GREEN GROWTH TOOLBOX

Wildlife and Natural Resource Stewardship in Planning

A Guide for Planners, Communities and Developers

NORTH CAROLINA Wildlife RESOURCES COMMISSION

WHAT IS GREEN GROWTH?

***Green Growth** means conserving wildlife, habitat and other valuable natural resources as communities continue to grow.*

Green Growth Toolbox Handbook 2017 Edition

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COLLABORATORS

INTRODUCTION AND SUMMARY

Welcome to The Green Growth Toolbox, a cooperative, non-regulatory effort led by the Wildlife Diversity program of the North Carolina Wildlife Resources Commission. The Green Growth Toolbox, consisting of a handbook, GIS data package and website, provides North Carolina towns, cities and counties with tools, land use planning methods and case studies to conserve wildlife and natural resources as they grow.

To use the Green Growth Toolbox:

- Download the handbook and GIS dataset from the project website.
- Local government staff, officials and consultants can enroll in training workshops.
- Communities that participate can receive follow-up technical guidance.
- Individual town, city and county governments can exhibit innovative leadership among their peers.

With initiative, creativity and support for "Green Growth," North Carolina communities can stem the decline of our wildlife heritage while continuing to build homes, workplaces and shopping centers.

In addition to protecting environmental health, Green Growth can bring significant economic and social dividends to communities.

Here is what you will find in the Green Growth Toolbox (GGT) Handbook.

SECTION 1. The Green Growth Toolbox: How it works and why it is needed

- Over the next 20 years, 3 million people will move to North Carolina. This unprecedented population growth is fueling sprawling patterns of land development that threaten North Carolina's environment, public health and quality of life.
- The North Carolina Wildlife Action Plan identified sprawling patterns of land development as a top threat to the future of wildlife resources across the state.

The N.C. Wildlife Resources Commission developed the GGT to help communities conserve priority wildlife habitats for future generations while continuing to grow.

SECTION 2. Using Conservation Data: Wildlife habitat and natural resource maps and data explained

- Learn what the data mean.
- Use this data in development site selection and the three levels of planning: visioning and plan making, ordinance and rule setting and development design and review.
- Learn how to use the data to identify priority wildlife, habitats and natural resource conservation areas.
- Learn how to start a community-wide natural resource inventory.

SECTION 3. Habitat Conservation Recommendations: What the science tells us about how to minimize impacts to wildlife

We recommend doing what is possible to incorporate these habitat conservation measures into the three levels of land use planning.

- Recommendations are non-regulatory and come from an expert review of the scientific literature regarding how much habitat wildlife need in developing landscapes.
- These recommendations are based on the NCWRC guidance document, "Conservation Recommendations for Priority Terrestrial Wildlife and Habitats in North Carolina."
- Explore options for greenway design, stream buffers, habitat open space standards and other conservation measures for priority areas.

SECTION 4. Green Planning: Enabling wildlife conservation in visioning and planning

"Green planning" means crafting a vision, goals and strategies in planning documents specific to conserving important species, habitats and ecosystems while continuing to grow.

- Learn a six-step process for creating a jurisdiction-wide conservation plan.
- Apply this process to write habitat conservation sections for existing land use plans.
- Link to examples of "green planning" documents from communities around the U.S.

SECTION 5. Greening Incentives and Ordinances: Incentives and policies necessary to achieve green planning goals

"Greening incentives and ordinances" means using conservation data to design incentives, land use districts and conservation development standards that can minimize impacts to wildlife and delays in environmental permit review.

- Consider types of incentives that reward development projects for minimizing impacts to wildlife and natural resources.
- Review land use patterns that maintain wildlife and natural resources and consider how elements of land development ordinances can be crafted to conserve priority habitats and ecosystems.
- Explore example incentives and ordinances from around the U.S.

SECTION 6. Greening Development Site Location, Review and Design: Siting, designing and reviewing development projects to minimize impacts

"Greening Development Review" means using conservation data and habitat conservation recommendations to site, review and design developments.

- This section can benefit planning staff and advisory boards that review development proposals. It can also benefit developers, engineers, consultants, and landscape architects that want to design conservation areas in developments.
- See a visual step-by-step example of interpreting and using conservation data in development review and site design.
- Use links to explore developments that embody many green growth principles.

The Green Growth Toolbox is funded by State Wildlife Grants and the N.C. Nongame and Endangered Wildlife Tax Check-off Fund.

SECTION 1. THE GREEN GROWTH TOOLBOX

ANNE OUTLAW

wood thrush chicks

SECTION 1

PROJECT OVERVIEW

Land Use Planning Methods to Conserve Priority Habitats

Wildlife and plant species are our canaries in the coal mine. Their abundance and diversity indicate the health of our natural resources. Hundreds of North Carolina wildlife species are declining in population due to loss of habitats. Habitats are the natural areas that our communities depend on for clean water and protection from flooding or drought, among other benefits. The Green Growth Toolbox is a technical assistance tool designed to help North Carolina's counties, towns and cities grow in ways that maintain priority wildlife and habitats. We all need a place to live and work and development can be done in a way that stewards our wildlife and natural resources.

The Toolbox includes how-to information on the following topics.

A. The Justification and Benefits of Green Growth. — Provided in this section.

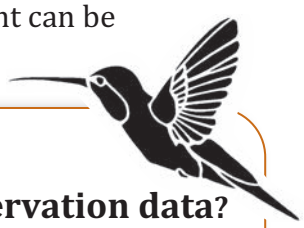
B. Using Conservation Data — in site selection and land use planning activities. Detailed information is in Section 2.

C. Understanding Habitat Conservation Recommendations and Best Practices — and how to use them in each level of planning. Detailed information is in Section 3.

D. Green Planning — to create land use plans that will enable conservation of your community's natural assets. Detailed information is in Section 4.

E. Greening Incentives and Ordinances — methods for encouraging conservation and structuring local ordinances and standards to conserve, buffer and connect important habitats as growth occurs. Detailed information is in Section 5.

F. Greening Development Review and Site Design—by using conservation data and recommendations to review site location and development proposals. Detailed information is in Section 6.



What are conservation data?

Conservation data are information about the conservation status and location of important wildlife and plant species and their habitats. The conservation data in this toolbox are based on the N.C. Conservation Planning Tool. They are in a Geographic Information System (GIS) format of maps representing priority wildlife habitats.

How it Works

The Green Growth Toolbox consists of a handbook, packaged GIS dataset, training workshops and technical assistance. All resources are available for download from our website. www.ncwildlife.org/greengrowth

This project is a cooperative, non-regulatory effort led by the Wildlife Diversity program of the North Carolina Wildlife Resources Commission in collaboration with organizations featured in the acknowledgements.

Training Workshops and Presentations

The Green Growth Toolbox is introduced to local government staff, advisory boards and consultants through a training workshop. Brief presentations can also be delivered to town councils, boards of commissioners and other decision makers. Local government officials or planning staff who want to use the Green Growth Toolbox should request a training workshop.

Technical Guidance

Local government officials and planning staff who have participated in the Green Growth training workshop are eligible for individualized technical guidance on the following topics:

- integrating the Green Growth dataset with your community's GIS database
- creating habitat and natural resources maps for local planning
- non-regulatory review of conservation plans, land use plans, ordinances, policies and development designs
- incorporating habitat conservation into
  - land use plans
  - policies and ordinances and
  - development review and site design
- developing habitat management plans for parks and open space.

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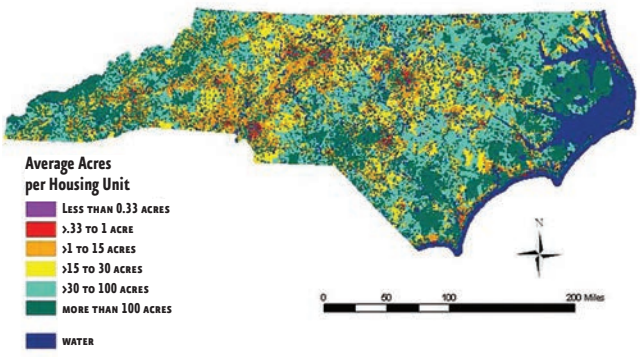
North Carolina has more sprawling development patterns than any other state.[1]

WHY GREEN GROWTH?

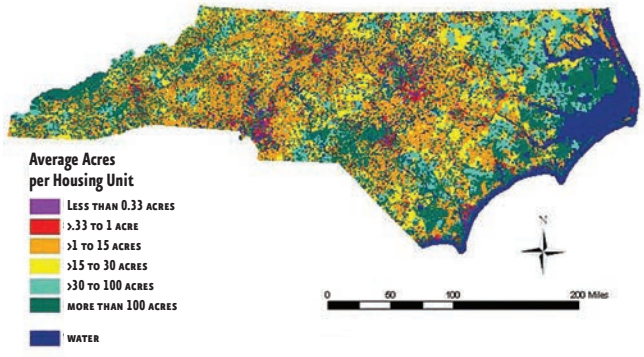
North Carolina's Challenge

North Carolina is facing unprecedented population growth and inefficient land development patterns that are putting pressure on the health of our natural resources.

Housing Density 1990



Projected Housing Density 2030



GRAPHICS COURTESY OF CONSERVATION TRUST FOR NORTH CAROLINA AND DR. VOLKER RADELOFF, UNIVERSITY OF WISCONSIN-MADISON

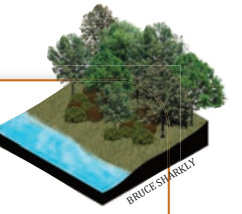
Suburban sprawl is generally defined in the literature as areas with 0.33 to one development unit per acre and where development uses are not mixed. Exurban or rural sprawl is generally defined as having one development unit per one to 20 acres, where farms and forests are converted to low density development on large lots.

Land Development Outpaces Population Growth

- According to the U.S. Census Bureau, North Carolina is consistently among the top ten fastest-growing and most populous states in the country.[2]
- Between 2000 and 2010, our population grew by 18.5 percent. The population is expected to increase from 9.5 to 12.4 million by 2030.[3]
- This population growth is fueling patterns of land development that threaten our environment, health, quality of life and wildlife habitat. Instead of concentrating development in town and city centers, our communities are spreading outward and using land less efficiently, which is also more costly to taxpayers.[4]
- Over one acre of land is developed for each new resident in North Carolina and the rate of land development has been growing faster than the rate of population growth.[5] Our major cities are developing over five times more land per new resident than in the 1970s.[6] Our land mass is 34.5 million acres on which we also accommodate agriculture and natural areas as well as development.
- In fact, North Carolina contains more sprawl regions: the Triangle, the Triad and the Charlotte metro area, than any other state.[7]
- On average over 100,000 acres of forests and fields are developed each year[8]— an area the size of Winston Salem and High Point combined.
- Over 30 percent of streams sampled for water quality are classified as impaired and do not meet standards for safe drinking water or their best use.[9]

The Status of Our Wildlife Species and Habitats

- Of more than 1000 wildlife species found in North Carolina, over 370 species are of conservation concern including 38 species already federally endangered or threatened and 101 species that are state endangered or threatened.[10]
- North Carolina contains eight of the 21 most endangered ecosystems in the United States—including spruce-fir forests, longleaf pine forests and forested wetlands.[11]


BRUCE SHARKLY

What is habitat?

Habitat is the natural environment that plants and wildlife need to survive. Streams, forests, rock outcrops, beaches, wetlands and fields are habitat types. Many wildlife of conservation concern need unique habitats and are declining due to habitat loss.

Examples of Impacts to Wildlife and Habitat from Development Patterns[12]

Habitats are reduced and fragmented by roads and other development.


DIRK STEVENSON

softshell turtle

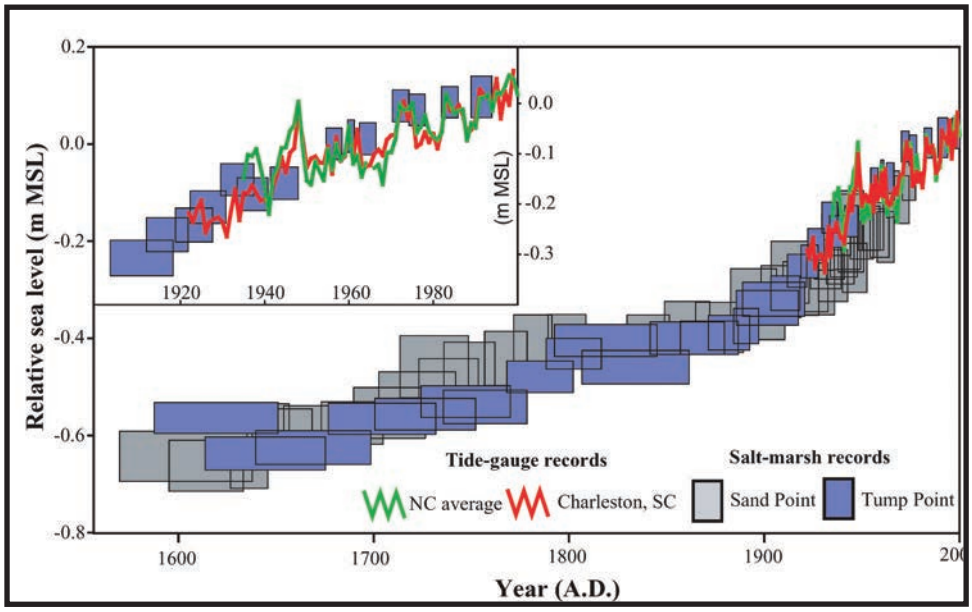
- Many songbird species are steadily declining with the loss of large areas of forest of 75 to 500 acres or more in the United States. Predation by feral and domestic cats and collisions of songbirds with tall structures, during migration, are also major factors.
- Amphibians and reptiles experience almost 100 percent mortality when crossing roads with over 2000 cars per day (1.4 cars per minute).
- Bald eagles[13] and colonial nesting waterbirds[14,15] often abandon their nests when development takes place during the nesting season within 330 feet or more of their nests.
- Tiger salamanders, Carolina gopher frogs and Bachman's sparrows are examples of fire-dependent species. Without regular low-intensity fires in their longleaf forest habitat, they will become extinct. Because of this and other reasons, contiguous stands of natural longleaf pine forest that are > 2,000 acres in size are needed.

What is prescribed fire?

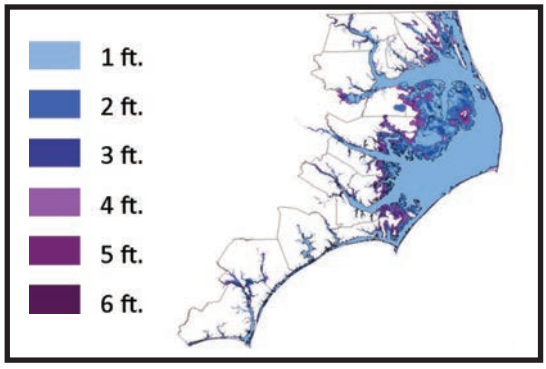
Most plant and wildlife species actually need occasional brush and forest fires. Fire clears out thick tree and shrub growth allowing plant seeds to germinate on bare mineral soil and receive enough sunlight to grow on the forest floor, improving forage and habitat. Occasional controlled burning, also called prescribed burning, conducted by professionals, is used to maintain fire disturbance for habitat management. Prescribed fire also protects our communities from wildfires that happen due to woody fuel build-up from lack of occasional fire. For more information, see the N.C. Prescribed Fire Council at www.ncprescribedfirecouncil.org.

The Increased Need for Safeguards: Climate Change and Sea Level Rise

- North Carolina experiences more billion-dollar climate and weather disasters than 43 other U.S. states and these events have been increasing in recorded frequency since 1980.[16]
- According to the State Climate Office of North Carolina (led by N.C. State University), the evidence of Global Climate Change is compelling and we can expect extreme weather events to increase in the future.[17]
- Sea level in North Carolina is reported to have risen 13 inches over the last century. Independent studies show that the rate of sea level rise increased 2 to 4 times over the last century.[18]
- The N.C. Coastal Resources Commission Science Panel concluded by consensus that a 3.3 foot increase in N.C. sea level is likely by 2100.[19]
- Climate change will likely cause increases in flood events and droughts in parts of our state.



Kemp et al. 2009. Reconstructed measured sea level along North and South Carolina. "Relative sea level (m MSL)" in graph is meters of mean sea level relative to the present. In 1900 sea level was about 0.32 m (13 inches) below present. The rate of sea level rise increased in the last century two to four fold over the rate from 1600 to 1900. [21]



Division of Coastal Management (2011). North Carolina coastal elevations from one to six feet. All areas in blue (up to three feet) would be submerged by 2100 if sea level continues to rise at observed rates. Inland flooding from storm surge and salt water intrusion would also result from increased sea level.[22]

diamondback terrapin STEPHANIE CHAVEZ

chestnut-sided warbler PLANETOFBIRDS.COM

How Will Climate Change Affect Wildlife?[20]

Patterns of development that fragment or isolate habitats will make it more difficult for many species to adapt to changing conditions.

- Increased severity and frequency of flood and drought events will alter the structure and availability of habitat and water in streams and wetlands. This will likely reduce wildlife survival.
- Coastal habitats, such as beaches, dunes and marshes, will be lost more rapidly than is natural, altered by rising sea level, increased storm surge and salt water intrusion.
- Because of climate change, plants are flowering and fruiting outside of the typical growing season, which impacts wildlife and pollinators that no longer have plant and insect food available at the right time of year.
- Plant communities in high elevation habitats may be severely altered if temperatures exceed the tolerances of those species. Worldwide, some wildlife species that can adapt are shifting their geographic ranges due to climate change.
- As habitats are altered or lost, it is more difficult in the face of climate change for wildlife and plants to relocate to areas with more suitable climatic conditions.

The Land Use Planning Gap

A critical gap in land use planning underlies these problems. Many communities in North Carolina lack adequate access to and training on how to incorporate wildlife and habitat conservation strategies in local and regional planning.

The Green Growth Solution

The Green Growth Toolbox bridges the land-use planning gap by providing recommended land use planning measures that will conserve valuable biodiversity and habitat without preventing necessary growth.

The Critical Role of Land Use Planning

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Land use planning will play a critical role in helping to safeguard our communities and make them more resilient to extreme weather events. Likewise, land use planning can help to make wildlife habitats and populations more resilient to the common threats we may face.

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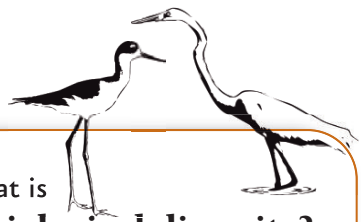
GREEN GROWTH PAYS DIVIDENDS—BENEFITS TO COMMUNITIES

Green Growth is a way to encourage wildlife habitat conservation while developing communities. It means more centralized growth that also conserves habitat and biological diversity while building homes, roads, businesses and shopping centers.

The N.C. Wildlife Resources Commission and its partners encourage you to put the Green Growth Toolbox to work to benefit local wildlife, habitats, communities and economies. Green Growth will pay dividends for generations to come—dividends that our children, grandchildren and great-grandchildren will need and enjoy.



What is biological diversity?

Biological diversity (or biodiversity) is the entire diversity of life—including individual species, habitats and entire ecosystems—in a given area.

Ten Ways Green Growth Benefits Communities

BENEFIT #1 Better health all around: Green Growth leads to healthy ecosystems and healthy communities.

The streams, rivers, soils, plants and animals in North Carolina's counties, cities and towns are part of complex ecosystems upon which our lives depend. Healthy ecosystems function well because they have more wildlife and plant species to support our web of life. When a community's biological diversity is maintained, healthy ecosystems support human health and the negative effects of disturbances are minimized. For example, without enough trees on the edge of streams, our waterways die because all aquatic life, including fish, depend on tree leaves for the base of their food chain. Without forested streams and aquatic life that naturally break down pollutants and harmful bacteria, our waterways pose risks to human health.

Natural areas benefit our health in other ways as well.

- Research at East Carolina University found that North Carolina communities with access to natural areas have lower rates of obesity.[23]
- Spending time experiencing nature is commonly shown to reduce stress and depression,[24,25] the leading causes of lower economic productivity.[26]
- Richard Louv's book, "Last Child in the Woods," demonstrates that some growing childhood behavior problems and obesity are linked to spending less time in nature.[27]

BENEFIT #2 Economic returns: Green Growth helps communities maintain ecosystem services, which can have significant economic returns.

Natural ecosystems provide us with trillions of dollars' worth of "free" services—flood control, water and air purification, crop pollination, groundwater recharge and climate regulation.

What are ecosystems & ecosystem services?

An ecosystem contains one or many types of habitat. An ecosystem is a natural system of all wildlife and plants that depend on one another for survival. Interactions among species and their environment in an ecosystem help to create human benefits as well. Through predation and uptake of nutrients, wildlife and plants clean our water and keep our forests, soils, fields and crops healthy. Forests and wetlands provide flood control and help to prevent drought. These and other benefits are called ecosystem services, which make up our natural life support system.

- One study estimated the value of these ecosystem services worldwide at $33 trillion per year—about the same as the world's gross domestic product.[28]
- Natural stormwater management, water filtration and air purification provided by nature preserves, stream buffers and trees in Charlotte and Mecklenburg County are valued at over $4.4 billion in avoided stormwater construction and $64 million in annual air purification.[29]
- New York City does not need to filter most of its drinking water because it receives most of it from the Catskills which is over 60% forested. This saved taxpayers over $8 billion in construction costs and $300 million in annual operating costs of a water filtration plant that is not needed.[30,31]
- In North Carolina, natural parks in Mecklenburg County generate five times more economic benefits (annually valued at $15 million) than they cost.[32] North Carolina public lands generate four times more economic benefit than their acquisition cost.[33]
- North Carolina National Wildlife Refuges provide $166 million per year in ecosystem services.[34]
- Bats contribute $4 and $53 billion per year to U.S. agriculture by feeding on insects that are harmful to crops. Native non-domestic insects contribute $57 billion per year to agriculture through pollination, predation and nutrient cycling.[36]

If ecosystems that provide these services are degraded, communities will need to spend an unreasonable amount of money to engineer and restore these services.

- Research shows us that protecting quality ecosystems, which possess the highest levels of biodiversity in a given area, ensures that the widest range of ecosystem services is maintained.[37]

BENEFIT #3 Environmental safeguards: Green Growth practices help your community mitigate damages from natural disasters, flooding, drought and climate change.

Natural disasters cost taxpayers and businesses exorbitant amounts of money to clean up. Communities can avoid many expensive outcomes by protecting wildlife habitat in hazard prone areas, which reduces the effects of natural disasters.

- Communities in our state and across the country are conserving natural floodplains in order to avoid loss of life and expensive flood-prone property buybacks. North Carolina receives $160 million on average annually in federal flood assistance.[38]
- For every dollar spent on prescribed fire to improve wildlife habitat and protect against wildfires, $2.14 was saved in wildfire fighting and property damage reduction.[39]
- Southern pine beetles cause up to $38 million of economic loss annually in North Carolina.[40] Woodpeckers have been shown to feed on up to 63% of adult southern pine beetles in forests, significantly reducing infestation.[41]

Green Growth Helps Minimize Drought Problems

Image of a highly eroded stream - Stream erosion results from stormwater runoff, which exacerbates drought.

Sprawling development exacerbates drought conditions. Impervious surfaces force water to flow out of a region rather than recharging groundwater.

- **Between 1982 and 1997, the N.C. Triangle Region lost between 9.4 and 21.9 billion gallons of water to runoff from impervious surfaces.**
- **Similarly, the Charlotte metro region lost between 13.5 and 31.5 billion gallons and the Greensboro region lost between 6.7 and 15.7 billion gallons.**[42]

By minimizing sprawling development patterns and impervious surfaces, communities can better avoid losing water and reduce the effects of future droughts.

BENEFIT #4 Streamline the permitting process and avoid environmental conflicts: The Green Growth Toolbox can help developers and your community avoid conflicts and environmental permit delays.

Public administration research demonstrates that environmental policies that reduce uncertainty actually enhance economic growth. With less uncertainty companies are more likely to invest.[43]

Use of the methods included in the Green Growth Toolbox can help your community proactively address endangered species issues. The Green Growth Toolbox can also help developers put sound conservation measures in place before the environmental review process, such as wetlands permitting, is initiated. While use of The Green Growth Toolbox cannot guarantee a permit outcome, when conservation measures are in place ahead of time, permits take less time.

BENEFIT #5 Attract new-economy businesses: By preserving high-quality and attractive green spaces, Green Growth can draw workers and businesses of the new economy to your community.

Today's marketplace is global, and information technology companies are key drivers of today's new economy.[44]

- In national and regional surveys, new economy companies rate natural amenities and environmental quality ahead of housing costs, cost of living, commuting patterns, schools and public safety in making decisions about where to locate. Businesses value greenways and their recreation opportunities because they decrease the health care costs of their employees.[45]
- Greenways attract recreation related businesses and improve quality of life.[46] Grand Forks, North Dakota restored the natural floodplain to prevent flooding and built a greenway to enhance economic development. *Cabella's* specialty retailers located a store near the greenway and doubled their retail sales expectations. Each greenway event generates $2.7 million in economic activity.[47]

BENEFIT #6 Increase prosperity: Incorporating Green Growth practices into development site design can increase property values, produce more profitable developments, and increase the economic competitiveness of a community.

It is important to buffer sensitive habitats from development with parks and natural areas so that development does not occur directly on the edge of a sensitive habitat. Buffering sensitive habitats with greenways and parks near development can make property more desirable and increase prosperity.

- In Apex, North Carolina, homes in the Shepherd's Vineyard development adjacent to the American Tobacco Trail sold for $5,000 more than other homes in the neighborhood.[48]
- In Brown County, Wisconsin, lots adjacent to the Mountain Bay Trail sold faster and for an average of nine percent more than similar property located away from the trail.[49]
- Homes within walking distance of natural parks sell for up to 20 percent more.[50] Larger parks are better for property values even in rural areas.[51]

Conservation developments are cheaper to build than conventional subdivisions.[52]

- In South Carolina, the costs of developing a 96-acre parcel in a conventional pattern were $10,000 more per lot than the cost of a conservation subdivision.[53]
- Analyses of recent major conservation subdivisions demonstrates an overall savings of 36 percent verses conventional subdivisions.
- Low impact development techniques to manage stormwater are dramatically and consistently less costly in the short and long-term due to less need for construction, maintenance and wastewater management. Savings range from 15 to 80 percent.[55]

Minimizing habitat impacts does not stop development.

- Ten years after small wetlands conservation bylaws were passed in Massachusetts the rate of land conversion from wetland to residential uses decreased. However, there were no decreases in housing units, housing values or housing density in those communities.[56]
- Seventy-six percent of homebuyers do not regard having a lawn as a very important feature.[57]
- Ninety-one percent of homebuyers in the Charlotte, North Carolina, region consider environmentally friendly community features and landscaping to be important.[58]

Adopting a Green Growth approach, therefore, can lead to more profitable developments and a competitive residential housing market in your community.

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The Cost of Sprawl

Studies on Cost of Community Services have shown that sprawl is far more expensive than compact development combined with protection of natural areas. If communities around the United States concentrated growth in city centers, it would save taxpayers the following amounts ANNUALLY through **2025**:

- **$110 billion in road infrastructure,**
- **$12.6 billion in water/sewer infrastructure and**
- **$4.2 billion in other public service costs.**[61]

Did you know that most residential development in North Carolina actually costs local governments more than what is covered by property taxes?

For example:

- **Residential development in Alamance County contributes 68 cents to the county for every dollar of public services used. That's a 32 percent average LOSS to the county.**
- **On the other hand, farm and forestland in Alamance County contribute $1.69 to the county for every dollar of services used. That's a 69 percent gain!**[62]

BENEFIT #7 Generate tourist income: Green Growth can help communities create responsible nature-based tourism opportunities.

Tourist dollars tied to nature-based recreation contribute substantially to North Carolina's economy. In 2011, 37 percent of North Carolinians participated in wildlife related recreation (primary purpose was wildlife sport or viewing) and $3.3 billion was spent by residents and visitors for this purpose. This is an increase of over 50 percent in spending from 2006.[59] Thirty percent of overnight visits in N.C. are for nature-related activities.[60] Protecting high-quality natural areas is a good investment in your community's tourism economy and the Green Growth Toolbox can help you identify the most valuable areas to protect.

BENEFIT #8 Reduce costs to taxpayers and local government: Green Growth can help local governments keep taxes low by reducing the cost of community services.

Strategically conserving important natural areas and concentrating development in county, town and city centers can provide big cost savings for communities.

- Spread-out residential and low density development far from town centers requires more expensive utility construction, maintenance and emergency services that need to extend over greater distances.[63]
- Seventy-eight percent of homebuyers in the Charlotte, North Carolina, area consider travel costs to be important.[64]
- For every 10 percent increase in forest and managed grassland cover in a watershed, water treatment costs decrease by 20 percent.[65]
- Stream restoration in North Carolina costs $1.2 million for every mile of stream.[66]
- Alternatively, the Green Growth approach of concentrating residential development in town and urban centers can help minimize these costs.
- By using hazard prevention policies that conserve wetlands, floodplain and surrounding upland habitat, fewer homes and businesses will require emergency services.

BENEFIT #9 Respond to public demand and promote your community: Green Growth helps local governments properly respond to citizens' conservation interests and this helps to attract new residents and businesses.

North Carolina citizens rank environmental protection as a high priority. In a 2005 public opinion survey, North Carolina residents felt it was very important to protect wildlife resources, even if it meant regulating land development.

- Of residents surveyed, 89% responded that it was very important that wildlife and natural areas exist in North Carolina for enjoying and experiencing nature.[67]
- In this same survey, citizens reported they were concerned that sprawl and overdevelopment will negatively impact North Carolina's wildlife.[68]

Successful local bond referendums also show citizen support for habitat protection.

- Nine North Carolina towns and cities have passed bond referendums totaling over $220 million to conserve land from 2005 to 2011.[69]

BENEFIT #10 Exemplary leadership: Leave a natural, economic and cultural legacy for future generations.

Our quality of life, our economy and our history come from and depend on the natural world. Using a Green Growth approach coupled with protection of property rights and effective economic development tools will comprehensively address the challenges of the future and enhance economic development. A Green Growth approach will help to leave a legacy for future generations that honors the responsibility to steward our wildlife, natural resources, economy and cultural heritage.

Resources for Conducting a Green Growth Benefits Analysis

For more on how your community can analyze the benefits of habitat conservation see:

- Cost of Community Services studies by N.C. State University and Dr. Mitch Renkow www.cals.ncsu.edu/wq/lpn/cost.html
- Charlotte and Mecklenburg County, North Carolina, Urban Ecosystem Analysis by American Forests http://charmeck.org/city/charlotte/epm/Services/LandDevelopment/trees/TreeCommission/
- NatureServe Vista is a free ArcMap 10 Extension based on CommunityViz that measures the benefits of conservation decisions for land use planning www.natureserve.org/prodServices/vista/overview.jsp
- "Ecosystem Services in Cecil County's Green Infrastructure," is a county local government example www.ccgov.org/dept_planning/DocsForms.cfm
- National Ecosystem Services Partnership, Duke University http://nicholasinstitute.duke.edu/initiatives/national-ecosystem-services-partnership
- United States Business Council, Ecosystem Services http://usbcsd.org/case-studies/biodiversity-and-ecosystem-services-case-studies/
- American Rivers, Natural Security Community Case Studies www.americanrivers.org/newsroom/resources/natural-security-how-sustainable-water-strategies-are-preparing-communities-for-a-changing-climate/

GETTING STARTED—TEN KEY STEPS TO GREEN GROWTH

How can your community get started with the Green Growth Toolbox?

1. Find out if Green Growth training workshops are offered in your region. If you work for a local government, then sign up! Contact us at greengrowth@ncwildlife.org.

2. Visit our website at www.ncwildlife.org/greengrowth. Download the Green Growth Toolbox GIS data package and begin using it in land use planning projects.

3. Establish a Conservation Commission or Environmental Review Board to help guide your community's Green Growth efforts.

4. Hire or assign a staff member to help implement and administer Green Growth projects in your community.

5. Develop a jurisdiction-wide strategic conservation plan. Work with conservation partners listed in Appendix B of the handbook to do this.

6. Meet cooperatively with neighboring municipalities, counties and regional planning organizations to cooperatively craft Green Growth strategies.

7. Amend your comprehensive plan to include Green Growth maps, goals and strategies appropriate for your community.

8. Streamline and enhance zoning and development ordinances to protect important species, habitats and ecosystems without hindering growth.

