



Conservation Management Strategy for the
Rocky and Deep Rivers



THE
CONSERVATION
FUND



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Stakeholders

North Carolina Division of Parks and Recreation

US Fish and Wildlife Service

Chatham County

Lee County

Sanford Area Growth Alliance

Triangle Land Conservancy

The Conservation Fund



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Chloe Ochocki, Triangle Land
Conservancy Conservation Planner
cochocki@triangleland.org

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9100ac
Permanently
protected



8825ac
Privately
conserved with
no permanent
protection



3
Natural Heritage
Program Preserves



17
Registered Natural
Heritage Areas on
4,470 acres



14
NC LWF Projects
on 3,250 acres



6%
River Corridor
Permanently
Preserved

Executive Summary

The Rocky and Deep Rivers collectively flow 155 miles and drain 1400 mi² of land in the Upper Cape Fear River Basin. Noted for their rich ecological and recreational value in the region, these rivers support a diverse collection of plant and animal species, a state-designated land and water trail, and drinking water for several communities along their reaches. Despite these important functions, only 6% of the 2-mile river corridors in Chatham and Lee Counties are permanently protected to date.

The rivers have been important for the cultural identity of the region since pre-colonization. Migratory fish species are speculated to have supported the earliest indigenous tribes. By the mid-1900s coal mining had left its own impact on both the riverbanks and communities' collective memory. New industrial and residential development is once again rapidly changing land use and is only expected to accelerate as the Research Triangle was identified as the fourth fastest growing region of the United States in 2022. Four large development projects have already been announced in the region. Therefore, proper planning is key to preserving the rivers' character and integrity.

This report aims to establish a proactive plan for safeguarding the ecological, hydrological, and recreational value of both 2-mile river corridors in Chatham and Lee Counties. It achieves this by identifying opportunities to convert temporary

conservation agreements into permanent protection and prioritize protection efforts for the highest impact with limited resources. It also aims to assess threats and barriers to future work.

Only 6% of the 2-mile river corridors in Chatham & Lee Counties are permanently protected to date

There are important challenges to consider when planning for future land management. Funding, staff time, stewardship needs, and volunteer availability can all affect the long-term success of a project. Learning from stakeholders who are already working in the region was a critical first step in determining desire and capacity for more conservation effort along the rivers. A combination of interviewing and surveying techniques were used to reach organizational partners working across the landscape. Interviews provided information on organizations' internal goals and capacity while surveying identified on the ground challenges and individuals' desires for the region. Both provided valuable insight that helped inform more robust recommendations for this plan. Service gaps were

also identified through this effort and offered an opportunity to open the door for new partnerships.

With rising land prices and organizational capacity highlighted as consistent challenges, projects must be prioritized to determine where to concentrate resources. Spatially explicit models are especially useful tools for this work. Four models were created to prioritize projects using geographic information systems (GIS) and publicly available environmental data. Each model assessed priorities for one of four public benefits of land conservation: protecting natural habitats, protecting clean drinking water, supporting farms, and working lands, and connecting people with nature. These benefits were ranked as the most important by the community.

Recommendations for each benefit were then drawn by combining the highest priority lands in the river corridor with insights informed by organizational outreach. They encompass goals for land to acquire, stewardship activities to pursue, and programs and partnerships to support that can advance the long-term health and ecological stability of the region. Converting temporary conservation agreements on over 8,000 acres into permanent protection and conserving 10% of the river corridors by 2035 are two crucial steps in making this vision a reality.

Background

Rocky and Deep River Basin

The Rocky and Deep Rivers collectively flow 155 miles and drain over 1,400 mi² of area within the Piedmont ecoregion of North Carolina¹. These two rivers form the most upstream area of the Cape Fear River Basin, the largest watershed contained entirely in North Carolina. The Rocky River headwaters originate in Randolph and Alamance Counties near the town of Liberty and flow nearly 30 miles southeast before joining the Deep River². The main stem of the Deep River originates near High Point and flows 125 miles south from Guilford County through Randolph County and east through Moore and Lee Counties. The confluence of these two rivers joins the Haw River to form the Cape Fear River.

This study focuses on the stretches of both rivers flowing through Chatham and Lee Counties, which together contain one third of the total Rocky and Deep River sub-basin. This

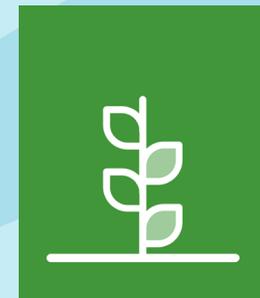
portion of the basin is currently undeveloped and largely rural in character. In 2019, the Multi-Resolution Land Characteristics Consortium estimated that approximately 4% of this land is developed (this increases to 7% basin-wide), 20% is used for agriculture, and 60% remains forested³. Only 6% of the 2-mile river corridors in Chatham and Lee Counties are protected to date. Major towns and cities in and around the basin include Siler City, Sanford, Goldston, and Pittsboro. Conservation efforts in this region are supported by numerous entities at nearly all organizational levels (Figure 1). This study aims to build upon past conservation efforts, to identify high priorities for land and water conservation and increase communication and collaboration between conservation partners. The study explores options to secure permanent protection for “conservation opportunity” areas, denoted on Figure 1 in gold.

155 miles
Total stream flow

1,400 mi²
Total drainage area



60%
Forest



20%
Agriculture



4%
Development

* The remaining 16% of sub-basin landcover includes grass and shrubland, open water and wetlands, and residential open space (lawns, etc.).

Geology

The hydrology of the Deep River sub-basin in Chatham and Lee Counties is intrinsically related to the geology of its two underlying basins. The Rocky River flows over the Carolina Slate belt, which is defined by igneous and metamorphic rock associated with oceanic volcanic islands 500-600 million years ago (mya)⁴. These rocks typically weather into soils that are nutrient poor, crystalline, and acidic. Their overall resistance to erosion is responsible for the narrow floodplains, steep rock outcrops, and bluffs that characterize the Rocky River.⁵

Contrastly, the most downstream stretch of the Deep River flows through the Triassic basin. This region contains a mix of sedimentary rock formed by mud, silt, sand, and gravel deposits from adjacent highlands 200 mya. The soil that weathers from these rocks is clay rich and poorly sorted, and therefore does not transmit or take up water well.⁶ Consequently, they contribute very little groundwater baseflow into the downstream reach of the Deep River. This basin also contains coal deposits, which have given rise to mining operations surrounding the Deep River in Chatham and Lee Counties as early as the late 1700s, and fossils of abundant Triassic species.⁷

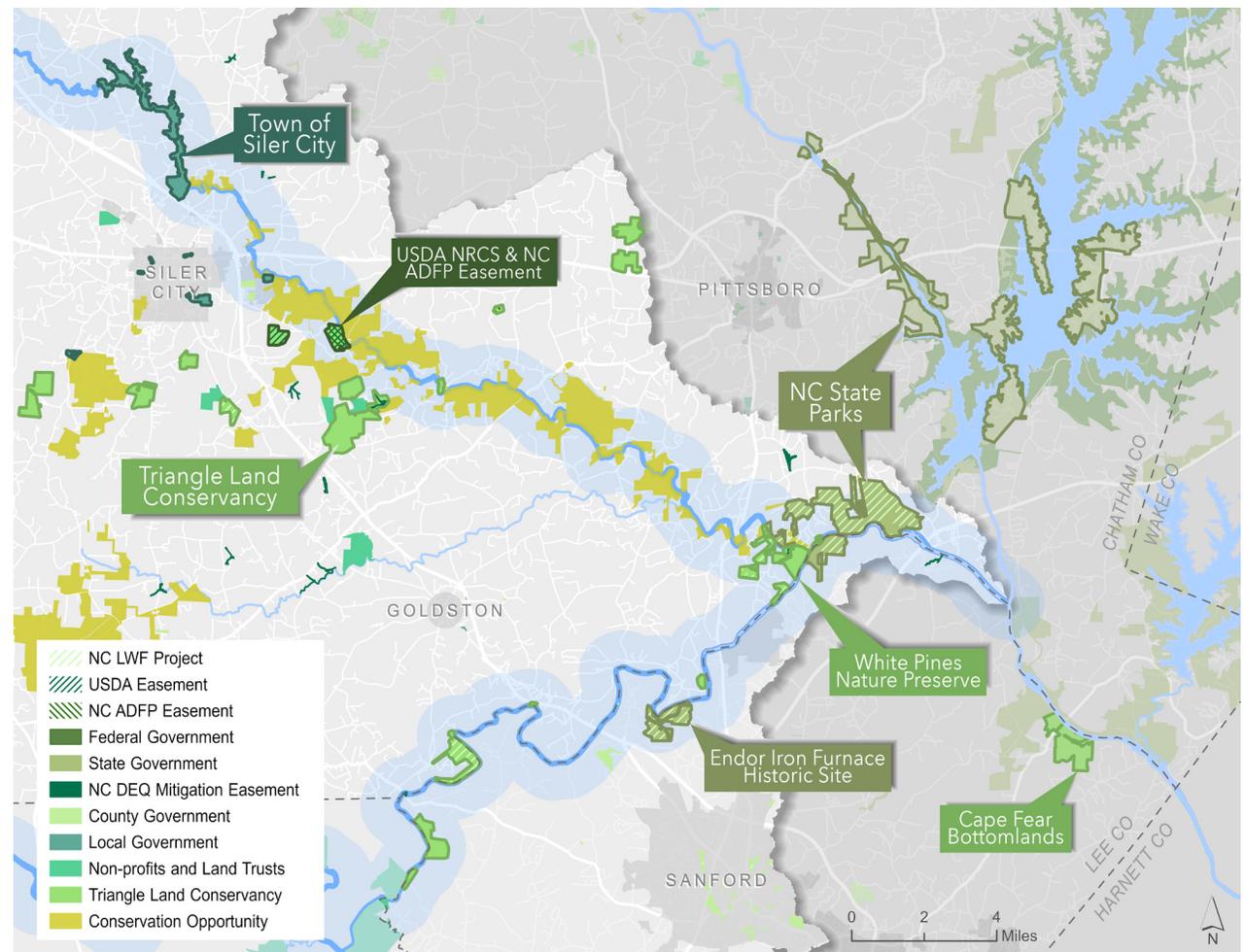


Figure 1. Overview of Rocky and Deep River sub-basin in Chatham and Lee Counties with highlighted ongoing conservation efforts. Blue shading represents 2-mile study area corridor.

Water Quality

Though the Deep River sub-basin is largely undeveloped, poor water quality in tributaries to both the Rocky and Deep Rivers remains a concern for surrounding communities and endemic species. The North Carolina DEQ Division of Water Resources 2022 Integrated Report cited over 57 miles of tributary to both the Rocky and Deep Rivers that exceeded acceptable water quality limits for chlorophyll-a concentration, dissolved oxygen level, fish community health, and riverbed quality. This includes stretches of Indian Creek, Big Buffalo Creek, Persimmon Creek, Loves Creek, Tick Creek, Hollands Creek, and Bear Creek. Additionally, portions of the main stem of the Rocky upstream of the Town of Siler City, as well as its drinking supply reservoir, were found to exceed chlorophyll-a concentrations⁸.

There are 33 active National Pollutant Discharge Elimination Service (NPDES) permits in this portion of the Deep River sub-basin, 11 of which fall within the 2-mile river corridor focus area. Three of these are classified as “major” and include the Town of Siler City and City of Sanford wastewater

treatment plants (WWTP) and the Arclin Chemical industrial plant in Moncure⁹. Sanford’s Big Buffalo Water Reclamation Water Quality facility discharges up to 12 million gallons per day (MGD) into the Deep River, and plans to increase its discharge to 18 MGD. Siler City discharges up to 4 MGD into the Rocky River and plans to increase its discharge to up to 6 MGD by 2025¹⁰. These discharge increases, coupled with increased commercial and residential development pressure, place additional strain on the watershed.

