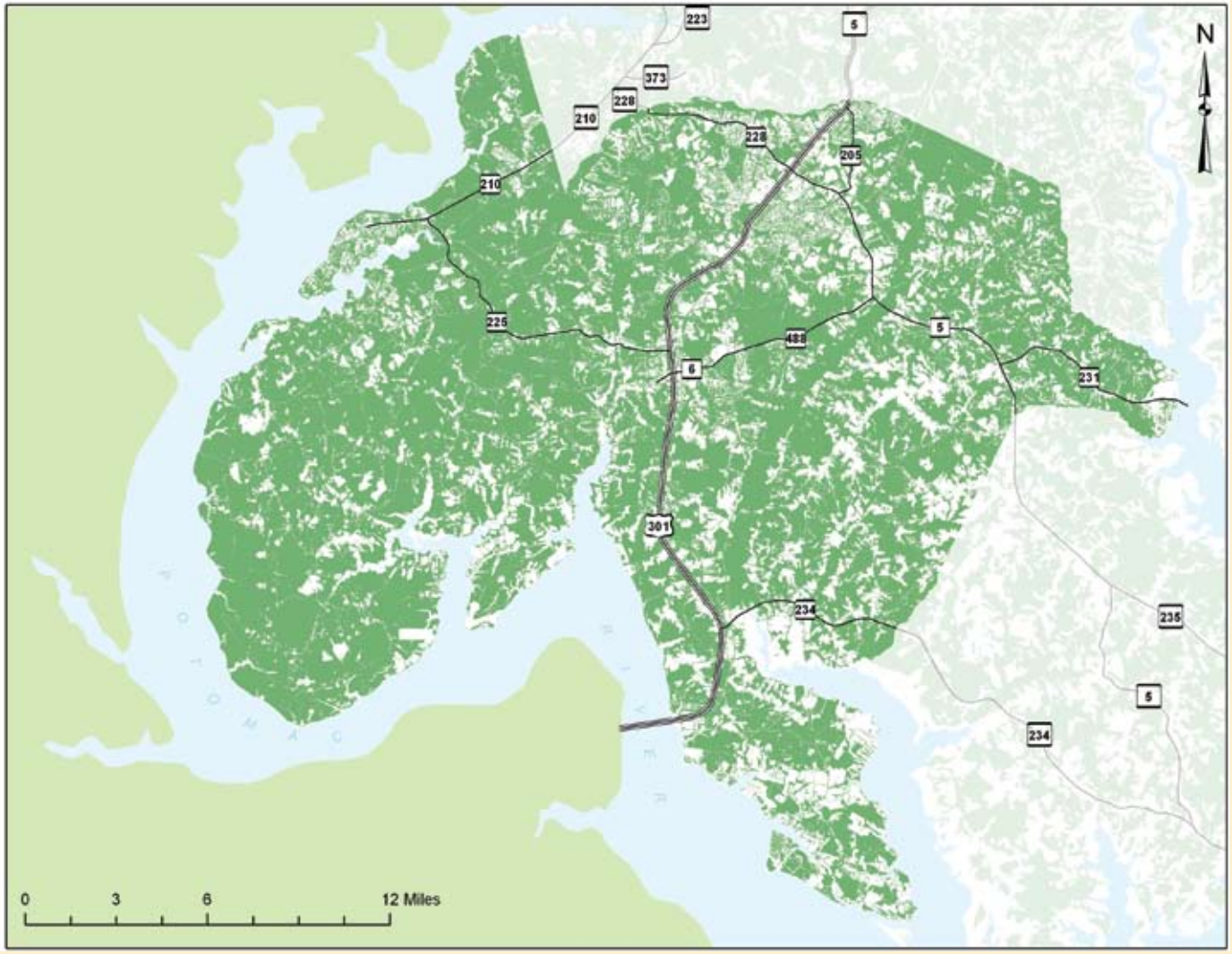


Figure 2: Forest Cover in Charles County, 2007, from TCF

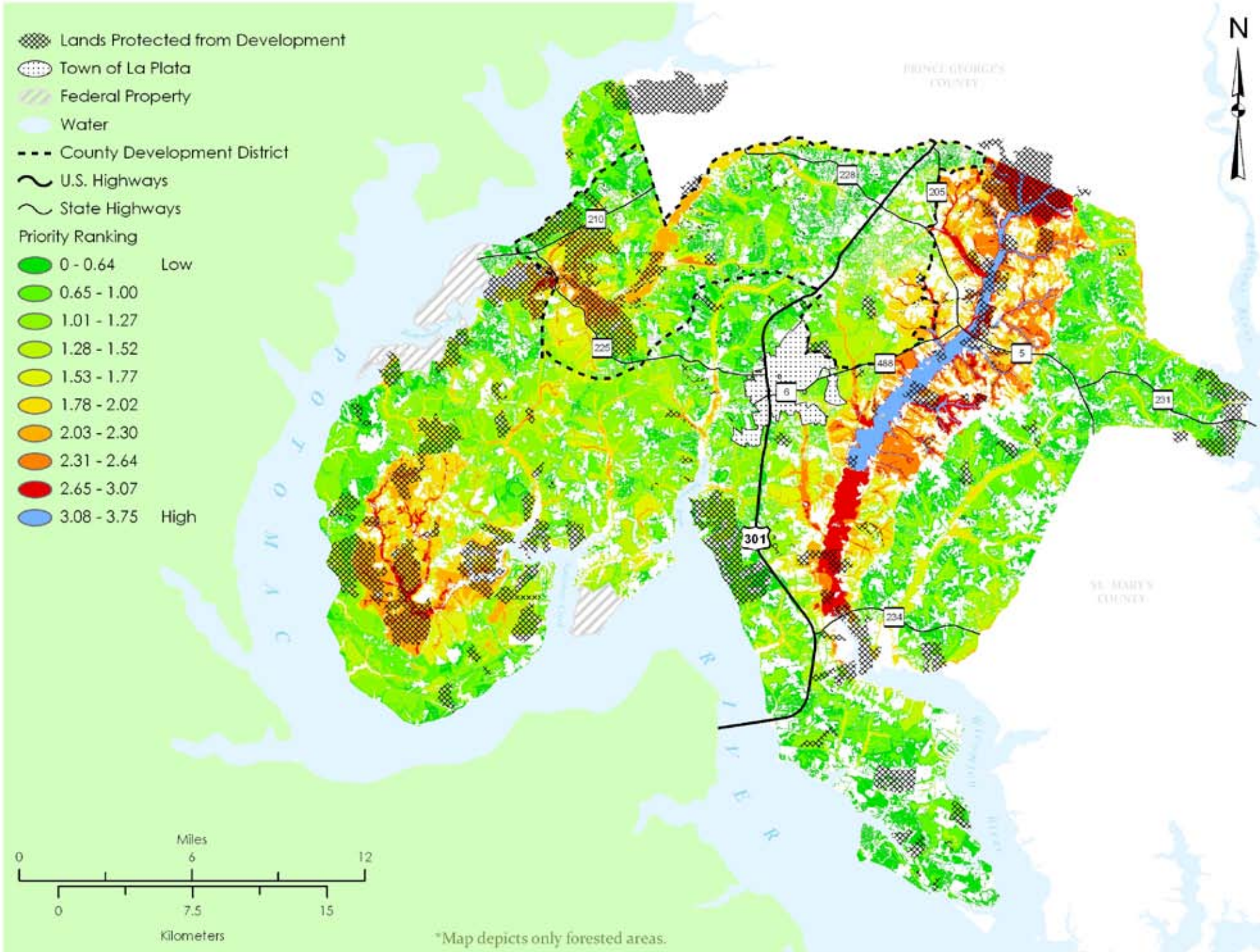


Figure 3: Forest Conservation Act: Conservation Priorities

CONSERVATION PRIORITIES FOR FOREST CONSERVATION ACT MITIGATION

The Forest Conservation Act (FCA) in Maryland requires protection or replacement of certain levels of forest cover on a development site. When Forest Conservation Act requirements for conserving forest can't be met on the development site itself, developers may find another location in the watershed or county and mitigate impacts to the forest off-site. Charles County allows both restoration projects (planting new trees on a site where trees have been absent for a long time) and conservation (placing long-term protection on existing mature forest at ratios ranging from 2:1 to 4:1, which is 2 to 4 acres conserved for every acre needed to be mitigated). The Forest Conservation Act also identifies priority areas to protect on-site and to focus on for off-site mitigation, including stream buffers, wetlands, and rare species habitat.

If mitigation can be focused in these environmentally important areas, it can bolster the ecological services the landscape provides over the long term and contribute to a more sustainable, livable community. The GIS analysis used layers related to forest characteristics, soils, and habitat to identify priority areas within the County. These areas, by virtue of their landscape position or inherent soil or habitat characteristics, would provide relatively higher values and functions if forests are protected, placed under permanent easements to retain forest land use. Layers are described in more detail in the appendix.

Prioritizing forest areas for conservation for FCA first used the detailed forest cover layer developed by The Conservation Fund in 2007 as a mask, so only currently forested areas were considered. The FCA is intended to protect forests for multiple functions, so layers related to water quality protection, enhancing sustainable forests, and habitat protection. The greatest weights were placed on core conservation functions like stream buffers (the RPZ, resource protection zone along streams), Stronghold Watersheds (hotspots of aquatic biodiversity and water quality identified through statewide stream sampling), and Green Infrastructure (large hubs and connecting corridors important for wildlife habitat). The County's Rural Legacy Area in the biologically diverse Zekiah watershed was also highly weighted as a County priority. Ecologically Significant Areas (ESAs) were used to emphasize important habitat areas like the Zekiah. The high weight on forest patch size (e.g., over 1300 acres) served to focus in on areas mostly likely to be sustainably managed over the long term. The high quality waters layers (MDE Tier II waters) were, like Stronghold Watersheds, identified using statewide stream survey data, but weighted less because rare species weren't emphasized. Forest Interior Dwelling Species (FIDS) habitat is an important resource that was weighted lower because data were more than 15 years old; layers for Green Infrastructure and forest patch size served to retain emphasis on core FIDS areas.

Other factors considered for FCA conservation priority areas were the identified Forest Legacy areas for the federal conservation program (which include the larger forest blocks in the undeveloped portion of the county) and Priority Watersheds identified by the County planning staff: Zekiah, Nanjemoy, Mattawoman, and Port Tobacco. Hydric soils and wetlands were included to reinforce areas with greater potential hydrologic function and ability to denitrify runoff within the matrix of important forests.