9. Start using Green Growth data to review development proposals and encourage developers to create wildlife-friendly development projects.

10. Establish a land acquisition fund and partner with your local land trust to purchase the highest quality natural areas in your community.

Communities across the country are addressing our natural resource challenges and realizing the benefits of conserving valuable ecosystems through innovative land use planning.

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SECTION 2. CONSERVATION DATA

TODD PIERSON

ornate chorus frog

The Green Growth Toolbox explains how to conserve priority wildlife and habitats in your community through three levels of land use planning:

- Visioning and plan making
- Incentives and ordinance and rule setting
- Development review and site design

To plan for Green Growth, communities need information and maps about important species, habitats and ecosystems in their jurisdiction. This section of the handbook describes the following for Geographic Information Systems (GIS) specialists and non-specialists:

- the three components of the Conservation Data for Green Growth,
- how to use the Conservation Data in site selection and the three levels of planning,
- and how to do natural resource inventories to supplement existing data.

THE CONSERVATION DATA FOR GREEN GROWTH

Available for download at www.ncwildlife.org/greengrowth

The Conservation Data for Green Growth is available for download from our website. It can be viewed with or without GIS software and online through the Natural Heritage Data Explorer. Our training workshops provide detailed guidance on how to interpret this data.

The highest priority wildlife habitats in greatest decline listed below are described in the N.C. Wildlife Action Plan and are represented in the GIS data explained in this section.

- Beaches and estuarine islands
- Coastal wetlands
- Maritime forests
- Longleaf pine forests
- Small wetland communities
- Mountain bogs
- Early successional habitat (grasslands and shrublands)
- Floodplain forests
- Habitats at high elevation
- Caves/mines
- Rock outcrops
- Streams and key aquatic habitats
- Large unfragmented, undeveloped parcels
- Undeveloped tracts in close proximity to existing Managed Areas
- Important wildlife travel corridors (natural areas between priority habitat areas)

Detailed information about priority habitats is available in the N.C. Wildlife Action Plan, which can be accessed at www.ncwildlife.org/Plan.aspx or via CD by emailing us at greengrowth@ncwildlife.org. Habitat descriptions are also available on the Wildlife Commission website at www.ncwildlife.org/Conserving/Habitats.aspx and in the Green Growth Toolbox regional appendices.

There are 3 components to the Conservation Data for Green Growth.

- **Component 1** (11 map layers)–centers on using the Biodiversity and Wildlife Habitat Assessment (BWHA) map. This assessment is part of the N.C. Conservation Planning Tool. The BWHA and other map layers that were used to create the BWHA values are provided as part of this component.
- **Component 2** (8 map layers)–is comprised of map layers that the N.C. Wildlife Resources Commission recommends be used in addition to the BWHA to give a complete picture of wildlife habitat conservation needs and opportunities in your community.
- **Component 3**– Additional regional information and map layers have been developed with more refined local data and appear as an appendix to the handbook if they are available in your planning area. See the map on page 33.

Collectively, these map layers constitute the Conservation Data for Green Growth.

When possible, we recommend downloading or receiving data from the original referenced source in order that you have the most up-to-date data. The boxes next to each map layer provide the original data title and source information.

Check the quick reference chart beginning on page 38 for summaries about how to use the data and to find out which map layers are appropriate to use in each level of planning.

The Natural Heritage Data Explorer

Most of the Conservation Data can be viewed online through the Natural Heritage Data Explorer available from the NC Conservation Planning Tool website or at https://ncnhde.natureserve.org.

What is the
N.C. Conservation Planning Tool?

The N.C. Conservation Planning Tool (http://ncnhp.org/conservation/conservation-planning-tool) is based on green infrastructure principles, which emphasize the importance of maintaining an interconnected network of green space that conserves natural ecosystems and provides associated benefits to our communities.

- The Conservation Planning Tool (CPT) identifies and prioritizes, on a statewide scale, essential high-quality natural resources required to maintain healthy ecosystems.
- This analysis pinpoints areas that are already protected as well as those areas that represent gaps, which are areas that would be a priority for conservation but are not protected.
- The goal of this tool is to highlight areas of opportunity to collaborate on conservation of significant natural resources.

ANNE OUTLAW

pine barrens treefrog

ANNE OUTLAW

marbled salamander

bobolink

COMPONENT 1 ➡ Biodiversity and Wildlife Habitat Assessment (BWHA)

Part of the N.C. Conservation Planning Tool

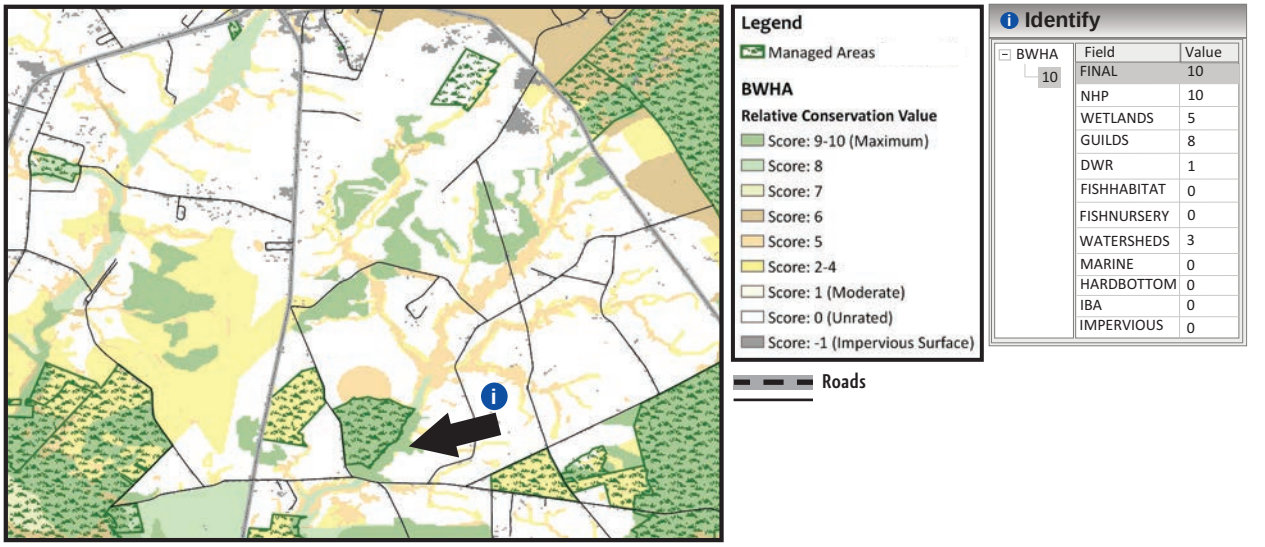
- GIS Raster File Title: bwha
- Original Source: N.C. Conservation Planning Tool

- The Biodiversity and Wildlife Habitat Assessment is a map that represents the highest priority areas for conservation of wildlife habitat and biodiversity in North Carolina.
- The BWHA is one map layer that is a composite 30 x 30 meter pixel grid comprised of most of the individual map layers used in the Green Growth Toolbox.
- The assessment is based on the best science and expertise from multiple sources. Areas with more rare, abundant and diverse species and habitats are rated as a higher conservation value on a scale of 10 to 1 in this map layer.
- The BWHA layer can be downloaded for the entire state by going to https://ncnhde.natureserve.org/content/data-download and from NC OneMap.
- The areas with a relative conservation value of maximum (10) to very high (7) are the most sensitive with the rarest species and habitats. These are the most important areas to conserve, buffer and connect for wildlife purposes.
- Areas with a rank of 6 to 1 are of high (6) to moderate (1) conservation priority. They play an important role in maintaining habitat connectivity and biodiversity but may not be as sensitive or rare as the higher ranked areas.
- The areas that appear as **grey** have at least 20 percent impervious surface and likely have the least habitat value. They have been assigned the value of –1.
- White areas are of unknown value and most have not been inventoried.
- Detailed information about the data used, the conservation value ranks and methods used for the BWHA can be found in Chapter 4 of the N.C. Conservation Planning Tool report at http://ncnhp.org/conservation/conservation-planning-tool/resources/report.

Recommended use of these data:

- To identify important habitats and wildlife travel corridors that can be used in transportation plans, land use plans and other plans, incentives and ordinances.
- At a fine scale, the boundaries of this layer may be inaccurate. We recommend using the individual component map layers in addition to the BWHA for development review and site design.
- If your conservation options are limited to only the highest priority areas, we recommend that the greatest conservation measures are placed in areas that rank from 10 to 7 in the BWHA. High priority areas can be connected by maintaining low density but clustered development in or outside low ranking areas.
- All areas with a value equal to or greater than 1 are very important to maintaining a healthy natural environment. Major development or major roads in these areas should be kept to a minimum as much as possible.

FIGURE 1. INTERPRETING THE BIODIVERSITY AND WILDLIFE HABITAT ASSESSMENT



- **When using the 'Identify' feature and clicking on the BWHA map layer in ArcMap or ArcMap Reader (free software available through our website) you will see the BWHA data table.**
- **A key to the BWHA legend and data table key is on page 37.**
- **The FINAL field shows the maximum Relative Conservation Value of 10. This value comes from the NHP (Natural Heritage Program) field value (10) which means that it is a Natural Heritage Natural Area (see below). The value of the highest ranked feature is the FINAL value.**
- **Also at that location are other natural features including a wetland with a value of 5, which means the data come from the National Wetlands Inventory (NWI). Please note that on the Coastal Plain the Coastal Region Evaluation of Wetland Significance (CREWS) data is available and is more accurate.**

What GIS Data Make up the Biodiversity and Wildlife Habitat Assessment?

N.C. Natural Heritage Program Map Layers

- The data below are provided by the N.C. Natural Heritage Program (NCNHP), which is within the N.C. Department of Environment and Natural Resources.
- The N.C. Natural Heritage Program website is www.ncnhp.org. See http://ncnhp.org/contact for contact information.
- NCNHP updates these data approximately four times each year. To inquire about receiving regular updates, contact the Conservation Information Manager.

Natural Heritage Natural Areas

(Formerly named Significant Natural Heritage Areas)

- GIS Shape File Title: nhna
- Original Source: N.C. Natural Heritage Program

Natural Heritage Natural Areas (NHNAs) are identified by N.C. Natural Heritage Program ecologists. These sites support rare and high-quality populations of native plants, wildlife and natural communities (habitats) on both land and water and are extremely important to the conservation of our state's biodiversity. A site's value rating may be due to the presence of rare species, rare or high-quality natural communities or other important ecological features.[1]

Aquatic Natural Heritage Natural Areas are included in this dataset.

Accuracy

All NHNAs are based on field surveys. These data are updated infrequently and some NHNAs may have been destroyed. It is important to verify their status on the ground ahead of site design or purchase.

Where can I find more information?

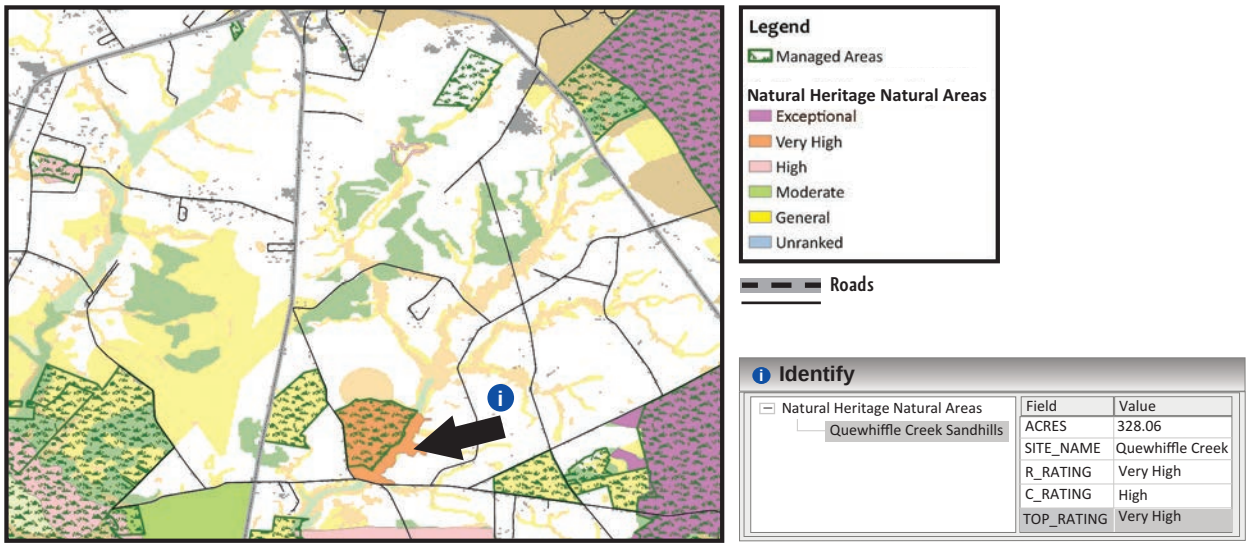
- Descriptions of each Natural Heritage Natural Area can be found in your county's Natural Heritage Inventory report, which can be accessed on the NCNHP website at http://www.ncnhp.org/references/publications by searching your county name.
- The file 'nhha.pdf' contains detailed instructions and comes with this map layer.
- The name and rating system for NHNAs have changed. The change is reflected in this GIS dataset and the 'nhna.pdf' file, but inventory reports may contain the old name (SNHA, Significant Natural Heritage Area) and rating system.

Recommended use of these data:

- To identify districts where conservation and connection of natural open space in development standards could be a priority.
- These areas should be set-aside from development as much as possible.
- To identify high priorities for new parks and conservation lands.
- To identify high priority areas where a proportion of the site could be required to be conserved, if habitat is verified by a site survey, or where the placement of required open space should be encouraged.
- To identify high priority routes for wildlife travel corridors.
- When using this data please contact us at greengrowth@ncwildlife.org.

Please note: The BWHA depicts a 300 foot wide area of high conservation value on each side of the waterways classified as *Aquatic* Natural Heritage Natural Areas (see Figure 4).

FIGURE 2. NATURAL HERITAGE NATURAL AREAS



*** Compare this to Figure 1 to view how NHNAs are depicted in the BWHA.**

Under the new NHNA rating system each NHNA has a C and R rating based on the biodiversity and rarity of species on the site (C rating) and the condition of the globally imperilled species populations on the site (R rating). The new TOP RATING field offers a single rating for each NHNA that is equal to the highest C or R rating.

Natural Heritage Element Occurrences

- GIS Shape File Title: nheo
- Original Source: N.C. Natural Heritage Program

- Natural Heritage Element Occurrence (NHEO) data identify approximate locations of rare plants, animals, unique natural communities and important animal assemblages (places where rare animals live in groups).
- These plants, animals, natural communities and animal assemblages are elements of natural diversity and features of conservation interest. Occurrences of these elements are referred to as element occurrences or "EOs."[2]
- Most agencies, biologists and ecologists in North Carolina contribute to this dataset so it is fairly comprehensive. It only contains data for rare species and habitats and not all priority wildlife and habitats species datasets are included.

The Limited vs. Detailed Data File

- The NHEO map layer included with the Conservation Data for Green Growth only shows limited information about each element occurrence and is appropriate for public use.
- The detailed data file contains sensitive information about the specific type of species. If you would like a copy of the full, detailed dataset for internal use, contact the N.C. Natural Heritage Program Conservation Information Manager. See http://ncnhp.org/contact.
- IMPORTANT – The detailed data file has been abused for illegal and damaging collection of rare wildlife and plants. The detailed data file should not be integrated into public online data systems or labeled with species names on maps.

These data may need to be filtered.

The limited NHEO data set provided with the Green Growth Toolbox has been filtered. No action is needed. When using the detailed NHEO layer obtained directly from the Natural Heritage Program or the limited layer from NC OneMap, please consider the following:

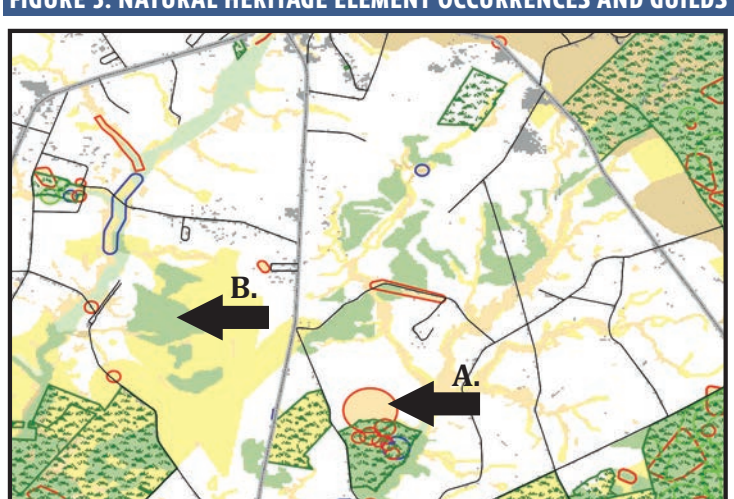
- The data set includes some historic records that are no longer viable and also some records for which the accuracy is low.
- Two steps are needed to filter the dataset:
  1. To display only occurrences that currently exist, delete records that are labeled “Historic” or “Destroyed” in the EO_Status column of the data table.
  2. To ensure that less accurate records are not used, delete records that are labeled “Low” or “Very Low” in the ESTI_ACCR column of the data table.

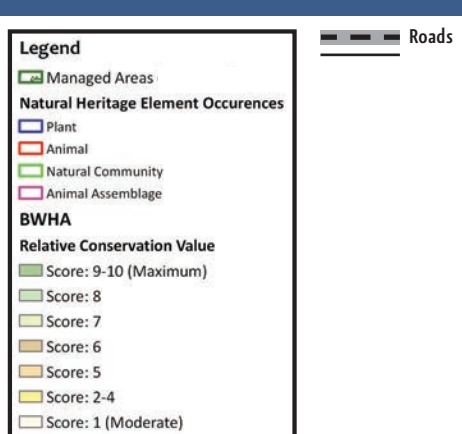
The Natural Heritage Program keeps these historic, destroyed and low accuracy records as part of the NHEO dataset because they are useful to biologists for habitat restoration and survey projects.

Where can I find more information?

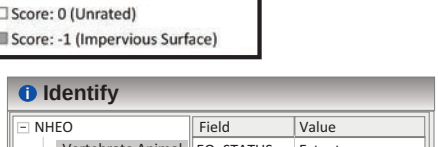
- Read the nheo.pdf file that comes with the data download *and*
- Contact the Natural Heritage Program
- Contact the Green Growth Toolbox Coordinator at greengrowth@ncwildlife.org

FIGURE 3. NATURAL HERITAGE ELEMENT OCCURRENCES AND GUILDS

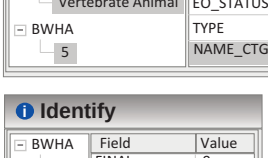




A.



B.



A) Depicts a Natural Heritage Element Occurrence for a rare animal. This area is ranked as a 5 out of 10 in the BWHA.

B) Depicts a habitat that is ranked as a 9 out of 10 in the BWHA because it is a 'Landscape Habitat Indicator Guild' (see below) of a rare and high-quality habitat type.

Accuracy

- These data come from field surveys and some NHEOs may have since been destroyed. It is important to verify their existence on site, if conservation is required.
- Some filtered NHEO data represents areas that are still quite large and general. NHEOs that are large perfect circles or squares mean that habitat for a species is likely to occur on undeveloped, natural areas within those polygons, but that the exact location has not been determined.
- The NHEO data used in the BWHA includes only the most accurate records.

Recommended use of these data:

See recommendations for Natural Heritage Natural Areas.

Landscape Habitat Indicator Guilds

- Interpret from the BWHA
- Original Source: N.C. Natural Heritage Program

Landscape Habitat Indicator Guilds (hereafter "guilds") represent high-quality, core wildlife habitats and connections between those habitats where wildlife can travel. These habitats are mapped based on the presence of guilds (groups) of species that use a particular type of habitat. These species are highly sensitive to habitat fragmentation and need large areas of habitat that are not separated by incompatible vegetation types, development or roads that they cannot travel across. Guild areas are ranked as a higher priority for conservation if they are more rare and if there are records of a larger number of guild species.

Where can I find more information?

- Chapter 4 of the CPT report at ncnhp.org/conservation/conservation- planning-tool/resources/report.

Accuracy
Each guild core habitat area is established only when field surveys confirm the presence of guild species within the habitat. The core areas and habitat connectors are then mapped using aerial photos. The extent of the habitat and wildlife travel corridors is based on the documented dispersal behavior of the guild species from the scientific literature.

Recommended use of these data:

- See recommendations for use of the BWHA.
- Interpret the presence of guilds from the BWHA where the data table "GUILDS" field is a value greater than 0.
- If using this data in site design, on the ground surveys may be needed.

Riparian Habitats and Priority Watersheds

The BWHA depicts buffers on all streams. These recommendations are based on extensive scientific research that demonstrates conditions necessary to conserve aquatic life. We recommend trying to keep impervious surfaces to 10 percent in all watersheds due to the detrimental effects of runoff on aquatic life. We recognize our recommendations may not always be possible and encourage local governments and developers to do as much as possible through development standards, especially in priority watersheds.

- GIS Shape File Title: Fed_hucs
- Original Source: N.C. Natural Heritage Program
- GIS map layer only available on the GGT website.

Streams within Subwatersheds with Federally Listed Fish and Mussels

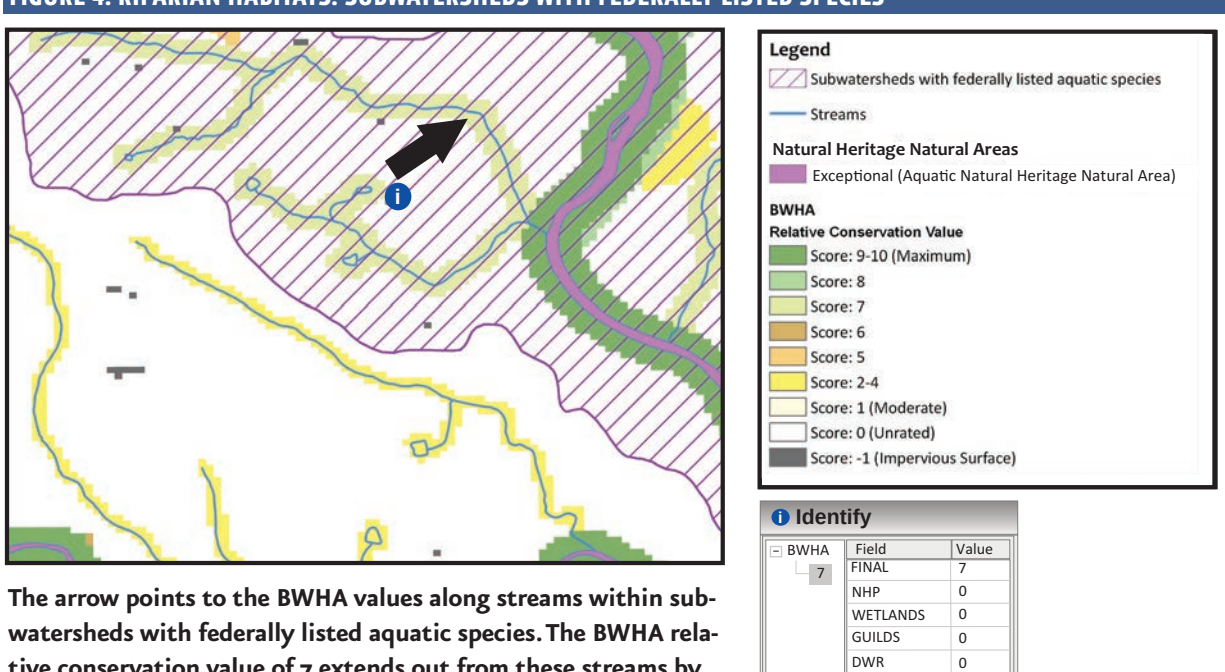
- Biologists with the N.C. Wildlife Resources Commission and the U.S. Fish and Wildlife Service conduct field surveys that help identify subsections of watersheds (subwatersheds) that contain federally listed fish and mussels.
- If a federally listed fish or mussel is found within streams in a subwatershed or if the subwatershed leads directly into waters that contain federally threatened or endangered species, the subwatershed will appear in this map layer.

Accuracy
These data are collected during field surveys and the map is updated every six months.

Recommended use of these data:

- All streams in these subwatersheds are recommended to have 200 foot buffers on each side of the stream to ensure the endangered animal's habitat is maintained. This buffer is represented on the BWHA map.
- Aim to keep impervious surfaces to a maximum of 10 percent in watersheds.
- These recommendations come from a scientific literature review and recommendations published by the NCWRC. See page 26, "Where can I find more information?" for details.

FIGURE 4. RIPARIAN HABITATS: SUBWATERSHEDS WITH FEDERALLY LISTED SPECIES



The arrow points to the BWHA values along streams within subwatersheds with federally listed aquatic species. The BWHA relative conservation value of 7 extends out from these streams by 200 feet to show that it is important to conserve native forests at least 200 feet wide on each side of these streams. Note that the Aquatic Natural Heritage Natural Area has a 300 foot wide area of high conservation value on each side. We recommend conservation of these buffer areas.

Map Layers from Other Organizations

Outstanding Resource Waters and High Quality Waters

- GIS Shape File Title: hqworw
- Original Source: N.C. Division of Water Resources

- In addition to using data on the location of streams, we recommend local governments use a layer that depicts watersheds that contain streams that are Outstanding Resource Waters and High Quality Waters.
- This map layer was developed by the North Carolina Division of Water Resources to, "enhance planning, siting and impact analysis in areas directly affecting waters considered as having excellent (high) water quality or designated as an outstanding resource."[3]
- Streams within these watersheds are important for wildlife habitat and biological diversity because they are high-quality, which means they are likely to support healthy ecosystems.

Accuracy
These waters go through a rigorous process to become designated but are not always taken off of this list once they become impaired and no longer meet the criteria.

Recommended use of these data:
- To identify priority watersheds within which streams or rivers could be buffered by at least 100 feet (or 200 feet if they also contain federally listed species) on each side.
- Aim to keep impervious surfaces to a maximum of 10 percent in watersheds.

Wild Brook Trout Streams (Mountains only)

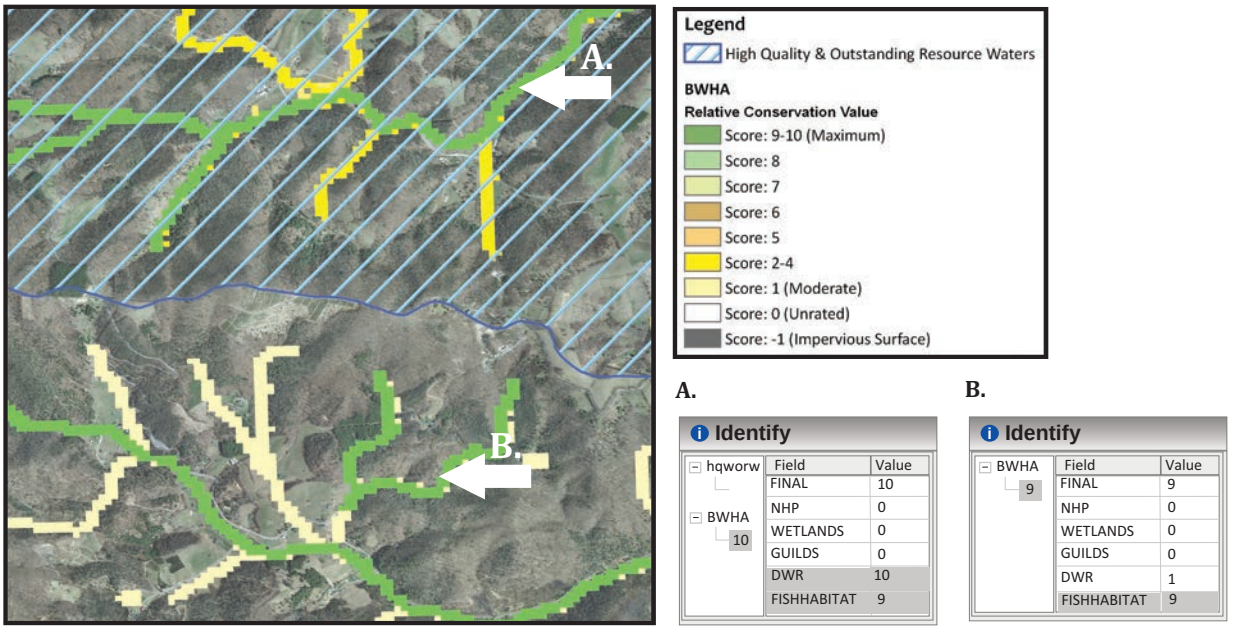
North Carolina is home to more brook trout than anywhere else in the Southeast, yet this prized fish has been greatly impacted and now exists only in 20 percent of its historic range.

We do not provide these streams as an individual map layer because it is possible to identify the location of these streams from the BWHA map and by using the 'hydro24k' streams map layer (on page 27). These streams are identified in the BWHA data table as FISHHABITAT with a BWHA rank of 9 and have a 100 foot buffer mapped on each side of them.

Recommended use of these data:

- To identify priority watersheds with streams or rivers that could be buffered by at least 100 feet (or 200 feet if they also contain federally listed species) on each side.

FIGURE 5. RIPARIAN HABITATS: HIGH QUALITY AND OUTSTANDING RESOURCE WATERS AND WILD TROUT STREAMS



A) The BWHA relative conservation value for this stream is a 10 because the stream is rated as Outstanding Resource Waters by the N.C. Division of Water Resources (DWR). The GIS map layer for High Quality and Outstanding Resource Waters, which is a statewide map is also depicted. The data table shows a value of 9 for FISHHABITAT. This means that the stream also contains wild trout. Wild trout only occur in some streams in the mountains.

B) This stream contains wild trout and is not rated as High Quality and Outstanding Resource Waters therefore the BWHA value at this location is 9 for the FISHHABITAT field and the FINAL field.

Where can I find more information on aquatic wildlife conservation?

N.C. Wildlife Resources Commission conservation recommendations for aquatic wildlife can be found in the publication, "Guidance Memorandum to Address and Mitigate Secondary and Cumulative Impacts to Aquatic and Terrestrial Wildlife Resources and Water Quality" (2002).
www.ncwildlife.org/Conserving/Programs/HabitatConservationProgram.aspx.

Streams

- GIS Shape File Title: hydro24k
- Original Source: N.C. Division of Water Resources
- Best GIS data are available for some streams via the N.C. Stream Mapping Project.

- State regulations administered by the N.C. Division of Water Resources require the use of their data by communities in several river basins. You should consult these regulations, located at http://deq.nc.gov/about/divisions/water-resources/water-resources-regulations, as this handbook is not meant to describe or replace these regulations.
- The best available source of data to identify and classify streams is from the North Carolina Stream Mapping Project. Unfortunately, this dataset is currently only available for certain mountain counties. Visit www.ncstreams.org.
- The dataset that is available statewide for streams is the 1*:24,000-scale Hydrography with Water Classifications based on the USGS 1:24,000 scale Topographic Quad Data* (also known as "blue-line" streams).

Accuracy
Research indicates that USGS topographic maps (and USDA Soil Survey maps) are somewhat inaccurate. Due to such inaccuracies, we recommend field surveys be conducted to identify and classify stream location and quality ahead of development.

Recommended use of these data:

Identify stream location on the ground.

- The 'hydro24k' map layer is most appropriate to use for viewing the general locations of streams. If N.C. Stream Mapping data is not available it is best to survey stream location on site.
- The North Carolina Division of Water Resources (DWR) has developed a stream identification manual that presents guidance on identifying intermittent and perennial streams in North Carolina, located at https://deq.nc.gov/about/divisions/water-resources/water-resources-permits/wastewater-branch/401-wetlands-buffer-permitting/stream-determinations.

Buffer verified streams in order to adequately conserve aquatic life and water quality.

Use the DWR Classifications in the data table to understand the BWHA rank for stream buffers.

- The BWHA ranks stream buffer areas based on the DWR surface waters classification – denoted as the field DWR in the BWHA data table. Refer to Chapter 4 of the N.C. Conservation Planning Tool Report for DWR Classifications and BWHA conservation value ranks.
- In the hydro24k streams map layer data table, refer to the 'CLASS' field for descriptions of the DWR Surface Water Classifications.
- Use the BWHA rank to identify priority stream buffers when stream buffers on all streams are not possible.

Where can I find more information?
The NCDENR Division of Water Resources website on Surface Water Classifications at https://deq.nc.gov/about/divisions/water-resources/planning/classification-standards/classifications.