Non-point pollution sources within the Deep River sub-basin also contribute to water

There are 33 active National Pollutant Discharge Elimination Service (NPDES) permits in this portion of the Deep River sub-basin, 11 of which fall within the 2-mile river corridor focus area.

quality issues within the rivers. In 2005, NC DEQ published a Cape Fear River Basinwide Water Quality plan that noted streambank erosion, sedimentation, and excessive algal growth as stressors for tributaries to the Rocky and Deep Rivers¹¹. Efforts to tackle these issues have been made since the report was released in 2005, and a 2022 update is currently underway (though it has not yet been published at the time of this plan). Several entities working within the Deep River sub-basin have adopted stormwater ordinances including Chatham County and the City of Sanford. However, no official stormwater utility has been formed. The costs and benefits of forming a utility should be considered with expanding growth in the region.

Conserving land is one method to help alleviate water quality issues within the sub-basin but is most successful when used as part of a holistic suite of solutions that include agricultural, storm/wastewater and green infrastructure upgrades, alongside sustainable investments in communities with fewer resources.

Flora and Fauna

Despite water quality challenges, the Rocky and Deep Rivers act as biodiversity hotspots throughout Chatham and Lee Counties. They host a large variety of native riparian mammals and reptiles including beaver, white-tailed deer, opossum, terrapin, snapping turtles, copperheads and banded water snakes. Common fish species include white catfish, pirate perch, bluegill, sunfish, largemouth bass and creek chub. Birders can find great blue and little green herons; red-shouldered, red-tail, and broad-wing hawks; prothonotary and other types of warblers; barred owls; hairy and pileated woodpeckers; kingfishers; ospreys; and various types of tanagers¹².

Additionally, the Rocky and Deep Rivers provide habitat for many state and federally recognized endangered species, including Carolina creekshell, yellow lampmussel, Carolina redhorse, Septima's clubtail

As of 2020, the Rocky and Deep River reaches are estimated to have the highest populations of Cape Fear Shiner in the world.

dragonflies, and the Cape Fear shiner (Figure 2)¹³. The river systems also support rare plants such as harperella, bog spicebush, showy aster, buttercup phacelia, and large witch alder. Additionally, the Rocky River alone supports 5 other freshwater mussel species that are crucial for filtering water (improving its quality) and providing food for other animals such as crayfish, otters, muskrats, and racoons¹⁴.

Maintaining healthy streambanks and hydrologic regimes within the basin are crucial for the survival of these organisms,

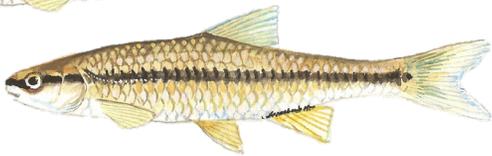
especially the Cape Fear shiner. Several dams have been removed in the region including the Carbonton Dam on the Deep River (2005) and the Hoosier (or Woody) Dam on the Rocky River (2018)¹⁵. These efforts by the US Fish and Wildlife Service (USFWS) and Unique Places to Save provided opportunities to connect river passages and isolated fish populations that had been previously fragmented. Further investments in dam removal projects that have been planned for the area by American Rivers, and funded through the National Oceanographic and Atmospheric Administration (NOAA), will continue to restore habitat for migratory fish species.

Figure 2. Cape Fear shiner background information. Illustration by Duane Raver and acquired via NC Wildlife Resources Commission

Illustration by Duane Raver

The **Cape Fear Shiner** (*Notropis mekistocholas*) is a species of minnow endemic to the Cape Fear river basin, distinguished by their black lateral stripe and lips¹⁶. Shiner are often found in slow-moving rocky shoals of main river stems or in smaller tributaries during wintertime. Their preferred habitat usually contains large bars of water willow (*Justica americana*), or other riverine vegetation used for protection from predators¹⁷. The Cape Fear shiner was placed under federal protection in 1987, through the Endangered Species Act, due to dramatic population declines.

The USFWS adopted a recovery plan for the species the following year, which identified the construction of dams, land use change, siltation, and agricultural runoff as major threats to the clean free-flowing river habitat shiner require to thrive¹⁸. In February 2022, a follow-up species status assessment was conducted that determined only 38% of the current shiner populations are considered to have moderate to healthy resiliency¹⁹. Though research and recovery efforts in the past 35 years have greatly improved the species' viability, further efforts to re-connect and propagate shiner are required, and should help inform land management decisions.





Cultural Significance

According to Native Land Digital, a non-profit that aims to map the pre-colonial ranges of Indigenous tribal lands, the Rocky and Deep Rivers in modern day Chatham and Lee Counties flow through the ancestral lands of Sissipahaw, Occaneechi, Lumbee, Cheraw, Catawba, and Skaruhreh/Tuscarora peoples²⁰. John Lawson (1674 - 1711), an explorer and naturalist, mentions the presence of “Enoe” and “Shoccora” people in a regional survey conducted around 1705. Artifacts dated back to 1000 AD have also been found upstream at the Payne site in Moore County. Colonial settlements formed in the lower Deep River region as early as the 1750s, contributing to the decline of indigenous tribes.

The region hosted the state’s first iron works founded by John Wilcox in 1768 in the settlement of Gulf. It was operated by a labor force of enslaved persons from loyalist-sympathizing plantations. Wilcox attempted to power the iron furnaces here by coalbed deposits discovered on nearby Deep River land. By 1796, the new state placed high priority on navigation along the Deep River, to export iron products to the coast. They supported the development of a lock and dam system through land acquisition and new infrastructure including the creation

of a town near modern day Moncure (formerly Lyons/Haywood). The region also supported several large plantations in the 1800s including LaGrange (Egypt), Belmont, Taylor, Murchison and McIver, whose chattel slavery was instrumental in the industrial rise of the region.

Deep Rivers in modern day Chatham and Lee Counties flow through the ancestral lands of Sissipahaw, Occaneechi, Lumbee, Cheraw, Catawba, and Skaruhreh/Tuscarora peoples²⁰.

Despite the presence of these agricultural plantations, the Lower Deep is most well-known for its role in the coal industry, which saw a boom in the 1850s. Fueled by the vision to turn Wilmington into the South’s largest coal exporter, several geological reports on the coalbeds of the region opened the door for the creation of six companies in a 5-year span. During the Civil War coal mines utilized forced labor in the form of conscripted Southerners or Union prisoners of war. During this same time frame, the Endor Iron Furnace opened its doors. However, mining operations became most

profitable following Reconstruction, through investments from the North and expanded transportation infrastructure.

The industry reached a peak in the 1920s, but several tragic accidents contributed to a downfall by the mid-1900s. The most notable of these is the Coal Glen mining disaster, a series of explosions in 1925 that killed at least 53 men, a disproportionate half of whom were Black. Following the disaster, the state attempted to resurrect the Coal Glen mining operation through the use of convict labor, but another deadly accident not even a year later brought the program to a stop. Though the coal mining industry did not persist, relics of its presence still mark the banks of the Deep River including the Endor Iron Furnace and the Lockville Dam.

The coal mining history, and its tragic losses, is still a piece of the collective memory of communities along the Lower Deep River reaches. Conserving land is valuable as a means of engaging, and preserving, this local history. This report recognizes the co-benefit that ecological conservation can have for uplifting historical narratives and acknowledges Cole Wicker as an invaluable resource for compiling the information presented in this section²¹.



Photography by Margot Lester

Environmental Equity

Several communities within the Deep River sub-basin face disproportionate environmental burdens and lack the resources required to address them, as compared to other communities across North Carolina and the United States at large. The Town of Siler City falls in the 99th percentile of most socially vulnerable communities in the United States²². Other nearby communities face similar challenges, including low household income, high unemployment rates, and poor educational outcomes. The EPA classifies much of the sub-basin area as a food desert, or region with low access to healthy food within a 10-mile radius²³. Lack of healthy food and access to clean greenspace for recreation can contribute to poor health outcomes, including higher incidence of heart disease.

In addition to similar food and greenspace access challenges, flooding is an additional burden in the Moncure community. This community's location downstream of the Rocky and Deep River

confluence contributes to an "extreme risk of flooding over the next 30 years" according to the First Street Foundation, with 14% of all properties at risk of severe impact²⁴. The NC Department of Environmental Quality recognized both the communities of Moncure and Siler City as potentially underserved in an assessment of data collected from 2019²⁵.

These social and economic structures place further stress on environmental resources. Targeted conservation efforts within these areas, with community support, can help alleviate some of this burden. Conserving greenspace for public use, working to protect land in drinking source watersheds, and preserving local farmland are all tools that can be used to advance equity goals. However, these solutions should be only one part of a multi-faceted approach to tackling environmental justice issues that also takes community needs and collective action into account.

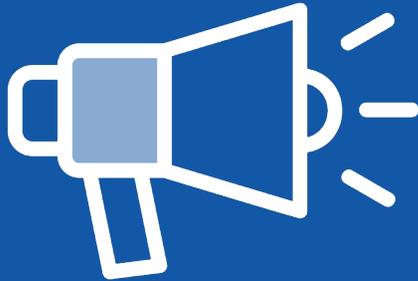
Future Management Considerations

Securing permanent protection on over 8,000 acres of temporarily conserved land along the Rocky and expanding river corridor protection along the Deep will require heavy investments from local communities, government agencies, and non-profit partners. Rapidly expanding land management at any organizational level requires long-term commitment and internal infrastructure. Therefore, before proposing long-term recommendations, it was necessary to assess the interest and current capacity of the collective organizations working along the Rocky and Deep Rivers in Chatham and Lee Counties. A combination of interviewing and surveying techniques was used to assess desired vision, future challenges, and community support for expanding conservation efforts around both rivers.



Photography by Triangle Land Conservancy

Call to Action



Planning for future generations of land use within the Deep River Sub-basin has never been more necessary. The American Growth Project, an initiative directed by the Kenan Institute of Private Enterprise, named the Research Triangle of North Carolina as the fourth fastest growing region in the country in 2022²⁶. Esri demographics predict population growth as large as 3-4% within portions of Chatham and Lee County in the next five years (for comparison, the NC population growth rate in 2021-2022 was 1.26%)²⁷.

Three major economic development projects are driving rapid land use change and population growth in the region. Toyota plans to build a battery and electric vehicle plant near Liberty in the Sandy Creek watershed (Deep River). The company has total investments of almost \$14 billion in the site and plans to employ 5100 individuals²⁸. In March 2022, VinFast also announced it would build a battery and electric vehicle plant in Moncure. They have plans to invest \$4 billion and hire 7500 employees²⁹. In 2022, Wolfspeed announced plans to build the world's largest silicon carbide materials plant near Siler City³⁰. They plan to invest \$5 billion.

This region has also experienced increases in dense residential development alongside industrial growth. In 2014, plans were announced to build 22,000 residences for 55,000 people on 7,100 acres of forested land

near Pittsboro (population < 5,000 in 2023) as part of a planned development district known as Chatham Park. Though the project sparked public outcry over its destruction of an unfragmented 10,000-acre forest south of the Haw River and Jordan Lake, it has proceeded with government approval and a 25-year construction timeline³¹.

Unprecedented rates of growth in turn increase land value, further development pressure, and recreational burden on natural systems, which are already vulnerable. According to the North Carolina Wildlife Resource Commission's State Wildlife Action Plan (2015)³², rivers in the Southeast rank eleventh of all US endangered ecosystems due to development pressure, and their high percentage of imperiled species. This plan also identifies riparian and floodplain habitats as one of six priority community types for the state and cites development and pollution as their top two threats.

The Rocky and Deep River Corridors currently contain over 8,000 acres of land held in temporary conservation protection (Figure 1). Securing the permanent protection of these lands is a crucial first step in ensuring growth does not come at the expense of precious environmental resources. Connecting these lands to the existing 9,000 acres of permanently conserved land will be critical for protecting the species of this area.