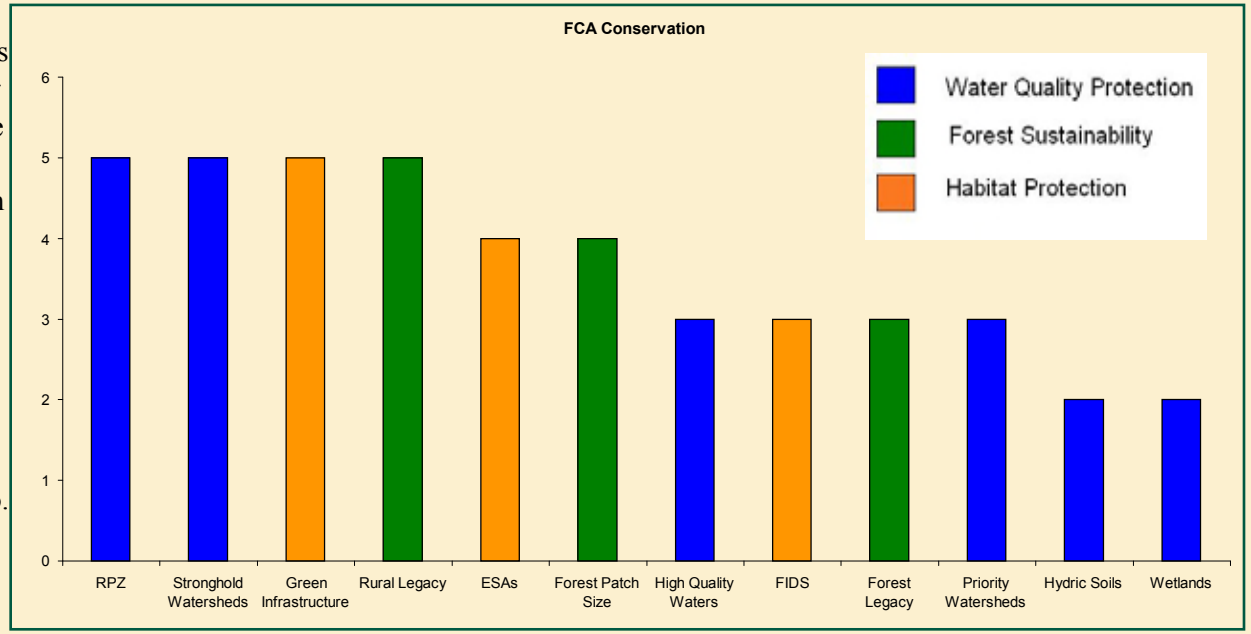


Figure 4: FCA Conservation Layer Weight Comparison

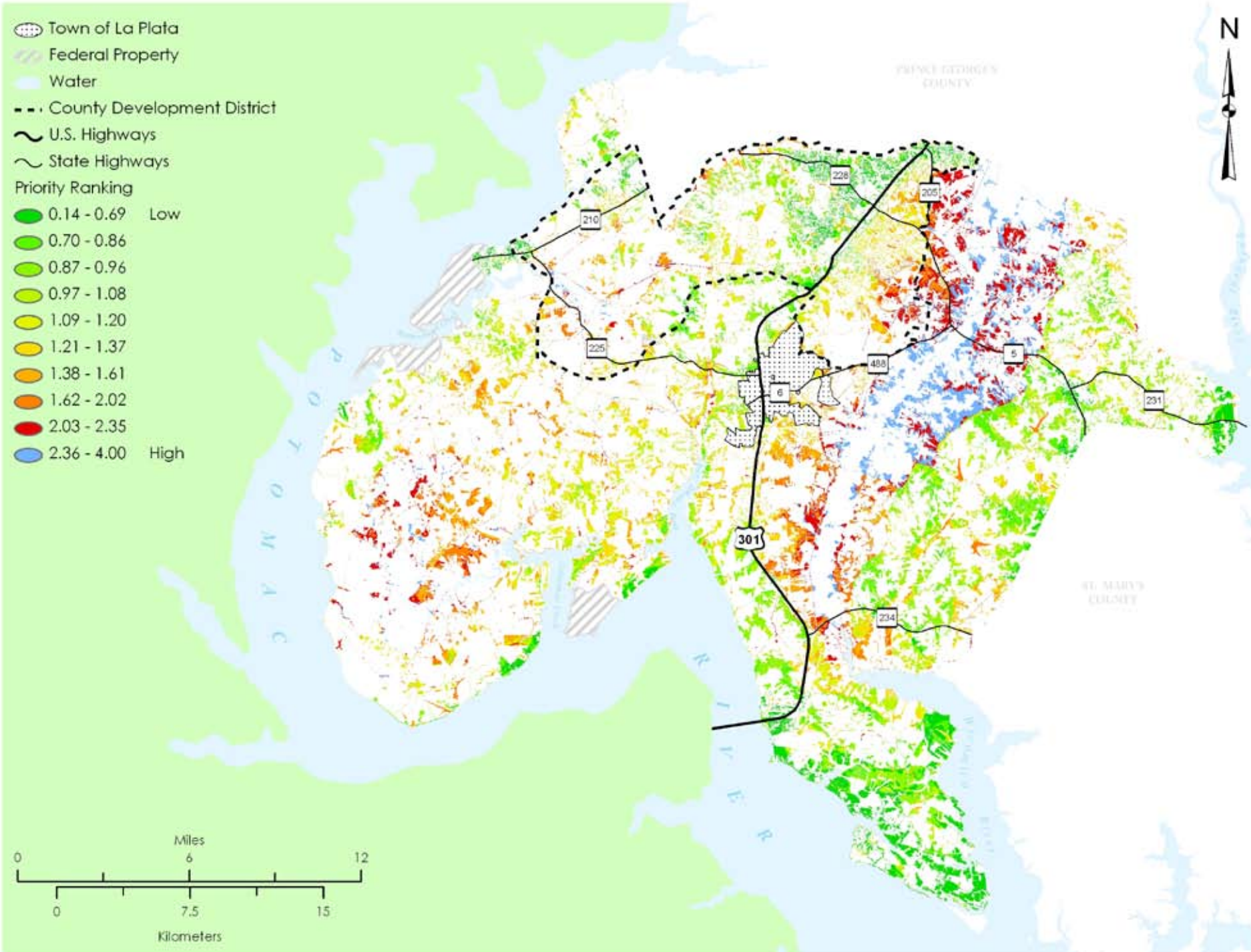


Figure 5: Forest Conservation Act: Restoration Priorities

RESTORATION PRIORITIES FOR FOREST CONSERVATION ACT MITIGATION

The Forest Conservation Act mitigation requirements for new development can result in new forests being planted in locations beyond the area of the development itself. Targeting these areas where they can best extend the functions of existing forest can bring long-term benefits. Generally, the Zekiah, Nanjemoy, and Mattawoman watersheds emerged as priority areas, along with unforested riparian areas. Layers are described in more detail in the appendix.

The information used to target FCA restoration tree plantings was similar to many layers used for the conservation priorities, although the relationships sometimes had to change, and the forest layer was used to mask out all existing forest and concentrate on currently unforested areas. Impervious, unplantable areas were also masked out. The multiple-function approach included water quality protection, enhancing sustainable forests, and habitat protection (Figure 6). The RPZ, Stronghold Watersheds, and Rural Legacy Area again were weighted highest as integrative layers where new areas of forest would augment water quality and habitat. Areas adjacent to Green Infrastructure (large hubs and connecting corridors important for wildlife habitat) were highlighted, with particular emphasis on the corridors connecting the major habitat hubs; these areas often have gaps where restoring a connection among forest areas is particularly valuable to allow wildlife to move to suitable habitat. Similarly, areas adjacent to large forest patches were a focus for restoration rather the existing forest patches themselves.

Restoration was also prioritized in Ecologically Significant Areas (ESAs) and adjacency to FIDS habitat for enhancing habitat functions. The high quality waters layers (MDE Tier II waters) are identified as areas where the good water quality is intended not to be degraded, so that layer, along with the County's Priority Watersheds, hydric soils, and nontidal wetlands, was used to highlight areas where locations would improve water quality. The approach was intended to support sustainable working landscapes including farmland. The restoration targeting was weighted to avoid prime agricultural lands, except for buffer areas. The extensive Forest Legacy areas were also included to augment a focus on working forests.