Wetlands

Coastal Region Evaluation of Wetland Significance (CREWS)

- GIS Shape File Title: [County name]_wets
- Original Source: N.C. Division of Coastal Management.

This dataset contains information on wetland quality and is sometimes more accurate than the National Wetlands Inventory below. The CREWS analysis differentiates between exceptional, substantial and beneficial wetlands. Exceptional wetlands are the highest quality and the best functioning. The CREWS data provided through the GGT website includes a legend for these wetland significance ratings. Please see the Green Growth Toolbox Coastal Region Appendix and N.C. Division of Coastal Management website (https://deq.nc.gov/about/divisions/coastal-management/coastal-management-data) for more information.

National Wetland Inventory (NWI) Wetlands

- GIS Shape File Title: CONUS_wet_poly
- Original Source: U.S. Fish & Wildlife Service

NWI Layer—and its Limitations

- The only available GIS layer that displays wetland locations across the state is the National Wetland Inventory layer, which was produced in 1983 using high altitude aerial photographs and elevation, soils maps and other information.
- Due to the inaccuracies in photo interpretation and draining and ditching of wetlands over the past decades, this layer is generally considered to have moderate to low accuracy because it does not completely reflect conditions on the ground.[4] In addition, this layer does not have easily accessible wetland quality information.
- Yet, because the NWI layer is the only available source of wetland data for the entire state, we recommend using this layer in planning.

Where can I find more information?

- For more information on the NWI, visit www.fws.gov/wetlands/index.html.

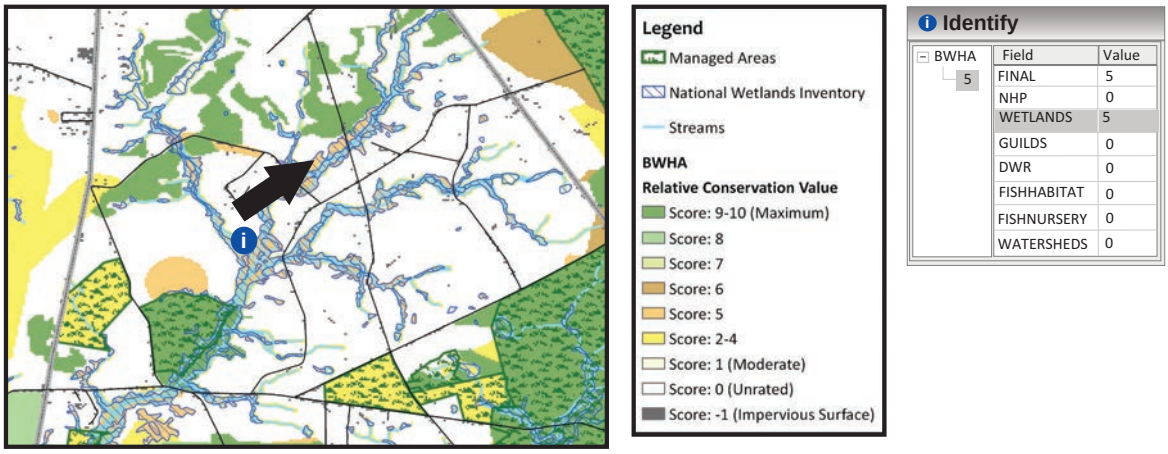
Recommended use of these data:

- To identify areas where many wetlands exist and where extensive development may not be appropriate in order to conserve water and wildlife.
- In order to conserve small wetland communities (isolated wetlands fed by surface water and not by streams or rivers) for wildlife and water quality, it is essential that wetlands be surrounded with undisturbed upland habitat. For more information and recommended buffer widths, see Section 3, pages 50 to 51.
- To identify areas to survey for confirmation of wetland presence and habitat quality.

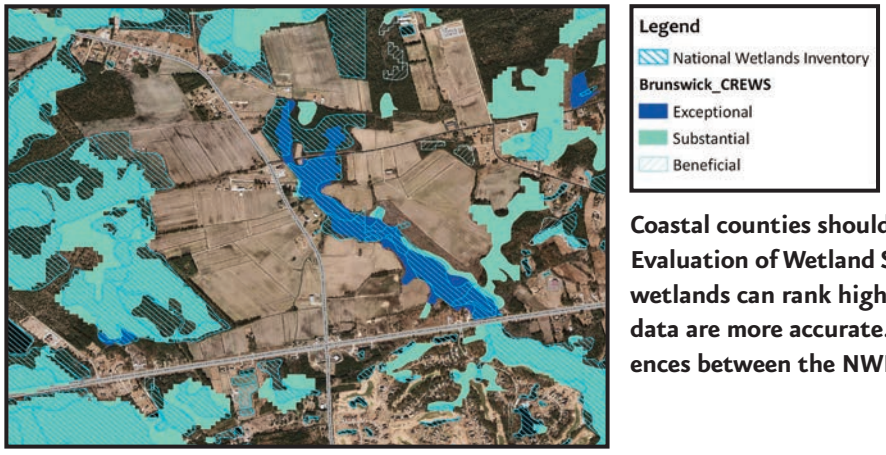
Why are wetlands important for wildlife?

- In addition to playing an important role in cleaning and storing our water, many wetlands provide outstanding wildlife habitat and have high biodiversity.
- The N.C. Wildlife Action Plan identifies wetland communities as priority habitats for conservation efforts across the state.[5]
- Small wetland habitats such as vernal pools, seeps, bogs and small depression ponds are especially important as breeding sites for amphibians and reptiles because they do not typically contain fish that prey on their eggs and young.
- Due to the lack of regulations for protecting small wetlands (typically < 0.1 acre), these are declining dramatically along with the unique animal and plant species that depend on these types of wetlands.

FIGURE 6. WETLANDS



For non-coastal counties the available wetlands data are from the National Wetlands Inventory (NWI), pictured above. The BWHA 'WETLANDS' value for NWI wetlands is always 5.



Coastal counties should refer to the Coastal Region Evaluation of Wetland Significance—CREWS. CREWS wetlands can rank higher in the BWHA because the data are more accurate. This image shows the differences between the NWI and the CREWS maps.

Important Bird Areas (IBAs)

Important Bird Areas are documented and mapped by the N.C. Audubon Society using field survey data. All IBAs rank as a 6 in the BWHA.

Audubon NORTH CAROLINA

- GIS Shape File Title: NC_IBAs
- Original Source: N.C. Audubon Society

"IBAs, are places that provide essential habitat for one or more species of birds at some time during their annual cycle, including breeding, migration and wintering periods. Well-known North Carolina IBAs include iconic landmarks such as Grandfather Mountain and Cape Lookout National Seashore. Nearly all of the state's IBAs include a state, federal, or nongovernmental conservation lands component, but many also contain a high percentage of privately owned and managed land" (N.C. Audubon).[6]

Recommended use of these data:

- This data is most appropriate for visioning and plan making because IBAs are typically very large. All areas within the IBAs are important to birds, however, specific habitat that should be conserved within the IBAs is best identified by a biologist or by using the other map layers in the Conservation Data for Green Growth.
- Identification, during visioning and plan making, of areas where large blocks of fields and forests should be maintained.

COMPONENT 2 ➡ Statewide Data to Use in Addition to the Biodiversity and Wildlife Habitat Assessment

Managed Areas

- GIS Shape File Title: marea
- Original Source: N.C. Natural Heritage Program

- This layer displays private and public lands that are managed under an agreement, easement or public ownership where habitat management is one of the goals. Management on these areas can include prescribed burning and tree thinning that enhances wildlife habitat.
- The N.C. Conservation Planning Tool provides a more extensive set of Open Space and Conservation Lands maps that include lands that are not managed for habitat.

Recommended use of these data:

- Buffer and connect these areas with other natural areas by encouraging agricultural districts around and between them. Managed Areas include NCWRC Game Lands discussed below.

Why is it important to connect Managed Areas with corridors of undeveloped land?
When lands that are permanently conserved are surrounded by development, many wildlife species and habitats within them will cease to exist. Wildlife and plant populations need to be connected with one another to maintain genetic diversity.

Smoke Awareness Areas

- GIS Shape File Title: Smoke_Awareness
- Original Source: N.C. Wildlife Resources Commission

Smoke awareness areas demonstrate locations that are most likely to experience smoke from prescribed burning. See page 4 for information on prescribed burning. These ares are indicated by a one half mile boundary drawn around the perimeter of lands managed with fire. The Sandhills GGT Regional Appendix has more refined Smoke Awareness Area maps based on local conditions. Most prescribed burns occur on smaller units within larger tracts of managed lands. Agencies and organizations that conduct prescribed burns do so only under conditions that are designed to maximize vertical smoke dispersal and minimize any impacts to public safety. See Section 5, page 94, for information on Wildfire and Smoke Management ordinances.

Recommended use of these data:

- To identify areas where working lands or natural areas should be encouraged to avoid the exposure of residents to smoke for a few days every two to three years.

Game Land Hunting Safety Buffer

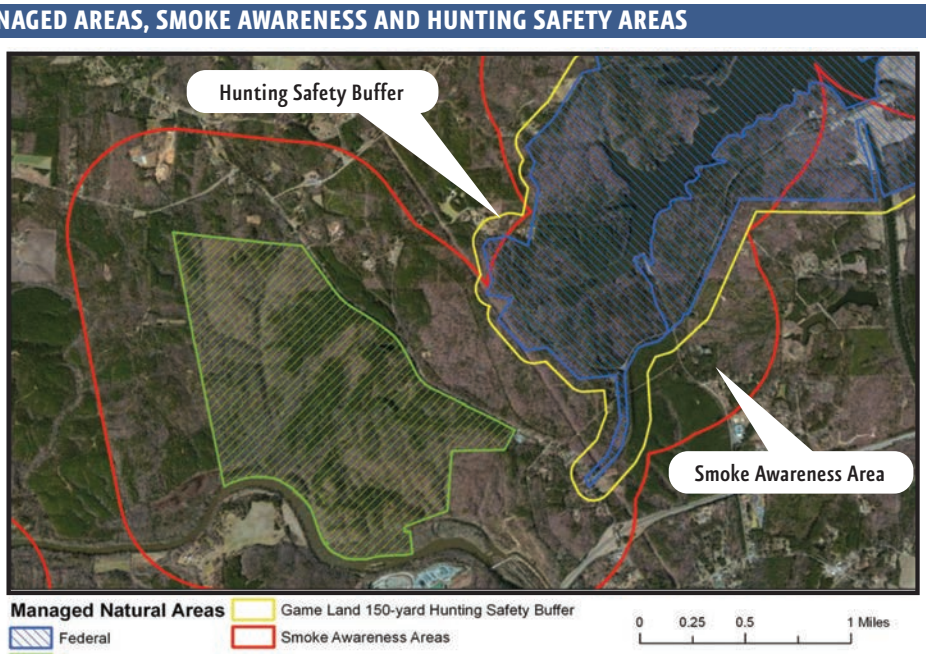
- GIS Shape File Title: gml_buffer
- Original Source: N.C. Wildlife Resources Commission

- Conflicts can arise between Game Land users and residents who live close to Game Lands, such as disturbance to homeowners and limits to hunting on Game Lands. To minimize such conflicts, we recommend establishing a 150 yard hunting safety buffer around Game Lands in your jurisdiction, especially in areas where Game Lands are narrow.
- The hunting safety buffer map layer displays this recommended 150 yard buffer.

Recommended use of these data:

- To identify areas where working lands or natural areas should be encouraged to maintain habitat quality and connectivity and the use of Game Lands for hunting.

FIGURE 7. MANAGED AREAS, SMOKE AWARENESS AND HUNTING SAFETY AREAS



Managed Areas are privately or publically owned and are managed for wildlife and biodiversity conservation to some extent under a conservation agreement. These areas appear in hatched colors above. The managed areas where prescribed fire takes place have a smoke awareness area mapped around them. N.C. Wildlife Commission Game Lands have a hunting safety buffer of 150 yards mapped around them. It is important to encourage working lands around and between Managed Areas to maintain habitat quality and wildlife travel corridors.

Colonial Waterbird Nesting Colony Buffers

- GIS Shape File Title: Waterbird_nest_buffers
- Original Source: N.C. Wildlife Resources Commission

This map layer displays areas where groups of waterbirds such as herons and egrets, nest in colonies. Research shows that disturbance from development causes colonial waterbirds to abandon their nests if the development takes place within 330 feet of the colony. This map layer displays the 330 foot buffer on each nesting colony.

Recommended use of these data:

- To identify areas for a 330 foot no-touch buffer that will protect colonial waterbirds.

Bald Eagle Nest Buffers

- GIS Shape File Title: Contact NCWRC for data
- Original Source: N.C. Wildlife Resources Commission

Bald eagles are protected under the Bald and Golden Eagle Protection Act. This map layer displays a 330 and a 660 foot buffer on each nest. See page 100 for more information.

Recommended use of these data:

- To identify areas for a 330 foot or 660 foot no-touch buffer that will protect bald eagles. A 660 foot buffer is needed if development is visible from the nest.
- We recommend consulting with the U.S. Fish and Wildlife Service. See Appendix B for contact information.

Floodplain Boundaries from the N.C. Floodplain Mapping Program

- In addition to using floodplain data to reduce flood hazards, data on floodplain location can help local governments plan to conserve valuable wildlife habitat.

> • Original Source: N.C. Floodplain Mapping Program
> • Download from their website at www.ncfloodmaps.com/

- The best available data on floodplains is the N.C. Floodplain Mapping Program.
- To download floodplain data for your county, visit www.ncfloodmaps.com.

Recommended use of these Data:

- Displaying floodplain boundaries can provide a starting place for identifying important floodplain forest habitats within floodplain boundaries either with aerial photos or on the ground surveys.
- Consider discouraging major development in the 100 or 500-year floodplains. One hundred-year floods (one percent chance of annual flooding) may become more common due to climate change. Property damage can be reduced by conserving habitats for wildlife and plant communities by not building in floodplains.

Other Assessments in the N.C. Conservation Planning Tool

Besides the Biodiversity and Wildlife Habitat Assessment, the CPT includes other natural resource assessments available at https://ncnhde.natureserve.org/content/data-download. Detailed information on the map layers is provided in the CPT report at http://ncnhp.org/conservation/conservation-planning-tool/resources/report.

- Open Space and Conservation Lands by the N.C. Natural Heritage Program
- Agricultural Lands Assessment by the N.C. Department of Agriculture www.ncmhtd.com/EnvironmentalPrograms/AgAssessment/
- Forest Lands Assessment by the N.C. Forest Service based on the N.C. Forest Action Plan (www.ncforestactionplan.com). www.ncmhtd.com/NCFS/ForestActionPlanPriorityLayers/.

Recommended use of this data:

- To identify areas where multiple natural resources and wildlife conservation objectives can be achieved through maintaining agricultural districts, connected wildlife habitat and working lands.

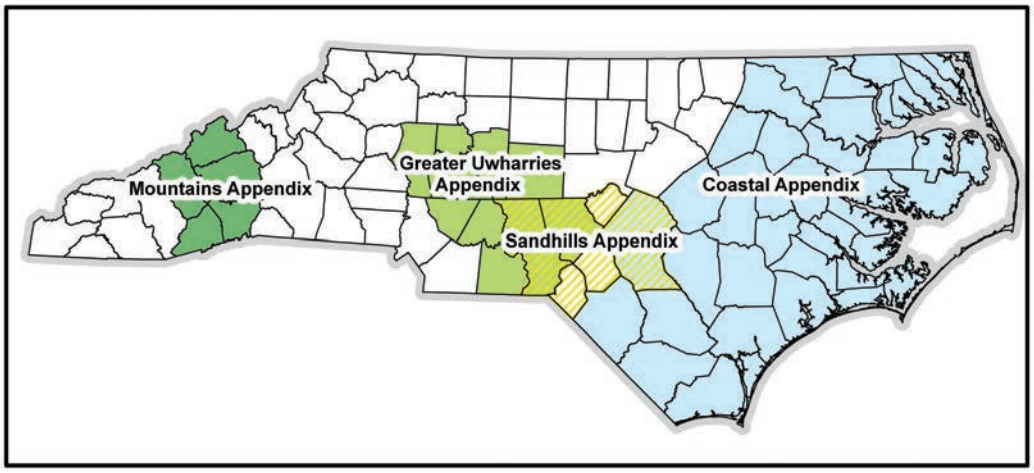
Further References for Conservation Planning

There are a variety of resources that can be used to identify priority areas to employ conservation-based development planning methods. The number of map layers and the scale of the tools below make them most appropriate for reference to identify priority conservation areas during planning as opposed to being part of the core set of Conservation Data for Green Growth map layers. See Appendix F for details and links.

- The Conservation Blue Print - crafted by "Landscape Conservation Cooperatives," the Blueprint identifies priority areas, habitat types and estimates habitat quality.
- The Conservation Planning Atlas - contains many map layers from habitat quality to projected development.
- Conservation Opportunity Areas - watersheds that have the most need for conservation due to the likely occurrence of species of greatest need on unprotected lands.

COMPONENT 3 ➡ Regional Datasets and Habitat Information

- In addition to data that are relevant statewide, more detailed conservation data exist for different regions of the state.
- Regional conservation datasets are available for the regions pictured below and are explained along with regional habitat information in a Regional Appendix of this handbook.



USING CONSERVATION DATA IN LOCAL PLANNING

Local governments can take four basic steps to start using the Conservation Data for Green Growth in planning activities:

1. **Integrate the data with your community's online or networked GIS database.**
2. **Use the data in visioning and plan making.**
3. **Use the data in incentives and ordinance and rule setting.**
4. **Use the data in development site location, review and design.**

1. Integrate the dataset with your community's GIS database.

- The most effective way to use this dataset is to integrate it with your community's existing GIS database and online interactive map server.
- These layers can then be easily accessed by developers for site selection, all local government departments and the public during planning projects.
- Prevent illegal collection of rare species by displaying only the public Natural Heritage Element Occurrence data without species names on public maps.

Example

- To see an example, visit Chatham County, North Carolina's mapping website, located at www.chathamgis.com/mapguide/ChathamGISWeb. Click on the folders labeled "conservation planning," "natural heritage" and "wildlife resources commission" to see layers from the Conservation Data for Green Growth in action.

Update Data Regularly

It is important to schedule regular updates of your community's Conservation Data. The dataset available for download on the Green Growth website will be updated once per year. It is best if you schedule updates for different layers from their original source using information provided in the quick reference guide on page 38.

2. Use the dataset in visioning and plan making.

For more detailed information, see Section 4, "Green Planning."

Green planning refers to creating and revising planning documents and stand-alone conservation plans to consider, encourage and enable conservation of priority habitats.

To integrate the Conservation Data for Green Growth in visioning and plan making follow these steps:

1) Display the map layers in planning documents and provide descriptions of what each layer means.
2) Develop strategies to conserve and connect the important species, habitats and ecosystems displayed on maps. A menu of conservation strategies is presented in Section 4.
3) Identify natural areas that may contain important wildlife habitats that have not been mapped such as springs, seeps and vernal pools. Establish goals and strategies to gather this information.

3. Use the dataset in incentives and ordinance and rule setting.

For more detailed information, see Section 5, "Greening Ordinances."

Greening incentives, ordinances and rule setting involves creating and revising land use incentives and regulations to implement the goals and strategies for habitat conservation set forth in planning documents.

To use the Conservation Data for Green Growth in ordinance and rule setting:

1) Display the map layers on parcel maps and use these maps to help guide development of incentives, placement of zoning districts or subdivision ordinances that encourage open space conservation.
2) Integrate requirements for using the data in relevant parts of your subdivision ordinance. For instance, require development proposals to display conservation data map layers on development plans to help guide voluntary conservation.

4. Use the dataset in development site location, review and design.

For more detailed information, see Section 6, "Greening Development Site Location, Review and Design."

To "green" developments planners and local government staff can follow three basic steps:

1) Consult the Conservation Data for Green Growth to see if any map layers overlap with the parcels to be developed.
2) Highlight any overlapping habitat areas on preliminary development sketch plans and bring these areas to the applicant's attention.
3) Help the applicant incorporate wildlife friendly development practices into their preliminary plans using the recommendations in Section 3.

Caveats:

* Please note it is not appropriate to require conservation of natural areas solely based on map boundaries. Site surveys are needed to verify habitat presence ahead of development design when specific habitats are required to be conserved.
* It is appropriate to use maps to guide which *districts* require open space set asides. If site surveys before development are not a desired requirement, it is appropriate to encourage (but not to require) that the specific location of natural open space be within mapped habitats.
* It is appropriate to require some form of open space conservation within the boundaries of the game land hunting safety buffers and other map layers based on property boundaries if desired.

NATURAL RESOURCE INVENTORIES AND SITE SURVEYS

A natural resource inventory or a site survey involves biologists and ecologists doing fieldwork to collect information about the location and status (condition or rarity) of important species and habitats. The Conservation Data for Green Growth may not always provide all of the information your community may need to understand the condition of local natural assets. Although using conservation data is a good starting point, you may wish to do a more extensive field inventory to supplement existing information.

Natural Resource Inventories—Where to start

The following five steps will help you get started.

Step 1. Determine if your county or city needs additional natural resource information.

- First, identify what field inventory work has already been done in your jurisdiction.
- The N.C. Natural Heritage Program has conducted "Natural Heritage Inventories" for many counties across the state. To determine whether an inventory has been completed for your county, visit www.ncnhp.org/activities/inventories and search for your county's name in the Natural Heritage Program's publications database at http://www.ncnhp.org/references/publications.
- Even if a Natural Heritage Inventory has been conducted recently, you may want additional information—whether for a specific watershed or your entire jurisdiction.

Step 2. Identify how the inventory will be used. You could use the inventory to:

- Better guide transportation and hazard planning
- Develop conservation strategies for your comprehensive plan
- Update outdated inventories
- Improve information to be more competitive for land acquisition grants for natural parks and historic sites
- Identify important districts or sites for conservation subdivisions
- Improve management of parks, open space, trails and greenways

Step 3. Develop a list of the types of natural resources to be inventoried. A qualified biologist can assist in developing this list, which may include:

- Streams, wetlands, springs, seeps
- High-quality and rare natural communities
- Important wildlife habitats identified in the N.C. Wildlife Action Plan
- Significant or sensitive native plant communities
- Forest resources, including canopy cover, native forest communities and plantations
- Location of invasive, exotic species outbreaks

Step 4. Identify how the inventory will be completed.

- An ecological consultant could be hired to complete the inventory.
- Refer to Appendix B for contact information of partner agencies and organizations who may be able to assist your community to complete the inventory at lower expense.
- Work with a biologist to organize a "Bioblitz" as part of your inventory. These are fun events where families, school groups and ecological experts team up to inventory every area possible within 24 hours.
- Whatever your approach, be certain to involve organizations with biological expertise to ensure the inventory methodology is sound.

Step 5. Conduct the inventory, analyze the data and develop your product.

- Qualified natural resource professionals should lead the inventory and data analysis efforts.
- One of the most useful products can be a database containing the inventory results.
- Maps displaying the inventory and other conservation data can then be used in all of your community's planning activities.

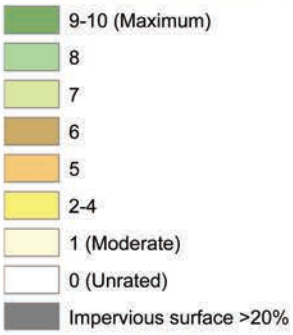
Examples of Local Natural Resource Inventories

- Mecklenburg County, North Carolina, Division of Natural Resources conducts biological inventories to guide park management and purchase.
- Orange County, North Carolina, actively updates and uses their Natural Heritage Inventory (http://orangecountync.gov/ercd/NaturalAreasReportIntoduction.asp) in their comprehensive plan and in their Natural and Cultural Resources Conservation programs (http://orangecountync.gov/deapr/nat_cul_resources.asp).
- Wake County, North Carolina, Parks, Recreation and Open Space Department conduct natural resources inventories for their parks and work to dedicate nature preserves in partnership with the Wake Nature Preserves Partnership. http://wakenature.wordpress.com/
- The City of Portland, Oregon, Natural Resource Inventory uses aerial photography and GIS to map important buffers, habitats and wildlife travel corridors. www.portlandoregon.gov/bps/59299
- The City of Lakeland, Tennessee, conducts a Natural Resources Assessment used in their Comprehensive Plan. www.lakelandtn.gov/index.aspx?NID=155
- Dutchess County, NY, has an award winning Natural Resources Inventory used in land use decision making. http://dutchessemc.org/projects/dutchess-county-nri/

LEGENDS FOR CPT ASSESSMENT LAYERS

Biodiversity/Wildlife Habitat Assessment

Relative Conservation Value



Identify Tool results for the Biodiversity/Wildlife Habitat Assessment			
Category Name	**Value**	**Individual Input Layers**	**Source for Input Layers**
NHP	10	Significant Natural Heritage Areas – Outstanding and Very High Ranking	*NC Natural Heritage Program*
NHP	8	Significant Natural Heritage Areas – High and Moderate Ranking	
NHP	6	Significant Natural Heritage Areas - General Ranking	
NHP	5	Element Occurrences – High Ranking	
NHP	4	Element Occurrences – Other	
Wetlands	7	Coastal Region Evaluation of Wetland Significance (CREWS) – Exceptional	*NC Division of Coastal Management*
Wetlands	6	Coastal Region Evaluation of Wetland Significance (CREWS) – Substantial	
Wetlands	5	National Wetlands Inventory	*US Fish and Wildlife Service*
Wetlands	2	Coastal Region Evaluation of Wetland Significance (CREWS) – Beneficial	*NC Division of Coastal Management*
Guilds	1-10	Landscape Habitat Indicator Guilds	*NC Natural Heritage Program*
DWQ	10	Outstanding Resource Waters	*NC Division of Water Quality*
DWQ	9	Stream BioClassification - Excellent	
DWQ	8	High Quality Waters	
DWQ	7	Stream BioClassification - Good	
DWQ	1	All other streams	
FishHabitat	9	Wild Brook Trout	*NC Wildlife Resources Commission*
FishHabitat	8	Anadromous Fish Spawning Areas	*NC Division of Marine Fisheries*
FishNursery	8	Fish Nursery Areas	*NC Division of Marine Fisheries*
Watersheds	7	Stream buffer tributaries to Threatened & Endangered Species	*NC Natural Heritage Program*
Watersheds	3	Priority Watersheds	*NC Natural Heritage Program, NC Wildlife Resources Commission*
Marine	8	Oyster Sanctuaries	*NC. Division of Marine Fisheries*
Marine	6	Submerged Aquatic Vegetation	
Hardbottom	8	Open Shellfish /Shellbottom	*NC Division of Marine Fisheries*
Hardbottom	7	Hard Bottom	
Hardbottom	5	Closed Shellfish /Shellbottom	
IBA	6	Important Bird Area	*Audubon Society*
Impervious	-1	Impervious Surface above 20%	*US Environmental Protection Agency*

DWQ is now DWR, the NC Division of Water Resources

Source: N.C. Conservation Planning Tool, 2013

STATEWIDE GIS CONSERVATION DATA REFERENCE CHART

These conservation data map layers are the most applicable data available statewide for land use planning. The 'Levels of Planning' column denotes whether the map layer is appropriate for use in the planning activity. Additional regional datasets are referenced in the regional appendices.

REFERENCE INFORMATION[8]					LEVELS OF PLANNING[9]		
GIS Data Layer	**Layer Label**	**Where to Download Directly**	**Update Frequency**	**Summary of Interpretation & Recommendations for use[10]**	**Visioning & Plan-Making**	**Ordinance & Rule-Setting**	**Development Review & Design**
Biodiversity and Wildlife Habitat Assessment (BWHA)	bwha	N.C. Conservation Planning Tool[11] or via N.C. One Map[12]	Biannual	• To identify priority areas for conservation. • To identify wildlife and habitat corridors that connect important natural areas. • Areas that rank 10 to 7 or 6 should receive the strongest protections. • Low intensity land uses should be encouraged.	X	X	
Map Layers that were used to create the Biodiversity and Wildlife Habitat Assessment - The map layers below were used to create the BWHA. They can be used for a higher degree of accuracy, more detailed information and to highlight specific types of habitat and priority areas in land use planning activities.							
Landscape Habitat Indicator Guilds	N/A	Interpret these areas directly from the BWHA data table.	Biannual	(Same as those for BWHA above). These represent large habitats where area sensitive species have been found in surveys.	X	X	
Tier 1 Resources: Sensitive Wildlife Habitats - The map layers below are used in the BWHA and represent the following: a) data of high accuracy that should be ground-truthed at the site level, b) areas that are highly sensitive to development and that should be set aside from development to the maximum extent possible.							
Natural Heritage Natural Areas	nhna	N.C. One Map	Quarterly	Field-delineated high-quality habitats that should receive the highest protections.	X	X	X
Natural Heritage Element Occurrences[13]	nheo	Limited dataset from N.C. One Map. Contact N.C. Natural Heritage for detailed dataset.	Quarterly	(Same as NHNA above) Data available via the GGT website has been filtered to remove inaccurate, destroyed or historic records.	X	X	X
Streams	hydro24k	N.C. One Map	Irregular	Maintain buffer of natural forest at least 100 feet wide, especially in priority watersheds.	X	X	X
Subwatersheds with federally listed fish and mussels	Fed_HUCs	Green Growth Toolbox website[14]	Biannual	Buffer streams within these watersheds by 200 feet to protect imperilled species.	X	X	X
Wild Brook Trout Streams	N/A	Interpret these areas directly from the BWHA data table.	Biannual	The 100 foot stream buffers mapped in the BWHA are a high priority (9 out of 10).	X	X	X
CREWS Wetlands (Coastal counties only)	[County name]_wets	Division of Coastal Management. Obtain from the Green Growth Toolbox website for easier to use legend.	Irregular	• Sites where a federal or state wetlands permit is likely required. • Verify wetlands by survey ahead of development. • Set aside development especially for higher quality wetlands. • Buffer and connect verified wetlands to each other and to streams.	X	X	
National Wetland Inventory wetlands	CONUS_wet_poly	U.S. Fish & Wildlife Service website[15]	Irregular		X		

STATEWIDE GIS CONSERVATION DATA REFERENCE CHART

REFERENCE INFORMATION					LEVELS OF PLANNING		
GIS Data Layer	**Layer Label**	**Where to Download Directly**	**Update Frequency**	**Summary of Interpretation & Recommendations for use**	**Visioning & Plan-Making**	**Ordinance & Rule-Setting**	**Development Review & Design**
Tier 2 Resources: Wildlife Habitat Landscapes - The map layers below represent the following: a) data that are meant to be used at large scales and b) areas where agricultural districts should be encouraged and c) areas where low overall development density is recommended but rural cluster development is encouraged outside of sensitive areas and away from Managed Areas.							
High Quality Waters and Outstanding Resource Waters	hqworw	N.C. One Map	Irregular	Streams documented to be high-quality and support important resources. If all streams cannot receive wide buffers consider these as priority for buffers.	X	X	
Important Bird Areas (IBAs)	NC_IBAs	N.C. Audubon Society http://ncaudubonblog.org/downloads/	Irregular	To identify areas where widespread or intense development will negatively impact priority bird species and should be avoided if possible.	X	X	
Map layers not used in the BWHA that we recommend should be used in addition to the BWHA These layers will give a more complete picture of wildlife habitat conservation needs and opportunities in your community.							
Managed Areas	marea	N.C. One Map	Quarterly	Buffer and connect these areas with other managed and high priority areas by encouraging agricultural land uses around and between Managed Areas.	X	X	X
Tier 1 Resources: Sensitive Wildlife Habitats							
Colonial waterbird nest site buffers	Waterbird_ nest _buffers	Green Growth Toolbox website	Yearly	Maintain a 330 foot undeveloped buffer to avoid disturbing large groups of nests.	X	X	X
Bald Eagle nests	N/A	Obtain from the N.C. Wildlife Resources Commission and filter the detailed NHEO dataset.	Irregular	A formal or informal permit may be needed from the U.S. Fish & Wildlife Service. Buffers range from approximately 330 to 660 feet.[16]	X	X	X
Floodplain boundaries[17]	fldmaphazar	N.C. Floodplain Mapping Program www.ncfloodmaps.com	Irregular	Locations with flooding risk and high potential for important wildlife habitats. Should be set aside from development to the maximum extent possible.	X	X	X
Tier 2 Resources: Wildlife Habitat Landscapes							
Smoke Awareness Areas (approx. ½ mile)	smoke awareness	Green Growth Toolbox website	Yearly	An area that may experience smoke from controlled burning periodically, where it is best to encourage non-developed land uses.	X	X	X
Game Land Hunting Safety Buffer (150 yards)	gml_buffer	Green Growth Toolbox website	Yearly	An area where it is best to encourage non-developed land uses to prevent conflicts between hunting and private property.	X	X	X
Forestry Lands Assessment		N.C. Conservation Planning Tool	Irregular	Encourage agricultural districts especially in high priority areas.	X	X	
Agriculture Lands Assessment					X	X	

[1] N.C. Natural Heritage Program. 2015. Natural Heritage Natural Areas. GIS coverage. Accessed 2015 May.
[2] Ibid. Natural Heritage Element Occurrences.
[3] N.C. Division of Water Quality. 2011. High quality water and outstanding resource water management zones metadata. GIS coverage. Accessed 2012 Dec.
[4] Beginning with habitat: An approach to conserving Maine's natural landscape for plants, animals, and people [Internet]. [2003]. Maine Department of Inland Fisheries and Wildlife. Available from: www.beginningwithhabitat.org Accessed 2012 Feb. 2.
[5] N.C. Wildlife Resources Commission. 2015. North Carolina Wildlife Action Plan. Available from: www.ncwildlife.org/Plan.aspx.
[6] Important Bird Areas in N.C. [Internet]. [2011]. Audubon N.C. Available from: http://ncaudubonblog.org/iba/. Accessed 2012 Jan. 1.
[7] Idib. 5, P.,177-183.
[8] The columns under the header "Reference Information" mean the following. The "GIS Data Layer" column presents the name of each data layer that is described in Section 2 of this handbook. The column titled "Layer Label" displays the name of the shapefile. The "Where to Download Directly" column contains instructions on where to download the most up-to-date data from the original source. The "Update Frequency" column indicates how often updates are made by the data originator and should be made to each data layer.
[9] The columns under the header "Levels of Planning" contain "X" marks that show which levels of planning are appropriate for each data layer. For example, all three boxes in Natural Heritage Natural Areas row are marked with an "X." This means that this data layer should be used in visioning and plan making, ordinance and rule setting, and development review. On the other hand, only one box in the "National Wetland Inventory wetlands" row is marked with an "X". This means that layer is only appropriate for use in visioning and plan making.
[10] The 'Summary of Interpretation & Recommendations for Use' column summarizes the recommendations of the N.C. Wildlife Resources Commission for use of this GIS data to conserve wildlife and habitats of conservation concern.
[11] http://ncnhp.org/conservation/conservation-planning-tool
[12] http://data.nconemap.com/geoportal/
[13] The Natural Heritage Element Occurrence layer downloaded through the Green Growth Toolbox website or NC OneMap only has a minimal set of attributes. Because the full dataset contains sensitive information, it must be obtained by contacting the N.C. Natural Heritage Program Conservation Information Manager (www.ncnhp.org/web/nhp/contact).
[14] www.ncwildlife.org/Conserving/Programs/GreenGrowthToolbox/ConservationData.aspx
[15] www.fws.gov/wetlands/Data/State-Downloads.html
[16] U.S. FWS Bald Eagle Management Guidelines and Permits. [Internet]. [2013]. U.S. Fish and Wildlife Service. Available from: http://www.fws.gov/midwest/MidwestBird/EaglePermits/baeatakepermit.html
[17] Floodplain data is not available for download on the GGT website. The best available data for your county should be downloaded from www.ncfloodmaps.com.