Interviews

Thirteen individuals from eight organizations were interviewed throughout September and October 2023. The questions spanned topics that included their organizations' internal strategic priorities, current and future capacity, anticipated challenges, and desired vision for future management within the study area. Each interview was recorded and transcribed. The following common themes were identified:

Theme 1: The Rocky & Deep Rivers are Invaluable Resources

Stakeholders at all organizational levels – federal, state, local government and non-profit – reinforced the inherent value of the Rocky and Deep Rivers for supporting wildlife habitat, clean water, and community health. The Rocky River, especially, was cited as being of high ecological importance, given its support of rare species such as the Cape Fear Shiner and harperella. Though much work has already been done to support the recovery of these species³³, they are not yet ready to be delisted from federal protection. Additionally, the NC General

Assembly designated the Deep River State Trail in 2007. The Deep River State Trail is a land and water state trail that is an asset to the communities who live and recreate in surrounding counties. As such, it has become a priority for the state and local government parks and recreation departments. A new paddle access has been built near the US 15-501 crossing as part of the water trail and there are proposed plans to build a second downstream at the Justice tract, an assemblage of 900 acres of land in Moncure near the Old US-1 access. Expanding these

river access points upstream in the future is crucial for the Deep River State Trail's connectivity. The potential to increase the value of these rivers is further elevated by recent dam removal projects in the area and thousands of acres held in temporary conservation agreements. Removing dams offers the opportunity to restore hydrologic regimes beneficial to culturally and ecologically significant migratory fish species, such as shad. These ongoing efforts represent an investment improving holistic long-term river health.

Theme 2: There's no Better Time to Plan for the Future... and it Requires Additional Capacity

The Rocky and Deep River system is unique in that its rich ecological and recreational value is in close proximity to urban communities. Many interviewees noted that working in rapidly urbanizing areas is a key component to their strategic priorities. The river corridor also passes through historically underserved and socially vulnerable communities, broadening the possible intersection of benefits that can be achieved with conservation projects.

However, the burden of rapid urbanization and rising land prices in the Triangle region were also cited as challenges for the entire community, that will require thoughtful proactive planning. The associated development stress on natural systems is compounded by the already high volume of visitors that recreate at Jordan Lake State Park, San-Lee Park, and White Pines Nature Preserve. With local government master plans and feasibility studies identifying

more hiking opportunities as one of the top requests by county residents, the time to be proactive about future land use is now^{34,35}. With planning efforts comes the need for additional resources in the form of funding, staff and volunteer hours, and local community support. Managing additional land often requires additional staff, and organizational growth needs to be sustainable to be effective.

Theme 3: Collaborative Management is the Best Way Forward

When asked about ideal management scenarios, interviewees resoundingly supported a collaborative style of management between interested stakeholders. This requires management recommendations that draw on the strengths of both the managing organizations and the characteristics of the rivers themselves. For example, in river stretches that support more communities of rare species, a managing organization that specializes in wildlife protection is most appropriate. Conversely, in portions of the river corridors

that are better suited for paddle and hiking access, a managing partner that specializes in recreation is more appropriate. Drawing on the strengths of individual organizations produces a more robust overall system of long-term management for these rivers.

Interviewees also emphasized the importance of maintaining authenticity in collaborative relationships. Ensuring that access to resources and opportunities are shared equitably across organizations and communities is paramount for the

overall longevity of partner relationships. In addition, several organizations who were interviewed have utilized community engagement to great success when it has been thoughtfully implemented. With the right education, volunteer corps, workdays, and "adopt a trail" programs are useful ways to increase management capacity while simultaneously building relationships with the community. These programs should be considered when planning for increased management workloads.



Community Surveys

In addition to interviews, an 11-question anonymous survey was created to reach a broader cross-section of stakeholders including non-profit organizations, special interest groups, and community members. The survey form was open and collecting responses for 2 weeks in November 2023.

At the end of the collection window, there were a total of 75 submissions – 10 of the respondents identified as residents of Lee County (13.3%) and 41 identified as residents of Chatham County (55%). Twenty-eight responses (37%) were submitted by individuals working at organizations that help conserve the Rocky and Deep Rivers through land protection, state advocacy, community outreach, or recreation. An additional 7 respondents (9.3%) voluntarily

13 Stakeholder Interviews
75 Community survey responses

identified as recreators who value the Rocky and Deep River but live in other counties.

The rivers received an average score of 4.5 out of 5, in terms of their personal significance to individuals who responded to the survey. When asked, “Do you feel that there is enough work being done to protect the water quality and habitat of the Rocky and Deep Rivers into the



Fig 3. Public benefits of land conservation, ranked by community survey respondents.

Photography by Nikki Witt & The Conservation Fund

future?” 91% of respondents answered no. When asked, “Would you like to see more land conservation efforts focused along the Rocky and Deep Rivers corridors in the future?” a resounding 98% answered yes. These questions were included to gauge community investment and interest, which was found to be overwhelmingly positive.

The survey also asked participants to identify what they believe to be the greatest threat to the rivers in the future. Respondents noted poorly planned development in the watershed (65%), industrial discharge (39%), sedimentation and urban runoff (28%), and habitat fragmentation (11%) in their responses. When asked for suggestions on what can be improved upon, top answers included increased land management

and local non-profit cooperation (31%), increased legislative support and accountability for industrial pollution (23%), and better wastewater management practices (15%) and monitoring programs (11%). Respondents were also asked to rank 5 different ecosystem services and benefits that can be achieved with land conservation (Figure 3). The top two highest rated benefits were water quality and natural habitat protection.

Community support is critical for the successful implementation of conservation programs, and the data gleaned from this survey helped inform the recommendations to follow.



64%
poorly planned
watershed
development



39%
Industrial
discharge



28%
sedimentation &
urban runoff

Greatest threat believed by
respondents (by percentage)



Case Study

Costs of Stewardship

(LaGrange Riparian Preserve)

Nestled into a bend of the Deep River in southeast Chatham County is a 300-acre tract of land known as the La Grange Riparian Preserve. This property, owned by Triangle Land Conservancy (TLC), contains over 2.5 miles of Deep River frontage. It provides a great example of not only the rare beauty of the region, but the time, effort, and funds required to maintain ecological integrity of stewarded lands. This property was originally a part of the La Grange Farm dating back to the 1700s and was acquired by TLC in 1998. It contains a rare diabase seepage bog resulting from a unique intersection of hydrology and geology. This community type in turn generates soils that support habitat niches for rare plant and animal species in the region.

In the early 2000s, a grant from the US Fish and

Wildlife Service funded an effort to restore native upland and bottomland hardwood forest on La Grange that was previously cleared for cattle meadow. Thousands of trees were planted, and invasive Chinese privet plants were removed. In the 20 years that followed, stewardship priorities and capacity within the organization changed, and the project now requires another significant effort to ensure long-term success of its original 2005 goals. An overgrowth in the mid forest canopy and high density of young saplings requires prescribed burns through the reforestation project area and manual thinning within the seepage bog. The resurgence of Chinese privet must also be cut back again.

Challenges are associated with each of these stewardship goals including the need

for more funding to perform contract work, the project distance and remoteness limiting volunteer usage, and limited staff capacity for in-house restoration. Restoration projects can require several visits a quarter, burns must be performed every few years, and Chinese privet removal can involve multiple workdays per dormant season even with volunteer help.

Although volunteers are valuable, conserved land must be managed and stewarded by adequate staff. Planning for future acquisitions must include therefore planning for the addition of full and part-time staff members, ongoing equipment maintenance, and restoration activities common for this region (trails, prescribed burns, invasive species removal, native plantings). Large projects, like those

undertaken at the LaGrange Riparian Preserve, are often necessary to maintain the ecological integrity of land. Figure 4 provides an example of some of the expenditures needed for land-management practices on 100-acres of land in the region including in-house staff, routine maintenance, and larger efforts requiring outside contractors. The

example at La Grange illustrates that successful long-term projects often require an average of three or more phases over 30 years. This increases the additional funding needed to steward a property beyond yearly recurring costs. All values presented in Figure 4 are conservative estimates derived from work performed at Triangle Land Conservancy nature preserves.

Generally, government and non-profit organizations have different methods of budgeting for land management needs. While government agencies incorporate recurring expenses into their annual budget, non-profits will often use endowments to ensure fiscal stability. For the costs presented in Figure 4, a \$4.5 million endowment would be necessary to support annual expenses in perpetuity, assuming a 4.85% average 30-yr treasury bond rate of return and 2.45% inflation rate.

Internal Recurring Expenses

1 Full-Time Employee	\$60,000
1 Part-Time Employee	\$30,000
Equipment	\$10,000
Restoration Cost	\$10,000
Total	\$110,000

Other Contract Expenses (for a 100-ac project)

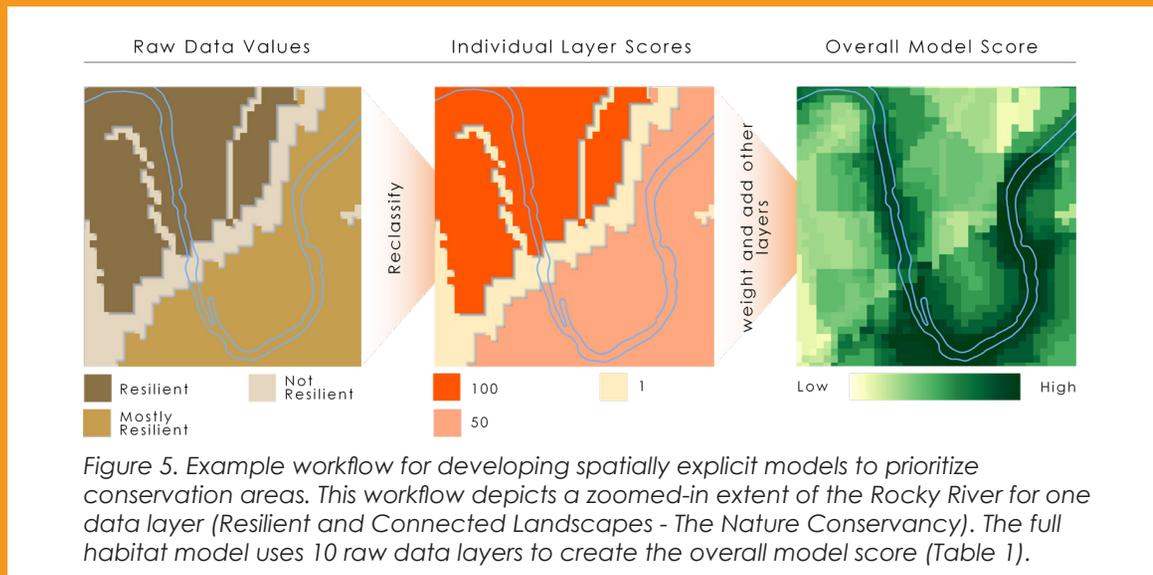
Invasive Species Removal	\$950/ac
Restoration Work	\$3,000/ac
Average Cost	\$2,000/ac
Project size	x100 ac
Total (one 100-ac project)	\$200,000

Figure 4. Example expenses required to take on additional land stewardship. Expenses are broken down into internal recurring that require perpetual funding and example project costs that are finite expenditures for larger management undertakings.

Recommendations

With limited resources and lack of capacity being two common challenges identified in stakeholder outreach, it is necessary to identify priority areas across both river corridors. Spatially explicit modeling with geographic information systems (GIS) is a commonly used tool for prioritizing landscapes. Four models were created for this management plan to identify areas where conservation can help achieve the following goals: (1) protect intact habitats, (2) safeguard clean water, (3) support local farms, and (4) connect more people to nature. The models draw on both publicly available

and privately requested data published from a variety of authoritative sources including the North Carolina Natural Heritage Program and The Nature Conservancy. Each model synthesizes individual data layers into one overall scoring system. This is performed by first transforming raw data into numerically scored layers between 1 and 100. These reclassified layers are then weighted according to their importance for each model and added together to create an overall score (Figure 5). For more specific information on the geoprocessing steps used in each model, a Technical Appendix is available upon request.