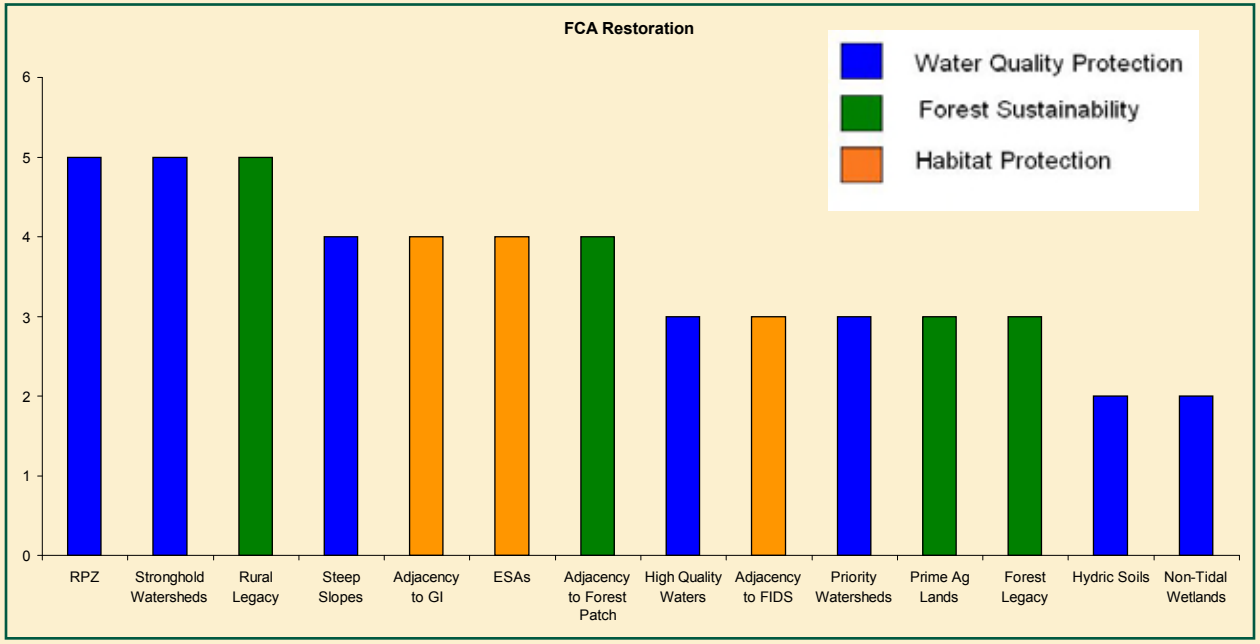


Figure 6: FCA Restoration Layer Weight Comparison

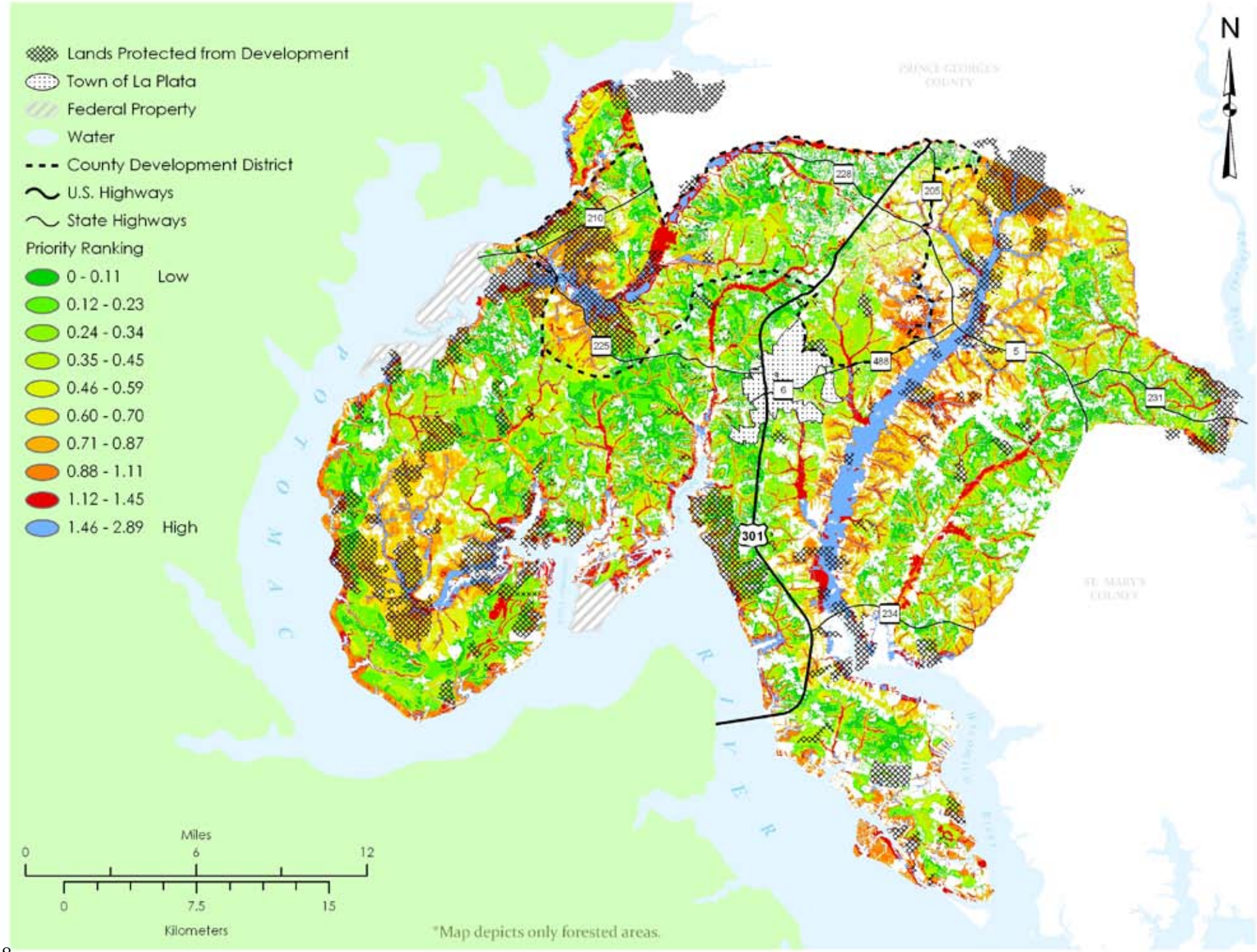


Figure 7: Chesapeake Bay Critical Area: Forest Conservation Priorities

CONSERVATION PRIORITIES FOR CHESAPEAKE BAY CRITICAL AREA MITIGATION

Targeting forest conservation in the Critical Area emphasized the water quality and habitat goals of the Maryland Chesapeake Bay Critical Area Law. Forest replacement requirements within the Critical Area are substantially greater since its area is limited to 1000 feet from tidal waters. Analysis used the forest cover layer to consider only currently forested lands. Layers are described in more detail in the appendix.

Conservation within the Critical Area is the highest priority, so was given over twice the weight of other layers. Areas beyond the Critical Area were also included for consideration, in case mitigation within the Critical Area was not feasible, and mitigation could be done elsewhere in the watershed. The stream buffers areas were emphasized through the use of both the RPZ and the 100-foot stream buffers. Layers unique to the Critical Area were Habitat Protection Areas, Colonial Nesting Waterbird Nesting Areas (which include some areas far up in the Zekiah wetlands), Bald eagle nesting sites, and Historic Waterfowl Staging Areas. Because the Bald eagle nest locations can vary over time and waterfowl staging areas were most strongly related to open water features, these were given somewhat lower weight for long-term forest conservation.

Layers used to emphasize water quality function included steep slopes, MDE high quality watersheds, wetlands, and hydric soils. Wetlands also have important habitat functions, so were used to prioritize good habitat along with Green Infrastructure and interior forests. The analysis identifies some clear priorities for conserving the unprotected portions of the Zekiah, Nanjemoy, and Mattawoman streamsides, as well as other riparian areas, if mitigation cannot occur in the Critical Area itself.

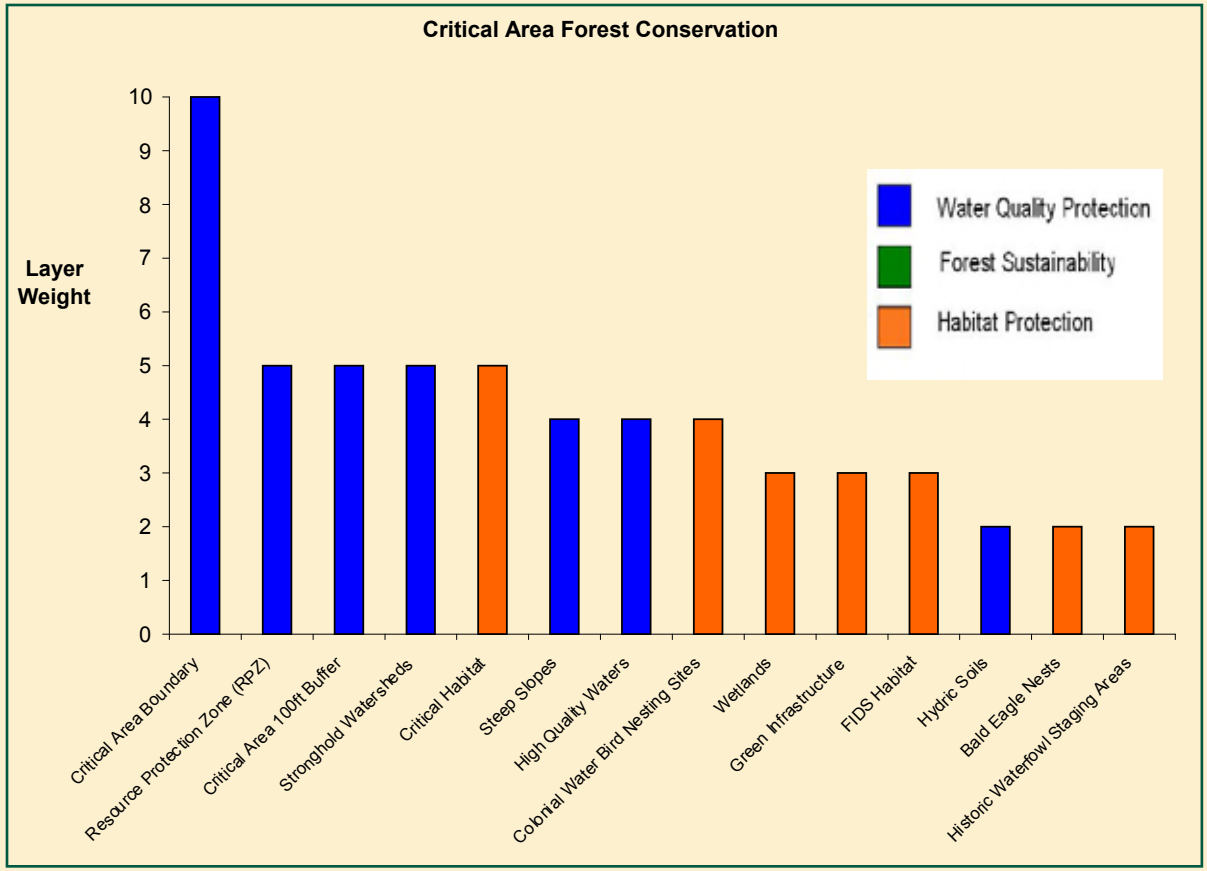


Figure 8: Critical Area Forest Conservation Layer Weight Comparison

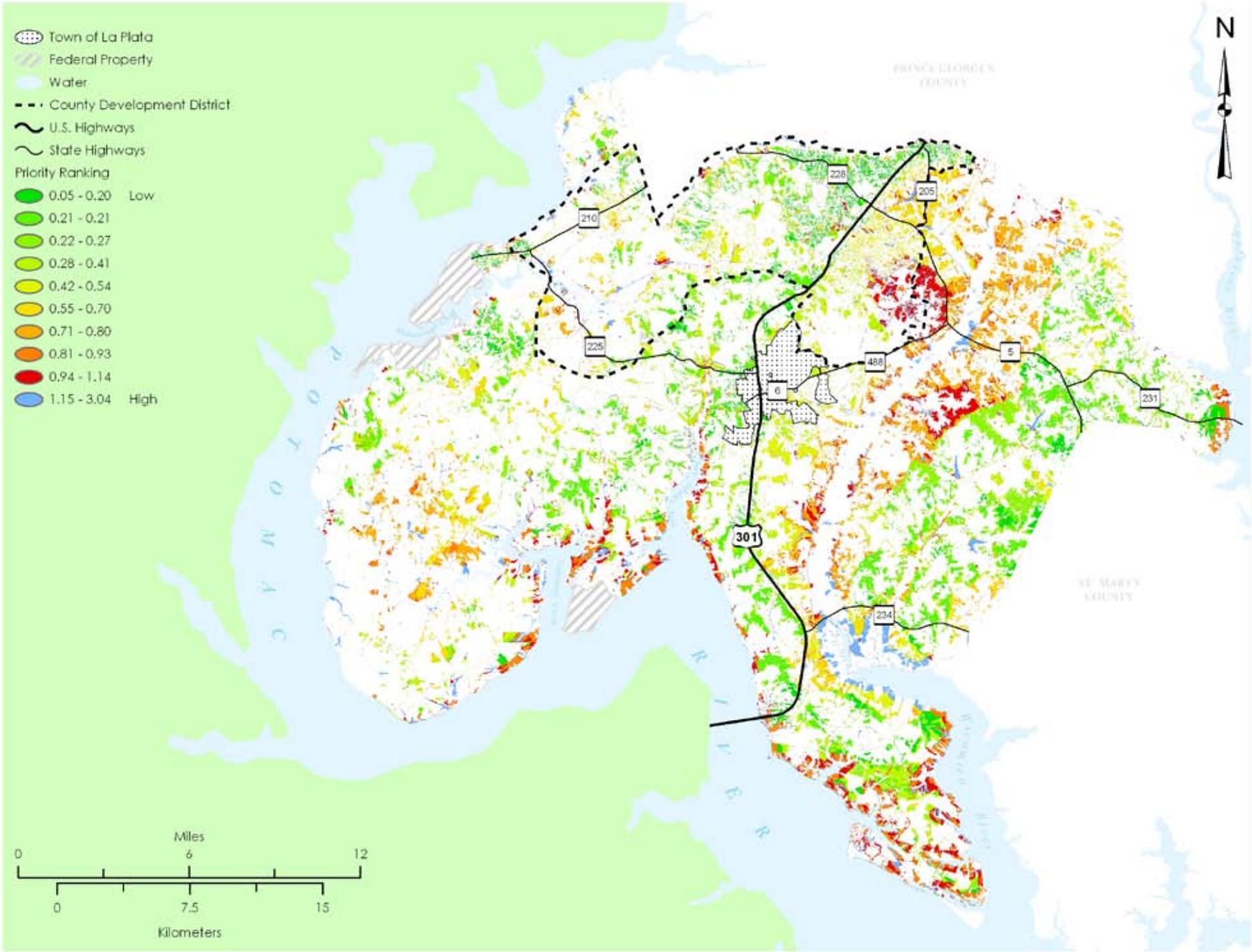


Figure 9: Chesapeake Bay Critical Area: Forest Restoration Priorities

RESTORATION PRIORITIES FOR CHESAPEAKE BAY CRITICAL AREA MITIGATION

The Critical Area forest restoration priorities analysis masked out currently forested areas to consider only non-forested areas. Areas with impervious surfaces were also masked out as unlikely areas for planting trees. The 1,000-foot Critical Area (CA) was weighted heavily to reflect the preference for mitigating impacts within the CA, but areas outside the CA line were also ranked for possible mitigation in the watershed. Layers are described in more detail in the appendix.