SECTION 3. HABITAT CONSERVATION RECOMMENDATIONS

The purpose of this section is to provide conservation recommendations that are based on the scientific literature regarding how much habitat priority wildlife need in order to remain in developing landscapes. These recommendations come from two N.C. Wildlife Resources Commission guidance documents referenced at the end of this section: the NCWRC (2012) conservation recommendations, available from www.ncwildlife.org/greengrowth,[1] and the NCWRC (2002) guidance to address cumulative impacts. Many wildlife species need a large amount of habitat. We encourage readers to use this information to do what is possible to minimize negative impacts to wildlife through planning, policies and development design. Because developed landscapes are becoming the face of our state, implementing these guidelines as much as possible in land use planning is essential to preventing the loss of much of our state's wildlife and biodiversity.

This section details the wildlife habitat conservation component of green infrastructure. Large habitat areas can be conserved by connecting contiguous habitat among different parcels. Habitat open space can be owned by the homeowner association, which can also fund habitat management.

NATURAL RESOURCE-BASED LAND USE AND DEVELOPMENT PRACTICES

Comprehensive natural resource stewardship includes conservation of priority wildlife species and habitats. Scientific research has revealed certain conservation thresholds, or minimum habitat area requirements, that are needed to sustain priority species and habitats near built areas.

- Incorporating these recommendations in plans, incentives, ordinances and development designs will help reduce the likelihood that species are placed on the federal endangered and threatened species list and reduce permit delays.
- We encourage local governments and developers to conserve as much habitat as possible as a first step, even if it is less than what is recommended.

How can this information be used?

In local government planning documents to inform:

- The goals, objectives, strategies and natural resources component in all community planning documents (in addition to the N.C. Wildlife Action Plan).
- Policy recommendations.

In incentives and ordinances to inform:

- The proportion or width of open space conservation to consider in certain districts or development standards.

In development review and site design to inform:

- Review of development proposals to evaluate habitat conservation opportunities.
- Development designs that will enhance wildlife habitat conservation.

Referencing the Conservation Data for Green Growth

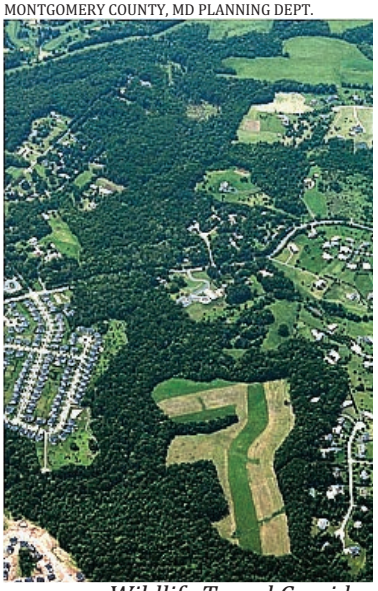
Habitats described in this section can be identified using the Conservation Data map layers described in Section 2. The **blue boxes** throughout this section highlight specific conservation map layers associated with habitat recommendations. The GIS map layers contain a data table with information on habitat type and can be searched or filtered.

Principles for Maintaining Healthy Ecosystems

Keep ecosystems and our communities healthy by maintaining a connected network of healthy habitats.

The land use principles below are basic guidelines for designing communities that maintain healthy ecosystems. These principles can be goals to help your community achieve Green Growth.[2]

MONTGOMERY COUNTY, MD PLANNING DEPT.



Wildlife Travel Corridor

1) Maintain large, wide blocks of contiguous habitat to avoid habitat fragmentation.
2) Maintain functional connections between core habitat areas that wildlife can travel through to avoid isolating habitats. Major roads and large developments, make wildlife travel difficult or impossible while working farms and forests are more conducive to species movement.
3) Protect rare landscape elements, sensitive areas and associated species. Not all open spaces are created equal. Natural open spaces—such as wetlands, riparian and native upland forests—will protect water, air and wildlife much better than manicured open spaces.
4) Allow patterns of natural disturbance to continue such as periodic fire and river flow patterns. Encourage habitat management, which can be funded by homeowner associations and parks departments.
5) Minimize the introduction and spread of nonnative, invasive species.
6) Minimize the human introduction of nutrients, chemicals and pollutants, particularly near wetlands and streams.
7) Avoid and compensate for adverse effects of development on natural processes, such as the cumulative effects of stormwater runoff on aquatic ecosystems. Maintain or mimic the natural hydrology on development sites.
8) Avoid land uses that deplete or degrade natural resources in environmentally sensitive areas, including habitat for species of conservation concern.

Associated Conservation Data

Any areas that rank 1 – 10 in the Biodiversity and Wildlife Habitat Assessment are very important to ecosystem function.

Area Sensitive Species Need Large Core Habitat Areas


AURTHER GROSSET

black-throated green warbler


JEFF HALL

tiger salamander

Many of the over 370 wildlife species of conservation concern in North Carolina require large areas of habitat that have sufficient interior habitat. Interior habitat is an area of contiguous habitat far from an edge, or a transition to an incompatible land type. Interior habitat is maximized when habitats are more circular in shape and have minimal edge. Interior habitat is different for forest dwelling and grass or shrubland dwelling wildlife. Interior habitat for forest dwelling species begins approximately 350 feet from the edge of a large unforested or developed area. Sufficient habitat interior for grass and shrubland species is only present in agricultural landscapes with many grasslands greater than 20 acres. Grass and shrubland species need 125 to 250 acres of habitat in patches greater than 15 acres, in close proximity, in an urban setting.
See page 44 to 45 for more information.

Reduce Habitat Fragmentation and Maintain Wildlife Travel Corridors

In sensitive areas consider encouraging or requiring that wide contiguous natural open space be set-aside on developed parcels and that it be connected to natural open space on adjacent parcels. In priority areas maintain wildlife travel corridors that are at least 150 to 330 feet wide through development standards. Coupled with appropriate land use districts this will maintain interior habitat and connectivity in developed areas.

Maintain Agricultural or Conservation Districts Around and Between Managed Areas

- Development projects located adjacent to NCWRC Game Lands and other Managed Areas degrade habitat quality within conserved lands and make prescribed fire difficult. See page 4 for information on prescribed fire. Ideally, agricultural districts should be maintained in these areas. Developments should try to create as wide a buffer as possible between built structures and public land boundaries.
- If buffers cannot be placed around entire Game Lands or in all Smoke Awareness Areas:
  - maintain buffers around narrow portions of Game Lands,
  - prioritize buffers along parts of Managed Areas where prescribed fire is used
  - and buffer areas mapped in the Biodiversity and Wildlife Habitat Assessment.

How much area is ideal?

- Within Smoke Awareness Areas, design a land use category, district or a development project so that a ½ mile smoke management buffer—or the widest buffer possible—without inhabited structures exists. This will minimize resident's exposure to smoke from prescribed fire every two to five years.
- If the development will occur adjacent to NCWRC Game Lands, design a land use category, district or a development project so that permanently inhabited structures are located at least 150 yards from the edge of the Game Land.

Associated Conservation Data
- **Managed Areas**
- **Game Lands Hunting Safety Buffer**
- **Smoke Awareness Areas**

Core Habitat, Habitat Edge and Connectivity

Maximum habitat interior (core habitat) and minumum edge

Maximum habitat edge and no interior habitat

Connect core habitat 'nodes' to prevent habitat fragmentation

Images courtesy of Benjamin Penington, 1000 Friends of Florida

Maintain large circular nodes (core areas) of habitat to maximize interior habitat and minimize edge. Habitat edges occur at the border of incompatible land and are generally detrimental to priority wildlife species because edges are more accessible to predators and parasites that reduce the survival of their young. For this reason, wider wildlife travel corridors are better. Wildlife also need to be able to travel through uninterrupted, contiguous habitat.

Conservation Recommendations for Upland Habitats

"Upland" habitats are terrestrial habitats that are located outside of the floodplain, wetlands and riparian zones. Priority upland habitats in North Carolina include longleaf pine forests, grasslands - shrublands (early successional habitat), high elevation habitats (above 3500 ft.), caves and mines, rock outcrops and large, unfragmented forests.

Upland Forest Habitats

- Try to conserve a connected network of forests and create plans to properly manage habitats post-construction.
- We recommend as little development as possible take place in: Natural Heritage Natural Areas, areas with natural vegetation within Natural Heritage Element Occurrence polygons or within Landscape Habitat Indicator Guilds that rank a 7 to 10 on the Biodiversity and Wildlife Habitat Assessment.
- Try to conserve more than 50 percent of the total tree cover within your jurisdiction or at least 50 percent of forest cover within 1.5 miles of existing Managed Areas.
- Try to conserve larger, wide blocks of forest with less edge on open areas. This can be done by encouraging connection of natural open space among parcels. Forest dwelling priority species need the following areas of forest in North Carolina:
  - Contiguous upland, floodplain and wetland forest blocks of at least 500 acres in the Mountains, southern Piedmont and Coastal Plain.
  - Seventy-five contiguous acres of non-floodplain (upland) forests in the Piedmont and Coastal Plain can support most priority bird species.
  - Cerulean warblers in the southwest Mountains and many fire dependent species in the Sandhills and the Coastal Plain only occur in forests of over 1,750 acres.
  - Smaller blocks of forest have conservation value as bird migration stop over areas but do not support as many priority species.
- Longleaf pine forest needs to be managed with prescribed fire if fire-dependent wildlife are intended to be conserved.

Associated Conservation Data

- **Natural Heritage Natural Areas**
- **Natural Heritage Element Occurrences**
- **Biodiversity and Wildlife Habitat Assessment**
- **Forest Lands Assessment**

Grassland Habitats

Many grasslands are not mapped, but can be defined as pastures and fallow fields of at least 20 acres in agricultural landscapes and 15 acre fields in close proximity, totaling 125 to 250 acres, overall, in urbanizing areas.

- Develop farmland protection plans and integrate grassland and early successional habitat conservation and management recommendations.
- Focus on policies that maintain viable, contiguous working farms.
- Revegetate utility rights-of-way into grassland or shrubland habitat using native plant species and establish rotational vegetation control schedules. Native plants use less water and require less maintenance.
- Mow half to one-third of grasslands per year to maintain habitat structure. Try to mow only from mid-March and mid-April to reduce impacts to ground nesting birds.
- Prescribed fire can produce better habitat at less cost than mowing or herbicides.
- Utilize and promote the many state and federal programs that provide monetary and technical assistance for landowners to create and maintain early successional habitats (www.ncwildlife.org/CURE.aspx). Many of these programs can also be used for prescribed burning of longleaf pine forest as well.
- If your community has the resources to conduct active resource management, prioritize the protection and management of some early successional habitat when purchasing land for open space. Consult with a qualified biologist to develop a management plan for long-term management of this habitat.
- When early successional habitat is to be protected as open space in a development project, require applicants to submit 1) a long-term habitat management plan, and 2) plans to fund long-term management. Habitat management can be funded and administered by the homeowner association.

Associated Conservation Data

- **Agricultural Lands Assessment**
- **Natural Heritage Element Occurrences for grassland wildlife species**
- **Aerial photos (available on NCOneMap)**

Riparian Habitat Conservation Recommendations

Protect wide forest areas along streams.

USFWS

Benefits of Conserving Forested Riparian Buffers

- Some of the greatest environmental health benefits come from improving downstream water quality and reducing the intensity of floods and droughts.
- Forest soils and root systems filter up to 15 inches of water per hour storing and cleaning water while preventing floods and drought.[3]
- The riparian forest along rivers and streams is the sole source of the food base (leaves) and shade necessary for fish and other aquatic life to live in streams.
- Once pollution is released in water, the only things that keep air and water clean are the animals and plants that remove pollutants through filter feeding.
- Forests adjacent to streams support a high diversity and abundance of wildlife.

Protecting wide buffers around rivers and streams in as many places as possible is necessary to preserve habitat for species using riparian zones.

All recommended stream buffers presented here are mapped in the Biodiversity and Wildlife Habitat Assessment

What conservation measures are needed?

- Forested buffers comprised of native trees and plants are recommended around all streams (perennial, intermittent and ephemeral channels).
- Because wider buffers produce the most environmental benefits and also safeguard communities, we recommend protecting and maintaining the maximum width buffer possible in as many places as possible along streams.
- If wide buffers are not possible everywhere, focus on buffers in priority watersheds (see page 24). Conserving large 'nodes' of wide buffers can be encouraged through development standards.
- We recommend that impervious surfaces be kept below 10 percent within all watersheds in order to safeguard aquatic life and fishing.

Stream Buffers to Protect Water Quality for Aquatic Life [4]

Recognizing that wider is always better and that some buffer is better than no buffer, the N.C. Wildlife Resources Commission typically recommends the following buffer widths to minimize impacts to aquatic species (such as fish and mussels):

- In subwatersheds **without federally listed aquatic species**
  - Preserve 100 foot native, forested buffers on *each side* of perennial streams
  - Preserve 50 foot native, forested buffers on *each side* of intermittent streams.
- In subwatersheds **that contain federally listed aquatic species**:
  - Preserve 200 foot native, forested buffers on *each side* of perennial streams.
  - Preserve 100 foot native, forested buffers on *each side* of intermittent streams.
- In all watersheds, buffer ephemeral streams and drainages. Narrower buffers than those recommended for perennial streams will suffice, but again, wider is better.
- Note that subwatersheds containing federally listed species are identified in the Conservation Data for Green Growth.

M.C. BARHART

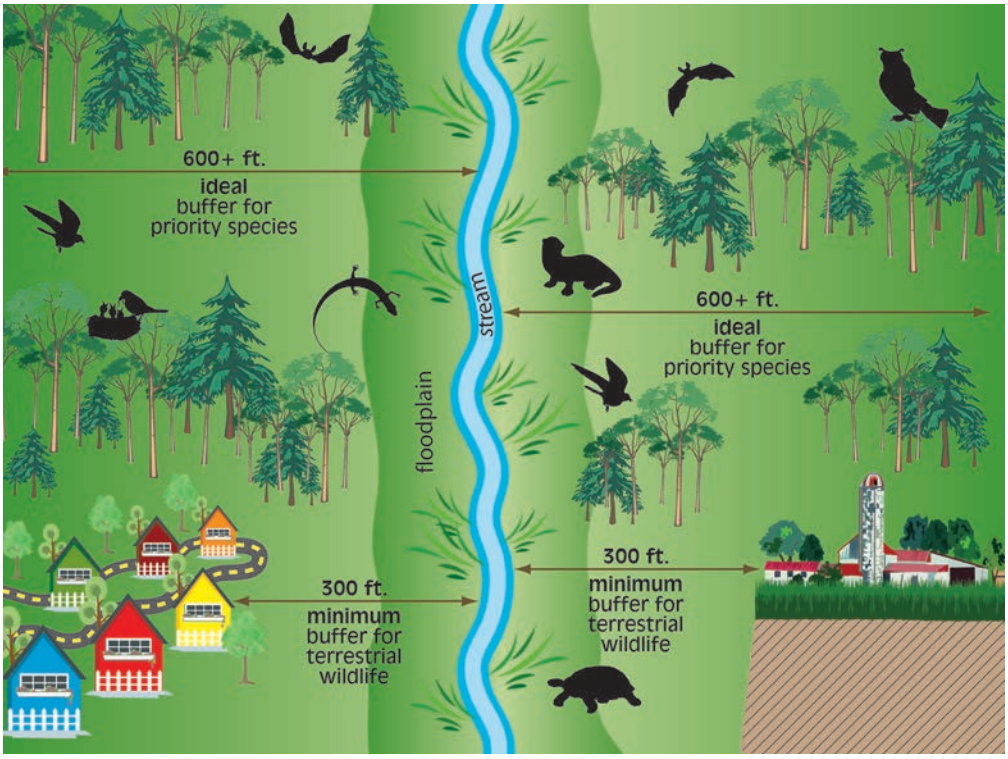
Freshwatwater mussel filtering water and removing pollutants.

Why are stream species important?

Freshwater mussels are an important signal of our own health. They clean our water by filtering bacteria and chemicals. Without enough forest along streams to soak up rain water, sediment and other pollutants can reach levels that kill the aquatic life that help to keep our water clean and safe.

Relevant Conservation Data from Section 2:

- **Biodiversity and Wildlife Habitat Assessment**
- **'hydro_24k' streams layer includes DWR stream class**
- **Subwatersheds with Federally Listed Fish and Mussels**
- **Outstanding Resource Waters and and High Quality Waters**
- **Natural Heritage Natural Areas**
- **Natural Heritage Element Occurrences**



GRAPHIC BY KIMBERLY KC SCHOTT, RED GATE DESIGN

Riparian Forest Habitat and Wildlife Travel Corridors

A majority of wildlife rely on riparian forest zones to raise their young and to feed. As such, wide riparian forest buffers are needed to conserve a majority of wildlife.

- Protect wide forested buffers of 300–600 feet or more on each side of the stream. Research has shown this will provide sufficient travel corridors and some habitat for forest interior birds (such as the wood thrush), while 250 foot buffers are needed for most stream salamanders.[5]
- Other species of conservation concern, however, require forested travel corridors at least 1000 feet wide.[6] This is why it is important to conserve some nodes this wide along streams and rivers where possible.
- Use the relevant Conservation Data to identify priority places for wide stream buffer areas and habitat nodes if wide buffers are not possible along entire waterways.
- Wide riparian forest buffers can be achieved through properly designed and managed greenways.

Recommendations for Minimizing On-Site Stream Impacts

In addition to protecting wide riparian buffers, incorporating the following practices into the design and construction of development projects will help minimize negative impacts to aquatic species and habitats.

- Identify and delineate all streams using the N.C. Division of Water Resources criteria. See https://deq.nc.gov/about/divisions/water-resources/water-resources-permits/wastewater-branch/401-wetlands-buffer-permitting/stream-determinations for information.
- Refer to the NCWRC (2002) guidance to address cumulative impacts available from www.ncwildlife.org/Conserving/Programs/HabitatConservationProgram.aspx.

Recommendations for Floodplains

Rapid development in some parts of North Carolina is leading to changes in floodplain boundaries and flooding frequency. Floodplains may widen and become more inundated due to urbanization.

Benefits of Floodplains

In addition to helping to protect communities from flood hazards, intact floodplain forests are a priority wildlife habitat identified in the N.C. Wildlife Action Plan. Conservation can greatly help to keep species off of endangered species lists.[7] Many floodplain pools provide important habitat for breeding turtles, salamanders and frogs. When floodplain corridors are intact, they provide migration corridors for birds and mammals.

Conserve Floodplains

- Where the floodplain is wider than required stream buffers, protect the full extent of the 100-year floodplain.
- Where feasible, do not place sewer lines, water lines, manholes and other utility infrastructure in the 100-year floodplain.
- Try to avoid clearing, excavating, filling, altering, draining, or placing structures of any kind within the floodplain boundaries. This will also help to prevent or reduce the burden to taxpayers from disaster clean up.
- Consider extending these practices to the 500-year floodplain to safeguard against increasing extreme flood events.

Stewarding Floodplain Property

In addition to keeping built areas outside of the floodplain, plans are needed to minimize floodplain impacts during and after construction.

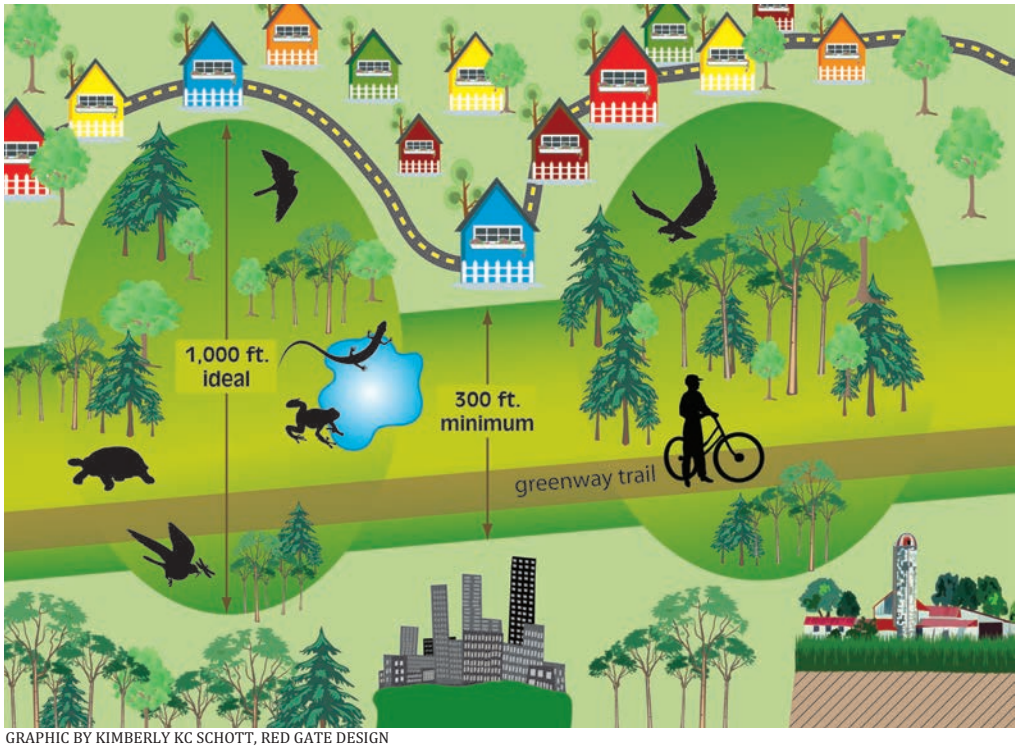
- Floodplain land can be dedicated and deeded to the local government, Homeowners Association, or land trust as permanent open space.
- In partnership with a qualified natural resource manager, develop plans to properly manage floodplain wetland resources during and post-construction. See pages 50 to 52 for wetlands recommendations.

Associated Conservation Data

• 100 and 500-year floodplains interpreted from the N.C. Floodplain Mapping Program dataset

Recommendations for Greenways

- Greenways are a great community resource for providing recreation opportunities and for connecting core habitat areas.
- Maintain forested areas at least 1,000 feet wide over as much of the greenway as possible. This has been shown to conserve the full suite of forest wildlife habitat.
- Greenways that are at least 330 feet wide still offer breeding habitat to some forest interior species.



GRAPHIC BY KIMBERLY KC SCHOTT, RED GATE DESIGN

- Greenways that are 150 feet wide provide wildlife travel corridors for some priority species but do not provide enough breeding habitat for most species.
- If wide greenway areas are not possible along the entire greenway, nodes of wide habitat areas should be encouraged for conservation along thinner areas.
- Locate trails toward the edge of the greenway rather than the middle and keep trails as far as possible from streams, ideally 100 feet away.

Conserving Wetlands for Declining Wildlife

Protect wide upland buffers around wetlands, especially small wetlands.

Benefits of Wetlands Conservation

Wetlands are important because of their role in helping to mitigate floods and droughts, purifying and storing surface water and for providing important wildlife habitat, particularly for amphibians and reptiles. Dramatic amphibian and reptile declines are occurring around the world due to habitat loss and road construction, among other factors. As with streams, wider buffers will produce the most environmental benefits. Small wetland communities are identified as a priority for conservation in the N.C. Wildlife Action Plan.[8]

Wetland Buffers for Water Quality

- To minimize negative impacts to water quality associated with wetlands along streams, at minimum 100 foot buffers are needed for wetlands on perennial streams and 50 foot buffers are needed for wetlands on intermittent streams.[9] To conserve wetland wildlife habitat wider buffers are needed.

Relevant Conservation Data from Section 2:
(Filter databases for small wetland types)

- **Natural Heritage Natural Areas**
- **Natural Heritage Element Occurrences (detailed dataset)**
- **The National Wetlands Inventory or Coastal Region Evaluation of Wetland Significance**

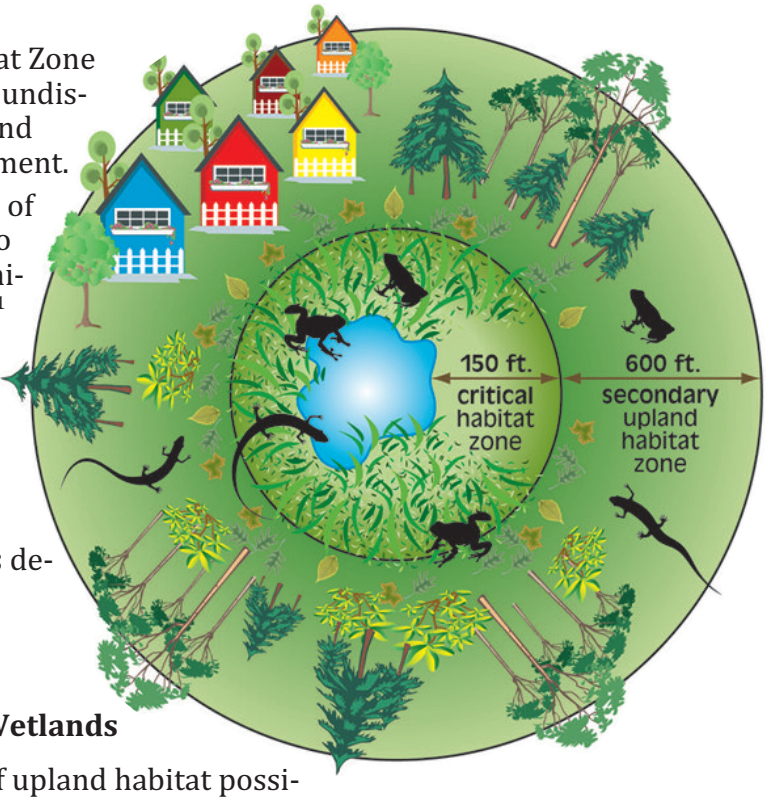
Buffers Needed to Protect Wildlife Habitat at Small Wetlands

Buffer widths that will protect basic water quality are more narrow than buffers needed to protect wildlife habitat at small wetlands.

Amphibians and reptiles live part of the year far from the wetland pool in the surrounding upland forest where they forage and burrow to escape extreme temperatures. As such the intensity of land use surrounding the wetland pool will affect wildlife diversity and abundance in small wetlands. In addition, the amount of disturbance and development in a watershed affects local extinction of amphibians.[10]

The following buffer recommendations based on the scientific literature are particularly important to reducing threats to wildlife and our communities caused by extreme flooding and drought.

- Maintain a 150 foot Critical Habitat Zone around each wetland pool, that is undisturbed to ensure that many wetland species are not lost from development.
- A Secondary Upland Habitat Zone of an additional 600 feet is needed to protect core habitat for many semi-aquatic reptiles and amphibians.[11] This Secondary Upland Habitat Zone does not need to be symmetrical and can be more narrow or wide in places.
- Habitat conservation can still be achieved when 25 percent of the Secondary Upland Habitat Zone is developed in a clustered manner.



Limit Impacts of Development Near Wetlands

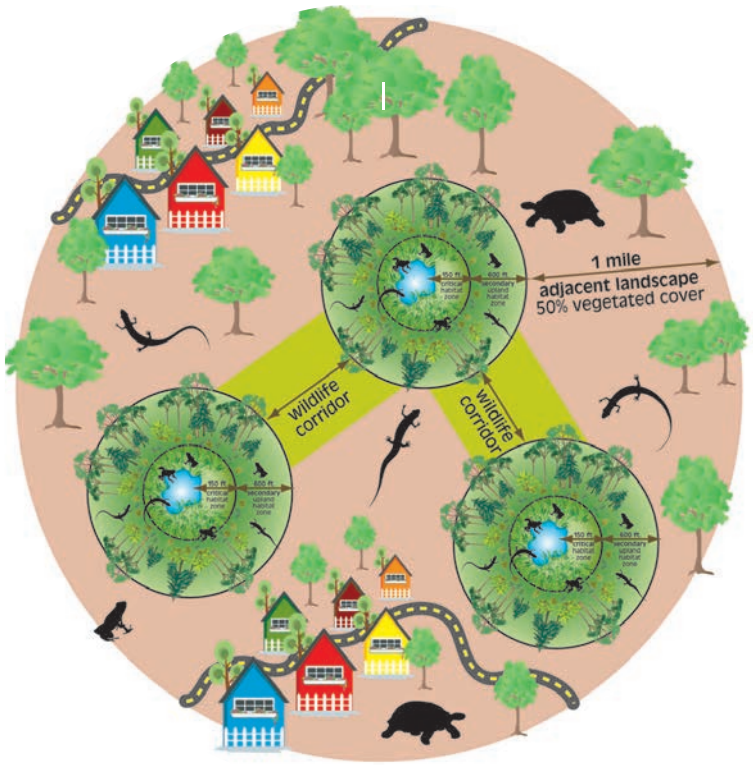
- Maintain the maximum amount of upland habitat possible around and between wetlands.
- Minimize impervious surfaces around wetlands, particularly pools with many different amphibian and reptile species.
- Exclude roads and driveways from upland areas within 750 feet of priority wetland habitats.
- If roads must run between important wetlands, install wildlife underpasses to allow for reptile and amphibian movement under roads between wetlands. See page 66 for information on wildlife road crossing structures.
- Cluster development and place houses as far away from upland pools as possible.
- Do not use small wetlands for storm water retention ponds and locate retention ponds at least 750 feet from small wetlands to minimize hydrological disturbance to natural water flow into small wetlands.