Protecting Natural Habitats

The Rocky and Deep Rivers are local hubs of biodiversity for Chatham and Lee Counties, and protecting intact habitats along them has never been more critical for the longevity of species in the region. Habitat in river corridors provides migration connectivity across a landscape that is becoming increasingly fragmented. Community survey respondents noted that habitat fragmentation is a looming threat for the region and identified biodiversity protection as one of the top two most important benefits of land conservation. The Rocky and Deep River corridors contain some of the most ecologically rich lands in all of Chatham and Lee Counties, making them high priority areas for protecting natural habitats. The river corridor contains just shy of 20 different significant natural areas identified by the NC Natural Heritage Program, over half of which have a representational rating of high (R3), very high (R4), or exceptional (R5)³⁶. According to the results of the habitat model, land within the 2-mile study area corridors scored two times higher on average than the remainder of land within the Chatham and Lee portion of Deep River sub-basin, and 1.5 times higher than the average

for all of Chatham and Lee Counties.

High quality habitat was defined in this model, in part, from a methodology published by the North Carolina Natural Heritage Program in 2018 for their statewide Conservation Planning Tool³⁷. Data layers from this method included information on individual species occurrences, broader habitat extents, and important hydrologic features. Modifications to the NHP protocol were made for this analysis to account for landscape connectivity and geologic features specific to the Piedmont ecoregion of North Carolina³⁸. Table 1 lists each model parameter used to assess habitat value, its source, and the percentage of total weight it contributes to the final model scoring system.

Lands rich in high quality habitat are found clustered throughout the extent of both river corridors (Figure 6). Regions depicted in darker green on this map scored high in recognized ecological value. The trend is driven in large part by the presence of rare species and important natural communities in this area. Permanently conserved lands are colored brown for clarity.

Variables	Data Sources	Model Weight
Ecological Value		
Natural Areas	NC Natural Heritage Program	8%
Species of Concern	NC Natural Heritage Program	8%
Landscape Habitat Guilds	NC Natural Heritage Program	8%
Streams	NC DEQ Division of Water Resources	10%
National Wetland Inventory	US Fish and Wildlife Service	8%
Forested Land	National Landcover Dataset (MRLC)	8%
Important Bird Areas	National Audubon Society	25%
Ecologically Significant Watersheds	US Geological Survey	5%
Connectivity		
Resilient and Connected Landscapes	The Nature Conservancy	25%
Proximity to Other Protected Land	NC Natural Heritage Program	15%

Table 1. Habitat model parameters, data sources and weight in overall model.

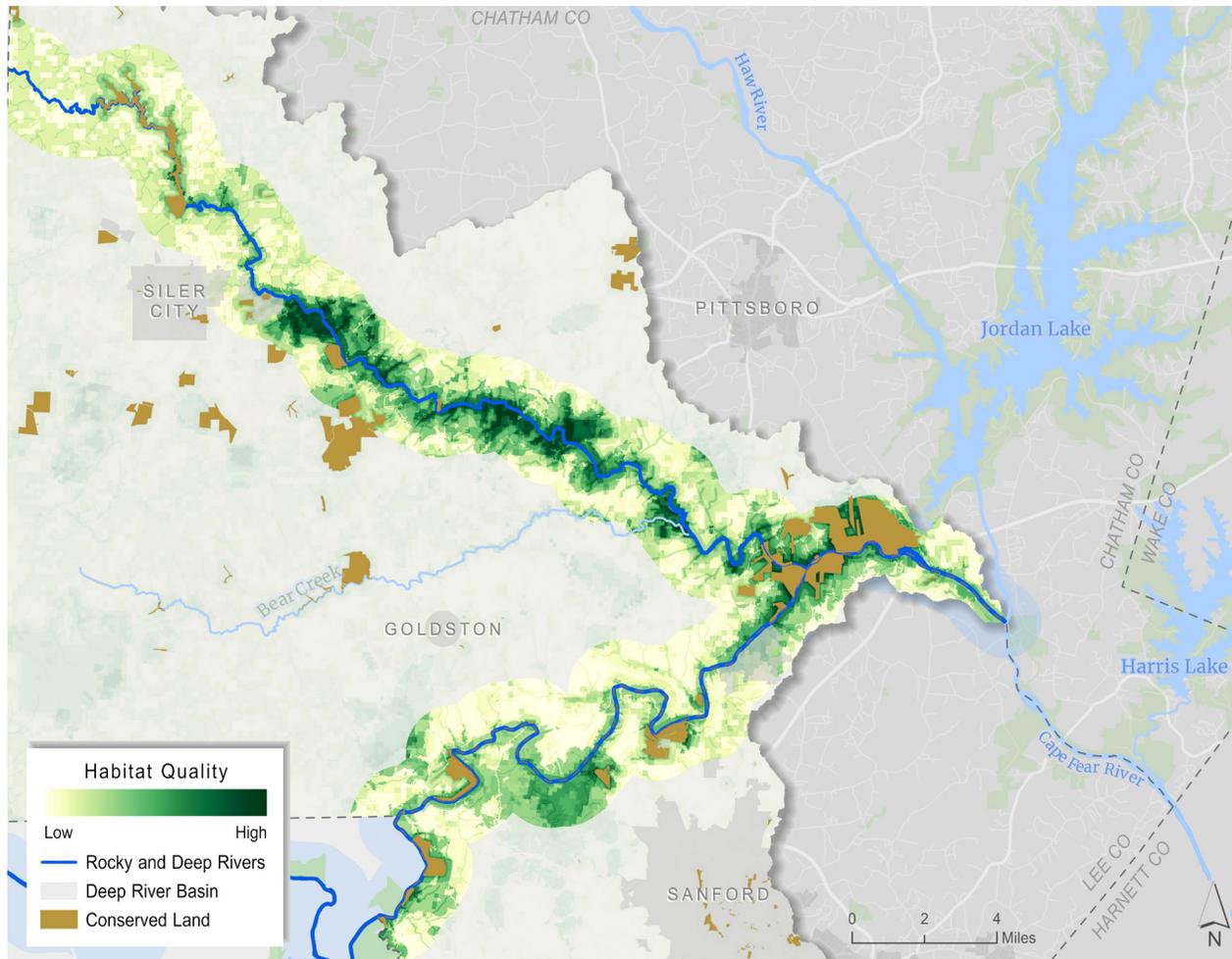


Figure 6. Habitat quality data for Rocky and Deep River 2-mile study area corridor. Darker green colors represent lands with high ecological value. Lighter yellow colors represent land with fewer ecological benefits. Brown areas indicate permanently protected land.

Specific priority areas were then isolated from the model results and grouped based on proximity to managed lands and potential management strategies identified during stakeholder outreach (Figure 7). The focus areas contain land that scored within the top 5% of all habitat model results for Chatham and Lee Counties, including all land within a 500-ft buffer of the rivers. Alphabetical labels were assigned for discussion purposes only and indicate regions where there is opportunity to build off existing capacity or work in an underserved area in the future. It is important to note that all conservation efforts within the two-mile river corridor present an opportunity to advance the ecological integrity of the Rocky and Deep River systems. Priority areas should not be used to deter projects outside their extents, but rather to provide starting points for future work in this region.

Protecting Natural Habitats Recommendations

- Work with individual organizations to adopt priority focus areas specific to their strategic goals and conserve more land in these regions.
- Create a new nature preserve or system for long-term management for land in priority group B, which currently lacks any permanent protection in proximity (much of this land is temporarily conserved "Registered Heritage Areas" denoted as conservation opportunities in Figure 1).
- Work with US Fish and Wildlife to explore options for a new Urban National Wildlife Refuge in this area
- Protect land within each of the 19 different NC Natural Heritage Program identified significant and diverse natural community areas.
- Continue work along the Deep River to incorporate high quality natural heritage areas into the Deep River State Trail
- Continue dam removal projects along both rivers to allow fish access to native habitat ranges and isolated populations to reintegrate.
- Undertake more restoration efforts, such as those presented in Case Study: LaGrange Riparian Preserve to limit the spread of invasive species and protect the ecological character of the river corridor.
- Protect 10% of the river corridor in the next 10 years (approximately 90 projects, 7,600 acres, and \$36 million in county assessed tax value)
- Protect 25% of the river corridor in the next 25 years (approximately 200 projects, are 19,000 acres, and \$88 million in county assessed tax value)

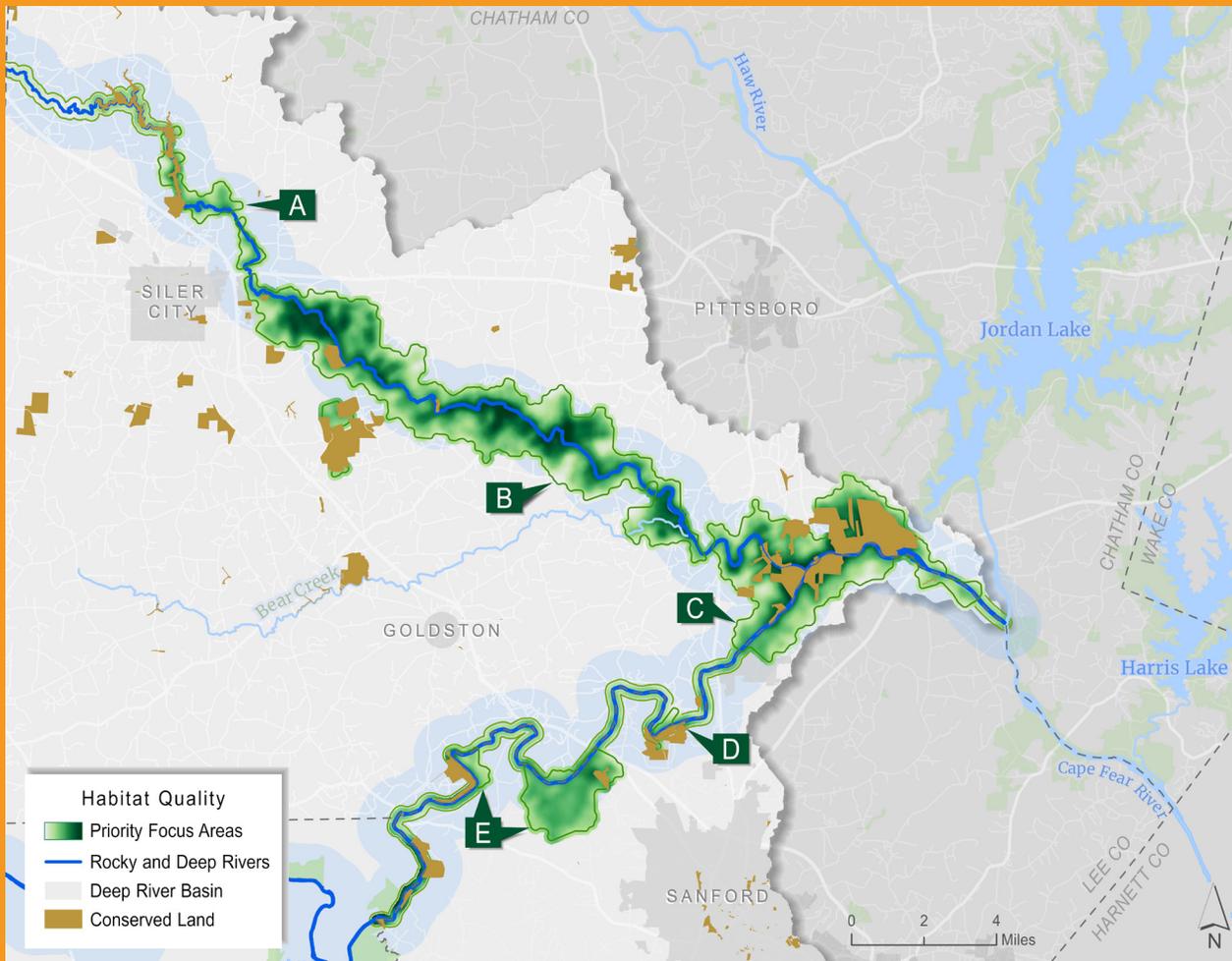


Figure 7. Priority areas for protecting natural habitats throughout Rocky and Deep River 2-mile study area corridor (green outline, alphabetical labels). Color strength within focus areas corresponds to model assessed ecological value, where darker colors indicate higher value. Brown areas indicate permanently protected land.