Layers used were similar to the conservation priorities, with changes made to identify areas that would augment important forest areas with new plantings nearby. Green Infrastructure and FIDS habitat would not show up outside the forest mask, so priority was placed on adjacency to these areas. Corridors were emphasized in the weighting for Green Infrastructure to encourage greater connectivity between habitats.

The analysis identified small-scale areas in the Critical Area that would provide a wide range of benefits with restoration, and focused more on the lower watershed, such as around Allen's Fresh at the bottom of the Zekiah Swamp and the mouth of Gilbert Run at the head of the Wicomico River.

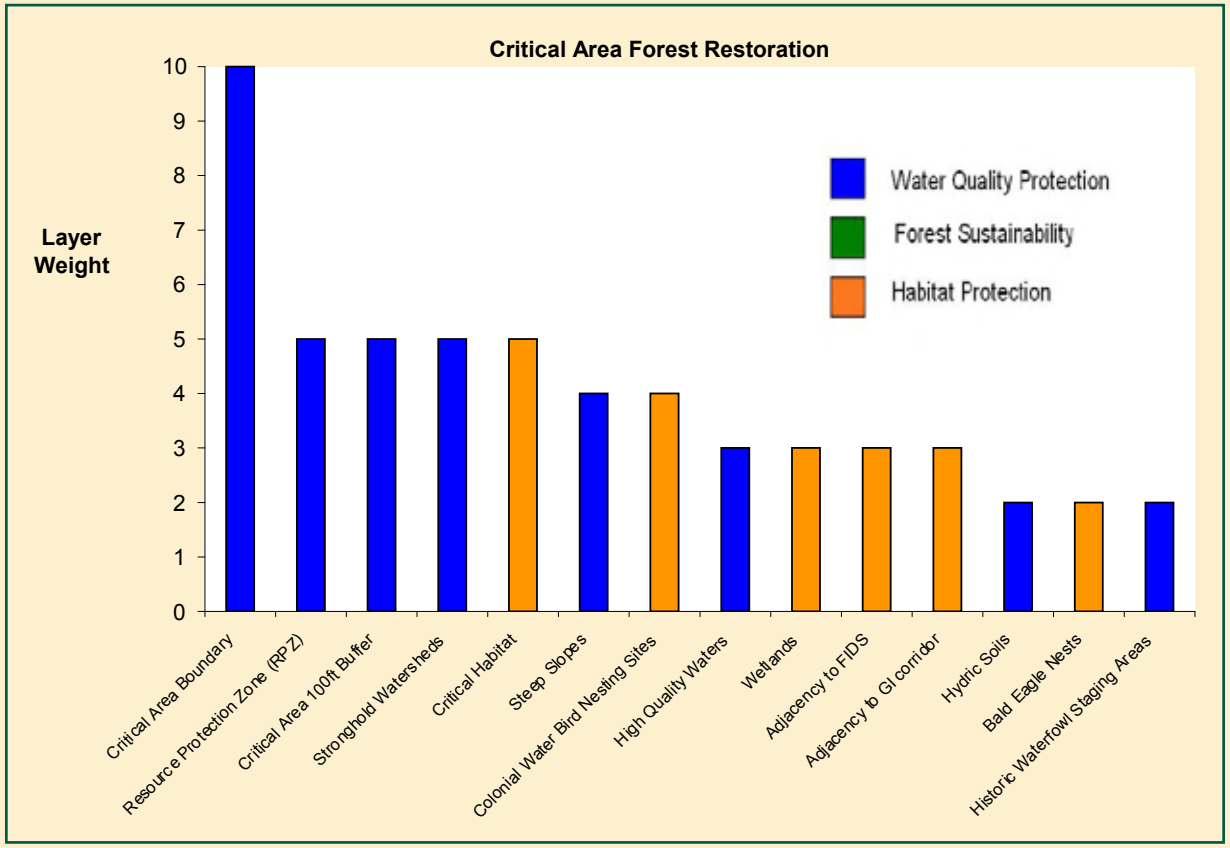


Figure 10: Critical Area Forest Restoration Layer Weight Comparison

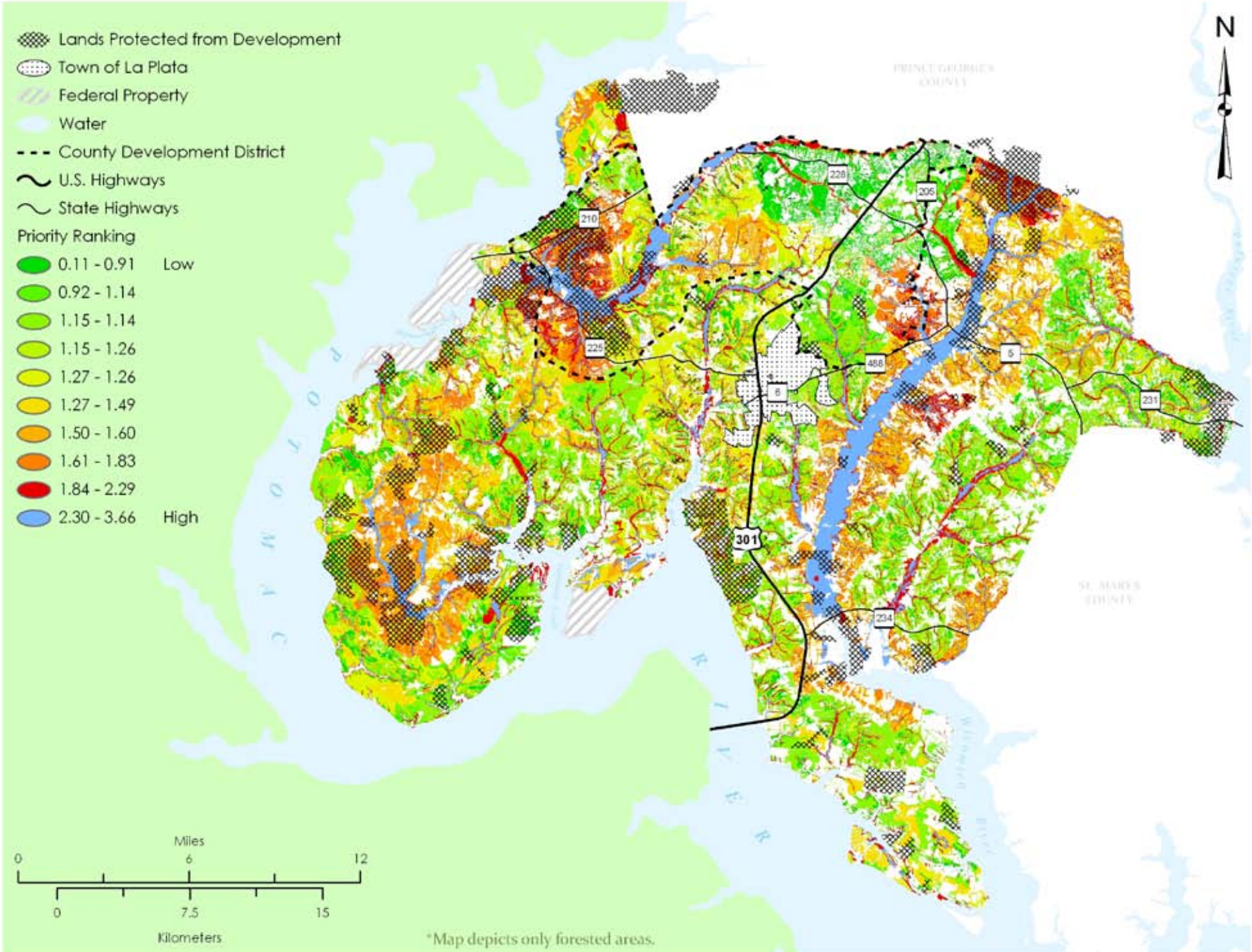


Figure 11: Forest Conservation for Water Quality Treatment

FOREST CONSERVATION FOR WATER QUALITY TREATMENT

Most areas in Maryland have waterways that are listed as unhealthy, or "impaired" for one or more measures or functions like excess nutrients, degraded habitat, excess sediment, heavy metals, or bacteria. Charles County is no exception; Total Maximum Daily Loads (TMDLs) are completed in several watersheds, with more to follow. A TMDL is an estimate of the amount or load of a particular pollutant that a water body can assimilate and still meet water quality standards. Improvements in water quality to meet desired TMDLs usually require a multi-faceted approach, from urban to rural areas, and controlling multiple sources of common pollutants like excess nitrogen. Some other streams have high quality waters that according to anti-degradation principles in the Clean Water Act should not be allowed to degrade to the brink of minimum functioning. Maryland has anti degradation regulations to better protect state waters where data indicates that water quality is significantly better than required to support its intended use, like drinking water and fish habitat. Forests generate the least pollutants of any land use and can be used to cleanse polluted runoff and shallow groundwater flow from upslope areas. Retaining or restoring forests in key areas should be an important part of responding to TMDLs, particularly those related to nonpoint source pollution.

The Water Quality analysis focused on identifying areas where forests would be most critical for protecting or improving water quality. Conserving existing forests isn't highlighted in most strategies for improving water quality because it simply maintains existing conditions. However, if forests converted to other land uses, greater pollutant loads are generated and the area is less able to function to mitigate for upslope pollutants. The closer to water, the more likely pollutants will be delivered into the water body.

Targeting forests to conserve for water quality functions focused on landscape positions and soil characteristics most likely to foster nitrogen removal. Watersheds in greater need of water quality protection were also used, along with Stronghold Watersheds, MDE High Quality Watersheds (anti-degradation Tier II), and areas with TMDLs. Locations close to water, the RPZ and 100-year floodplain, were priorities, with the RPZ having greater weight due to its greater extent up the stream network. Including both, and wetlands, reinforces the critical role of the saturated soils and flood storage of floodplains. Steep slopes were included as a means of preventing likely soil erosion following deforestation. Impervious surfaces are a critical factor in generating storm runoff, and targeting focused on watersheds that had modest amounts of impervious surfaces, where forests were needed to mitigate for runoff, but not so much that stream function was likely to be already impaired. The water quality analysis produced an even stronger emphasis on the stream corridors and wetlands for conservation priorities, particularly in the wetland complexes of Zekiah, Mattawoman, and Nanjemoy, areas also important for habitat benefits.