Small Wetland Communities

Small wetland communities include isolated upland pools, vernal pools, springs, bogs and seeps, where surface water collects or ground water feeds the beginning of a stream. These wetlands are not connected to water from the main body of a stream or river and are usually temporarily flooded such that they are dry for much of the year. They typically fill with water during the winter and hold water into the spring and early summer. Because they do not support fish, which prey heavily on amphibian eggs, these wetland communities provide the only breeding habitat for many amphibians and some reptiles. Vernal pools and other small wetland communities are often overlooked during land conversion because their protection is often not regulated and because they are small and dry for part of the year. As such, they have undergone extensive decline. Wetlands may become more threatened as weather events become more extreme. Frequent extreme flooding and drought can cause local wetland species extinctions.

Maintain Small Wetland Complexes and Priority Wetland Regions

- As much as possible, avoid placing development and roads between small wetlands that are within 1 mile of each other.
- Connect wetlands to one another and to streams via forested wildlife travel corridors that are made to be as wide as possible and at least 330 feet wide.
- Limit impervious surfaces to 10 percent and road density in watersheds that contain your jurisdiction's most biologically diverse and important wetlands.
- Maintain at least 50 percent natural vegetation in large, connected nodes throughout the landscape.



GRAPHICS BY KIMBERLY KC SCHOTT, RED GATE DESIGN

Wetlands Management Plan Guidelines

To manage wetlands, streams and floodplains during and after construction:

- Avoid the use of insecticides and herbicides within or adjacent to buffer areas.
- Avoid removal of forested tree cover or leaf litter and any soil disturbance in the surrounding upland forest.
- Eradicate and do not plant invasive, exotic vegetation.
- Covenants or deed restrictions can be used to ensure wetland habitats are managed properly by future homeowners or the homeowner association.

Recommendations for Stormwater

Manage stormwater on-site with structures that maintain natural hydrology and provide habitat.

State and federal law requires the implementation of certain stormwater management standards which affect many communities in North Carolina. The recommendations below are not intended to replace legal requirements.

These recommendations explain how a development project must manage stormwater in order to be beneficial for wildlife and better safeguard the community from heavy rain events and flash flooding.

- Control stormwater on-site and design stormwater management structures to mimic predevelopment hydrographic conditions.
- Incorporate "low impact development" (LID) practices into site design, such as capturing rainwater for irrigation use and incorporating rain gardens into residential landscaping. LID provides significant cost savings. Information about LID can be found at the following websites:
    - N.C. State University *Low Impact Development Guidebook* and training www.ces.ncsu.edu/depts/agecon/WECO/lid-curriculum/index.php
    - Cost benefit information - www.epa.gov/owow/NPS/lid/
    - Stormwater Manager's Resource Center - www.stormwatercenter.net
- Do not discharge stormwater to streams through pipes or ditches. Stormwater should only be released in a dispersed manner through vegetation.
- Avoid using wetlands for stormwater discharge or retention ponds.
- Design stormwater retention ponds to also provide or maintain wildlife habitat of native trees, shrubs and other plants around detention ponds.
- Create rain gardens with native plants and wildlife-friendly materials.

Recommendations for Sediment and Erosion Control

Minimize land clearing and grading.

Construction practices that completely clear and grade the landscape are extremely harmful to water quality, terrestrial and aquatic wildlife resources. Such practices often cause the loss of topsoil, forest cover and the sedimentation of streams and water bodies, which can be devastating to entire ecosystems in your community. [13]

The following wildlife friendly development practices will help minimize these harmful impacts:

- Minimize all clearing and grading associated with construction, particularly adjacent to waterways and steep slopes.
- Only perform clearing and grading based on a stream protection strategy.
- Instead of clearing and grading to landscape a site, retain as much natural vegetation and soil cover as possible.
- Phase construction to reduce the area and time over which soils are disturbed.
- Stabilize soils as quickly as possible (< 2 weeks) by establishing a native grass or mulch cover.
- Establish appropriate perimeter controls at the edge of construction sites to retain or filter concentrated runoff from relatively short distances before it leaves the site.

Recommendations for Impoundments

Minimize the negative effects of impoundments on wildlife.

Ponds and other small impoundments, if not properly constructed and managed, can negatively impact water quality as well as aquatic habitats and species. In-stream impoundments can negatively impact fish migration, reduce aquatic ecosystem diversity and abundance and introduce nonnative species that reduce ecosystem health. With thousands of ponds and small in-stream impoundments in North Carolina, the level of cumulative negative impacts on the state's streams is high.

To minimize the negative effects of impoundments when designing a development project:

- Locate impoundments away from stream channels. Locate ponds on stream channels only when there is no other option.
- Avoid constructing impoundments near existing wetlands to avoid altering the hydrology of that wetland.
- Avoid locating ponds in naturally reproducing trout waters, anadromous fish species waters and waters that contain state or federally listed species.

Recommendations for Right-of-Ways

Construction of utility right-of-ways (ROW), when properly maintained, can provide habitat for birds, reptiles and mammals.

To minimize wildlife impacts and maximize wildlife benefits:

- Minimize grading and retain large trees at the edges of construction corridors.
- When disturbing the soil, stabilize it as quickly as possible. Reseed with wildlife-beneficial seed mixtures (e.g., native warm season grasses or creeping red fescue, native seed or fruit producing plants and so forth).
- Avoid planting fescue (except creeping red fescue) or Bermuda grass based mixtures because these are invasive and provide little wildlife benefit.
- Keep brush piles of woody debris at the edges of cleared ROW. These provide good cover and food.
- Allow corridors to revegetate into a brush or scrub habitat.
- Minimize ROW corridor maintenance and mow only between mid-March and mid-April to minimize impacts to ground nesting birds.

Recommendations for Landscaping

Create landscaping plans that will benefit wildlife.

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Use Only Native Plants

One of the most important components of a wildlife friendly landscaping plan is using native plants and removing invasive, exotic plants where possible. Native plants are more nutritious for important pollinators and wildlife. Invasive, exotic plants often out-compete and gradually displace our native plants. This negatively impacts native wildlife and the overall health and stability of our environment.

- Avoid planting invasive, exotic plant species and, where practical, remove such species from the development site. Lists of invasive plants and methods for removal can be found in the, "Southeast Exotic Pest Plant Council Invasive Plant Manual," at www.se-eppc.org/weeds.cfm or through the North Carolina Botanical Garden's website at http://ncbg.unc.edu/invasive-plants-resources/.

- Avoid using insect resistant plants. Birds feed their young entirely on insects and are threatened by a reduction in insects.

Attract Birds and Butterflies for Wildlife Watching

In addition to using only native plants, landscaping plans can incorporate design elements that will attract popular species for wildlife watching. To attract birds, butterflies and other "watchable wildlife" species include these landscaping practices:

- Limit the amount of lawn. Replace lawn area with islands of native vegetation planted with native ground cover or wildflowers.
- Increase "vertical layering," or planting vegetation of different heights.
- Plant a butterfly garden.
- Create birdbaths or small ponds.
- Provide bird or bat houses and bird feeders.
- Reduce pesticide use.
- Do not use insect resistant plants.

Habitat Management is Important

Many developments, local parks and even utility lines that contain priority habitats need to conduct habitat management activities to truly conserve habitat for highly sensitive priority species. For example:

- Grasslands and shrublands will grow into forests if they are not mowed or burned.
- Longleaf pine forests need to burn every few years in order to maintain the grassland savannah structure that priority wildlife require. Longleaf pine forest species cannot live in dense thick forests dominated by hardwood trees, even if longleaf pine trees are present.

Going Native!

North Carolina State University's website Going Native! presents a step-by-step guide on how to landscape with native plants. The website also presents photos and descriptions of nonnative, invasive species. Planners, developers, engineers, landscape architects and homeowners will benefit from using this guide at www.ncsu.edu/goingnative/. Also see the N.C. Native Plant Society for native plant suggestions and suppliers at www.ncwildflower.org/index.php.

Habitat management in developments can be funded and administered by the home or property owner association dues. In local parks and public utility lines the local government can support habitat management. Habitat management recommendations are provided throughout this section and in the NCWRC (2012) conservation recommendations document that can be included in habitat management plans and activities.

REGIONAL DEVELOPMENT PRACTICES

Different development practices may be needed to create wildlife-friendly developments in different regions of the state, for example:

- Development projects in the mountains will need to avoid building on steep slopes.
- Development projects on the coast will need to protect shorebird nesting areas.
- Longleaf pine forest only benefits rare species when blocks of 2000 acres can be conserved as contiguous area among parcels and when prescribed burning is done.
- Small wetlands in the Sandhills and the Coastal Plain need wider upland forest buffers of more than 1000 feet and prescribed fire because the amphibian and reptile species in these regions need more space due to their unique habitat needs.

Regional wildlife friendly development practices are outlined in regional appendices to the Green Growth Toolbox handbook and in the NCWRC (2012) conservation recommendations document referenced below. Visit the Green Growth website at www.ncwildlife.org/greengrowth to download these documents.

For More Information

Many good resources exist that can provide information on ways to review and design development projects that will minimize impacts to wildlife habitats and important biological resources. A few of these are listed below.

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1 Information produced by an extensive review of the scientific literature for wildlife in the southeastern U.S. by the N.C. Wildlife Commission and other N.C. species experts. The resulting NCWRC documents are: a) NCWRC. 2012. Conservation Recommendations for Priority Terrestrial Wildlife Species and Habitats in North Carolina. North Carolina Wildlife Resources Commission Raleigh, N.C. Available from: www.ncwildlife.org/greengrowth and b) NCWRC. 2002. Guidance Memorandum to Address and Mitigate Secondary and Cumulative Impacts to Aquatic and Terrestrial Wildlife Resources and Water Quality. North Carolina Wildlife Resources Commission Raleigh, N.C. Available from: www.ncwildlife.org/Conserving/Programs/HabitatConservationProgram.aspx.

2 These nine guidelines were drawn from McElfish (2004). Nature Friendly Ordinances. Washington DC: Environmental Law Institute, and Dale et al. (2000). Ecological Society of America report: Ecological principles and guidelines for managing the use of land. Ecological Applications 10: 639-670.

3 PA Trees. Trees and forests reduce impacts of stormwater [Internet]. [Cited 2012 Dec 14]. Available from: www.patrees.org/trees-reduce-stormwater.

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5 Crawford, J.A. and Semlitsch, R.D. 2007. Estimation of Core Terrestrial Habitat for Protection of Biodiversity. Conservation Biology 21(1):152-158.

6 Mason, J., Moorman, C.E., Hess, G., and Sinclair, K. 2006. Designing suburban greenways to provide habitat for forest-breeding birds. Landscape and Urban Planning, 1-13; Sinclair, K.E., Hess, G.R., Moorman, C.E., and Mason, J.H. 2005. Mammalian nest predators respond to greenway width, landscape context, and habitat structure. Landscape and Urban Planning, 71, 277-293.

7 N.C. Wildlife Resources Commission. 2015. North Carolina Wildlife Action Plan. Available from: www.ncwildlife.org/plan.aspx.

8 Ibid. 7. "Small wetland communities," Pp. 185-188, 256-259.

9 These numbers should be doubled in watersheds that support federally listed species.

10 Willson, J.D. and Dorcas, M.E. 2003. Effects of Habitat Disturbance on Stream Salamanders: Implications for Buffer Zones and Watershed Management. Conservation Biology 17(3), 763-771; Rubbo, M.J. and J.M. Kiesecke. 2005. Amphibian Breeding Distribution in an Urbanized Landscape. Conservation Biology, 19 (2): 504-511; Houlahan, J.E. and C.S. Findlay. 2003. The Effects of Adjacent Land Use on Wetland Amphibian Species Richness and Community Composition. Canadian Journal of Fisheries and Aquatic Sciences. 60: 1078-1094.

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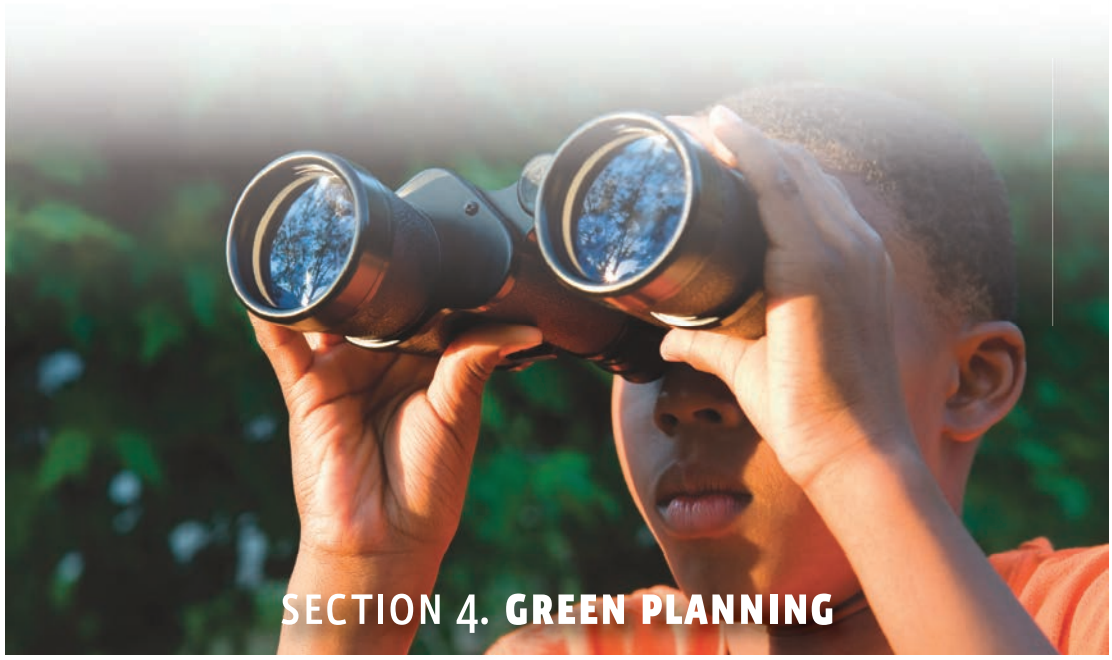
12 These recommendations were drawn primarily from the N.C. Wildlife Resources Commission's (2002) Guidance Memorandum to Address and Mitigate Secondary and Cumulative Impacts to Aquatic and Terrestrial Wildlife Resources and Water Quality. Available from: www.ncwildlife.org/Conserving/Programs/HabitatConservationProgram.aspx.

13 Ibid.



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ENABLE WILDLIFE AND HABITAT CONSERVATION THROUGH VISIONING AND PLAN MAKING

Green planning involves crafting the vision, goals, strategies and implementation sections in all planning documents that will enable conservation of important species and ecosystems as your community grows. In this section we provide guidelines on ways to include this priority in the following:

- Community-wide visioning documents
- Conservation plans
- Land use and comprehensive plans
- Transportation plans
- Park, greenway and open space plans
- Farmland protection plans
- Watershed management plans
- Risk assessment and hazard mitigation plans
- Strategic and economic development plans
- Green building and energy efficiency plans

Six Step Conservation Planning Process

Many communities identify a need for wildlife and natural resources conservation in planning. The following six step planning process will help to incorporate wildlife and habitat conservation in green infrastructure or conservation plans, land use, transportation, and other plans.

Step 1. Identify and describe the status of priority species and habitats in your community.

Identify the species, habitats and ecosystems that are of particular conservation interest or concern in your study area.

a) Consult the Conservation Data for Green Growth – Download and create maps that display priority habitats and ecosystems in and adjacent to your community.

What are

wildlife and habitat conservation priorities?

Conservation priorities are species, habitats, ecosystems or landscapes that conservation organizations are currently involved in protecting or that your community is particularly interested in. Scientifically-determined conservation priorities in North Carolina include priority wildlife species and habitats identified in the N.C. Wildlife Action Plan, rare species and natural communities identified by the N.C. Natural Heritage Program and landscapes identified by statewide assessments like the N.C. Conservation Planning Tool. Conservation priorities can also include other natural resources, such as areas that protect drinking water, important forest lands and agricultural lands. See page 17 for a list of priority habitats and Section 2 for maps of conservation priority areas in North Carolina.

b) Conduct any needed field inventories – Additional field inventory work may be needed to provide more complete information on important natural resources. If inventories cannot be completed in a timely manner, the plan should not be delayed but should allow for updates of new information.[1] See page 35 for information about conducting inventories.

c) Identify and display maps of wildlife and habitat conservation priority areas - Use the Conservation Data in Section 2 and local knowledge to analyze, map and describe the status of species, habitats and ecosystems. Below are a few questions you can use as a guide to identify important natural resources in need of conservation.[2]

- What is the condition of the species, habitats and ecosystems in your community?
- How well protected are your habitat and natural resource priorities?
- Where are the areas that could serve as wildlife travel corridors, to maintain as agricultural and conservation development districts between natural areas?
- What outside forces are likely to negatively impact these linkages in the future-forces such as future development and extreme weather events?
- Are there conservation priorities outside your community's planning jurisdiction that may affect your area? If so, are they linked to natural areas within your community? If not, is there a potential to create a linkage?

Step 2. Through a public process, establish a conservation vision and set conservation goals for your community.

The vision statement can outline the specific attributes of the natural environment that community members would like conserved.

- Prior to writing the vision statement, you may want to develop a list of conservation "issues" the public thinks are important. This list—and information collected about these issues—can inform the vision and goal statements.
- Once stakeholders in your community agree on a conservation vision statement, conservation goals can be drafted.
- Then, outline concrete, measurable objectives to be followed in order to achieve each goal.

Avoid vague language in setting goals. Plans that are too vague in defining their goals and objectives are often not effective in realizing those goals.

Goals that will lead to wildlife and natural resources conservation include:

- Conservation of a network of connected natural habitats and resources.
- Greenways are designed to conserve priority wildlife habitats.
- Development patterns are less spread out and more centralized in all districts.
- Conservation planning is coordinated with neighboring counties and municipalities.

Objectives that support wildlife and natural resources conservation include:

- Revising land use districts and development standards to use land more efficiently and to better conserve contiguous, large, priority habitat core areas.
- Setting targets for acres of priority habitats that should be conserved.
- Creating a conservation district for highly sensitive areas in your community where a percent of contiguous natural open space will be set aside in new developments.

Step 3. Develop conservation strategies to achieve goals.

The conservation strategies you select should be designed to implement your vision, goals and objectives. A menu of conservation strategies is presented later in this section.

Step 4. Identify ways to implement the conservation strategies.

Each conservation goal and strategy outlined in your plan should be linked to objectives and information stating who is responsible for doing what and by when. Prioritize implementation activities and present a timeline for completing tasks.

Step 5. Write the conservation plan.

- In addition to creating a stand-alone plan, it is important to integrate the implementation schedule and the vision, goals, maps and strategies into all planning documents.
- If possible, obtain grant funds to hire a consultant to write your conservation plan. You will want to make the consultant aware of this Toolbox and the resources it includes.

The Implementation Crisis

Recent research suggests that conservation planning is, "mired in an implementation crisis."[3] In other words, conservation plans are being developed…but not carried out.

Focusing on the implementation accountability, funding and budgeting can help to turn plans into action.

Step 6. Implement the plan and monitor progress.

The final step is to include implementation activities in budgets and work schedules, create a network for implementation support and monitor your progress using practical measures of success. Ideas for implementation are provided throughout this section.

Developing a County or City-Wide Conservation Plan

Creating even a simple, brief jurisdiction-wide conservation plan is the most effective way to help ensure the realization of your community's vision for conserving wildlife, habitat and other natural resources.

Examples of Conservation Plans in the Carolinas

- The Chatham County, North Carolina, Comprehensive Conservation Plan was funded by external grants and was created by a partnership of scientific experts, community members, the planning department and elected officials. www.chathamconservation.wikispaces.com/Comprehensive+Conservation+Plan
- Jasper County, South Carolina, Natural Resources Conservation Plan www.dnr.sc.gov/conservation/districtsdnr/jasper/

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Greening Existing Plans

A good compromise for busy communities

Depending on your community's immediate priorities it may be easier to write a habitat conservation section for your land use, transportation or comprehensive plan. It is important to incorporate habitat conservation goals, objectives and strategies into other sections of all local plans to fully enable habitat conservation.

The process of writing a habitat conservation section for an existing plan is less in-depth but follows the same general process as the six step process outlined above.

Leverage all of your conservation resources.

Utilize complementary public investment grants and programs.

Public investments are expenditures toward the future public good, such as roads, water and sanitation. Public investments also need to be made to support a community's natural assets through funding conservation education and planning, land acquisition, transaction costs for conservation easements and habitat stewardship on locally owned public lands. Funds can come from external grants but also from bonds and minimal fees.

Collaborate with local, state and federal natural resource agencies.

- Call on your local land trust, Soil and Water Conservation District and Extension agency to assist with conservation planning and projects.
- See Appendix B for a list of organizations that can provide technical assistance.

Use the best conservation data and strategic planning tools available.

- Integrate and regularly update conservation GIS data in the community's online GIS mapping application or local government computer network.
- Use land use planning software that evaluates the fiscal impact of decisions.
  - Orton Family Foundation Planning Tool Exchange www.orton.org/tools/planning_tool_exchange
  - NatureServe Vista is a free ArcMap 10 Extension based on CommunityViz that measures the benefits of conservation decisions for land use planning www.natureserve.org/prodServices/vista/overview.jsp
  - Open Source Scenario Planning Tools from the Lincoln Institute for Land Policy http://scenarioplanningtools.org

Green Infrastructure Planning


bald eagle

In that last decade, green infrastructure planning has taken off as a preferred framework by local governments to plan for conservation of natural resources, including biodiversity. The central principle of green infrastructure is to plan the green before the gray. It is important to include the information in Section 3 to effectively conserve wildlife habitat, which is not fully addressed in green infrastructure guidance. See the Conservation Fund website for more information at www.conservationfund.org (search term "green infrastructure").

A MENU OF CONSERVATION STRATEGIES[4]

Listed below is a menu of planning strategies that can help your community achieve its conservation goals.

Involve local citizens, businesses, landowners and other representatives from every interest group in conservation visioning exercises.

- Ask stakeholders to rate how important wildlife and habitats are to them to demonstrate the level of demand for conservation in the community. If you do not have the resources for this, poll your Planning Board or Board of Commissioners.
- Arrange mapping workshops with representatives of every interest group and ask them to identify important conservation areas on maps. Consider using the Conservation Data for Green Growth and identifying target growth areas.

Include language in planning documents detailing the importance of conserving areas of high wildlife and biodiversity value.

- During the planning document updates include information about wildlife and habitats from existing statewide and local conservation plans (see page 65).
- During the plan creation or update process, propose that information be included on the benefits of Green Growth from Section 1.

Translate conservation goals and objectives into policies in the land use, transportation or comprehensive plan. Address conservation goals and strategies in all other community planning documents.

- Refer to Sections 3 through 6 of the Green Growth Toolbox for specific recommendations on the amount of habitat wildlife need and what land use planning techniques can be used to better conserve habitats and natural resources. This science-based information can help in creating policies that actually conserve priority wildlife habitat.

Coordinate with neighboring counties and municipalities.

- Adopt a regional wildlife and habitat conservation resolution to coordinate planning actions, implementation strategies, land acquisition activities, stewardship activities and other conservation actions.

When planning for the creation of greenways and trails, consider the needs of wildlife that could also use these greenways as habitats and travel corridors.

- Refer to Section 3 for specific recommendations on designing greenways to conserve priority wildlife habitat.

Encourage setting aside contiguous large core areas of natural open space in developments in sensitive areas. Encourage clustered rural and urban development and agricultural districts to enable conservation of a network of priority habitats.

- Identify which ordinances, programs and other tools could be used to make development patterns less spread out and more centralized in rural developments and in urban areas. Schedule when the revisions and ordinances will be drafted and considered by local boards.
- Refer to Sections 3 to 6 for measures to conserve priority wildlife habitat at all levels of land use planning.

Implementation Support

Implementation is the most challenging aspect of planning. Listed below are a few key components that will help to ensure that your plans do not sit on a shelf.

To support implementation activities:

- Include implementation responsibilities in plans, work unit business plans and individual staff work plans.
- Create line items in work unit budgets to provide funds needed to implement conservation strategies.
- Make certain all appropriate staff and elected officials are educated about their roles to ensure successful implementation.
- Develop and publish a list of contacts for conservation partners that can assist in Green Growth planning and implementation (see Appendix B).

Create and Update an Action Plan

Create an implementation action plan that will outline specifically who, what, when, where and how conservation strategies will be implemented. For instance, Orange County, North Carolina, adopts two-year action plans to guide implementation of the strategies outlined in their Lands Legacy Program guiding document. www.co.orange.nc.us/ercd/lands_legacy.asp
.

Conservation Advisory Boards

A number of North Carolina communities have conservation related boards. These boards can play an active role in helping your community achieve Green Growth. A conservation advisory board can:

- Inform or guide development of a local conservation plan.
- Work with elected officials, planning staff and the planning board to structure zoning and development ordinances to improve habitat conservation.
- Review development applications and assist developers in creating wildlife friendly development projects.
- Initiate and guide a countywide natural resource inventory.
- Guide development of management plans for natural areas in the town.
- Work with local land trusts to purchase strategic parcels of land for conservation.

Consider appointing a staff member with some biological expertise to assist the conservation advisory board in the roles described above.

Land Acquisition and Conservation Easements

- Public education on the benefits and need for land conservation generated public support for conservation funding in York County, S.C.
- Establish funding for transaction or total costs of conservation easements on important natural areas in your community. A conservation easement is a voluntary agreement that allows a landowner to permanently limit the type and amount of development on their property while retaining private ownership.
- Coordinate land acquisition strategies with other jurisdictions to conserve landscapes that may cross your own community's boundaries.

Scuppernong River boardwalk

- Develop a partnership with your local land trust to cooperatively work toward conserving high-quality natural areas in your community. Encourage your Soil and Water Conservation District to accept and monitor conservation easements.
- Plan for your land acquisition program to obtain strategic parcels of land.

Examples

Raleigh, North Carolina, has a watershed protection fee on water bills. The fee averages 45 cents per month per family and is used to protect lands important to drinking water quality.
www.raleighnc.gov/home/content/FinUtilityBilling/Articles/UtilityBillingDepositFees.html

York County Forever is a commission of York County, South Carolina, that funds transaction costs of conservation easements. It is funded by a small proportion of local taxes voted in by the public after a conservation education campaign.
www.yorkcountygov.com/departments/PlanningAndDevelopment/planning/ForeverCommission

Public Works and Utilities


JEFF MARCUS

Native grassland along a powerine

- Integrate wildlife habitat conservation and restoration strategies into existing public works programs (i.e., solid waste programs, water resources programs).
- Incorporate wildlife conservation priorities into transportation facility planning, design, development and maintenance.
- Restore and develop wildlife habitat management plans for community-owned lands, including parks, greenways, natural areas, schoolyards and other open spaces. The Wake Nature Preserves Partnership (Wake County, North Carolina) is a good example of collaboration between the county, a university and natural resource agencies to manage county parks for natural habitat (wakenature.wordpress.com).
- Use native landscaping on municipal and county building sites.
- Work with businesses, government agencies and other groups to reduce bright night lighting and its negative impact on wildlife. This can also save public energy costs.

Incentive Programs

- Create a local recognition or rewards program for landowners or developers who maintain wildlife habitat on their properties.
- Promote wildlife habitat management cost-share programs and tax incentives.
- See Section 5 for more incentives information.
- See the Defenders of Wildlife report, "Incentives for Biodiversity Conservation," at www.defenders.org/publications/incentives_for_biodiversity_conservation.pdf.

Education

Public education about the value of our wildlife and habitats is essential to natural resources conservation at the local level.

- Encourage your newspaper to run a regular wildlife conservation-related column.
- Utilize social media to educate the public about wildlife and conservation issues.
- Work with conservation partners to develop wildlife education programs and facilities to provide opportunities for citizens to learn about the species, habitats, and important ecosystems in your community.
- Provide information to residents and visitors about how to avoid wildlife conflict situations and respond appropriately when they arise (see Appendix C).

INTEGRATING STATE AND REGIONAL CONSERVATION PLANS

Although local governments focus on developing plans for individual jurisdictions, it is important to examine the larger, regional context within which these plans are being created. When putting together a local conservation plan—or a "habitat conservation" section for an existing plan—integrate the goals and strategies of state and regional conservation plans into your local plan.

State and regional plans are important because they can help your community to:

- Analyze the impacts of land use policies in a regional context.
- Leverage the expertise of prior planning efforts.
- Establish a fruitful partnership with state and regional conservation initiatives.

North Carolina Wildlife Action Plan
This plan was developed by the North Carolina Wildlife Resources Commission in partnership with hundreds of stakeholders and wildlife experts across the state. The plan provides science-based information on the wildlife and habitat conservation priorities in our state.

- The plan identifies fish and wildlife species and describes associated habitats that are priorities for conservation.
- Use and reference the habitat descriptions and priority species lists from this plan in planning documents as appropriate.
- To access the N.C. Wildlife Action Plan go to www.ncwildlife.org/plan.aspx.

N.C. Conservation Planning Tool
The North Carolina Natural Heritage Program has developed a conservation planning tool.

- This tool consists primarily of six GIS assessments that identify the highest quality lands and waters for conservation across the state.
- For more information, see Handbook Section 2.

Regional Conservation Plans
In addition to these statewide initiatives, many conservation planning efforts have been undertaken at the regional level. Regional conservation plans specific to your area are available in your Green Growth Toolbox Regional Appendix. Some links to regional plans are:

- The N.C. Conservation Planning Tool Web page on other conservation planning efforts at www.ncnhp.org/conservation/conservation-planning-tool/resources/other-efforts
- The Coastal Habitat Protection Plan, which provides information on the status of marine habitats and coastal fisheries and outlines management needs for threatened coastal resources. http://portal.ncdenr.org/web/mf/habitat
- Basinwide Water Quality Plans from NCDENR which contain information about local natural resources conditions. https://deq.nc.gov/plans
- Available through your Council of Government and include watershed, green infrastructure and other conservation related plans.

KEY CONCEPTS FOR ENABLING HABITAT CONSERVATION IN PLANNING

It is essential to incorporate conservation goals, objectives and strategies in all types of community plans and to include an implementation action section in all plans. The following are key concepts to address in community plans that will enable wildlife and habitat conservation. Refer also to Handbook Sections 3, 5 and 6 for additional policy ideas.

Land Use Planning

The action that is most important to enable wildlife and habitat conservation in land use planning is to encourage a connected network of priority habitats. Design land use districts and policies to avoid extensive spread out development in high priority habitat areas and to encourage agricultural districts around and between protected lands.

Transportation Planning

Roads have a great impact on the health and stability of habitats and wildlife populations, especially for those animals that move on land such as amphibians and reptiles, but also for species that fly or glide, including bats and flying squirrels.

- Encourage development patterns and resulting road projects that encourage centralized growth and will avoid priority wildlife habitats.
- Take advantage of Federal Highway Administration (FHWA) grant programs for ecological conservation.
- Emphasize "Transit Oriented Development," public, bike and walking transit options.
- Avoid wetlands and minimize road stream crossings.
- Encourage roads and developments that are set out in a grid system versus cul-de-sacs and unconnected streets. This allows for compact development and walking.

Wildlife Crossing Structures

Wildlife Crossing Structures are structures that can enable wildlife to cross under or over busy roads. These can be placed in areas where major roads bisect high priority wildlife habitats and travel corridors. Wildlife crossing structures are effective in preventing collisions and reducing injuries, deaths and vehicle repair costs. Costs are approximately 8 percent of the road project cost.[5] The N.C. Department of Transportation (NCDOT) consider installing these at locations between permanently conserved lands. Therefore, it is important to target land acquisition in key areas.

- Request that NCDOT or FHWA fund wildlife road underpasses in your community.
- Collaborate with federal, state and local partners to plan a system of wildlife underpasses using programs such as the FHWA "Eco-Logical" grants. environment.fhwa.dot.gov/ecological/eco_index.asp

For more information on wildlife crossing structures see:

- Federal Highway Administration's Critter Crossings website at www.fhwa.dot.gov/environment/critter_crossings/main.cfm
- Wildlife and Roads Decision Guide at www.wildlifeandroads.org

Park and Greenway Plans

- Refer to Section 3 and specifically discuss the width and area of habitat needed to conserve priority wildlife habitat and travel corridors with greenways.
- Create a category of public parks that conserve and manage natural habitats with a goal along the lines of connecting the public with nature.
- Set up a method to remain aware of conservation opportunities with willing landowners in priority habitat areas. Work with your land trust.
- When designing parks and greenways try to conserve and manage a connected network of large habitat hubs and wide natural corridors that connect the hubs.