Protecting Clean Drinking Water

Protecting undeveloped land within watersheds is crucial for safeguarding water quality. Experts agree that when the percentage of impervious surface within a watershed exceeds a threshold of around 10%, rivers experience negative impacts to their natural hydrologic regimes³⁹. Heavy rain creates flashier runoff that increases streambank erosion. Heat stored in impervious surfaces also drastically increases runoff temperature, causing adverse impacts to wildlife with narrow temperature ranges. With adverse climate impacts creating stronger storms across the Southeastern United States⁴⁰, and increased rates of development, it has never been more important to protect the Rocky and Deep Rivers from degradation and pollution. Community survey respondents highlighted

many water quality challenges as burdens for both river systems and identified clean water protection as the single most important benefit of land conservation in the region (Community Surveys pg. 14-15).

The Rocky River provides drinking water to the Town of Siler City, which can withdraw up to 4 million gallons of water per day (MGD). The City of Sanford withdraws up to 12 MGD from the Cape Fear River just downstream from the confluence of the Deep and Haw Rivers. Sanford is becoming a regional water supplier and plans to expand its drinking water capacity up to 30 MGD. In the future, Sanford will provide drinking water to communities in Chatham, Lee, and Wake counties. The Rocky and Deep Rivers also contain 6 different

tributaries that exceed NC DEQ water quality criteria in 2022⁴¹. The entire Deep River sub-basin is currently estimated to be 7% impervious surface. These parameters were used in the water quality model to evaluate potential land conservation projects, in addition to variables identified by local experts during the creation of the Raleigh Watershed Protection Program model⁴² (2005). These include mitigating erosion hazards, increasing retention in wetlands, and protecting riparian buffers. Table 2 lists each model parameter used to assess water quality protection potential, its source, and the percentage of total weight it contributes to the final model scoring system.

Variables	Data Sources	Model Weight
Hydrologic Regime		
Proximity to National Wetland Inventory	US Fish and Wildlife Service	10%
Higher Order Streams	US Geological Survey	10%
Public Supply Watersheds	NC DEQ Division of Water Resources	10%
Watershed Impervious Surface	National Landcover Dataset (MRLC)	10%
Mitigation		
Flood Hazard Areas	Federal Emergency Management Agency	15%
Erosion Hazard Potential	Natural Resources Conservation Service	15%
Contaminated Streams	NC DEQ Division of Water Resources	15%
Watersheds Containing Contaminated Streams	NC DEQ Division of Water Resources	15%

Table 2. Clean water model parameters, data sources and weight in overall model.



Photography by Don Kinney

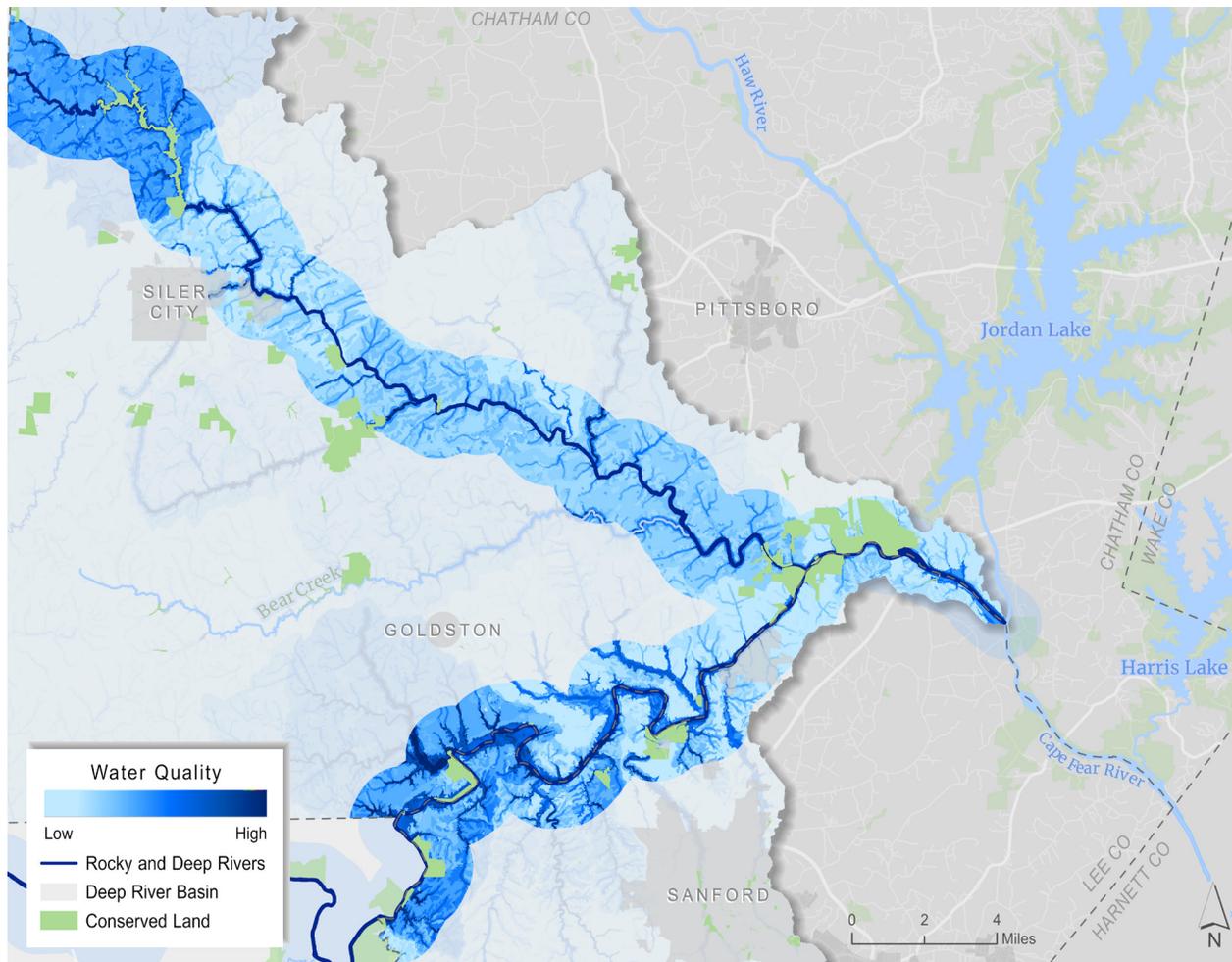


Figure 8. Water quality protection data for Rocky and Deep River 2-mile study area corridor. Darker blue colors represent lands with high value opportunities to protect water quality. Lighter blue colors represent land with fewer water protection benefits. Green areas indicate permanently protected land.

Lands with high potential for safeguarding clean water are found throughout the extent of both river corridors (Figure 8) as well as along all tributaries. Regions depicted in darker blue on this map scored high in their potential to protect water quality with land conservation. The trend is driven in large part by the location of streams that occur as natural hydrologic features within the Deep River sub-basin. Additionally, darker blue land in the upstream portions of both river corridors correspond to sub-basins that are contaminated and/or drain into public drinking sources. Permanently conserved lands are colored green in this map for clarity.

Specific priority areas were then isolated from the model results and grouped based on potential management strategies identified during stakeholder outreach and water quality threats within the basin (Figure 9). The focus areas contain land that scored within the top 10% of all water quality model results for Chatham and Lee Counties, including land within the riparian corridor.

Protecting Water Quality Recommendations

- Work with Siler City, Sanford and other organizations to adopt priority focus areas specific to their source water protection strategic goals and conserve more land in these regions.
- Conserve land along tributaries in groups B and C that struggle with poor riverbed and fish community health.
- Support Siler City and its partner Sanford's investments in upgrading their wastewater treatment plant (WWTP) capacity to reduce NPDES discharge into Loves Creek and the Rocky River.
- Advocate for increased water quality monitoring and legislative accountability for industrial pollution discharges.
- Invest in streambank restoration projects where there is degradation or invasive species have established.
- Continue dam removal projects along both rivers to restore natural hydrology.
- Support the creation of a stormwater utility in Sanford alongside the planned expansion of water utilities.
- Work with Sanford, Siler City, Chatham County and Pittsboro to dedicate a watershed protection fund based on volumetric use to support future conservation efforts (see Case Study: Collaboration for Successful Watershed Protection) with a sustained source of revenue.
- Protect 10% of the river corridor in the next 10 years (approximately 90 projects, 7,600 acres, and \$29 million in county assessed tax value)
- Protect 25% of the river corridor in the next 25 years (approximately 250 projects, 19,000 acres, and \$73 million in county assessed tax value)

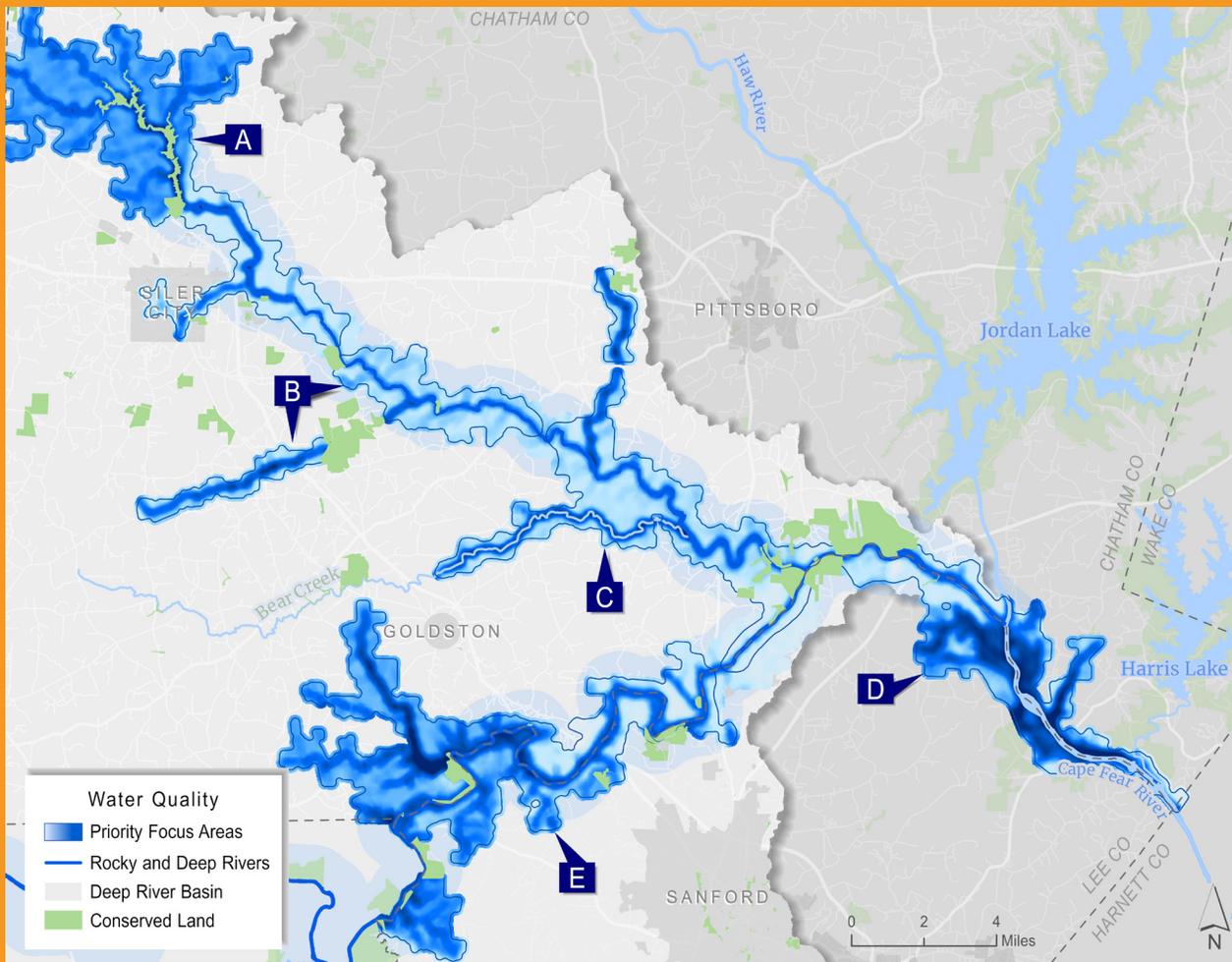


Figure 9. Priority areas for protecting clean water throughout Rocky and Deep River 2-mile study area corridor (blue outline, alphabetical labels). Color strength within focus areas corresponds to model assessed hydrological value, where darker colors indicate higher value. Green areas indicate permanently protected land.