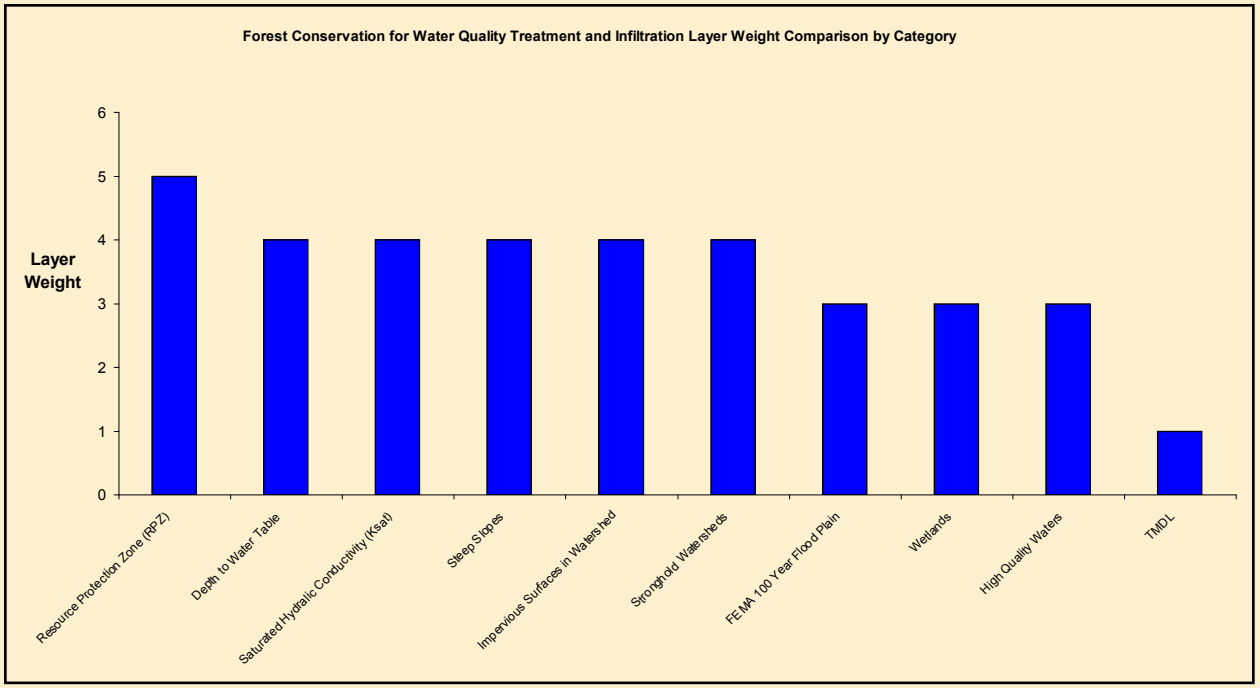


Figure 12: Forest Conservation for Water Quality Treatment and Infiltration Layer Weight Comparison by Category

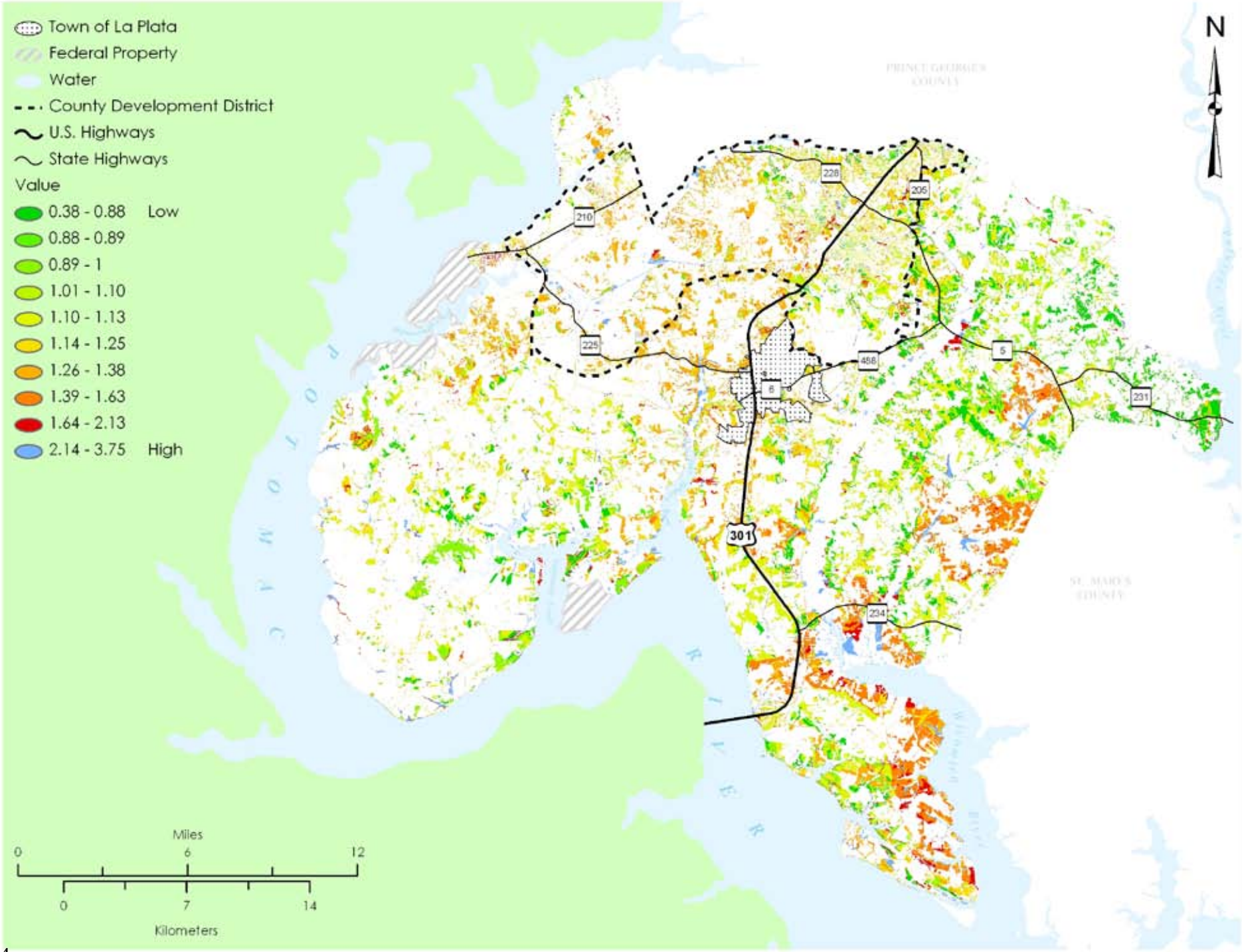


Figure 13: Forest Restoration for Water Quality Treatment

FOREST RESTORATION FOR WATER QUALITY TREATMENT

The restoration analysis for water quality identified areas where newly planted forests would have greater potential to reduce nutrient and sediment pollution, with a focus on nitrogen reduction, a keystone pollutant in the Chesapeake estuary. It continued the emphasis on landscape positions close to water with the RPZ and floodplains. Soil characteristics were identified that would promote the intermittently saturated conditions favorable to denitrification and interception of shallow groundwater by tree roots, i.e., lower saturated hydraulic conductivity, hydric soils, and shallow depths to the water table. Watersheds with potential pollutants to mitigate, impervious surfaces, agriculture, and TMDLs, were also prioritized.

Some areas of Mattawoman Creek are priority areas for conservation and restoration, but are also within the County's current development district. The consistent appearance as priority for forest conservation and restoration suggests that some different rules for development should be applied in these watersheds. The Mattawoman Stream Valley area was made available to the County as a shapefile to facilitate the interest in providing greater protection in this sensitive area.

The analysis prioritizing forest restoration for water quality produced more targeted areas in the southeastern portion of the county, in the Wicomico River watershed and tidal portion. Smaller areas for restoration where also identified throughout the County, emphasizing areas in need of buffers and wetland restoration.

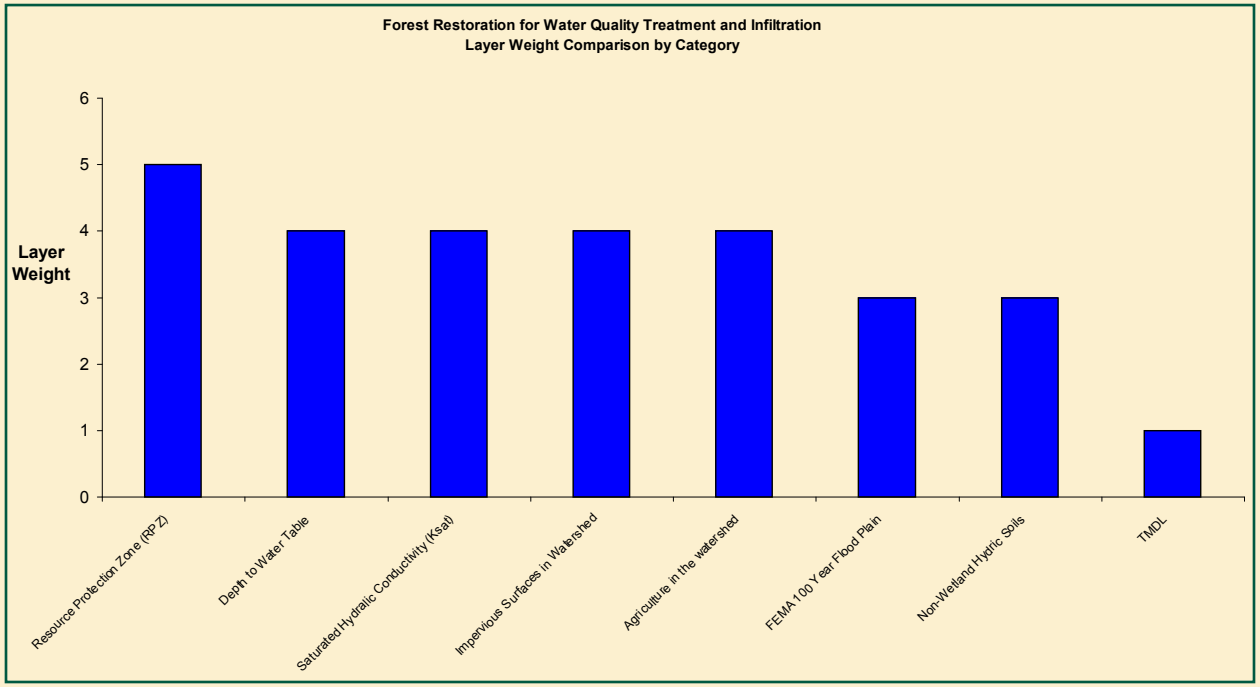


Figure 14: Forest Restoration for Water Quality Treatment and Infiltration Layer Weight Comparison by Category