Risk Assessments and Hazard Mitigation Plans

Healthy ecosystems, compact development patterns and wildlife friendly development practices protect our communities from storms, floods, drought and wildfire. Actions your community takes to conserve wildlife and habitat will reduce the risk of natural disasters.

- Address the importance of supporting prescribed fire on managed areas through land use planning. See pages 4, 30 and 94 for more information.
- Encourage Firewise design and keep intensely developed areas far from large natural areas and working lands.
- Discuss the benefits of conserving floodplain forests, large and small wetland communities and large blocks of forest.
- Identify ordinances that could protect natural resources and habitat.

Watershed Management Plans

- Address the importance of conserving high-quality streams proactively.
- Emphasize conservation of stream buffers. Restoration is much more costly than preserving riparian forest buffers to maintain water quality and healthy streams.
- Encourage the use of wildlife friendly low impact development and management practices to minimize nutrient, sediment, stormwater and other polluted runoff.
- Identify wildlife and habitat conservation priority areas that overlap with watershed priorities.

ERIN HANCOCK, NCWRC

What is

a watershed?

All land is part of a watershed where water flows from higher to lower elevations into streams, rivers and, eventually, the ocean. Riparian forest stream buffers are essential to filter and clean water, maintain top soil, trap sediment and filter polluted runoff. Without riparian forest buffers rainwater runs off directly into streams without being filtered by trees and plants, which increases drought conditions and pollution.

Farmland Protection Plans

- Address the importance of farm and forest land as buffers to Managed Areas and as wildlife travel corridors (see page 30).
- Evaluate where priority species that depend on cropland or forest connectivity occur.
- Stress the importance of habitat management on working lands and easements.
- Address the role of biodiversity in pollination.
- Include information about the Wildlife Conservation Lands Program as a mechanism to conserve priority wildlife habitats on private land. www.ncwildlife.org/Conserving/Programs/LandConservationProgram.aspx.

JEFF MARCUS

Floodplain forests protect farms

Strategic and Economic Development Plans

- Include information on the benefits of Green Growth from Section 1.
- Address the importance of Green Growth practices in maintaining rural, scenic and nature-related recreation, spending and tourism.
- Enable wildlife related recreation, including hunting and fishing, through coordinated acquisitions, easements and land use planning measures.
- Recognize the importance of wildlife friendly greenways to economic development.
- Address the importance of outdoor nature-related opportunities to attracting new business and skilled workers.

Green Building and Energy Efficiency Plans

- Encourage conservation of natural, contiguous open space in green building criteria in priority habitat areas.
- Address the cost and energy savings that are gained from more centralized development patterns and mixed uses that encourage less driving.
- Encourage wildlife friendly site selection for wind and solar facilities.

Performance Measures

Performance measures for local government habitat conservation planning include:

- Acres of conserved priority habitat and average habitat patch core area
- Number of cluster developments in each land use district
- Feet of stream buffered by riparian forest and average buffer width
- Water and air quality metrics
- Number of parcels with connected natural open space
- Forest cover using the National Land Cover Database available at www. mrlc.gov
- Acres of forests or agriculture in Present Use Value
- Acres of land enrolled in the N.C. Wildlife Conservation Lands Program
- The number of planning processes and ordinances that improve habitat and natural resource protection

Examples of Local Government Performance Measures

- Mecklenburg County, North Carolina, State of the Environment Report issuu.com/mecklenburgcounty/docs/final_2010_soer
- King County Washington Water and Land Resources Performance Measures your.kingcounty.gov/dnrp/measures/2010/performance/environment.aspx
- Portland, Oregon 2040 Performance Measures www.oregonmetro.gov/index.cfm/go/by.web/id=13104

Example Plans

Land Use and Comprehensive Plans

- Town of Navassa, North Carolina, CAMA Land Use Plan - provides an example for a rural community near a major city. www.townofnavassa.org/longrangeplanning.html
- Madison County, NC Land Use Plan - is an example of how a rural community chose to incorporate green growth principles. www.madisoncountync.org/downloads/zoning/Madison_County_Comprehensive_Plan.pdf
- Randolph County, N.C., Growth Management Plan - emphasizes a vision and practical goals to conserve natural heritage through cluster development. It also lays out techniques to allow for higher density development, once public water and sewer are available on previously developed sites. www.co.randolph.nc.us/pz/gmp.htm
- Raleigh, North Carolina, Comprehensive Plan - integrates wildlife and habitat conservation and compact development strategies in all planning elements. Section C, "Environmental Protection," provides detailed priority wildlife habitat conservation information, justification, goals and strategies. www.raleighnc.gov/business/content/PlanLongRange/Articles/2030ComprehensivePlan.html
- Orange County, North Carolina, Comprehensive Plan, Section 6.4.4 - contains a description of the county's wildlife and plant resources and establishes conservation strategies. www.co.orange.nc.us/planning/compre_cpupdate.asp
- City of Tampa, Florida, Comprehensive Plan, Chapter 5, "Sustainable Environment" – includes a rationale, goals and policies to conserve significant wildlife habitats. The plan's policies are further implemented through the city's Upland Habitat Protection Ordinance and Urban Environmental Coordinator. www.planhillsborough.org/tampa-comprehensive-plan/

Transportation Planning

- McHenry County, Illinois, Long Range Transportation Plan - is based on a Green Infrastructure plan and maps that include important wildlife habitat areas. www.2040mchenrycountyplan.org/documents-0
- Arizona Department of Transportation Wildlife Linkages Assessment - was created in consultation with wildlife professionals to identify key areas for wildlife underpasses and to minimize road construction. azdot.gov/business/environmental-services-and-planning/programs/wildlife-linkages

Watershed Management Plans

- Lincoln County, North Carolina, used the Green Growth Toolbox and the N.C. Conservation Planning Tool in the Indian Creek and Howards Creek Local Watershed Plan. www.lincolncounty.org/index.aspx?NID=559

Greenway Plans

- The Westmoreland County, Pennsylvania, "New Horizons: A County-wide Greenways and Blueways Network," plan uses habitat conservation data to identify a network of large habitat hubs and corridors. Strategies, land use methods and funding mechanisms to conserve the network are discussed. www.dcnr.state.pa.us/cs/groups/public/documents/document/d_001213.pdf

Risk Assessment and Hazard Mitigation Planning

- See the Environmental Law Institute's Series on, "Wetlands, Wildlife Habitat and Flood Hazards," for guidance on integrating priority habitat conservation in local hazard planning. www.eli.org/Program_Areas/natural_hazard_mitigation.cfm
- See, "Integrated Planning for Resilient Communities: A Technical Guide to Hazard, Ecosystem and Land Use Planning, South Carolina Ecosystem-Based Management Demonstration Project." www.ebmtoolsdatabase.org/resource/integrated-planning-resilient-communities-technical-guide-integrating-hazard-ecosystem-and-

Wildlife and Biodiversity Conservation Plans

- Village of Schaumburg, Illinois, Biodiversity Recovery Plan - is part of their Comprehensive Plan. It guides the community's efforts to preserve, restore and maintain biodiversity within the community. http://futureofschaumburg.wordpress.com/biodiversity/
- Anchorage, Alaska's municipal Comprehensive Wildlife Management Plan - was developed in partnership with multiple state and federal agencies. www.adfg.alaska.gov/index.cfm?adfg=anchorageplanning.anchoraged

Local Government Green Infrastructure Programs

- The Conservation Fund is one organization that maintains a website of local government green infrastructure case studies. www.conservationfund.org/our-conservation-strategy/focus-areas/green-infrastructure/case-studies/

Regional Comprehensive Assessments

- The Western North Carolina Vitality Index provides information on the status of the economic, social, natural and built environment indicators of 27 counties in western North Carolina. It incorporates the N.C. Conservation Planning Tool and summary information on the biodiversity resources of the region. www.wncvitalityindex.org
- GroWNC was created by the Land of Sky Regional Council and is based on planning that will increase economic competitiveness and job creation in the Council's region of the southwest North Carolina mountains. It incorporates a green infrastructure analysis and scenario mapping for development patterns and natural resource conservation. www.gro-wnc.org/index.html

Multiple Examples of Wildlife Conservation-Based Planning and Development

- See the Minnesota Department of Natural Resources, "Guide to Using Natural Resource Information in Local Decision Making." www.dnr.state.mn.us/nrig/index.html

For More Information and Resources

American Planning Association. 1999. Policy Guide on Endangered Species and Habitat Protection. Available from: www.planning.org/policy/guides/adopted/endanger.htm.

Austin et al. 2004. Conserving Vermont's Natural Heritage: A Guide to Community-Based Planning for the Conservation of Vermont's Fish, Wildlife and Biological Diversity. Waterbury, VT. Available from: www.vtfishandwildlife.com/cwp_home.cfm.

Chicago Wilderness Consortium. 2007. Chicago Wilderness Biodiversity Recovery Plan. Available from: www.chicagowilderness.org/resources/.

Corridor Design: GIS Tools for Designing Wildlife Corridors. [Internet]. Available from: http://corridordesign.org

Duerksen, C. and C. Snyder. 2005. Nature-Friendly Communities: Habitat Protection and Land Use Planning. Island Press: Washington, DC.

Elliott, D. L. 1998. Planning and Development for People and Wildlife, American Planning Association.

Maine Department of Inland Fisheries and Wildlife. 2003. Beginning with Habitat: An Approach to Conserving Maine's Natural Landscape for Plants, Animals and People. Available from: www.beginningwithhabitat.org.

Minnesota Department of Natural Resources. Guide to Using Natural Resource Information in Local Decision Making. [Internet]. [Cited Dec 2012]. Available from: www.dnr.state.mn.us/nrig/index.html#.

Perlman, D.L. and Milder, J.C. 2005. Practical Ecology for Planners, Developers and Citizens. Lincoln Institute of Land Policy. Washington DC: Island Press.

White, P. A. and M. Ernst. Second Nature: Improving Transportation Without Putting Nature Second. Washington D.C: Defenders of Wildlife. Available from: www.transact.org/library/reports_pdfs/biodiversity/second_nature.pdf

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1 Hedley, S. G., K. A. Wilson, A. Moilanen, T. Rebelo and H. P. Possingham. 2009. Delaying conservation actions for improved knowledge: how long should we wait? Ecology Letters 12:293 – 301.

2 Perlman, D.L. and Milder, J.C. 2005. Practical Ecology for Planners, Developers, and Citizens. Lincoln Institute of Land Policy.

3 Knight, Andrew T., Cowling, R.M., Campbell, B.M. 2006. An Operational Model for Implementing Conservation Action. Conservation Biology, 20(2), 408-419.

4 These suggestions are drawn from several sources cited under 'For More Information' in this section: Chicago Wilderness Consortium (2007), Austin et al. (2004) and Maine Department of Inland Fisheries and WIldlife (2003).

5 Bank, F. G., C. L. Irwin, G. L. Evink, M. E. Gray, S. Hagood, J. R. Kinar, A. Levy, D. Paulson, B. Ruediger, R. M. Sauvajot, D. J. Scott, and P. White. 2002. Wildlife habitat connectivity across European highways. U. S. Department of Transportation Federal Highway Administration Report: 1-45.

U.S. FISH & WILDLIFE SERVICE

ACHIEVE GREEN GROWTH THROUGH INCENTIVES AND ORDINANCES

Green Growth includes providing growth management incentives and revising ordinances to remove barriers to wildlife, habitat and natural resource conservation. This section outlines the components of greening incentives and ordinances and provides links to methods used by other communities.

Check our website www.ncwildlife.org\greengrowth for additional examples.

For the most threatened unique ecosystems, especially those with the most threatened and endangered wildlife (such as areas of intact longleaf pine forest), encouraging extensive land development will not conserve high priority wildlife or habitats. In this scenario, a combination of public and private land acquisition investments and policy that supports managed regional growth has been shown to work. The Pinelands of New Jersey is a good case study for how to achieve conservation of large landscapes of unique habitat under significant development pressure. The New Jersey Pinelands Commission regional planning compacts provide incentives to participating communities. The Pinelands Commission also monitors the economic health of the region. Pinelands communities consistently issue more building permits than other areas of the state and have a 4 percent higher median sales price. Building transactions during the economic recession beginning in 2007 were 50 percent higher in the Pinelands and the unemployment rate was the same as other areas.[1]
www.state.nj.us/pinelands/

Land Use Patterns that Maintain Natural Resources

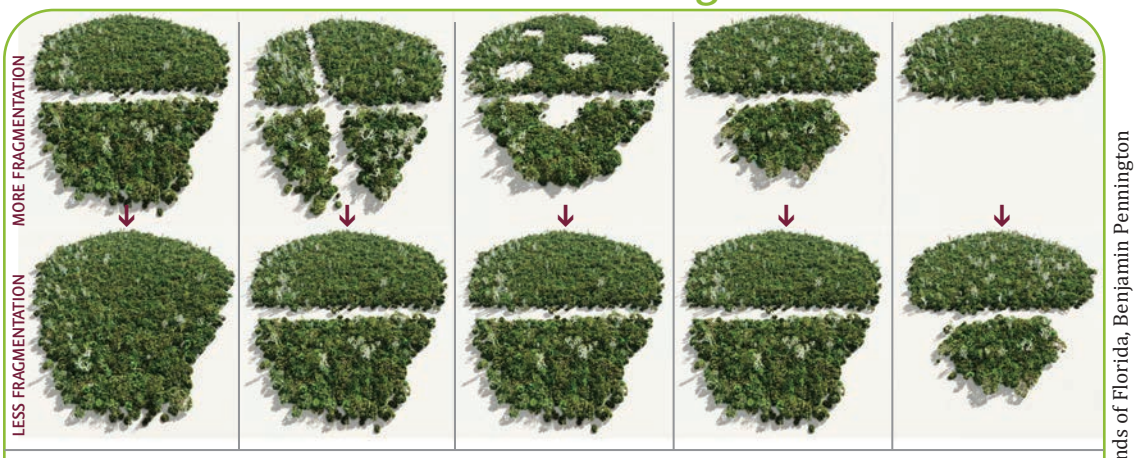
Making better use of opportunities to conserve biodiversity

Land use patterns that conserve, buffer and connect priority wildlife habitats and other natural resources can allow communities to maintain the benefits of Green Growth. These patterns are most assured when incentives and ordinances encourage centered, more dense growth patterns, mixed uses, rural cluster development, transit oriented development, appropriate habitat conservation and low impact development measures. Greener development decisions can allow for the same number of development projects that are needed while encouraging more efficient land use without harming private property rights.
See page 84 for a visual representation of land use patterns that maintain natural resources.

Benefits of Natural Resource-Based Land Use Patterns

- Less tax payer dollars spent on infrastructure maintenance and more funds to provide business incentives and labor force training.
- More free services provided by nature, such as water quality and quantity.
- Lower transportation costs which improves housing affordability.
- More walking and biking opportunities for healthier, more desirable communities.

Reduce Wildlife Habitat Fragmentation



Many local governments nationwide have ordinances that require or encourage habitat conservation. However, these policies are failing to prevent habitat loss because they do not clearly state that wildlife habitat should remain unfragmented. To prevent fragmentation, the habitat interior to edge ratio should be minimized by being as close to circular, without perforation, and as large as possible. Natural open space on adjacent developments should be connected so that a connected network of natural areas can be formed. Private or public greenways or trails can be placed in connected natural open space.

Source: 1000 Friends of Florida, Benjamin Pennington

GREENING INCENTIVES

Use of incentives is important to creating development patterns and practices that maintain wildlife habitat and natural resources. Here, we summarize the incentives available in North Carolina and also some popular incentives used by other states but which would require approval from our State Legislature to implement.

We recommend that local governments employ and provide information to landowners about the following incentives that encourage natural resource-based land use patterns.

Conservation Easements

Under a conservation easement the landowner retains full ownership of their property. Conservation easements are voluntary legal agreements that permanently protect land from intensive development. Landowners can donate conservation easements that meet the qualifying criteria of their local land trust, local or state government or other government entity, such as a Soil and Water Conservation District. An easement donation can offer significant tax reduction to landowners. Conservation measures in the easement are negotiable and match landowner's property-use objectives and needs with long-term benefits to their community.

Local governments can greatly support the ability of landowners to utilize conservation easements by creating funding mechanisms to finance legal and real estate transactions fees for conservation easement projects led by local land trusts. Local governments and Soil and Water Conservation Districts can also hold conservation easements. Target easement projects to the highest priority wildlife habitat and natural resources.

Find your local land trust at www.ctnc.org/land-trusts/find-your-local-land-trust/.

For examples of local government support of conservation easements, see Section 4, page 63.

N.C. Conservation Tax Credit Program

This program could provide tax credits for land that conserves habitat, if it is re-established by the N.C. Legislature. www.ctc-nc.org

The Wildlife Conservation Lands Program (WCLP)

This is a new program that enables landowners to receive a reduced property tax rate for conserving priority wildlife habitat. Landowners must have owned their property for at least five years. The N.C. Wildlife Resources Commission must verify 20 acres or more of contiguous priority wildlife habitat on the land for landowners to qualify.

bog turtle

For more information:
www.ncwildlife.org/Conserving/Programs/LandConservationProgram.aspx

Agricultural and Forestry Present-Use Value

Landowners with an approved forest management plan or a working farm can qualify for a reduced property tax rate.

For more information:

- Present-Use Value Program for Forestland:
  http://ncforestservice.gov/Managing_your_forest/managing_presentuse.htm
- Example of Present-Use Value on a county website:
  www.hendersoncountync.org/ca/taxpvalue.html
- Voluntary Agricultural Districts:
  Voluntary Agricultural Districts encourage agricultural land uses. For more information visit the Land Preservation Notebook at www.cals.ncsu.edu/wq/lpn/index.htm.

Conservation-Based Development Incentives

Make any conservation-based development use by right, to reduce regulatory barriers. Make conventional development methods a special use in conservation districts that contain the most sensitive areas.

Provide a density bonus incentive outside sensitive areas in exchange for natural, unfragmented, open space set-asides.

In urban and urbanizing areas, conservation development should usually only be encouraged to conserve unfragmented forests along waterways, including intermittent streams, floodplains and wetlands as opposed to tracts of upland habitat. This will help to prevent habitat fragmentation and sprawl.

In rural areas consider creating a conservation district in the most environmentally sensitive areas that encourages large, unfragmented natural open space set-asides in exchange for a density bonus.

- Reduce the fees charged to developers for services in exchange for conservation.
- Flexible development standards such as reduced set-backs and screening buffers.
- Reduced development application fees.
- Priority development review and personal assistance to expedite permitting.
- Awards and certification for developers that avoid sensitive natural areas and minimize urban sprawl.

Examples

- See handbook page 89 for conservation development incentives ordinances used by Franklin, Chatham and Randolph Counties. Their ordinances provide a density bonus in exchange for up to 50 percent or more unfragmented, priority wildlife habitat conservation. These options are consistently chosen by developers in those counties.
- The Wildlife Friendly Development Certification program (developer application fee required) certifies qualifying developments. www.ncwildcertify.org
- LEED certification (developer application fee required), particularly the LEED Neighborhood Development Certification. www.usgbc.org/leed
- The Greater Triangle Stewardship Development Awards program. www.trianglestewardship.org

Incentives that Require Approval by the N.C. Legislature

Voluntary Transfer of Development Rights (TDR)

This is an important tool that can protect ecosystems while promoting economic growth.

- In N.C., communities must obtain approval from the state legislature to use TDRs. Davidson and the counties of Orange, Chatham and Currituck have worked to do this.
- Willing landowners enroll their land voluntarily in a development rights sending area that contains environmentally sensitive and agricultural areas. Development receiving areas are where higher density development is desired.

Voluntary Transfer of Development Rights

MCSWEEN PHOTOGRAPHY

- The TDR program facilitates transactions where willing landowners in sending areas sell development rights to developers in receiving areas.
- Twenty states have passed legislation that enables TDRs,[2] including Georgia and Tennessee. Two hundred such programs exist in the country.[3]

Example TDR Programs

- King County, Washington's TFDR program has preserved 92,000 acres, while accommodating needed growth. www.kingcounty.gov/environment/stewardship/sustainable-building/transfer-development-rights.aspx
- Montgomery County, Maryland's TDR program was established to preserve farmland and to curb sprawl originating from Washington D.C. www.montgomeryplanning.org/community/plan_areas/rural_area/planning_process/about_the_process/tdr.shtm

The Rural Lands Stewardship Program (RLSP)

A non-regulatory, market-driven, incentive program led by landowners

Although the results of the RLSP program have been mixed, it is a promising approach. The RLSP was spearheaded by Collier County, Florida and major landowners to find an incentive-based solution for growth management. The program can serve communities nationwide. It is a credit-trading program whereby willing landowners and developers trade credits to conserve valued natural resources and wildlife habitat. Some outcomes may lead to scattered urbanization in rural areas, which fragments habitat.[4] The program was deemed a success by Collier County, who still employs it and plans to improve it to address problems. The lack of parity between Florida State Land Use Planning rules and the RLSP has prevented adoption by other counties to date (Chapin and Coutts, 2011, reference on page 97). http://privatelands.org/rural/RLSP.htm

GREENING ORDINANCES

Rework existing ordinances to make better use of open space by reducing habitat fragmentation and removing barriers for developments that conserve habitat and natural resources.

Communities around the country have developed ordinances with the goal of protecting important wildlife habitats. However, recent research by the University of Colorado has shown that most ordinances lack measures to encourage habitat continuity and are leading to habitat fragmentation.[5] The information in this section and the handbook aims to provide effective planning methods that conserve habitats and reduce habitat fragmentation.

Protection of Important Wildlife Habitats

Protection of important wildlife habitats is necessary to achieve Green Growth. To preserve viable habitat, it is important to do the following:

- Direct extensive development away from the boundaries of Managed Areas. Maintain a rural landscape in conservation priority areas between protected areas.
- Have an understanding of your region's priority wildlife habitats detailed in the N.C. Wildlife Action Plan.
- Develop an understanding of the Conservation Data provided in Section 2 and in the regional appendix and where these habitats are in your region.
- Learn about federal and state-listed endangered and threatened species detailed in Appendix A.
- Work toward conserving a network of important habitats - larger core habitat areas linked by wildlife travel corridors. Encourage or require connection of large blocks natural open space on adjacent developments.
- Conserve Natural Heritage Natural Areas and Natural Heritage Elements.
- Take any steps toward Green Growth that your community supports.

Example Ordinances

- The N.C. Model Natural Resources Conservation Ordinance (see next page). www.ncwildlife.org/greengrowth
- The City of Tampa, Florida, Upland Habitat Protection Ordinance is designed to protect important plant communities and wildlife habitat. Approved upland habitat plans are required before major development within the overlay district. http://landuse.law.pace.edu/landuse/documents/laws/reg4/FL-ORD-Tampa-UplandHabitatProtection.doc
- The Town of Falmouth, Massachusetts, has a Wildlife Overlay District within which any proposed development must take concrete steps to protect habitat. www.falmouthmass.us/planning/corridor_map.pdf
- The Town of Brunswick, Maine, Wildlife Habitat Overlay District creates incentives to maintain contiguous blocks of natural open space during development and is intended to supplement underlying subdivision ordinances. www.beginningwithhabitat.org/pdf/Brunswick%20Wildlife%20Habitat%20Overlay%20District.pdf
- The King County, Washington, Critical Areas Ordinance requires protection of Wildlife Habitat Conservation Areas, for wildlife species listed as priorities in the Comprehensive Plan. www.kingcounty.gov/property/permits/codes/CAO.aspx

A Model Natural Resources Conservation Ordinance for North Carolina

The N.C. Wildlife Resources Commission and the Duke Nicholas Institute for Environmental Policy Solutions teamed up with the Town of Navassa, N.C., to provide a model ordinance for comprehensive natural resource and habitat conservation in North Carolina communities. The model ordinance acts as an overlay district and is meant to conserve only the most sensitive natural resource areas and the most rare types of upland wildlife habitats. It can be modified to work as an option in exchange for a density bonus incentive.
Please see www.ncwildlife.org\greengrowth for details.

Open Space Standards and Habitat Conservation

Wildlife habitat conditions change over time. As such, if conservation of specific habitat areas is required on developed sites, the delineation of the habitat must be based on a site survey and not only on a map depicting wildlife habitat. If the specific location of required open space on a development is voluntary, a site survey does not need to be required.

Protection of Natural Heritage Sites

Natural Heritage sites are Natural Heritage Natural Areas (NHNAs) and the locations of Natural Heritage Element Occurrences (NHEOs). These areas are identified and mapped by the N.C. Natural Heritage Program. They support rare wildlife, plants and natural communities. GIS map layers of NHNAs and NHEOs are provided through the Conservation Data for Green Growth and are detailed in Section 2.

- Because they contain the rarest and most outstanding elements of biological diversity in our state, these areas are not appropriate for development.
- Permanently protecting these areas through land acquisition or conservation easements is the best way to conserve these areas.

If building must occur within Natural Heritage sites, these land development standards should be considered:

- Completion of an environmental assessment to identify negative impacts that any proposed development project will have on the Natural Heritage site.
- Review of the environmental assessment by the N.C. Natural Heritage Program.

Example Ordinances

- The N.C. Model Natural Resources Conservation Ordinance. www.ncwildlife.org/greengrowth
- Article IV of the Orange County, North Carolina, Unified Development Ordinance requires creation of one or more strategies to protect Natural Heritage sites. www.co.orange.nc.us/planning/Ordinances.asp
- Section 8.10 in Article 8, "Environmental Protection," of the Durham County, North Carolina, Unified Development Ordinance sets forth measures for protecting sites identified in Durham County's Natural Heritage Inventory. http://durhamnc.gov/ich/cb/ccpd/Pages/Durham-Unified-Development-Ordinance.aspx

On-Site Development Patterns that Conserve Habitat

In the figure below, A and B have the same development density, but in image B the lots are clustered and roads are designed to avoid habitat fragmentation.

A. Less habitat conserved

B. More habitat conserved

A. **Habitat fragmentation created by large lot zoning and no clustering. This also increases impervious surfaces and stormwater run off due to longer driveways.**

B. **Clustered development outside sensitive areas and near the main road conserves wider connected habitat.**

Source: 1000 Friends of Florida, created by Benjamin Pennington

How can Green Growth Improve Conventional Zoning?

Without zoning, essentially any land use could take place anywhere and there is less capacity to manage community character or public service costs. Done correctly, zoning a jurisdiction based on the suitability of the land to accommodate different land uses can protect natural resources, public health and the economy. However, mid-density residential development (or 1 to 3 acre minimum lot sizes) and large minimum lot sizes from 3 to 10 acres result in extensive manicured landscaping and inefficient land use. Such patterns fragment habitat and waste water, degrading the network of natural areas on which our communities depend.

Natural resource-based zoning:

- Bases the design of disricts and policies on an analyses of the Conservation Data and maps presented in Section 2, in addition to the common considerations.
- Maintains healthy streams and wetlands and encourages development patterns and standards that conserve upland priority wildlife habitats.
- Encourages more concentrated and high density growth near existing urban services and public transportation.
- Encourages rural and urban cluster development.
- Maintains a rural landscape around and between permanently protected areas.

Please see page 84 for a visual representation of a landscape that accommodates development, wildlife habitat and natural resource conservation.

On-Site Development Patterns that Connect Habitat

Encouraging clustered development and connected natural open space on adjacent lands allows wildlife and plants to disperse through the landscape. This reduces the chance that priority wildlife species will become threatened and maintains better function of habitats to provide ecosystem services benefits.

A. Habitat is fragmented **B.** Habitat is connected

A. Habitat is separated by large lawns and dispersed buildings.
B. More clustered development allows habitat to be connected.

Source: 1000 Friends of Florida, created by Benjamin Pennington

Considerations for Effective Natural Resource-Based Zoning

Enable the highest development density possible in cities and towns.

- Identify barriers to redevelopment and encourage it in urban areas.
- Identify and address economic and environmental barriers to maximizing city and town development densities. Low impact development techniques can remove environmental barriers and reduce the cost of construction.[6]
- Try to avoid placing high density developments, including Planned Use or Mixed Use Developments, in or near priority wildlife habitats.
- Use Transit Oriented Development to concentrate neighborhoods close to high-quality public transportation to ensure ridership.

Ensure that desired rural areas maintain character and natural resources.

- To absorb rural housing demand, encourage rural cluster developments or conservation subdivisions that set aside priority habitat areas and maximize clustering of development. Research demonstrates that this minimizes impacts to wildlife habitat.[7,8,9,10] These developments can conserve habitat and accommodate people who want to own large acreages if methods are used to minimize land conversion to lawns, cluster homes and protect and connect habitat on large lots.
- Zone by development units per acre instead of minimum lot size. This allows habitat open space to be clustered.[11] Many jurisdictions take this approach now. If your community and prospective residents value natural area conservation, development density can be lower than development designed for septic utilities.
- Remove permitting barriers by making clustered and conservation development a 'by right' development permit. When conservation-based development practices are by right this removes additional local government development review. Consider making larger lot size, spread-out developments a conditional use that requires extra review in your community's zoning ordinance.

Encourage very low overall development density coupled with cluster development in the highest priority areas.

- Zone districts with the most important habitats and wildlife corridors for agricultural uses and very low overall density. To lower impacts to the most threatened priority wildlife species in North Carolina, more than 30 acres per dwelling unit will be needed.[12,13] This density could be justified in highly sensitive areas and could meet demand for working lands and wildlife-related recreation. Building envelopes should be less than two acres and all developed areas should be clustered and not dispersed across the site. Wildlife habitat should be unfragmented by development.[14]
- For areas where more development is desired near sensitive habitat areas, encourage low density clustered rural subdivisions of one dwelling per four or more acres.[15] Built areas should be placed outside of and at least 350 feet from habitats. Lot sizes should be no more than one acre if possible.
- Even large lot zoning of 10 acre minimum lot sizes can fragment habitat for area-sensitive wildlife, including forest interior birds, some amphibians and reptiles and some mammals like bobcats and black bear.[16] Development densities of one development unit per 25 acres can lead to the loss of certain bird species from the area.[17]

Reduce the need to build costly new roads and utilities.

- Encourage mixed uses to provide nearby retail and services to residents. Utilize minimum density requirements where possible to encourage multifamily residences and higher densities of buildings.
- Establish commercial, appropriate industrial and high-density residential districts near city or town centers, public transportation hubs and in centers near interstate exchanges.
- Clustered development and conservation subdivisions require less road and infrastructure construction due to short driveways and more efficient design.

Conserve and connect habitat and natural resources.

- Consider a natural resources overlay district in the most sensitive areas with goals and standards focused on conserving, buffering and connecting habitat. See www.ncwildlife.org\greengrowth for the North Carolina Model Natural Resources Conservation Ordinance.
- Consider using feature-based density in which the area of important habitats is also considered with other site considerations when analyzing density options. It is necessary to exclude important habitats in the net site acreage in order to better conserve habitats. For more information see http://des.nh.gov/organization/divisions/water/wmb/repp/documents/ilupt_chpt_1.3.pdf.
- Consider Natural Resource Protection Zoning. These districts have no underlying zoning and are designed to be very low density and specifically to conserve sensitive resources applying the principles outlined above. This method is being developed in Massachusetts. For more information see www.nefainfo.org/Natural%20Resource%20Protection%20Zoning.pdf.

Challenges and Solutions for Natural Resource-Based Zoning

- Stormwater can present a challenge to high density development. Use Low Impact Development techniques and consider the space needed for these in calculating density.
- Large lots are sometimes in demand and are needed for individual septic systems. Please see page 90 for workarounds that will minimize impacts to wildlife and habitat.
- It is important to coordinate with other community departments, such as environmental health or fire and rescue, to ensure that their requirements do not unnecessarily compromise habitat conservation and connectivity.
- Who owns the contiguous open space outside of lots? The homeowner association can own the open space and pay property taxes on it. A land trust, your local Soil and Water District or other nonprofit may be able to place a conservation easement on the open space.