Case Study

Collaboration for Successful Watershed Protection

Conserving undeveloped land within a watershed is one of the most cost-effective methods of protecting clean drinking source water. The Raleigh Watershed Protection Program is an example of an innovative partnership created to facilitate this land protection process within the Upper Neuse River basin. Through the assessment of a volumetric water consumption tax (\$0.15 per 1,000 gallons) on Raleigh's residential customers, the program generates revenue

exclusively for land protection within the Upper Neuse River Basin. Though average residential customers pay only around \$0.60 more per month, their upstream impact is far greater. Since its conception in 2005, this program has helped protect 10,800 acres and 117 miles of streams within this critical water supply area. The City of Cary has adopted a similar program, dedicating \$7.5 million annually toward watershed protection efforts.



10,800
acres



117
Miles of Stream



7 to 1
Funding Leverage
from City of
Raleigh

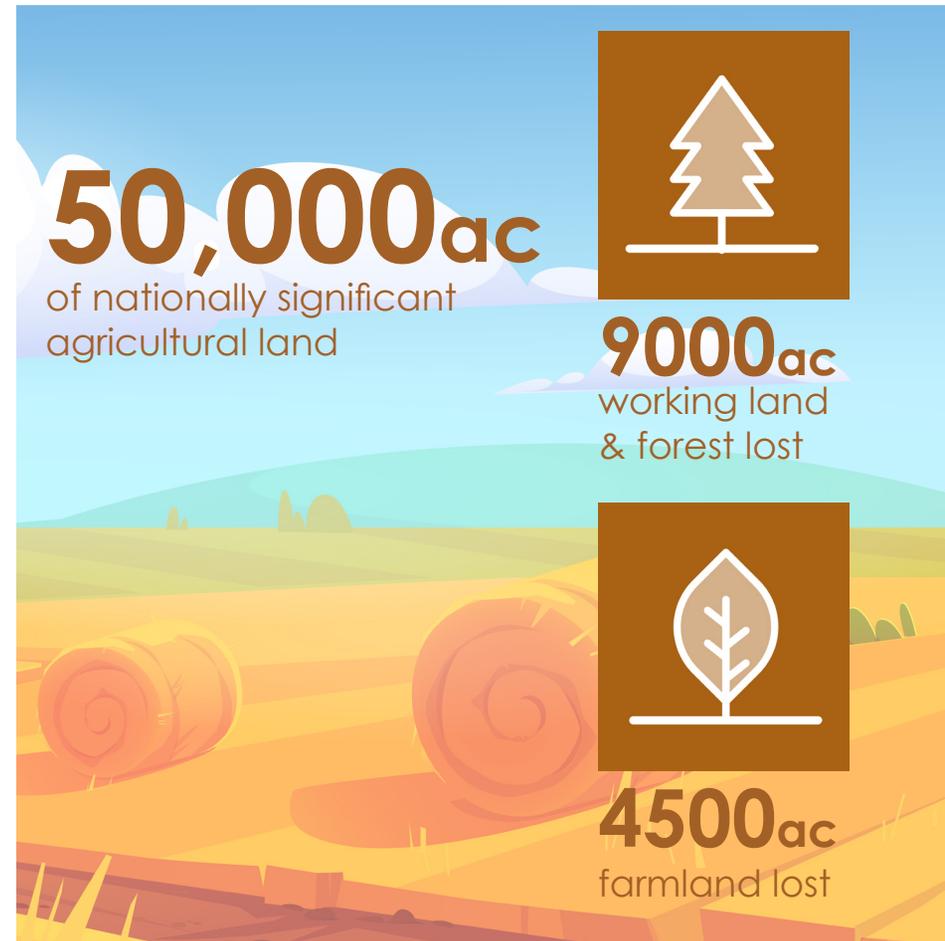
Photography by Triangle
Land Conservancy

Supporting Farms and Working Lands

Working farms and forests are crucial to the character of Chatham and Lee Counties and provide access to greenspace and local food. One method of evaluating working lands, coined by the American Farmland Trust, uses productivity, versatility, and resilience (PVR) metrics to assess land best-suited to cultivating human-edible food crops⁴³, taking future adverse climate impacts into consideration. The American Farmland Trust also sets a threshold on PVR values to identify “nationally significant” farmland. According to this definition, the Deep River Basin in Chatham and Lee Counties contains over 50,000 acres of nationally significant agricultural land (17% of the total area). Between 2001 and 2019, Chatham and Lee Counties are also estimated to have lost over 4,500 acres of farmland and over 9,000 acres of working and natural forested land for other land uses⁴⁴. The ongoing threat of working land conversion makes conservation

within the Deep River sub-basin paramount.

High value land for working farms and forests was identified in this model from a combination of methodologies published by the American Farmland Trust⁴⁵ and North Carolina Natural Heritage Program (2012) for their statewide agricultural assessment data layer⁴⁶. The data encompass information on underlying environmental factors conducive to high-quality working lands such as soil type, productivity potential, and resilience. It also identifies social structures that impact working lands projects such as county voluntary agricultural districts, the NC Present Use Value Program, and urbanization threats. Table 3 lists each model parameter used to assess area valuable for working lands, its source, and the percentage of total weight it contributes to the final model scoring system.



Variables	Data Sources	Model Weight
Geologic Value		
Prime Farming Soils	USDA Natural Resources Conservation Service	10%
Land Cover	National Landcover Dataset (MRLC)	15%
Productivity, Versatility, Resiliency	NC DEQ Division of Water Resources	20%
Social Structures		
Agricultural Land at Risk of Conversion	American Farmland Trust	15%
Voluntary Agricultural Districts (VAD)	Chatham and Lee County VAD Data	20%
Present Use Valuation (PUV) Program	Chatham and Lee County Parcel Tax Data	20%

Table 3. Quality working lands model parameters, data sources and weight in overall model.

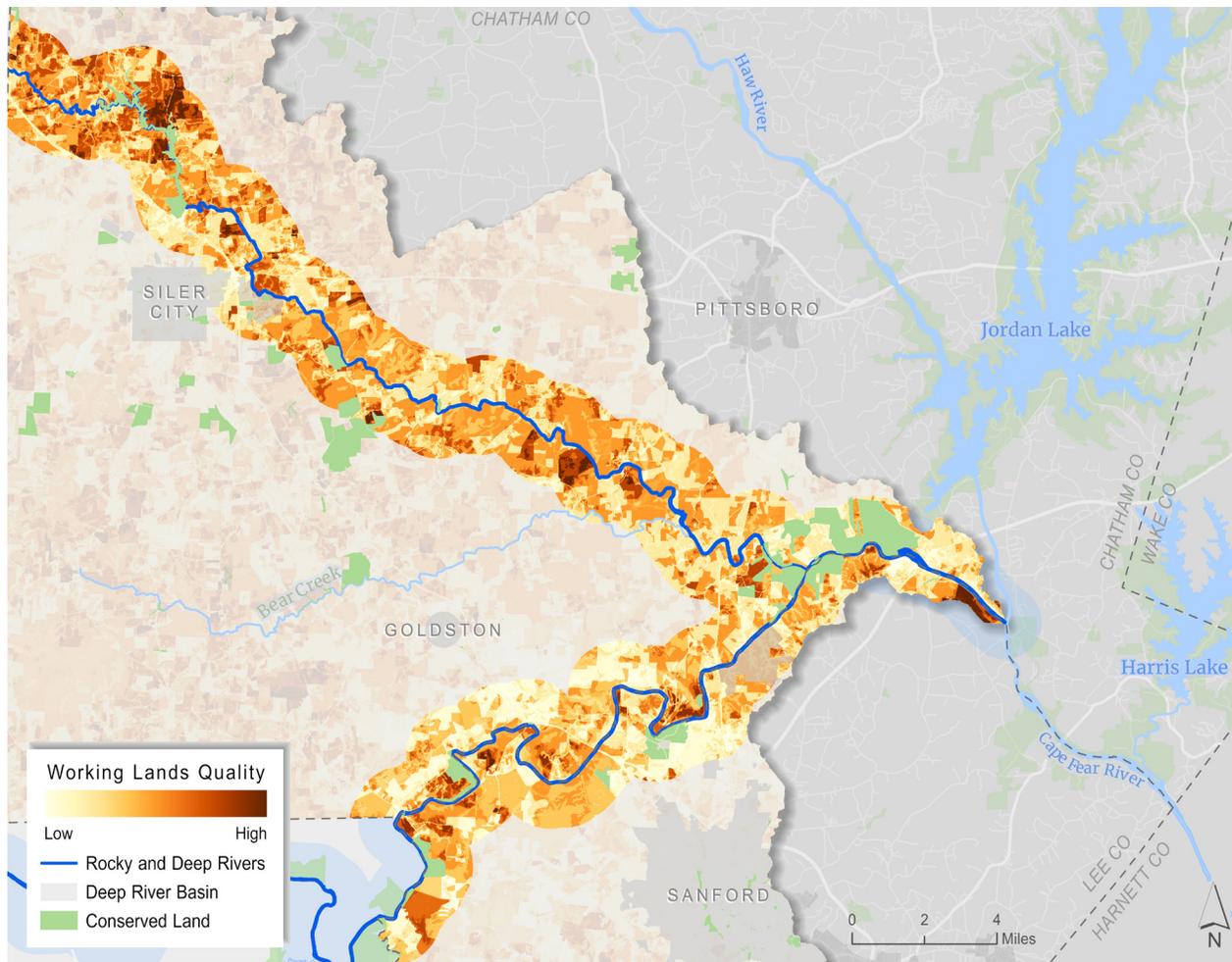


Figure 10. Quality working lands data for Rocky and Deep River 2-mile study area corridor. Darker brown colors represent areas with good opportunity to support working lands. Lighter yellow colors represent areas less suited for working lands. Green areas indicate permanently protected land.

High value working lands projects do not follow a strong spatial relationship along the Deep and Rocky River corridors but are rather more clustered throughout both counties (Figure 10). Regions depicted in darker brown on this map scored high in their potential value as working farms and forests. Regions in lighter yellow have fewer environmental and social structures conducive to productive working lands. Much of this trend is driven by the boundaries of voluntary agricultural districts (VAD) and the present use value program participants in Chatham and Lee Counties. Prime soil for farming exists throughout the county.

Specific priority areas were then isolated from the model results and grouped based on potential project density within the basin (Figure 11). The focus areas contain land that scored within the top 10% of all working land model results for Chatham and Lee Counties. Focus area A lies in northwestern Chatham County, also known as Silk Hope. This community has a long history of supporting working farms and forests. Securing protection for these hubs of agriculture are crucial foundations for natural resource conservation.