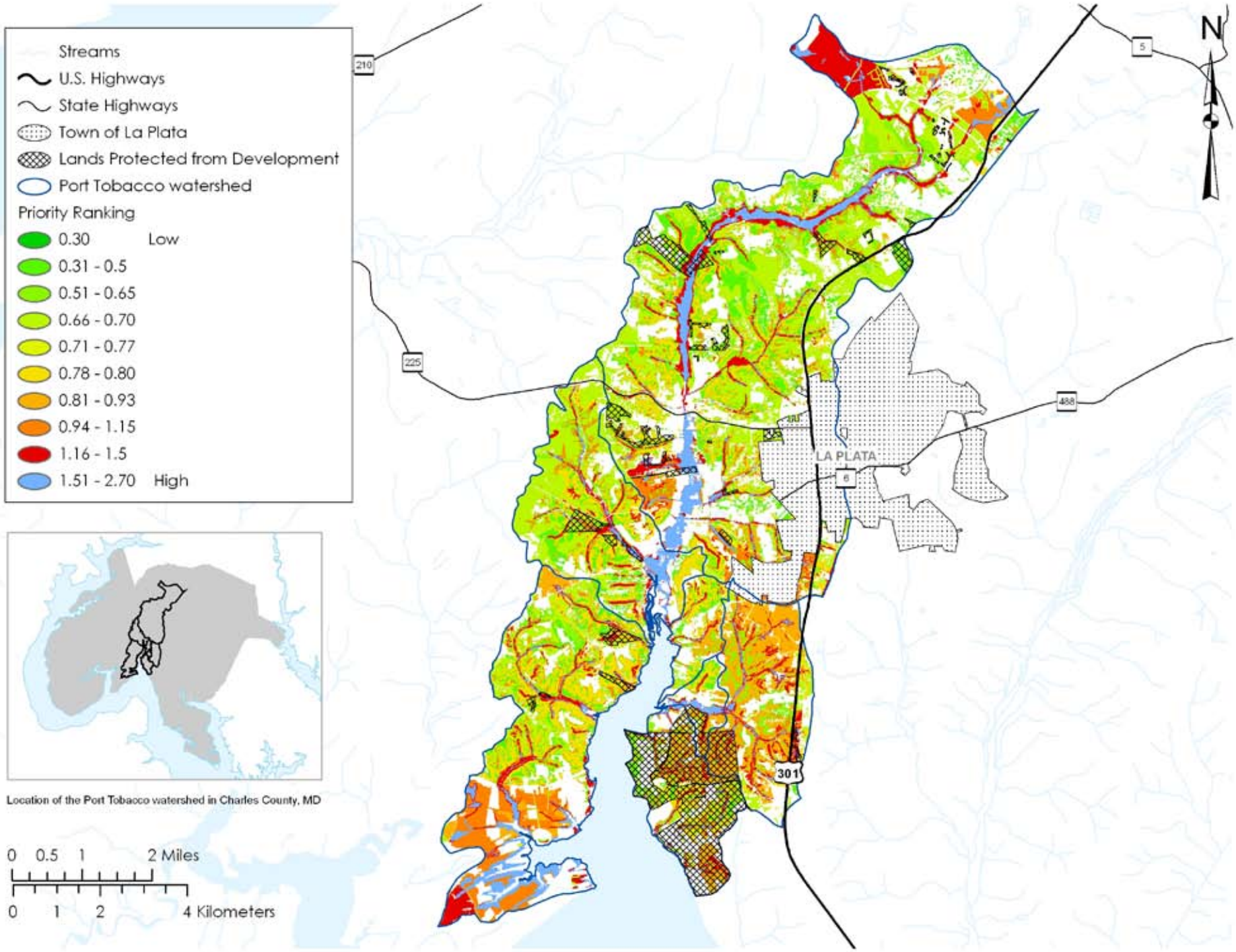


Figure 15: Port Tobacco Watershed Forest Conservation Priori-

FOREST CONSERVATION FOR THE PORT TOBACCO WATERSHED RESTORATION ACTION STRATEGY

Port Tobacco was the County's first area to develop a Watershed Restoration Action Strategy (WRAS), and was identified as an area of interest to develop a finer scale targeting strategy. In keeping with the water quality focus of a WRAS, layers associated with water quality functions were used. At this scale, some watershed-scale factors did not come into play; for example, the Port Tobacco watershed was not included as a Stronghold or MDE high-quality watershed.

The ability of the area to remove nitrogen in subsurface water is prioritized through the inclusion of the RPZ, floodplain, depth to water table (high water table gives more opportunity), hydric soils, and saturated hydraulic conductivity (slower water flow through finer-textured soils gives more opportunity). Steep slopes identify areas that should be protected to prevent erosion. High priority areas included Blossom Point at the mouth of Port Tobacco River, wetlands along the river, and forests northeast of LaPlata north of Billingsley Road. The majority of the high-priority land on Blossom Point has since been protected through Maryland Program Open Space.

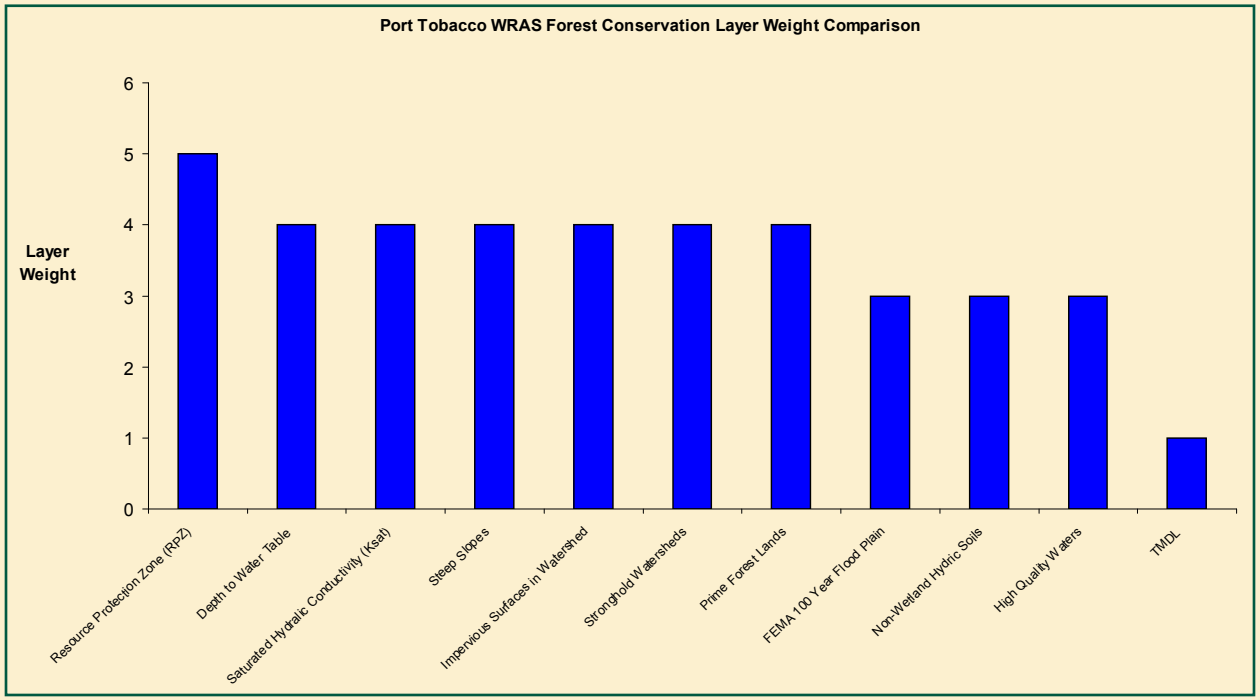


Figure 16: Port Tobacco WRAS Forest Conservation Layer Weight Comparison

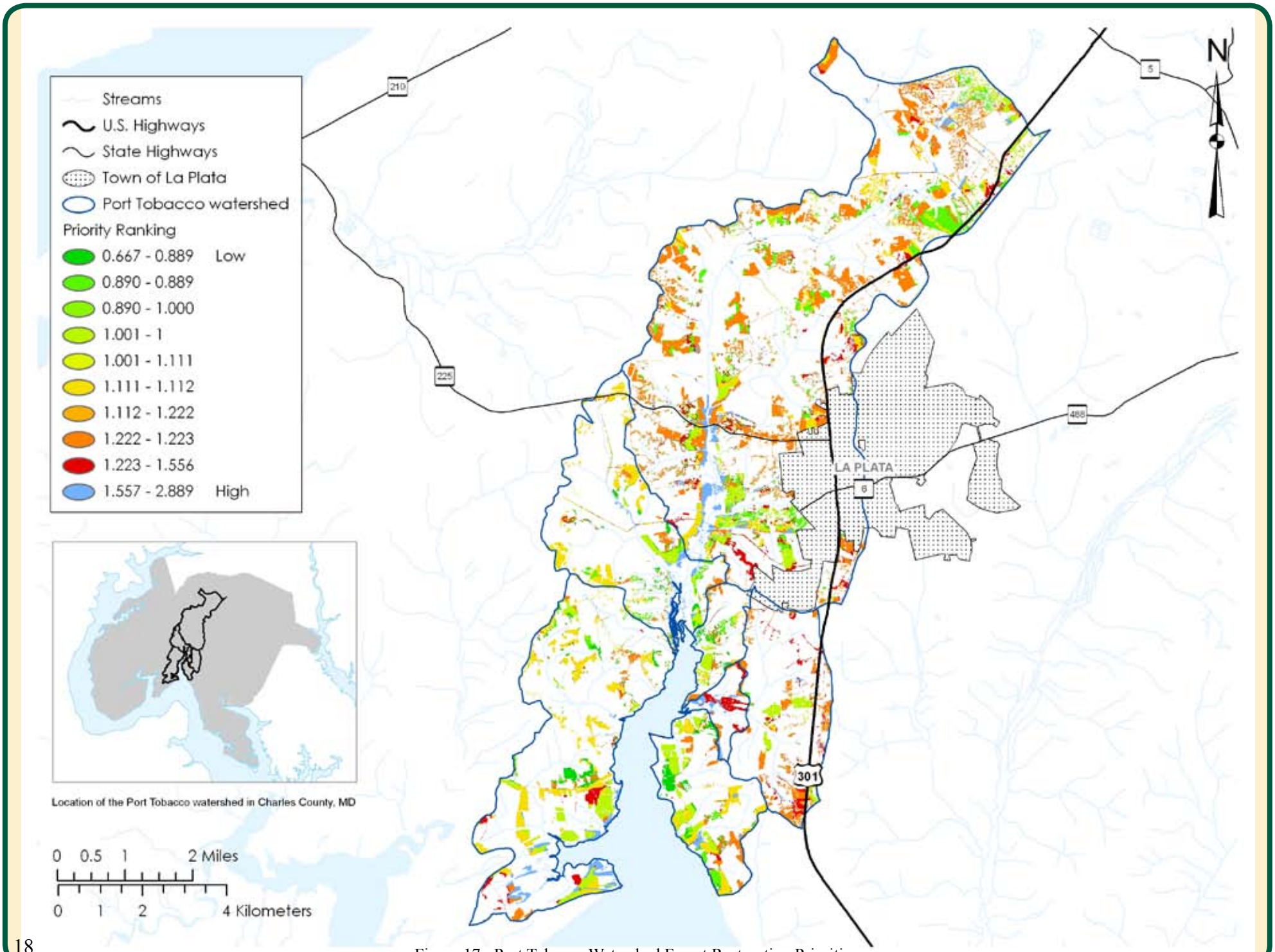


Figure 17: Port Tobacco Watershed Forest Restoration Priorities

FOREST RESTORATION FOR THE PORT TOBACCO WATERSHED RESTORATION ACTION STRATEGY

The focus for restoring forests in the WRAS watershed was on the landscape positions and soils likely to be effective in removing nitrogen. It included the highest weight on riparian buffers, and reinforced it with other wet areas such as floodplains and hydric soils. Soils with slow to moderate drainage and water tables relatively near the surface were added to highlight conditions whether tree root interception and denitrification were most likely to reduce nitrate pollution.