CHESAPEAKE BAY PROGRAM

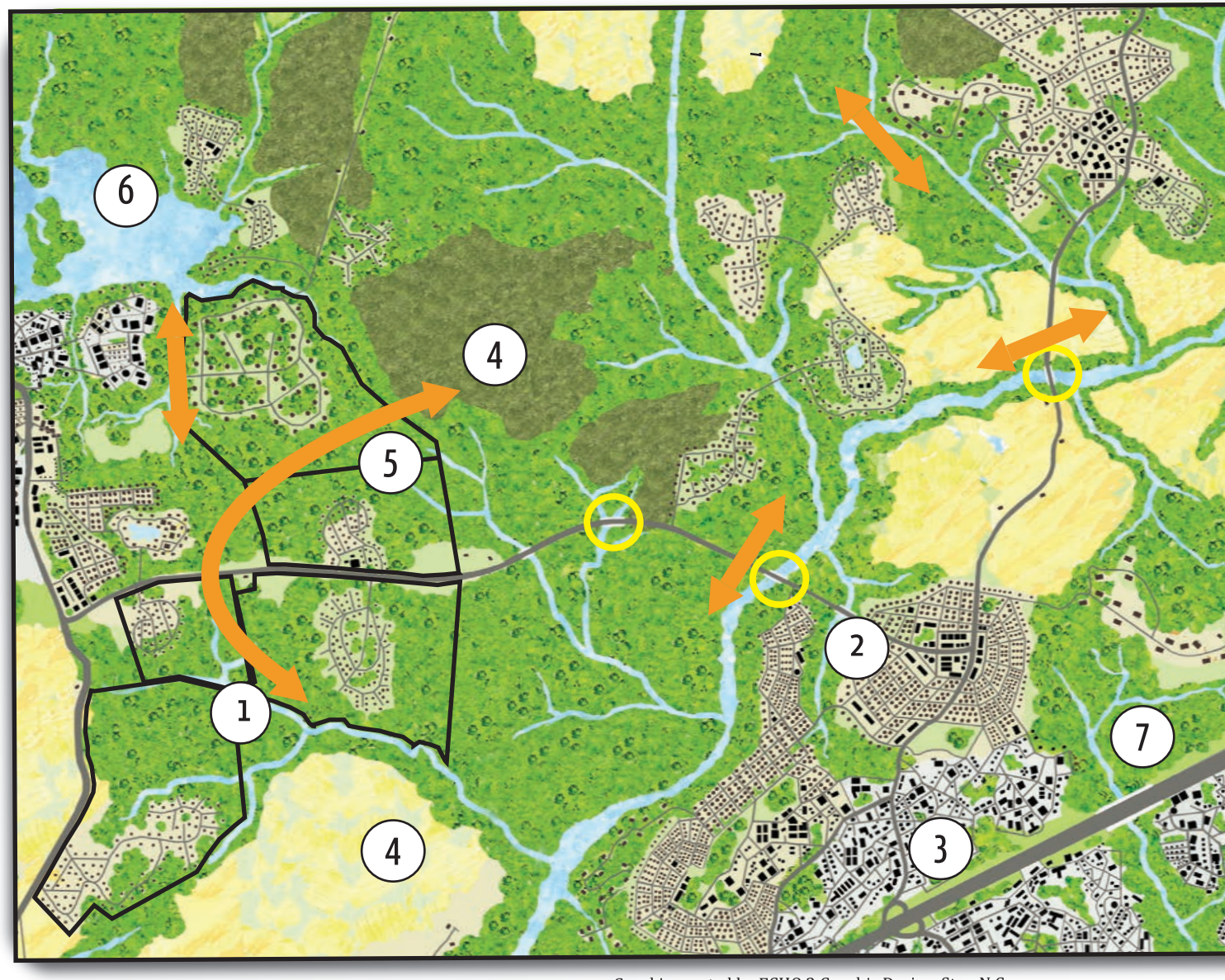
LID bioretention to collect street stormwater runoff in a densely developed area.

Example Zoning Ordinances

Examples of communities that have begun to establish nature-friendly zoning patterns include the following:

- Section 911 of the Burke County, North Carolina, Zoning Ordinance sets forth requirements for development within designated "conservation districts." Within these areas, developments must set aside a minimum amount of open space, built structures must be located within designated building envelopes and clustering of dwellings is encouraged. www.co.burke.nc.us
- Hillsborough County, Florida, uses maps of significant wildlife habitat, www.hillsboroughcounty.org/index.aspx?NID=1629, to determine some zoning district residential densities. Hillsborough County also offers an example of zoning by units per acre instead of minimum lot sizes. http://library.municode.com/HTML/12399/level2/ARTIVNAREADPUFA_PT4.01.00NARE.html#TOPTITLE
- The Town of Chapel Hill, North Carolina, Rural Buffer defines the extent of urban services provided. Joint planning among Chapel Hill, Orange County and Carrboro helps to manage growth using this approach. www.ci.carrboro.nc.us/PZI/BulletinBoard/PDFs/temp-071107/JointPlanning-RuralBufferOverviewforMgrSearch.pdf
- The Shutesbury, Massachusetts, Zoning Bylaw is based on Natural Resource Protection Zoning. www.shutesbury.org/bylaws/.
- The Model Rural Cluster Development Ordinance from the Southeastern Wisconsin Regional Planning Commission. www.sewrpc.org/SEWRPCFiles/CommunityAssistance/ModelOrdinances/cluster_ordinance.pdf
- See additional examples throughout this section and on our website.

Efficient, Natural Resource-Based Land Use Pattern



Large, connected priority habitat areas, working lands and other natural resources are secure with an efficient land use pattern.

1. Rural cluster developments conserve large areas of habitat that are connected to habitat on adjacent parcels.
2. Walkable communities are more compact and near commercial uses.
3. Industry and box retail commercial are located near highway junctions for prime vehicle access and less impact.
4. Farms and working forests are not threatened by development encroachment.
5. Small wetland upland habitat buffers are conserved among parcels.
6. Bald eagle nest and waterbird nesting colony buffers are conserved.
7. Stream and river forested buffers of 100 to 300 feet are in place. The floodplain is undeveloped. Greenways are extensive.

Graphic created by ECHO 3 Graphic Design, Star, N.C.

Bridges are designed as wildlife underpasses and retain non-flooded land for passage.

Residential

Commercial / Industrial

Wildlife Travel Corridors

Native Forest

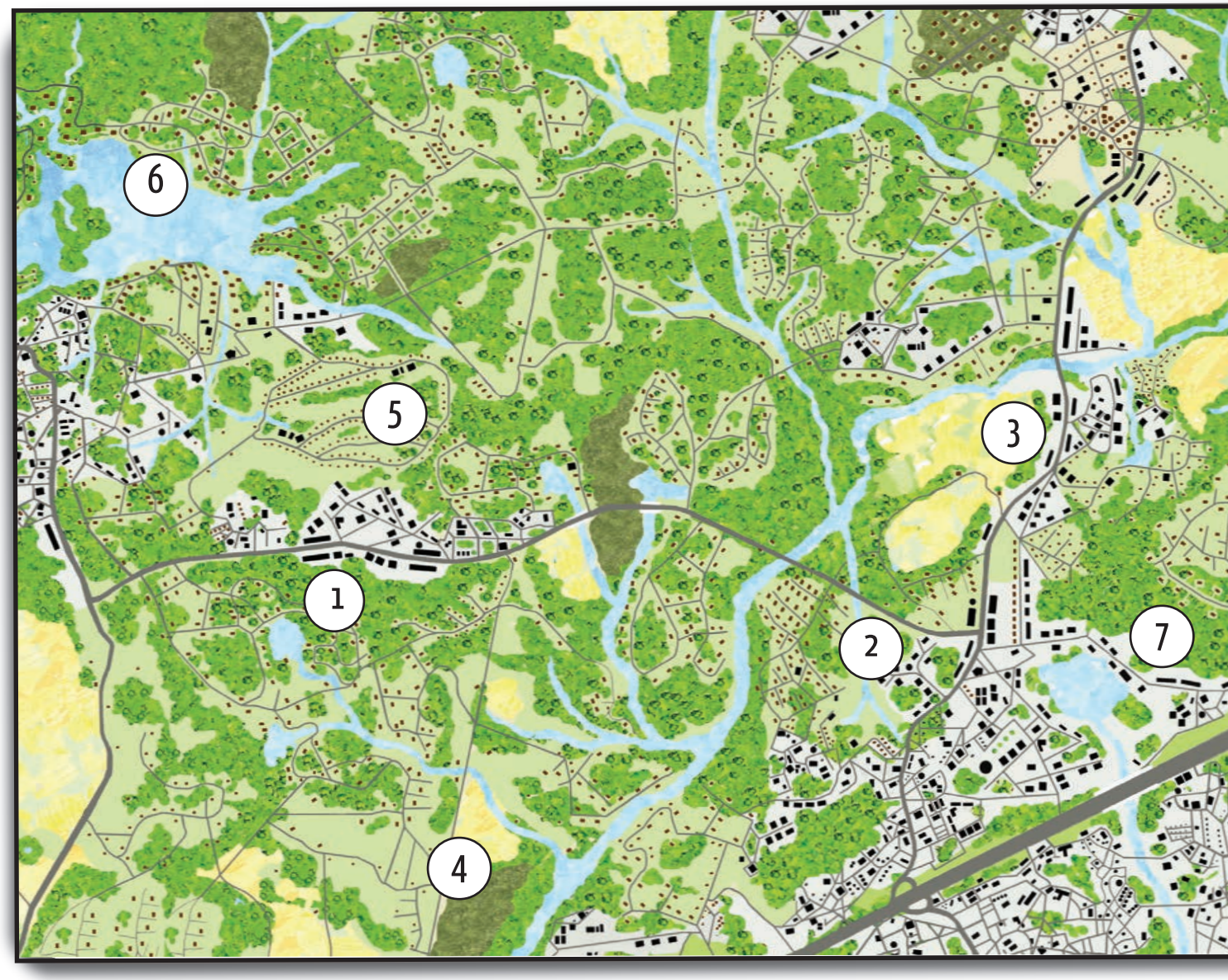
Farms

Lawn

Streams, Rivers & Reservoirs

Working Forests

Inefficient Land Use Pattern that Weakens Natural Resources



The same amount of development is pictured here. Habitat loss has occured due to fragmentation. More roads and spread-out sewer lines cost taxpayers more for maintainance.

1. Rural areas have become suburban sprawl. Intermittent streams are stormwater ponds that reduce groundwater recharge.
2. Communities are not walkable and are far from commercial uses.
3. Industry and box retail commercial sre not strategically located, leading to urban decay.
4. Farms and working forests are lost and threatened by development encroachment.
5. Wetlands are surounded by roads and do not have sufficient upland forest buffers.
6. Bald eagles and wading birds are uncommon.
7. Streams and rivers have minimal to no forested buffers. The floodplain is developed. Drought and flooding increase.

Graphic created by ECHO 3 Graphic Design, Star, N.C.

Bridges do not allow for terrestrial wildlife passage.
Priority wildlife and natural resources are threatened.

Urban Service Areas

An Urban Service Area (USA) is a mapped line within which urban services are provided and expanded regularly to meet development demand. Over 100 U.S. cities, counties and states, including Tennessee, use Urban Service Areas.[18]

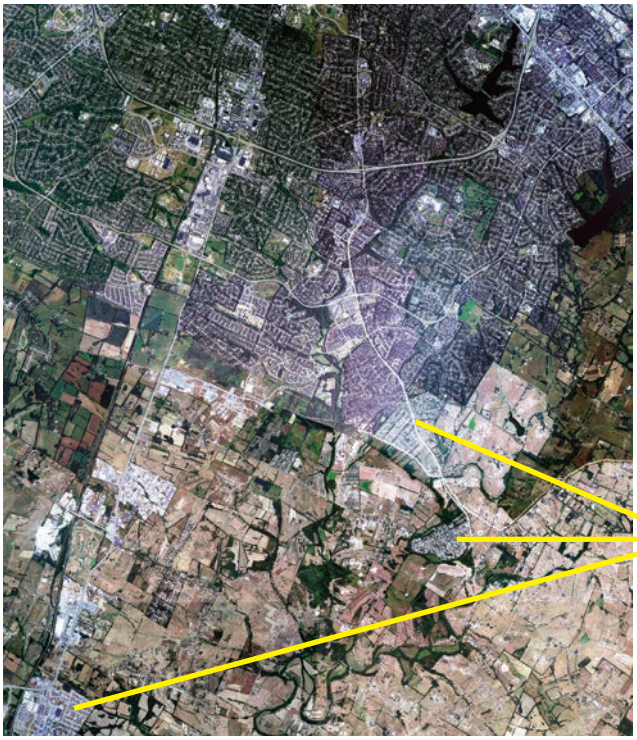
- Proper USA management coupled with other planning methods can help concentrate growth in city centers, curbing sprawl outside the urban fringe.[19]
- USAs maintain rural areas only if the county also uses them.[20]
- Other growth management mechanisms such as minimum density requirements and transfer of development rights are used in concert with the USA.[21]
- If drawn to exclude areas with important natural resources of high ecological value, a USA can help your community implement Green Growth.

Example Urban Service Areas

- Fayette County and towns and Lexington, Kentucky, were the first jurisdictions in the U.S. to implement a USA in 1958. They still use this growth management tool, which has resulted in less sprawl than is found in comparable cities.
- The Lancaster County, Pennsylvania, Urban Growth Area combines the boundary with agricultural zoning to support farming. www.co.lancaster.pa.us/planning/lib/planning/envision/planssummaries/balance_full_report.pdf

Implications of Urban Service Areas

Recent research has shown that USAs do not affect housing affordability and land values, or deter growth if the Urban Service Area is expanded in time to meet rising development demand.[22] Effective growth management policies do appear to significantly lower public service and infrastructure costs to taxpayers.[23] If insufficient housing or an overstock of commercial or industrial land is allowed within the USA, this can be a disadvantage to neighboring towns left with too much housing, fewer local jobs and less tax revenue.[24]



An Aerial View of Lexington, Kentucky

An aerial view of southeastern Lexington, Kentucky (National Agriculture Imagery Program, 2012) demonstrates the centralized growth pattern and agricultural conservation. This has resulted from the use of an Urban Service Area put in place and expanded since 1958. Notice the centralized pattern of development of other towns due to municipal and county USA policies.

Urban areas are centralized.

Farmland is not threatened by inefficient development patterns.

Wildlife Conservation in Development Ordinances

Other kinds of development ordinances, such as the Subdivision Ordinance, can help implement your community's conservation goals. This section presents guidance on how various types of ordinances can be enhanced.

Development Standards

When development needs to take place in sensitive areas, Natural Resource-Based Development Standards include:

- Placing high priority habitats in commonly-owned open space or conservation easement. The homeowner association can own and fund habitat management.
- Minimizing habitat fragmentation.
- Minimizing frontage and setback requirements to increase contiguous open space.
- Clustering development.
- Utilizing building envelopes to minimize disturbance of natural vegetation on lots.

It can save time in development review and produce more consistent results, to include habitat conservation measures in the development standards.

Fort Collins, Colorado, has included conservation of priority wildlife habitats in its development standards, Section 3.4.1, www.colocode.com/ftcollins/landuse/article3.htm#sec3d2d1. The Natural Habitat Inventory map on the GIS website helps to guide planning, www.fcgov.com/gis/maps.php.

Development Application and Review Requirements

Development ordinances can include development application and review requirements that will help projects minimize the negative impacts to your community's natural assets.

- Require a sketch plan and an initial project meeting between the developer, planning department staff, adjacent landowners and other stakeholders. Randolph County, North Carolina, experienced an increase in efficiency using this approach.
- Require all development applications to present information about the important species and habitats on and near the site. Encourage or require applicants to take the following steps:
  - Consult the Conservation Data for Green Growth and display map layers on development sketch plans and plats.
  - Obtain on-site survey information about the location of priority habitats during the stream or wetlands survey or from another biologist. See Appendix B for a list of natural resource agencies that may be able to conduct surveys free of charge.
  - Review the Conservation Data map layers that are near the site. Identify potentially important wildlife travel corridors, even when conservation GIS data are limited for the site.
  - By referencing site survey findings noted above, describe the significance of any important species and habitats on site.
  - Require a description of the methods the developer plans to use to conserve contiguous unfragmented habitats on or adjacent to the site.

- Major development proposals can be reviewed by a biologist or an outside entity with biological expertise.
- Applicants can demonstrate that they have received state or federal environmental permits ahead of construction.

For additional development standards that can be included in application and review requirements, see Section 6, "Greening Development Review and Site Design," beginning on page 99.

Example Ordinances

- Boulder County, Colorado, Land Use Code, Section 7-1700, requires development proposals to include a Wildlife Impact Report whenever the project is located within important wildlife habitats, wildlife corridors or other areas shown on conservation maps in the county's comprehensive plan. The wildlife impact report is developed by a biologist and is reviewed, approved and monitored by the County Parks and Open Space Department. www.bouldercounty.org/property/build/pages/lucode.aspx
- Section 8.2 of the Town of Davidson, N.C., Planning Ordinance requires environmental inventories, including identification of wildlife and distinctive natural features, for all development proposals. www.ci.davidson.nc.us/DocumentView.aspx?DID=1301
- Carrboro, North Carolina, Development Guide Application Checklist includes an initial staff meeting, site walk and the requirement to maintain contiguous habitat. www.ci.carrboro.nc.us/pzi/PDFs/ToCDevGuide/a6.pdf

Conservation and Cluster Subdivision Ordinances

Conservation subdivisions are popular because profit margins can be greater and the same number of homes can be accommodated while conserving open space. Many local governments have ordinances that provide incentives for developers to cluster homes and set-aside open space. This type of development has the potential to benefit wildlife habitat and biodiversity if policies address priority wildlife habitat conservation.

- Incorporate wildlife friendly design principles in these ordinances.
- For a detailed description of how to design wildlife friendly developments, see Section 6.
- A number of communities allow conservation subdivisions as by-right development in rural areas with sensitive resources, meaning that a variance or a conditional use permit is required for traditional subdivisions.
- It is often possible to accommodate a mix of housing densities, from large lots to more affordable and attractive condo-type development, on site due to open space amenities and attractive housing appearance.
- In general, it is best to conserve 50 percent or more of the site if possible.
- Contiguous open space can be owned by the homeowner association.

Example Ordinances

These North Carolina ordinances contain some, but not all, components of an ecologically sound conservation development ordinance.

- The N.C. State University Forestry and Environmental Outreach Program has produced a guide to conservation subdivisions. This free publication highlights numerous case studies and provides a model ordinance. www.ces.ncsu.edu/forestry/pdf/ag/ag742.pdf.
- Article 30, "Flexible Development," of the Franklin County, North Carolina, Unified Development Ordinance establishes open space standards for flexible developments that include requirements for preserving wildlife habitat and significant natural areas. www.franklincountync.us/services/planning-and-inspections/current-planning-2/unified-development-ordinance
- Section 3 of the Randolph County, North Carolina, Unified Development Ordinance outlines a Cluster Subdivision Overlay. Incentives such as density bonuses and planning assistance to developers, have led 50 percent of developers to choose cluster developments. They also address conservation of Natural Heritage Areas. www.co.randolph.nc.us/pz/UnifiedDevelopmentOrdinance.htm
- Section 7.7 in the Chatham County, North Carolina, Subdivision Regulations provides a density bonus for conserving natural heritage areas and N.C. Wildlife Action Plan priority habitats on a minimum of 32 percent of the site. www.chathamnc.org/Index.aspx?page=440

Conventional Subdivision

Farmland, grassland habitat and historical site are lost.

Conservation Subdivision

Natural and historic features are properly identified prior to design and maintained. Grassland and forest wildlife habitat is managed with funds from the homeowner association. A biologist is contracted for habitat management.

Image and information courtesy of Randall Arendt, from Arendt, R., M. Collins and A. Valentine (1996). Open Space Design Guidebook: Albemarle Pamlico Estuarine Region. Prepared for the North Carolina Association of County Commissioners. Media, PA, Natural Lands Trust.

Large Lot Subdivisions: Not ideal but sometimes in demand

Wildlife habitat will be better conserved in developments that have minimal lot sizes combined with larger blocks of unfragmented open space outside of development lots. However, where large lots (> 0.25 acres) are desired, ordinances could:

- Encourage built structures to be clustered and situated far from sensitive areas.
- Encourage most of the lot to be maintained in natural habitat except for a house, modest yard that accommodates the septic drain field (if applicable) and driveway.[25]
- Encourage the connection of large areas of contiguous habitat between adjacent subdivisions.
- Building envelopes, maximum lot coverage proportions and minimal set-back distances can be used to encourage habitat conservation on large lots.

Proper Community Wastewater Treatment can Encourage Clustering

No wastewater system will substitute if wastewater quantity exceeds the capacity of the land and it is best to direct growth towards existing towns and cities. However, where capacity exists and development is desired in rural areas, it is possible to encourage clustered development where sewer is not available by using community septic and other decentralized wastewater treatment systems. These systems are defined by the collection, treatment and reuse of wastewater close to the point of origin and are thus, better for the environment when care is taken to monitor and manage the system. Community septic systems should consist of septic tanks on individual lots to maintain homeowner accountability but should have the drain field on common open space. Open space can be maintained as a native grassland or native plant meadow or can be placed at the entrance to the community. Wastewater can be filtered and reused for non-potable uses. Once sewer becomes available, homes can be required to hook up to sewer and this common open space can be developed into a more compact neighborhood. Decentralized systems are even being considered for use in urban development. See the following for Low Impact Development guidance:

- N.C. State University *Low Impact Development Guidebook* chapter and curriculum module, "Wastewater Systems," available at www.ces.ncsu.edu/depts/agecon/WECO/lid-curriculum/index.php
- U.S. EPA guidance http://water.epa.gov/infrastructure/septic/.

GREENING HAZARD MITIGATION AND RELATED ORDINANCES

Many priority wildlife habitats occur in hazard prone areas such as floodplains and fire-prone forests. Conserving wildlife and habitat in hazard prone areas can reduce the severity of hazards to your community such as flooding, drought and wildfire. It is important to understand potential future hazards from climate change that could affect your community.

Stream, Wetland and Floodplain Ordinances

To adequately protect public safety and welfare, these ordinances also protect important species, habitats and ecosystems. To accomplish this these ordinances:

- State the economic and environmental importance of maintaining biologically functional streams, wetlands and floodplains.
- Define specific buffer widths, based on science, within which no permanent structures are allowed.

- Discourage or disallow major development in the 100 or 500-year floodplain.
- Encourage the management of stormwater on site through Low Impact Development techniques such as rain gardens, native vegetation, constructed wetlands and swales.
- Require that applicants demonstrate approved state and federal wetlands permits prior to construction.

Section 3, "Habitat Conservation Recommendations," outlines more specific stream, wetland and floodplain protection standards that can be codified into ordinances.

Example Ordinances

- Section 304 of Chatham County, North Carolina, Watershed Protection Ordinance establishes strong buffer requirements for perennial, intermittent and ephemeral streams, springs, seeps and wetlands. Section 304 also requires that field delineations of streams accompany development proposals. In addition, Chatham County's Flood Damage Prevention Ordinance prohibits development in the 100-year floodplain. www.chathamnc.org/Index.aspx?page=440
- The Town of Wolfeboro, New Hampshire, Wetland Conservation Overlay District, Zoning Ch.175 Article II, functions to buffer and connect wetlands and streams by establishing a 100 foot, no touch buffer around prime wetland complexes. http://ecode360.com/10186926#10186926
- Orange County, North Carolina, does not allow new structures in the floodplain. www.co.orange.nc.us/planning/floodplain_information.asp#FloodplainDevel

Tree Protection and Forest Conservation Ordinances

Ordinances that protect trees and forests will improve hazard mitigation, as well as, community appearance and other benefits. To improve ecosystem health, it is important to encourage removal of nonnative and invasive tree and plant species, retain the native tree canopy and plant native, non-invasive vegetation. Tree protection will reduce energy use and costs through shading of homes and businesses, among other benefits such as flood and drought reduction and ground water recharge. Retention of 50 percent of the tree canopy within a jurisdiction will greatly aid air quality and the drinking water supply, according to American Forests. This is also recommended for wildlife conservation. Consider the amount of development that zoning districts encourage over the study area to help determine the percent of canopy retention for certain types of development uses. Setting standards to conserve unfragmented, undeveloped forested areas on development tracts can simplify tree protection standards.


L.B. ROLLER

red-headed woodpecker

To effectively preserve the tree canopy within developed areas:

- Define requirements for minimizing the amount of *native* tree and shrub cover removed in connection with development.
- Require submission of a vegetation delineation as part of a development proposal that demonstrates the location of mature native trees and shrubs.[26]
- Ensure that the native tree and shrub species of the region will be retained by species and diameter requirements. For example, mature longleaf pine trees native to the Sandhills have a smaller diameter compared to mature hardwood trees. Small to midsize hardwoods should be removed in upland longleaf pine areas.

N.C. State University Forestry Extension Urban and Community Forestry Publications provide best practices for tree protection ordinances at www.ces.ncsu.edu/forestry/resources/publications/urban_forestry.php and a searchable database of local ordinances relating to forestry at www.ces.ncsu.edu/nreos/forest/ordinance/.

The North Carolina Division of Forest Resources Urban and Community Forestry Program offers grants and technical assistance to communities interested in tree protection. http://ncforestservice.gov/Urban/Urban_Forestry.htm

Example Ordinances

- The Town of Chapel Hill, N.C., Tree Protection Ordinance requires applicants to submit a Landscape Protection Plan that encourages preservation of specimen and rare trees and significant tree stands. As part of its carbon reduction strategy, the town is working to address no net loss of the canopy cover and an increase in trees proportional to population growth. www.ci.chapel-hill.nc.us/index.aspx?page=879
- Carroll County, Maryland's Forest Conservation Ordinance requires Forest Stand Delineations and Forest Protection Plans in development. The ordinance requires one acre of forest be planted for every acre removed. Reforestation is directed to priority areas (i.e., stream buffers, wildlife corridors, steep slopes, etc.).

  http://ccgovernment.carr.org/ccg/resmgmt/forconsmanual.pdf
- Pinehurst, North Carolina's Voluntary Tree Preservation and Xeriscaping Program outlines goals and measures to maintain Sandhill's native trees and shrubs on development sites. www.vopnc.org/Government/Boards-Commissions Committees/Conservation-Commission/Tree-Preservation-Committee

Landscaping and Vegetation Control Ordinances

Control invasives and maintain natives!

In addition to tree protection, local ordinances can include measures to promote and maintain native species of vegetation and discourage the introduction and proliferation of invasive, exotic species. These types of ordinances can vastly reduce water shortages because a significant amount of water is used to maintain nonnative landscaping. Native species are tolerant to local climate and do not need to be watered as often. Maintaining and planting native plants is critical to maintaining bird populations. In spring, young chicks are fed a 100 percent insect diet of hundreds of insects per day. Insect resistant and nonnative plants vastly reduce the abundance of beneficial insects, such as butterflies and native bees.

Components of an effective landscaping or vegetation control ordinances will include:

- Landscaping plant lists that feature native plants at the top of the list, as few nonnative plants as possible and no invasive plants.
- Language that prohibits the introduction of invasive, exotic plants and insect resistant plants during the development process.
- Language that limits planting of insect resistant plants to below ten percent.
- Requirements for the removal of invasive plants.
- Landscaping standards for public works projects so that native (and drought resistant) species are required in local landscaping projects.

For information and lists of invasive, nonnative plants in North Carolina, see pages 54 to 55.

What are
invasive, exotic plants?

Invasive, exotic plants are species that do not naturally occur in North Carolina but have been introduced by people. Many introduced plants pose no threat, but some grow out of control. Common invasive plants in North Carolina include:

- Kudzu *(Pueraria montana)*
- Japanese Stilt Grass *(Microstegium vimineum)*
- English Ivy *(Hedera helix)*
- Chinese Privet *(Ligustrum sinense)*
- Multiflora Rose *(Rosa multiflora)*

Kudzu has taken over this field.

Invasive species can cause significant damage to ecosystems, habitats, native species and agriculture productivity. There are large economic costs from invasive species, so controlling them early on is important.

Example Ordinance

- Brevard County, Florida's Land Clearing Performance Standards, Section 62-4341 (15), is a particularly exemplary model that requires removal of nonnative, invasive plants and requires vegetation control to curb proliferation. http://library.municode.com/index.aspx?clientId=10473

Steep Slope Protection Ordinances

Steep slopes are often biologically diverse and support unique plant communities, rock outcrops, cliffs and other important habitat features. When development occurs on or adjacent to steep slopes, sedimentation and erosion can damage important downhill resources and scenic views. Not to mention landslides put people and property at risk. Steep slope protection ordinances can assist in preserving important natural assets by limiting development on certain slopes, landslide prone areas and:

- Areas with important wildlife habitats on, near or downhill.
- Areas above a certain elevation.
- Areas with particularly important views.

Example Ordinances

- The Land of Sky Regional Council has developed a report to be used in the development of steep slope protection ordinances. www.landofsky.org/mrss.html.
- Park City, Utah's Sensitive Area Overlay Zone, Ch.15 - 2.21, regulations require protection of steep slopes and ridgelines as part of a broader set of overlay zones that also encourage preservation of wildlife habitat and wetlands. www.parkcity.org/index.aspx?page=89
- The Lyme, New Hampshire, Steep Slopes Conservation District, Article III 27.2, limits development activities where the average slope is 20 percent or greater. It limits development in areas that are visible from public waters and roads. www.lymenh.gov/Public_Documents/LymeNH_PlanZone/bzinfo
- Pickens County, Georgia's Mountain Protection Plan ordinance, Ch. 26, Article IV, limits development in areas that are 2,200 feet in elevation and on slopes of 25% or more. http://library.municode.com/index.aspx?clientId=13227

Wildfire Hazard and Smoke Management

Prescribed fire at the edge of a Managed Area threatened by housing encroachment.

Wildfire hazard ordinances can help your community minimize wildfire and manage smoke conflicts while keeping forests healthy.

Many habitats and wildlife in North Carolina are fire-dependent. Occasional fires clear out thick, dense, vegetation, improving habitat for many species. Prescribed burning is used as a resource management tool on many public lands (see page 4).

Prescribed fire is also an effective strategy to reduce woody fuels and wildfire risk to communities. This is especially important in preparation for periods of drought.

Why is this important to planning?

The smoke associated with prescribed burning can pose a risk to smoke sensitive individuals, such as people with asthma, and can cause hazards, such as reduced visibility on roadways.

The greatest risk occurs within a half-mile radius of a burn, which is referred to as a Smoke Awareness Area.

When housing, schools, prisons, businesses or extensive roads occur within a smoke awareness area, it is difficult for land managers to obtain a permit to conduct prescribed burns and the chance for catastrophic fires increases.

Many communities in North Carolina are located in the wildland-urban interface where development is encroaching on habitats where wildfire risks can be high, if habitats are not managed with prescribed fire.

How can an ordinance help?

Local ordinances can help to manage risks associated with built infrastructure next to areas where prescribed burning occurs. Effective ordinances can:

- Limit incompatible land uses (schools, roads, nursing homes, hospitals, high density development) within a half- mile buffer of lands where prescribed burning occurs regularly.
- Land use within Smoke Awareness Areas would ideally be limited to very low density residential uses and agricultural uses.
- Cluster structures instead of spreading them throughout the recommended half-mile Smoke Awareness Area.
- In addition, we recommend all new developments within this buffer provide disclosure forms to new residents explaining that they will occasionally be exposed to smoke from prescribed burns.
- If the development will take place near natural open space ensure that the applicant complies with Firewise Communities guidelines to protect homes from wildfire. www.firewise.org

Where does prescribed burning occur in my community?

The Smoke Awareness Area map is provided as part of the Conservation Data for Green Growth (see Section 2, page 30).

For more information about prescribed fire in North Carolina, see page 4 and the North Carolina Prescribed Fire Council website http://ncprescribedfirecouncil.org/.

Example Ordinance

- The Jefferson County, Colorado, Wildfire Hazard Overlay District, Section 32, limits land uses and requires hazard mitigation strategies around any dwellings and/or the submission of a wildfire mitigation site plan, for developments located within the district. http://jeffco.us/planning-and-zoning/regulations/zoning-resolution/

ENERGY SYSTEMS ORDINANCES: MINIMIZING WILDLIFE IMPACTS

Wind Energy Systems Ordinances

As communities seek to promote renewable energy to reach North Carolina's renewable energy standard, wind energy is often considered one of the ways to produce greener sources of energy. Certain wind energy systems, however, can have significant negative and avoidable impacts on wildlife.

The North Carolina Wind Energy Working Group defined the issues related to wind development for communities. Some of the issues that must be considered include public safety concerns like setbacks from buildings and property lines, noise and wildlife impacts, among other issues. For more information on common types of wind power projects visit the American Wind Energy Association website http://awea.org.