Supporting Working Lands Recommendations

- Prioritize highest scoring projects and smaller clusters of working lands opposed to adopting specific priority areas.
- Prioritize projects where the American Farmland Trust predicts high levels of urban development threat.
- Advance funding and education for farm upgrades that help promote sustainable practices while simultaneously protecting water quality and native habitat (i.e. fencing, increasing agricultural buffers)
- Fund programs that help support BIPOC communities retain working land ownership, such as Triangle Land Conservancy's Good Ground initiative.
- Fund programs that support individuals transitioning their working lands to prevent further conversion when land ownership changes.
- Establish sustaining sources of revenue for farmland protection. For example, dedicate the present use rollback taxes in each county to support farmland protection.
- Protect 10% of the river corridor in the next 10 years (approximately 90 projects, 7,600 acres, and \$29 million in county assessed tax value).
- Protect 25% of the river corridor in the next 25 years (approximately 270 projects, 19,000 acres, and \$82 million in county assessed tax value).

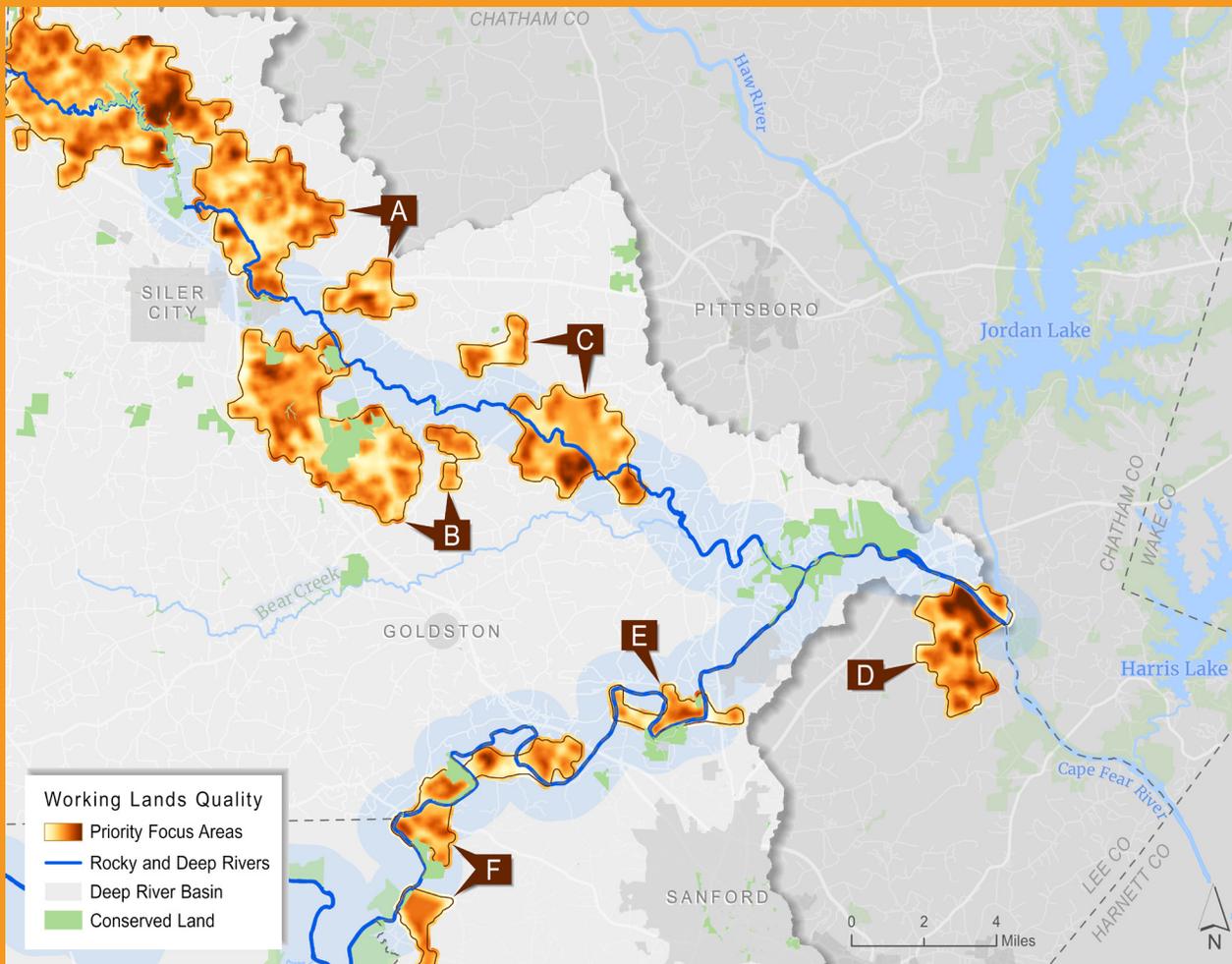


Figure 11. Priority areas for supporting working lands throughout Rocky and Deep River 2-mile study area corridor (brown outline, alphabetical labels). Color strength within focus areas corresponds to model assessed working land value, where darker colors indicate higher value. Green areas indicate permanently protected land.





Connecting People with Nature

Access to greenspace is crucial for the cultivation of physical, mental, spiritual, and emotional health. With population growth in the Triangle increasing rapidly, proactively planning for sustainable recreation is key to avoiding environmental harm from overuse. The COVID-19 pandemic in 2020 illustrates this issue well⁴⁷; unprecedented rates of recreation that resulted from the pandemic placed strain on both natural systems and the workers tasked with stewarding them. Offering new public access along other parts of the Rocky & Deep can help divert some of the recreational burden currently placed on nearby parks including Jordan Lake State Recreation Area (over 2M visitors in 2022⁴⁸), White Pines Nature Preserve, and San-Lee Park, three mainstays in the community. Connecting people with nature also requires new management strategies that can increase recreational opportunities in

underserved communities. Inequitable access to greenspace is an ongoing challenge. Investing in recreational opportunities for historically poor and marginalized communities is necessary for advancing community health alongside environmental health.

Good opportunities to connect people with nature were defined in this model by analyzing where people are distributed and their proximity to current recreational opportunities. The model assigns high value to areas that either build off existing capacity (managed land and greenways) or areas where there is no current capacity (service gaps). Two different methodologies of note include the use of environmental justice indices⁴⁹ published by the US EPA from census data and drive time analyses.

Variables	Data Sources	Model Weight
Social Structures		
Environmental Justice Indices	EJScreen: Center for Disease Control & US EPA	25%
K-12 School Proximity	Chatham and Lee County	10%
Areas Underserved by Park Systems	Chatham and Lee County	20%
Managed Area		
Proximity to Greenways	Chatham and Lee County	20%
Proximity to Other Managed Areas	NC Natural Heritage Program	12.5%
NC Cultural Resources	NC Department of Natural and Cultural Resources	12.5%

Table 4. Connecting people with nature model parameters, data sources and weight in overall model.

Photography by Don Kinney

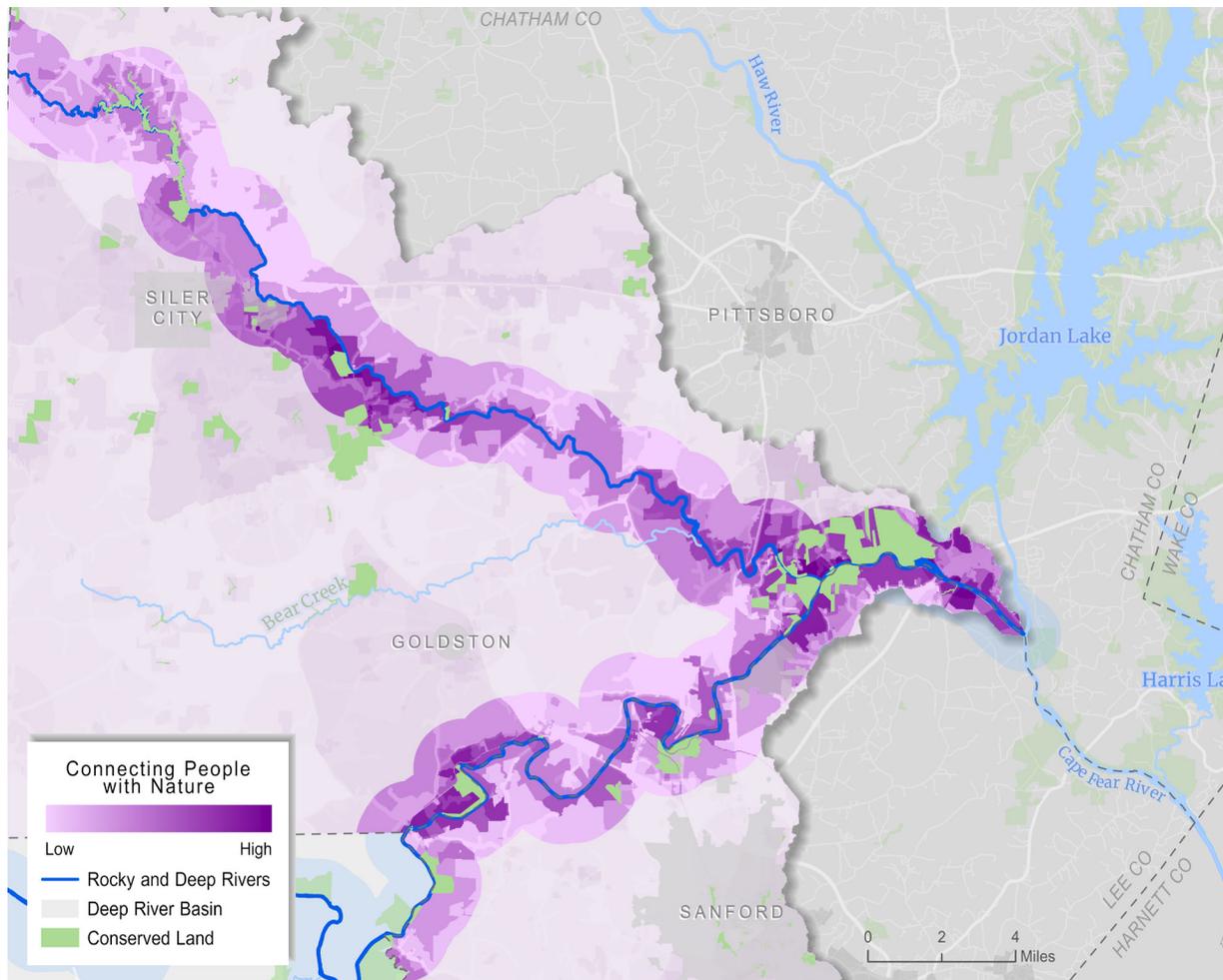


Figure 12. Opportunities to connect people with nature in Rocky and Deep River 2-mile study area corridor. Darker purple colors represent lands with high social and recreational value. Lighter purple colors represent land with fewer social and recreational benefits. Green areas represent permanently protected land.

Land that presents a good opportunity to connect people with nature is found all throughout the Rocky and Deep River corridor (Figure 12). Regions depicted in darker purple on this map scored higher in their potential to connect people with nature. This trend is driven by several factors including the presence of White Pines and the Deep River State Trail (at the confluence of the rivers). This area presents a good opportunity to expand the existing capacity of community resources. Conversely, the center of the Rocky River corridor in Chatham County is highlighted in this model because it currently has a gap in recreational service. This was identified using a drive-time analysis that aimed to measure which parts of the county can access a public park within a 15-minute drive.

Specific priority areas were then isolated from the model results and grouped based on potential management strategies and project density within the basin (Figure 13). The focus areas contain land that scored within the top 5% of all connecting people with nature model results for Chatham and Lee Counties, including land within the riparian corridor. Land in group A represents a service gap near a historically under resourced community. Group B contains land that can help build off the capacity of the Deep River State Trail, White Pines Nature Preserve, and Jordan Lake State Recreation Area. Land in Group C represents an opportunity to build off the capacity of the Endor Iron Furnace Site in Lee County, as well as provide connections for the Deep River State Trail.