Areas identified as potential restoration areas must be field verified to confirm suitability. Some locations may have healthy natural vegetation that is not forest but may be appropriate for saturated soil conditions or the current lands use. Replanting forest is likely to reduce nutrients and improve habitat anywhere in the watershed, but the prioritized areas should offer proportionately more nutrient reduction.

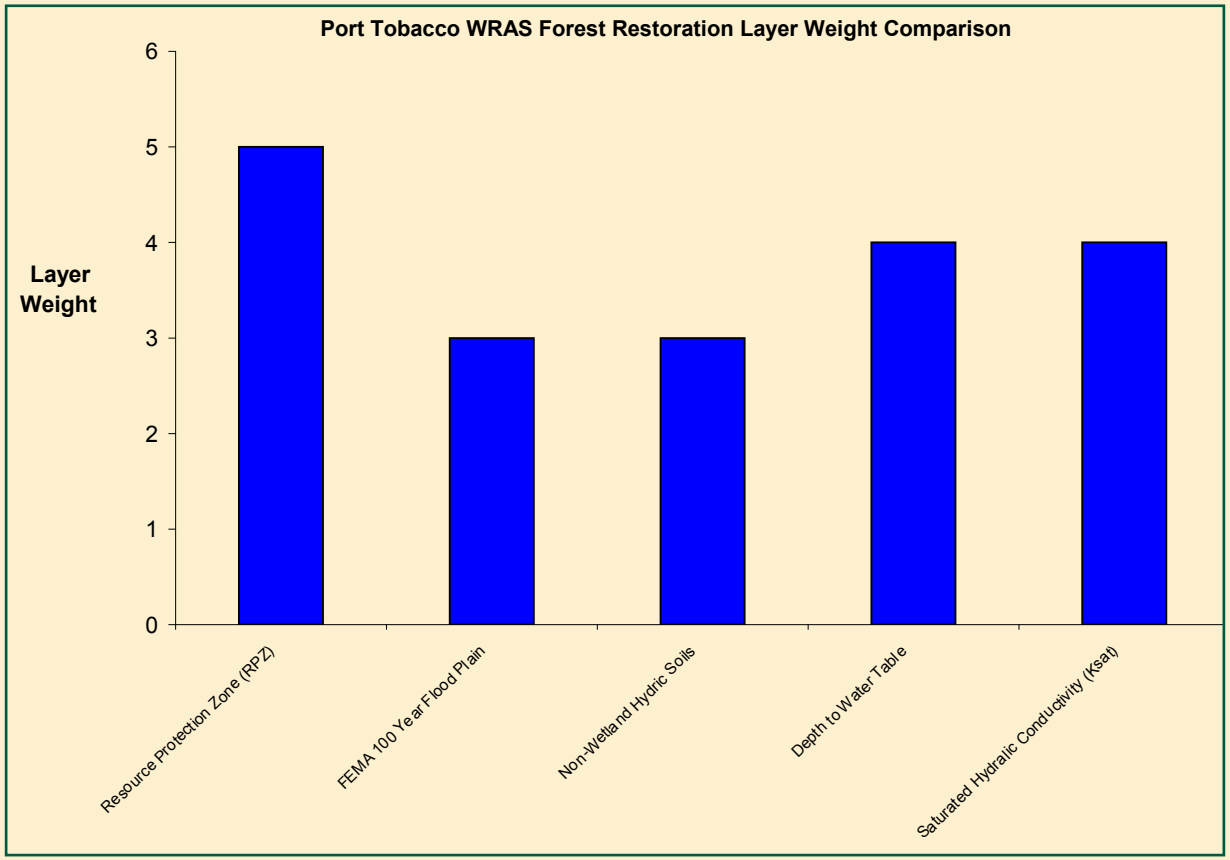


Figure 18: Port Tobacco Watershed Forest Restoration Priorities

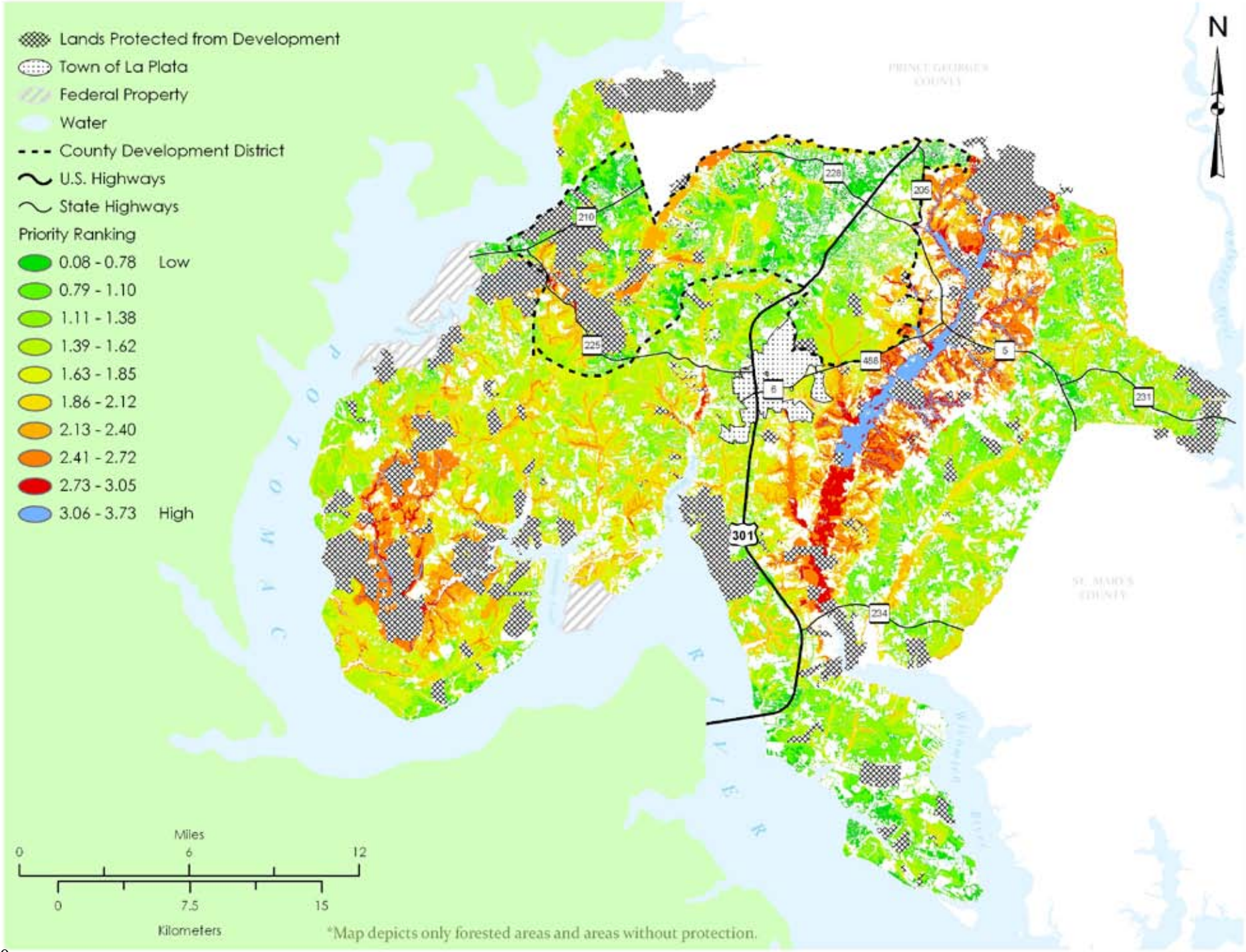


Figure 19: Charles County Open Space Protection Priorities

CONSERVATION FOR THE CHARLES COUNTY OPEN SPACE PROTECTION GOAL

Charles County established a goal of 50% open space in their most recent Land Preservation, Park, and Recreation Plan. The open space goal was intended to meet multiple goals, from preserving rural character and economy in the county to improving water quality and quality of life. The targeting for the open space goal included County priorities to emphasize, such as the Rural Legacy Area, and to avoid, such as the development district and priority funding areas. Other areas were included as important for maintaining working rural landscapes, including prime agricultural and forest lands and Forest Legacy Areas. Core layers for targeting water quality functions were included: RPZ, wetlands, and steep slopes. Habitat was highlighted through the use of Green Infrastructure, Ecologically Significant Areas, wetlands, and Stronghold Watersheds.

The net result for open space targeting shows the areas with many shared priorities and multiple ecological functions. Most of the Zekiah watershed shows up clearly as a priority. The County has already established a Rural Legacy area in the northern portion of the watershed, the Zekiah Swamp Run subwatershed. Expansion of the Rural Legacy Area or other measures could be considered for other parts of this important watershed, especially as greater proportions of the existing Rural Legacy Area are protected from development. The upper reaches of the Mattawoman and Nanjemoy basins also show high priority and relatively less protection from development, though the lower parts of the basins already have significant protected areas. Without careful treatment of the upstream areas, the downstream resources can deteriorate through changes in hydrology and water quality. Most of the Mattawoman basin and some of the headwater subwatersheds of the Zekiah are within the County's current development district, with portions identified as employment and industrial park districts, uses that are likely to create the greatest levels of impervious surfaces. Stormwater management regulations now required for new development will help mitigate some effects on hydrology, but additional measures could add greater safeguards, such as using environmentally sensitive design, stricter limits on contiguous impervious surface or forest clearing in these priority watersheds, and augmented protection of riparian and wetland areas.