Connecting People with Nature Recommendations

- Work with individual organizations to adopt priority focus areas specific to their strategic goals and conserve more land in these regions.
- Build off the existing capacity of the Deep River State Trail, connecting contiguous land parcels when opportunities to do so arise, and acquiring land conducive to support paddle access.
- Identify new managing partners, such as the US Fish and Wildlife Service, to tackle current gaps in service, such as the middle portion of the Rocky River in Chatham County.
- Make educational materials on publicly accessible open space and the status of land conservation more available for interested community members.
- Identify and improve corridors that connect Siler City and Sanford to the Deep River State Trail
- Protect 10% of the river corridor in the next 10 years (approximately 50 projects, 7,600 acres, and \$42 million in county assessed tax value).
- Protect 25% of the river corridor in the next 25 years (approximately 170 projects, 19,000 acres, and \$99 million in county assessed tax value).

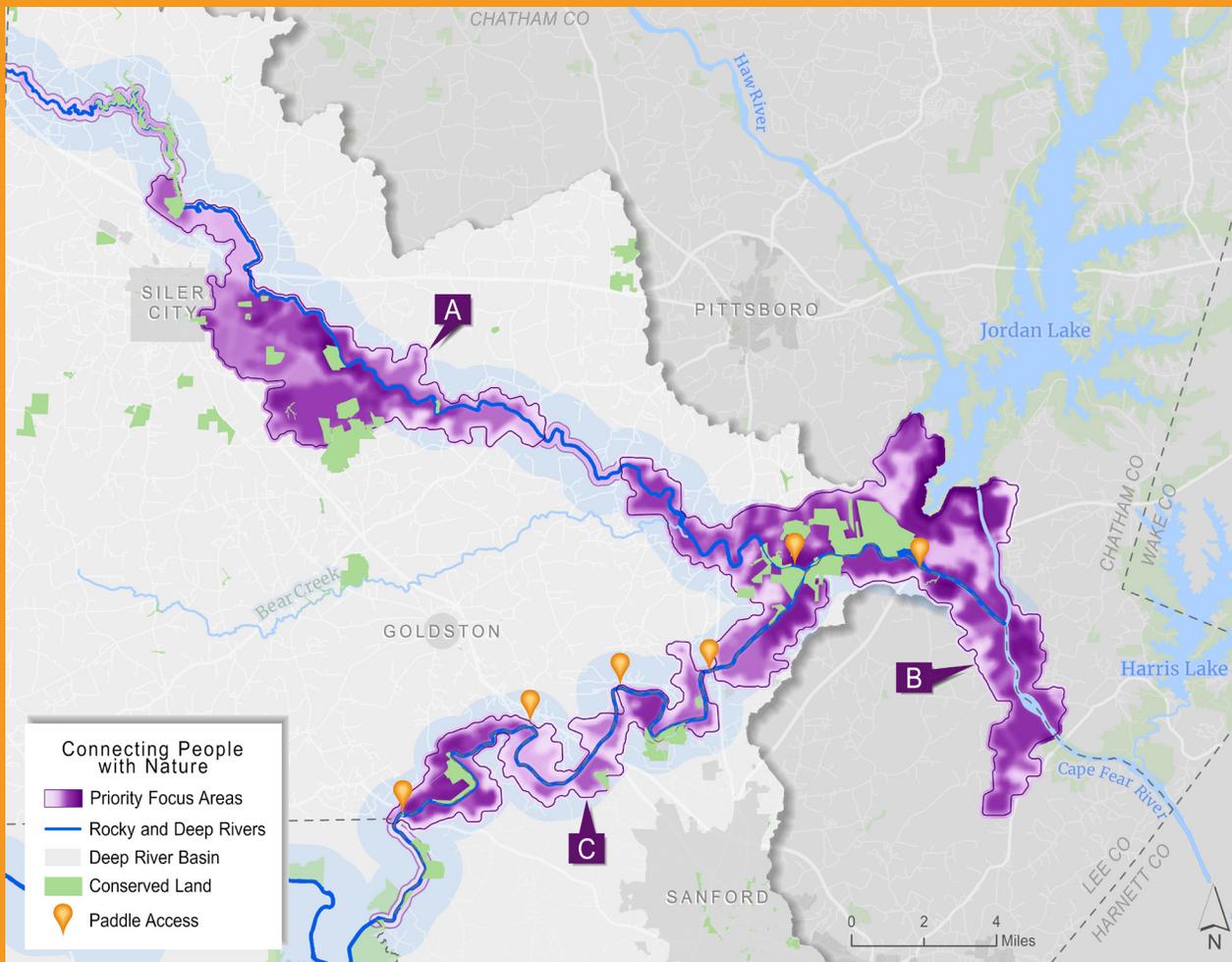


Figure 13. Priority areas for connecting people to nature throughout Rocky and Deep River 2-mile study area corridor (purple outline, alphabetical labels). Color strength within focus areas corresponds to model assessed social value, where darker colors indicate higher value. Green areas indicate permanently protected land.

Discussion

Evaluating projects and recommendations through a framework informed by the community's top four public benefits of conservation (Community Surveys pg. 15) is valuable for planning strategic action. However, one of the advantages of land conservation is that projects often have multiple co-benefits. For example, wetlands that improve water quality via retention can also make valuable habitat for rare species. Sustainable agricultural practices can improve wildlife migration corridors. Connecting people with nature can complement many types of projects, as demonstrated by TLC's White Pines Nature Preserve. It supports unique natural habitat that also buffers both rivers.

When moving forward with implementation, it can therefore be helpful to consider lands that touch on more than one public benefit priority area (Figure 14). This approach increases efficiency in tackling the recommendations of this plan and helps create a robust network of conservation in the region. More than 2/3 of the land within each benefit priority area, identified in the Recommendations Section of this report, shares overlapping area with other conservation priorities around the rivers (Figure 15).

Though not explicitly modeled for this study, the expansion of land conservation also has valuable economical co-benefits. Establishing additional conservation lands open to the public can bring the region sustainable tourism revenue. Ecosystem services, or environmental contributions that promote human wellbeing, also contribute financial value by providing amenities important for maintaining high quality of life. Building up the capacity of these ecosystem services ensures that people remain invested, both emotionally and fiscally, in the Rocky and Deep Rivers long-term.

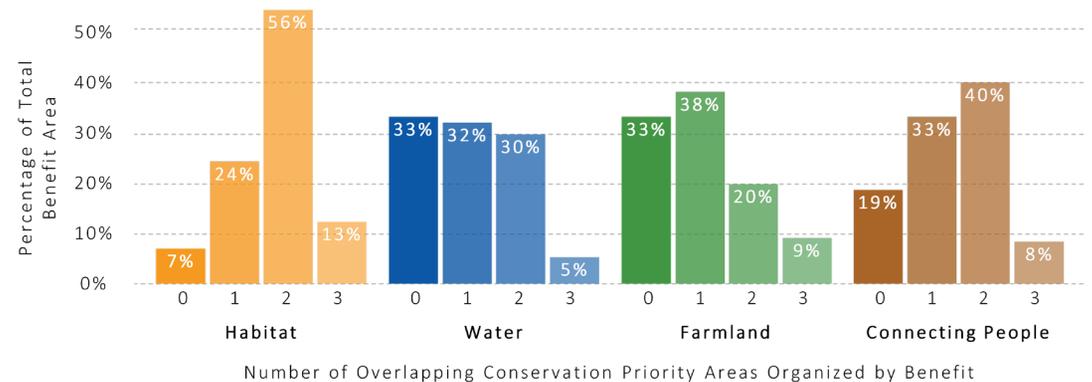
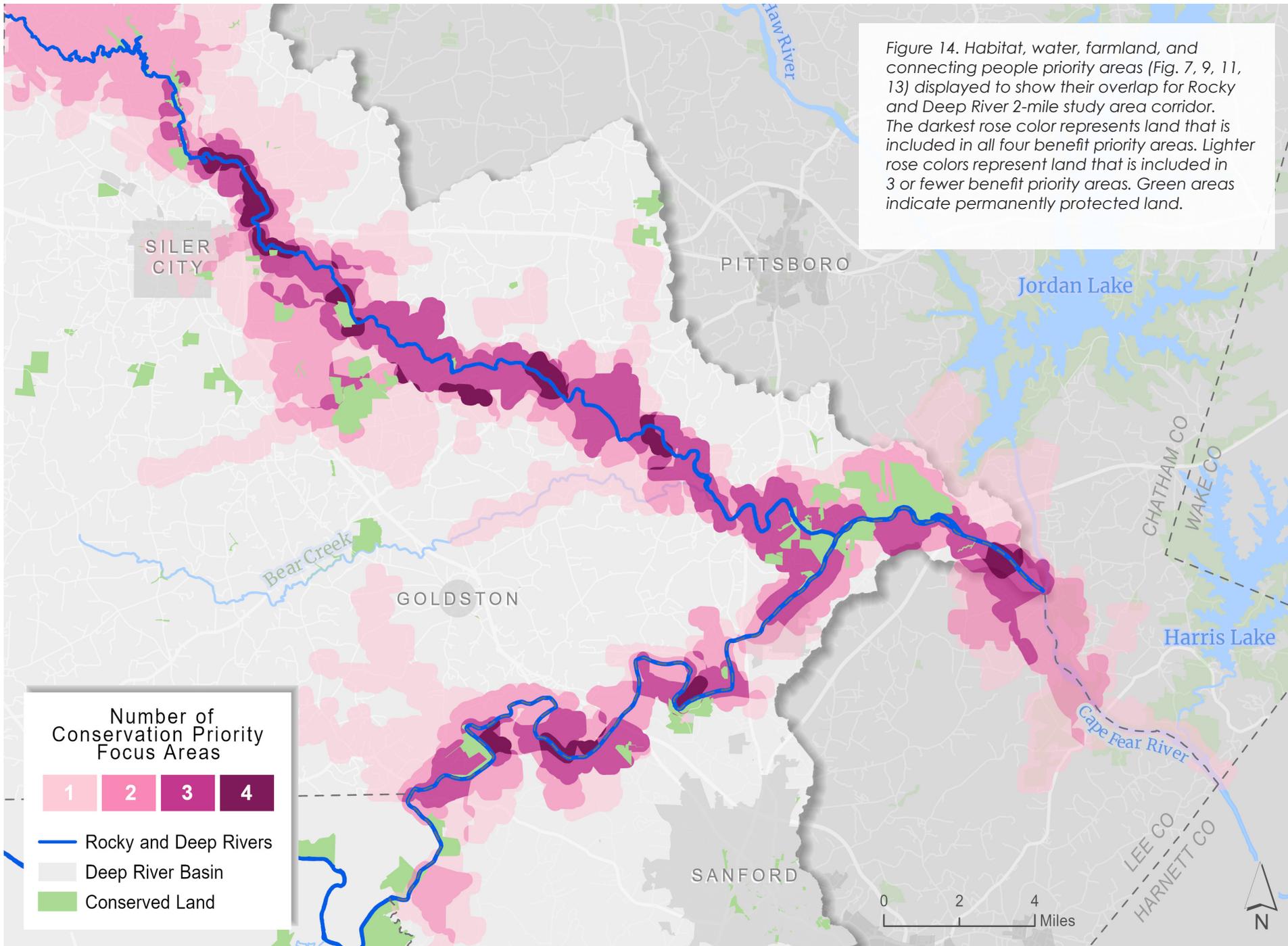


Figure 15. Statistics on the percentage of total priority area lands (Fig. 6, 8, 10, 12) that share overlap with other priority areas, broken down by benefit. For example, the first data bar of the habitat values can be interpreted as, "7% of all land in the natural habitat priority area does not overlap with any other conservation benefit priority area" and the second column of the habitat values can be interpreted as, "24% of all land in the natural habitat priority area overlaps with at least 1 other conservation benefit priority area."



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