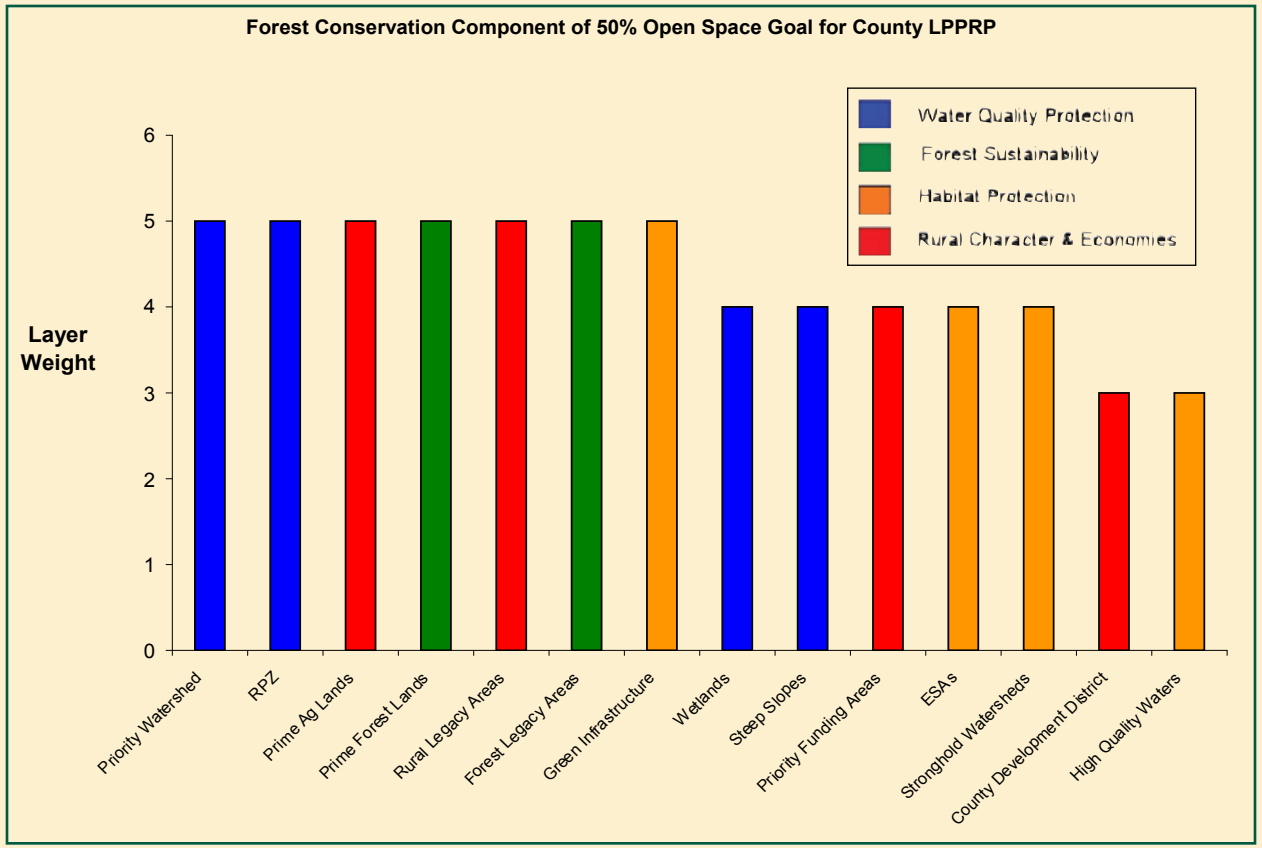
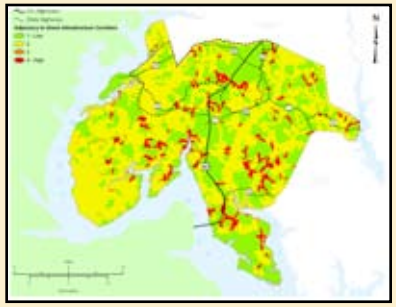


Figure 20: Forest Conservation Component of 50% Open Space Goal for County LPPRP

APPENDIX: MAP LAYERS USED IN ANALYSIS

Adjacency To GI Corridor



Non-forest areas adjacent to Green Infrastructure, with preference given to corridors that could improve connections among habitat areas.

Source: MD DNR, 2003

Agriculture in the Watershed

Areas of agricultural land use, including row crops, pasture and hay.

Priority given to areas with greater than 30% of land area in agriculture.

Source: RESAC Land Cover, 2006

Bald Eagle Nests

Known locations of bald eagle nesting sites, usually reused for multiple years, priority given to areas within a 1/4 mile radius.

Source: MD DNR Wildlife & Heritage Service, 2007

Colonial Water Bird Nesting Sites

Areas typically used for nesting areas by colony-forming water birds like blue herons, with priority given to areas within a 1/4 mile radius.

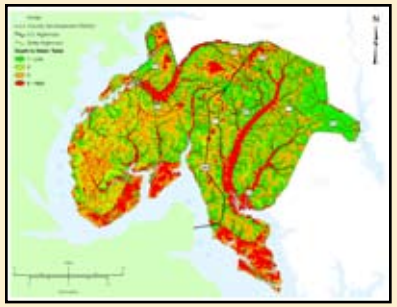
Source: MD DNR Wildlife & Heritage Service, 2003

Critical Area

The Chesapeake Bay Critical Area, lands within 1,000 feet of tidal waterways.

Source: MD DNR, 2008

Depth to Water Table



Soils with typical water tables at two feet or less given higher priority.

Source: NRCS Soil Survey for MD, 2008

Designated Growth Areas

County-identified Development District and state-identified Priority Funding Areas. These areas received a lower score than the outside areas.

Source: Charles County Planning Division and MD Department of Planning, 2007

Ecologically Significant Area

Areas designated by MD DNR Wildlife & Heritage Service as important for protecting rare, threatened, and endangered species.

Source: MD DNR Wildlife & Heritage Service, 2008

Existing Protected Lands

Lands with public ownership, easements restricting development or other protective mechanisms. Military areas are excluded. Shape files are for lands protected through 2007.

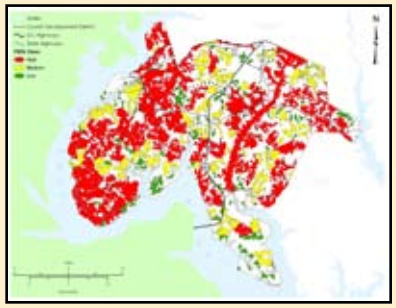
Source: MD DNR, 2007

FEMA 100 Year Flood Plain

Areas likely to be flooded every 100 years or more frequently.

Source: Federal Emergency Management Administration (FEMA), 2001

Forest Interior Dwelling Species Habitat



Areas of forest interior >300 feet from edge, field verified for suitable conditions, excluding areas in rights-of-way and current impervious surfaces.

Source MD DNR Wildlife & Heritage Service, 1993

Forest Cover

2007 forest cover, 10 x 10m resolution.

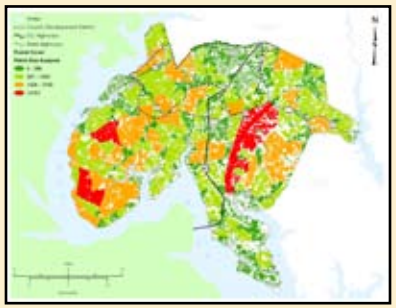
Source: The Conservation Fund, 2007

Forest Legacy

Eligible areas for the federal Forest Legacy Program through the USDA Forest Service.

Source: MD DNR Forest Service, 2008

Forest Patch Size



Forest areas sorted by natural breaks in data; priority given to areas over 1,300 acres, and highest priority over 3,160 acres.

Source: The Conservation Fund
Analysis: MD DNR Forest Service, 2007

Green Infrastructure

Large areas (hubs of 250+ acres) of significant forests and wetlands connected by corridors (1,000+ feet wide) important for maintaining viable wildlife habitat.

Source: MD DNR, 2003

High Quality Waters

Watersheds designated by MDE where water quality is not allowed to be degraded, based on high biodiversity of stream insects and good water quality.

Source: MD Dept. of Environment, 2008

Note: The main stem of the Zekiah watershed was intentionally left off of this data layer.

Historic Waterfowl Staging Areas

Areas typically used by waterfowl flocks during winter or migration, plus a 300 foot depth of adjacent shoreline.

Source: MD DNR Wildlife & Heritage Service, 2003

Hydric Soils

Soils classified as hydric, typically or seasonally saturated with water near the surface (gleyed or mottled soils).

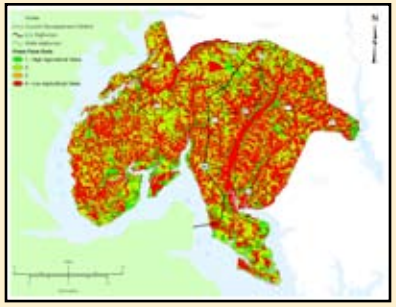
Source: NRCS Soil Survey, 2008

Impervious Surfaces in Watershed

Paved surfaces and rooftops averaged over the 12 digit state watershed, with priority given to watersheds with less than 15% impervious surface (green area).

Source: Charles County Planning Division, 2004

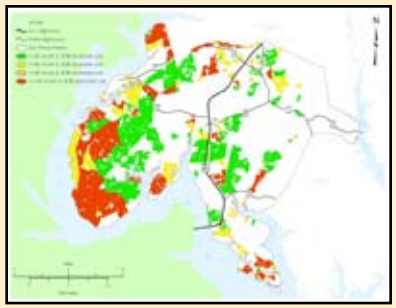
Prime Ag Lands



The land best suited to agricultural crops, including row crops, pasture, and woodland, with soil qualities that allow sustained high yields on well-cultivated soils.

Source: NRCS Soil Survey of Maryland, 2008

Prime Forest Lands



Areas important for a sustainable forest products based economy with priority given to areas over 50 acres in size and more than 50% of soils with site quality index of 80+ (highest priority given to blocks of over 100 acres).

Source: MD DNR Forest Service, 2007

Priority Watershed

County-designated watersheds of special concern: Nanjemoy, Port Tobacco, Mattawoman, and Zekiah Swamp.

Source: Charles County Planning Division, 2008

Resource Protection Zone

Riparian protection zone as defined by Charles Co. regulations (Article X1 subsections 297-171 & 172 50 feet from 1st and 2nd order streams and 100 feet from 3rd order and larger streams, expanded for wetlands, floodplains and slopes over 15% to 100 feet or break of slope, whichever is less.

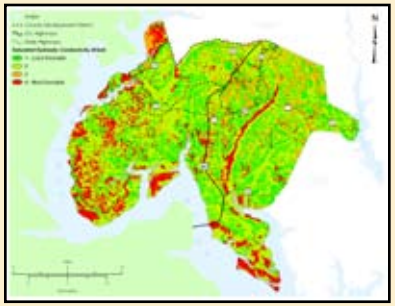
Source: MD DNR Forest Service and State Highway Administration Stream Layer, 2008

Rural Legacy Areas

County-designated lands eligible for the State Rural Legacy easement program (upper portion of Zekiah watershed).

Source: MD DNR, 2008

Saturated Hydralic Conductivity (Ksat)



Speed at which subsurface water will move through soil, which affects likelihood of denitrification. Slower rates are given higher priority (red areas).

Source: NRCS Soil Survey for MD, 2008

Steep Slopes

Slopes over 15% given higher priority.

Source: MD DNR from LiDAR, 2004

Stronghold Watersheds

Watersheds identified as areas with highest biodiversity of stream insects and greatest occurrence of rare aquatic species.

Source: MD DNR, MD Biological Stream Survey, 2008

Total Maximum Daily Load (TMDL)

Watersheds not meeting water quality standards for nutrients (e.g. nitrogen or phosphorous) and having requirements for Total Maximum Daily Load development.

Source: MD Dept of Environment 303(d) list, 2008

Wetlands

Wetland areas with soils, vegetation and hydrology typical of saturated conditions; includes tidal and non-tidal wetlands.

Source: MD DNR, 2008

DNR Publication Number: 02-8212008-339

Martin O'Malley, Governor
Anthony G. Brown, Lt. Governor

John R. Griffin, Secretary
Steven W. Koehn, Director / State Forester

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