There are unique sets of concerns and regulatory issues for projects of different scales. Fortunately, many examples are available. Given the current lack of a consolidated permitting process for the state, however, local governments can expect to be on the front lines of wind energy development in North Carolina.

Possible Wildlife Impacts from Wind Farms

Direct mortality - is the greatest impact to wildlife. The time of year and turbine speed directly affect mortality. On average, two birds are killed per turbine per year.[27] Estimates for bat mortality have reported that as many as 33,000 to 111,000 bats are killed per year by wind facilities in Pennsylvania, West Virginia, western Maryland and Virginia. [28]

Habitat loss or alteration - occurs when natural habitats are cleared for the installation of wind turbines, infrastructure and transmission lines. For example, ridgetop projects in the Appalachians have been converting forests to roadways and open fields.

Habitat and area avoidance by wildlife - Many declining species of wildlife will abandon areas or fields that contain wind turbines due to constant disturbance by the flickering shadows, lights and movements of turbines. This has been observed particularly in certain waterfowl [29,30,31] and raptors and many grassland birds[33].

Connectivity issues - Connecting wind farms to energy transmission lines requires building new, above ground infrastructure that can limit the mobility of wildlife in the area. Birds and bats can collide with above ground transmission lines.[34]

Resources for Wind Energy Systems Ordinances

- The North Carolina Wind Working Group has prepared a model wind ordinance for local communities. www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=NC18R
- Examples of how counties like Watauga, Ashe, Carteret, Camden and others have used and adapted this model and additional models from across the nation can be found at www.wind.appstate.edu/resources/reports.
- The Department of Energy and others also have produced a guide for county commissioners. www.osti.gov/bridge/product.biblio.jsp?query_id=0&page=0&osti_id=896718&Row=0&formname=basicsearch.jsp
- For commercial wind projects and their environmental review, two good summary documents include the, "U.S. Fish and Wildlife Services Guidance on Siting Land-based Wind Energy Projects," www.fws.gov/windenergy/docs/WEG_September_1-3_2011.pdf and the, "Comprehensive Guide to Studying Wind/Wildlife Interactions," www.nationalwind.org//publications/comprehensiveguide.aspx, produced by the National Wind Coordinating Committee.

A special thanks to Curtis Smalling of Audubon North Carolina for providing this information.

Solar Energy Systems Ordinances

Solar power has become a popular form of economic development, energy independence and low pollution source of power. Our state has more solar farms than most. Some wildlife friendly recommendations for solar installations include:

MICHA JOST *Rooftop Solar Farm*

- Encourage co-location of the solar installation on top of existing built structures. Doing so, where possible, uses less land.
- To reduce barriers to commercial and industrial or residential rooftop solar, include requirements for optimum solar building orientation and require that solar stub-ins be constructed during building renovation or construction. Stub-ins are the structures needed to support rooftop solar and are very affordable.
- Encourage land-based solar installations to be built away from sensitive wildlife habitats and that forests are not cut down in order to build a solar farm.
- Encourage compact solar panel design to allow for more energy generation in less space.

Resources for Solar Energy Systems Ordinances

- The N.C. Sustainable Energy Association and the N.C. Solar Center provide a template solar energy systems ordinance for North Carolina. www.planning.org/solar/data/content/?ContentID=1002562

Measures of Incentive and Ordinance Success

It is important not to simply measure the total acres of land conserved as a measure of conservation success because this does not account for habitat fragmentation.[35] Measures of habitat fragmentation measure the habitat core interior to habitat edge ratio (core area index) within the area of study. The Core Area Index can be measured in GIS using a free program called 'Fragstats' available from the University of Massachusetts at www.umass.edu/landeco/research/fragstats/fragstats.html.

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SECTION 6.
GREENING DEVELOPMENT SITE LOCATION, REVIEW & DESIGN

KENDRICK WEEKS

hooded warbler

ACHIEVE GREEN GROWTH IN DEVELOPMENTS

Greening development review and site design means *selecting appropriate development sites* and using conservation data and NCWRC habitat conservation recommendations to review and design developments. Sites that are next to Managed Areas or near high priority conservation areas will degrade wildlife habitat and natural resources regardless of how they are built. Wildlife that need especially large areas, that are impacted by roads or that depend on fire disturbance will not be conserved on a single development tract. Developments that are appropriately located and that maintain large areas of connected habitat among adjacent tracts can be designed to lower many impacts to wildlife.

- Planning staff and advisory boards can "green" the development review process by:
  - Requiring a sketch plan and a pre-design meeting with stakeholders.[1]
  - Using the Conservation Data for Green Growth and habitat conservation recommendations in Section 3 to evaluate development proposals.
  - Advising applicants on how to design wildlife friendly development projects.

- Developers, consultants and engineers can "green" site design by:
  - Using the Conservation Data for Green Growth and habitat conservation recommendations in Section 3 *prior to site selection* and design.
  - Selecting sites that are not next to Managed Areas or priority conservation areas.
  - Mapping and protecting unfragmented habitats and buffers.
  - Applying for Wildlife Friendly Development Certification ahead of site design. www.ncwildcertify.org.

Why "green" site design?

"Greening" site design can:
- **Increase property values for desired lots.**
- **Produce more profitable developments.**
- **Connect children and residents with the outdoors.**
- **Preserve ecological resources for future generations.**
- **Help to prevent hazards such as flooding and drought.**

STEPS TO MAINTAIN A CONNECTED NETWORK OF HABITATS ACROSS DEVELOPMENTS

Wildlife do not live solely within the wet areas of wetlands, streams or rivers. Wildlife need to range on land adjacent to water bodies. A wildlife friendly development conserves terrestrial habitats located in the uplands next to wetlands, floodplains and riparian areas.

Following these steps may also help ensure that developers comply with the Endangered Species Act and other environmental requirements ahead of permitting.

Step 1. Select an appropriate site for the type of development. Appropriate, green sites for major development are:

a.) Centered around towns and cities such that urban or suburban areas will not spread extensively into rural areas. Rural cluster developments are an exception to this.

b). Not adjacent to Managed Areas (conserved lands) or within priority conservation areas.

Step 2. Create a map of important upland and wetland habitats on and adjacent to the site.

a.) Depict the Conservation Data for Green Growth (statewide and regional appendix data) on development maps. Include areas adjacent to the parcel.

b.) Map the boundaries of upland terrestrial and wetland habitats that will be conserved on site. The boundaries of these habitats can be partially mapped through analyzing aerial photos, but field surveys will be needed to fully delineate boundaries.

c.) As needed, have a qualified biologist survey for mapped and unmapped priority habitats on site. If staff or funds are not available for this, see Appendix B for a list of conservation partners who may be able to conduct surveys at no cost. Surveys can typically be done in a few hours to one day.

Step 3. Use the habitat map created in Step 2 to design an upland and wetland habitat network that will be protected and connected to other natural areas on and off site.

a.) This green infrastructure network should consist of large core areas of unfragmented, continuous habitats that are connected by wildlife travel corridors.[2]

b.) Design wildlife habitat core areas to be as large as possible and to maximize interior area while minimizing habitat edge.

Protecting Habitat for Bald Eagles

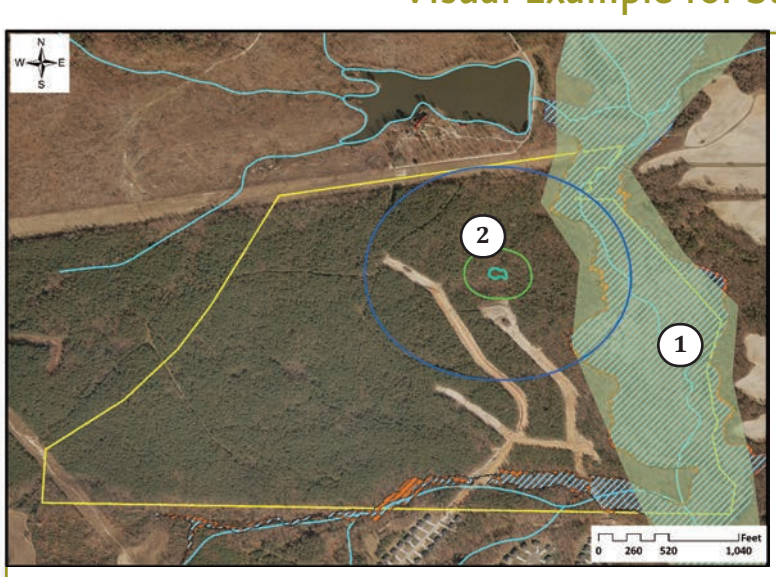
U.S. FISH & WILDLIFE SERVICE

Although bald eagles are no longer listed as endangered they are still protected under the Bald and Golden Eagle Protection Act.

The U.S. Fish and Wildlife Service has created a set of National Bald Eagle Management Guidelines (www.fws.gov/southeast/es/baldeagle/) for protecting bald eagle nesting sites alongside other land uses.

The N.C. Wildlife Resources Commission can provide maps of bald eagle nests to local governments and landowners. Contact us for a copy of this data at greengrowth@ncwildlife.org.

Visual Example for Step 2



This is a development scenario near Knightdale, North Carolina, and the route of a future major highway. The scenario exemplifies the need to review a development using conservation data before any final plans are made. This example is hypothetical and in reality a field survey was not conducted on-site. The site is outlined in yellow. The tract is about 160 acres and the zoning is 1 – 4 units per acre. 1) The floodplain underlies most of the Natural Heritage Natural Area. 2) A small wetland found during a site survey is in turquoise. There are two buffers mapped on the small wetland a critical habitat 150 foot buffer and a further 600 foot secondary upland habitat zone. See Section 3 pages 50 to 51 for more information on these buffers. Ideally, this second buffer zone would lie completely out of the floodplain to provide non-flooded areas for amphibians and reptiles to burrow underground.

c.) Design wildlife corridors to be as wide as possible, minimize trail widths, maintain any forest canopy cover and the forest understory of shrubs and ground cover.[3]

d.) Design wildlife core habitat and travel corridors following the habitat conservation recommendations in Section 3 to conserve:

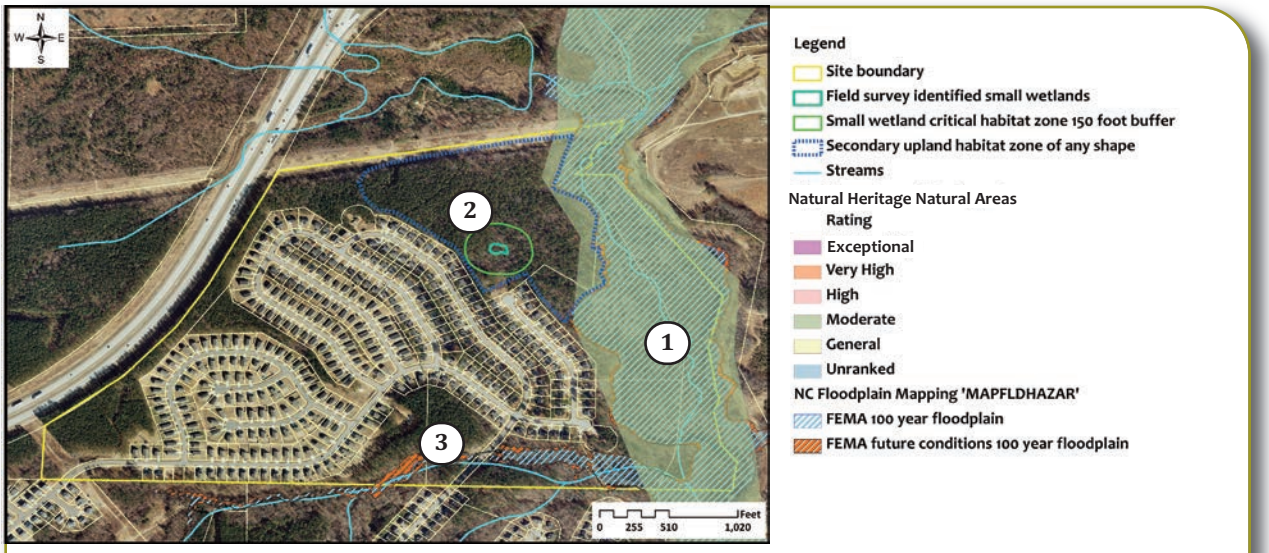
- Habitat for federally protected species, such as bald eagles.
- Natural Heritage Natural Areas
- Priority wildlife habitats identified in the N.C. Wildlife Action Plan.
- Wetland, stream or river buffers.
- Natural open spaces that connect or buffer existing protected natural areas.

Step 4. Permanently protect as much of this upland habitat network as possible by:

a.) Clustering homes on smaller lots as much as possible.

b.) Using a conservation easement or equivalent legal tool. See Appendix B for potential land conservation partner contacts.

Visual Example for Steps 3 and 4



Development is centralized and habitat edge is minimized. 1) The floodplain and Natural Heritage Natural Area are conserved by being outside of lots. 2) The small wetland critical habitat zone is not disturbed and the secondary zone is connected to the floodplain. This secondary zone can be of any shape but should be outside flooded areas and should be of equal size to a further 600 foot buffer on the critical zone, which was not completely achieved here. 3) The streams to the south are buffered by at least 100 feet and lots are outside of the stream buffer and floodplain. The homeowner association owns the natural contiguous open space.

Step 5. Create an upland habitat management plan for the habitat network.

a.) Without active management, habitat structure and plant species composition may deteriorate and the habitat may become unusable to priority species. This is because habitat management mimics natural disturbance, such as fire, that no longer occurs in developed areas.

b.) Plans can be developed to actively manage protected natural areas using techniques, such as: periodic mowing outside of the nesting season, thinning of trees, reforestation, protection of dead trees and canopy gap creations (small clearings in the forest).

c.) Create a long-term funding mechanism to implement goals and objectives of the natural resource management plan, such as collecting fees from the homeowner association. The HOA can profit from tree cutting and mowing by selling timber or native grass hay.

d.) Partner with a land trust, parks department or natural resource agency to create and implement the management plan. Habitat management may qualify the land for tax credit and financial incentive programs.

e.) Seek outside assistance from natural resource professionals in crafting and reviewing such plans. See Appendix B for an abbreviated directory of professionals who may be able to provide such assistance.

Step 6. Landscape using native plants.

- Native plants are more adapted to the local climate and do not need as much water or maintenance. See Section 3, page 54, for more information.

A note about emergency response and street design

Public health and safety is one of the paramount concerns for making certain streets are interconnected among neighborhoods. Grid street designs are more space efficient and lead to more walking and sense of community. To avoid impacts to streams, avoid or minimize stream road crossings.

Example Developments

Listed below are a few examples of development projects that have incorporated many wildlife friendly development practices.

The Woodlands, Davidson, North Carolina

- An award-winning, 56-home neighborhood that is a Certified Wildlife Friendly Development.
- The developer conserved a wide riparian buffer and 23 acres of contiguous riparian forest in an urbanizing area.
  www.thewoodlandsatdavidson.com

Harmony, Florida

- Voted one of the top 50 places to retire in the U.S.
- Over half of the development has been set aside as a nature preserve, which is actively managed for preservation and enhancement of wildlife habitat.
- Harmony has a well-qualified Conservation Director on staff who guides conservation and management activities in this planned community.
- The development uses "Dark Sky" streetlights to minimize the negative effects of artificial night lighting on wildlife. See their website for more information. www.harmonyfl.com.
- The developer also partnered with the University of Florida's Wildlife Extension department to develop an environmental education website and outreach programs for residents. See www.wec.ufl.edu/extension/gc/harmony/index.htm for more information.

Creston, North Carolina

- The Creston Development has placed 40 percent of the project area under a conservation easement with Foothills Land Conservancy, the local land trust.
- The conservation property is actively stewarded by land trust staff.
- See www.creston-nc.com for more information.

Bundoran Farm, Virginia

- This planned community has a large contiguous wildlife habitat conservation area that is connected to adjacent protected habitat, off-site.
- Large, conserved grasslands are also used for ranching.
- Building envelopes were designed for habitat conservation and connectivity.
  www.bundoranfarm.com

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APPENDIX A

LISTED SPECIES AND PRIORITY HABITATS

As we have explained throughout the toolbox, it is important to know about the species and habitats that are priorities for conservation in your community.

Federally Listed Species

- The U.S. Fish and Wildlife Service maintains a list of plant and animal species that are federally endangered, threatened and of special concern.
- Species listed as federally endangered or threatened are protected under the Federal Endangered Species Act (16 U.S.C. 1531 to 1543), meaning that the plant/animal or habitat cannot be harmed unless a permit is obtained through consultation with the U.S. Fish and Wildlife Service.
- Federal species of concern are considered at-risk species that may become federally listed in the future.
- Further research is typically needed to determine the conservation status of a federal species of concern.
- Following the recommendations in this guide will help to avoid and minimize negative impact to endangered species, but will not necessarily fulfill all regulatory requirements under the Endangered Species Act.
- For specific regulatory questions about a federally listed species, please contact the U.S. Fish and Wildlife Service at (919) 856-4520 in eastern NC, (828) 258-3939 in western NC, or visit www.fws.gov/raleigh/es.html
- To find out what federally listed species exist in your county and to view fact sheets about the species, visit www.fws.gov/raleigh/species/cntylist/nc_counties.html.

State-Listed Species

- State-listed species are protected under the State Endangered Species Act (G.S. 113-331 to 113-337), which is administered by the North Carolina Wildlife Resources Commission.
- For a complete list of state listed species (divided by region) in North Carolina, download the document, "Protected Wildlife Species of North Carolina," from www.ncwildlife.org/Learning/Species.aspx.

Other Priority Habitats and Species

- In addition to federal and state listed species, other species and habitats are considered priorities for conservation. Priority habitats, and the species that depend on them, are identified and described in North Carolina's Wildlife Action Plan.
- For more information on priority species listed in the North Carolina Wildlife Action Plan in your region, visit www.ncwildlife.org/Plan.aspx.

APPENDIX B

AGENCIES AND ORGANIZATIONS WITH TECHNICAL EXPERTISE

Many organizations and agencies can provide technical expertise to your town or county on Green Growth or related topics. Each organization's general contact information and primary expertise is outlined below.

State and Federal Agencies

The state and federal agencies listed below possess expertise related to planning for Green Growth. Note that agencies with regional expertise (particularly coastal agencies) are not listed below; these agencies are listed in regional appendices.

Agency	Primary Expertise	Contact
N.C. Wildlife Resources Commission	• Can assist local governments with Green Growth planning • Information about listed and priority species identified in the NC Wildlife Action Plan • The agency's Habitat Conservation program can provide information and assistance related to environmental permitting.	• For general Green Growth Toolbox Project: (910) 638-4887 • For environmental permitting issues: Habitat Conservation staff at: (919) 707-0222.
U.S. Fish & Wildlife Service	• Endangered Species Act • Information on planning related to federally listed species	• Raleigh Field Office: (919) 856-4520 • Asheville Field Office: (828) 258-3939
N.C. Natural Heritage Program	• Can assist local governments with Green Growth planning • Inventories, catalogues and supports conservation of the rarest and the most outstanding elements of the natural diversity of our state • Can conduct, update or help interpret your county's Natural Heritage Inventory	• (919) 707-8637
N.C. Forest Service, Urban Forestry Program	• Provides technical guidance to communities on tree preservation and urban forestry issues • Provides funding, through the Urban and Community Forestry Grant Program, for developing local urban forestry programs	• Urban Forestry Program Coordinator: (919) 857-4842

N.C. Division of Water Resources (DEQ), Planning Section	• Coordinates nonpoint source reduction efforts	• Contact Planning Section staff at: (919) 807-6440
N.C. Division of Parks and Recreation (DCNR)—State Trails Program	• Guidance to help local governments plan, develop and manage trails and greenways • Provides grant funding to help organizations, including county and municipal governments, fund trail development and management	• Contact State Trails Program at: (919) 707-9325
N.C. Land Quality Section (DEQ)	• Technical assistance on local erosion, sedimentation control issues and stormwater management	• Contact the Land Quality office for your region at: http://portal.ncdenr.org/web/lr/division-contacts
N.C. Division of Soil and Water Conservation (N.C. Department of Agriculture)	• Provides technical assistance to soil and water conservation districts and local governments to protect soil resources and improve water quality • Guidance on a variety of water shed management issues	• Contact Technical Services Section at: (252) 948-3903
N.C. Ecosystem Enhancement Program (DEQ)	• Develops local watershed plans that address sources of water quality degradation • Coordinates watershed improvement and restoration projects • Guidance on strategies and solutions to address watershed degradation	• Contact or ask for your county's project manager. • Raleigh Office: (919) 707-8976 • Asheville Office: (828) 232-4420
N.C. Cooperative Extension—Ecology or Wildlife Programs	• Multiple programs that provide technical guidance related to local environmental planning	• http://appliedecology.cals.ncsu.edu/extension/wildlife/

Land Trusts

Land trusts are primarily involved in protecting land through acquisition or conservation easements. Land trusts can be good partners in helping your community craft strategies to protect important lands for future generations.

Agency	Primary Expertise	Contact
Conservation Trust for North Carolina (and other NC Land Trusts)	• Guidance related to conservation planning, land protection and land management/stewardship	• www.ctnc.org/land-trusts/find-your-local-land-trust/
Trust for Public Land	• Guidance or partnerships to protect land in certain areas of North Carolina • Guidance related to conservation finance (i.e., developing local means to pay for land conservation)	• Contact the North Carolina Chapter Office at: (919) 836-0571
The Nature Conservancy	• Conservation planning, land protection and stewardship expertise	• Contact the North Carolina office: (919) 403-8558 or northcarolina@tnc.org
The Conservation Fund	• The Community and Economic Development Program provides assistance to communities on integrating environmental protection and community development, including conservation plans for affordable housing.	• Contact the North Carolina office at: (919) 967-2223

Regional Organizations

Communities in different regions will have access to different sources of technical guidance. Lists of regional organizations you can contact for assistance are provided in the Regional Appendices. However, most communities across the state will have a Council of Government or a conservation partnership nearby that may be able to provide assistance.

Agency	Primary Expertise	Contact
Councils of Government	• Land use planning-related technical assistance • If available, see addendum specific to your region for more information.	• www.ncregions.org
Conservation Partnerships	• Regional conservation partnerships in North Carolina can provide technical guidance related to conservation planning. • If available, see appendix specific to your region for more information.	• See your GGT Regional Appendix if available. • N.C. Conservation Planning Tool, Resources page click on Other Planning Efforts.

HUMAN-WILDLIFE CONFLICT PREVENTION

As development in North Carolina spreads, urban-adapted wildlife and people are increasingly coming into contact with one another. Certain species—Canada geese, deer, raccoons, rabbits, opossums, bears, coyotes and foxes can adapt to developed environments and will take advantage of available food and shelter. Conflicts can arise when animals dwell around stormwater ponds, dig up gardens, prey on outdoor pets, den in, near or under housing structures, consume or destroy landscaping vegetation or root through trash cans.

The presence of some wildlife, such as foxes, coyotes, raccoons, opossums and even bears, in suburban areas is a result of these species being able to access garbage cans, outdoor pets, pet food and bird feeders, especially at night. If food sources are made unavailable, these species will leave the area. The public often call wildlife control professionals and wildlife agency staff to remove wildlife from residential areas, which is not possible or is unsuccessful in many cases. The key to preventing human-wildlife conflicts is for: residents to remove trash and pet food sources around their homes, communities to have large natural habitat open space areas and to allow for well-controlled hunting in suburban areas.

Overpopulation by urban-adapted wildlife not only can cause problems for people, but can also cause harm to wildlife. For example, when too many deer exist in an area they can overgraze their wild plant foods and many end up starving or surviving in very poor health.

The key to managing human-wildlife conflict is to educate the public on the points below and to look for the most effective way to reduce outdoor trash and pet food availability, increase natural open space and amend local laws to allow trapping or hunting. Increasing natural open spaces in fields and forests will allow for food availability away from residential areas. Hunting and trapping will in turn reduce the high density of urban-adapted species.

Local governments and residents can take steps to proactively prevent human-wildlife conflicts.

- Provide animal and bear proof trash cans through your community's waste disposal program. Several companies can supply these. If you have black bears make sure the cans are proven to be truly bear proof.
- Educate, encourage or require the public not to actively feed wild animals by taking in their bird feeders in the evening and not placing food in their yards to feed pets, feral cats or wildlife.

  Please note: It is beneficial to plant annual native wildflowers and warm season grasses in backyards to benefit wild birds and other native wildlife that are not considered a nuisance. Annual plants that are not as abundant in the winter will help to reduce deer conflicts.

- Prevent overpopulation of deer.
  - Explore the feasibility of an urban archery season. www.ncwildlife.org/Conserving/MunicipalitiesCounties.aspx
  - Consider enabling hunting with firearms in large open spaces associated with conservation subdivisions or parks on a few days when public access is restricted.
  - Encourage the use of deer fencing, especially around food gardens.
- Provide trapping opportunities during the trapping season to manage problematic animal populations—such as raccoons and foxes—in certain areas.
- Encourage homeowners to keep domestic cats and dogs indoors. Cats allowed outdoors negatively impact sensitive bird, reptile and amphibian populations, while also attracting problematic wild animals that hunt cats and dogs.

For more information about preventing human-wildlife conflicts, visit the following website, www.ncwildlife.org/Trapping/HaveaProblem.aspx.

Bats in the attic and chimney swifts in the chimney.

In suburban areas large hollow trees are scarce and houses are usually the only remaining structures where certain bat species and chimney swifts can roost or raise their young.

It is important to the conservation of these species to provide alternative roosting structures for them if you need to close off your home or chimney to bats, chimney swifts or other native wildlife that have taken up residence (owls, flying squirrels, etc.). There are a variety of nesting or roosting boxes that can be placed in the appropriate habitat nearby.

It is critical that you do not trap animals in the house when screening is put into place. Chimney swifts are protected under the Migratory Bird Treaty Act. Contact the U.S. Fish and Wildlife Service if you feel you need to do something. See Appendix B for contacts.

For chimney swifts:

- Consider tolerating the swifts which only use chimneys during the spring through early fall when fire places are not typically used. Make sure you clean out the chimney before you intend to use it in the fall after the nesting season is over.
- If possible consider constructing an alternative chimney like structure near your home for the swifts to use. See www.chimneyswifts.org for more information.
- Screening the top of the chimney should be done during winter to avoid trapping actively nesting birds inside the chimney.

For bats:

- Contact a professional who will do the following:
  - Screen house openings only outside of the breeding season during the winter.
  - Screen house openings during night hours while bats are outside.
- Consider constructing a bat house nearby where your 'house bats' can go. This is a very affordable and fun project. Bats are great to have in the yard to control insects and mosquitos. See the following website for bat house information www.batcon.org/index.php/get-involved/install-a-bat-house.html.

APPENDIX D
GLOSSARY

Aquatic Species: Species of organisms that require water during their entire life cycle.

Biological Diversity: Also known as biodiversity, this term refers to the entire diversity of life in an area—including variation within and among species, natural communities and ecosystems. The more types of species and habitats in an area, the higher its biodiversity.

Conservation Concern: Sufficient evidence exists that species and or habitats may become threatened or endangered with extinction.

Conservation Data: Maps and information about habitats, animal and plant species of conservation concern. This data is mostly collected on the ground and is compiled by experts.

Conservation Planning: Process that occurs when a group of stakeholders consider the status of an area's natural environment and identify goals and strategies for conserving the area's natural heritage and biological diversity.

Conservation Priority: See page 58.

Conservation Strategies: Steps that can be taken to conserve a community's most valuable environmental assets. See page 61.

Conservation Value (and rank): The importance level of conserving a natural area due to the presence of rare species and habitats, high biodiversity or the presence of high-quality habitats or populations of wildlife.

Core Habitat: High-quality habitat that is not fragmented and has a large interior far from a habitat edge of incompatible land. Conditions where wildlife and plant populations can obtain most of the resources needed for maintenance of their population levels. See page 44.

Data Layer: A map layer that is in a Geographical Information System and which contains data about the features represented in a mapped location.

Ecosystem and Ecosystem Services: See page 8.

Ephemeral Wetland: A type of small wetland community. Temporary wetland pool that typically fills with water during winter and dries by summer. Because they dry out during part of the year, these wetlands do not support fish which prey heavily on amphibian eggs. These pools provide important breeding habitat for semi-aquatic amphibians.

Field (or Site) Survey: Biological surveys conducted by experienced natural resource professionals during suitable times of the year to document flora, fauna and habitats.

Fire-dependent Species: Species of animals and plants that require habitat where occassional fire occurs. Fire clears out old vegetation, leading to a more open habitat structure. This allows plant seeds to open and or touch bare mineral soil, which is needed for fire-dependent plant growth.

Food Web: Also called a "food chain." The feeding connections (who eats what) in a natural community of animals and plants. Food webs help to maintain natural levels of various species and nutrients in a habitat and ecosystem.

Game Land: Public land that is owned or managed by the North Carolina Wildlife Resources Commission. Game Lands are actively managed to provide wildlife habitat and wildlife-related recreation opportunities, including hunting, fishing and wildlife watching.

Geographical Information Systems (GIS): A computer-based system for mapping and analyzing spatial data and information about mapped features (map layers).

Green Growth: A type of land use planning that conserves biological diversity, important fish and wildlife habitat and associated natural resources as communities continue to grow.

Green Growth Toolbox: Instructional materials that explain how to do Green Growth, including a handbook, data CD and download and training workshops.

Habitat: See page 4.

Habitat Edge: The edge of a habitat adjoining incompatible land. For example, forest habitat edge adjoins grassland, crops or development and grassland habitat edge adjoins development or forest. Habitat edge causes 'edge effects' whereby species are negatively impacted due to edge conditions including a higher number of predators, such as outdoor cats. The width of edge effects differs for different species. See page 44.

Habitat Fragmentation: Habitat is reduced in size and separated from other habitat areas such that wildlife that require the habitat decline in abundance or become extinct locally. See page 74.

Interior Habitat: The habitat far from a habitat edge and of sufficient size to support a species or group (guild) of species. See page 44.

Invasive, Exotic Plants: Any plant species that does not occur naturally in North Carolina and poses serious threats to native ecosystems, due to the plant's propensity to spread rapidly and out-compete native plant communities. See page 93.

Natural Area or Community: An area containing mostly native plants and animals.

Natural Heritage Element Occurrence (NHEO): Occurrences of rare plants and animals, exemplary or unique natural communities and important animal groupings, as tracked and documented by the North Carolina Natural Heritage Program (NCNHP). Collectively, these plants, animals, natural communities and animal assemblages are referred to as "elements of natural diversity" or simply as "elements." Maps of NHEOs are maintained and distributed by the NCNHP and are updated quarterly. See page 22.

Natural Heritage Inventory Report: These reports are available for most North Carolina counties from the N.C. Natural Heritage Program website at http://www.ncnhp.org/references/publications. These reports are prepared by NCNHP based on field surveys of public and private properties for which they have permission to survey. The reports are by county and document the details about Natural Heritage Natural Areas (formerly named Significant Natural Heritage Areas) and other features that are of critical importance to conserving the state's biodiversity.

Natural Heritage Natural Area (NHNA): Terrestrial or aquatic sites that are of special biodiversity significance as defined by the North Carolina Natural Heritage Program. A site's conservation priority rating or significance may be due to the presence of rare species, rare or high-quality natural communities or other important ecological features. Maps of NHNAs are updated quarterly. These were formerly named Significant Natural Heritage Areas. See page 20.

Natural Resource-Based Land Use Patterns: See page 84.

Natural Resource Inventory: See Field Survey.

North Carolina Conservation Planning Tool: See page 18.

North Carolina Wildlife Action Plan: Every state wildlife agency develops a Wildlife Action Plan in compliance with a U.S. Congressional mandate. The North Carolina Wildlife Resources Commission completed the first plan in the nation in 2005. The plan identifies priority wildlife species, defines priority wildlife habitats and offers a blueprint for fish and wildlife conservation in NC. It is updated every 10 years.

Prescribed Fire See page 4.

Priority Wildlife Species and Habitats: Identified and described in the N.C. Wildlife Action Plan, these are wildlife species and habitats most of which are declining and may become threatened with extinction if conservation actions are not taken. See page 17.

Riparian: Natural vegetation and forest along the banks of waterways.

Seep: A small spring or a wet place where water rises from the ground to the surface.

Small Wetland Community: See page 51.

Sprawl: Low density development patterns where buildings and roads are not clustered and where travel by a car is required for most needs (i.e., uses are not mixed). See page 3.

Spring: Any natural flow of water from rock or soil onto land or into a body of surface water.

Subwatersheds: Smaller watersheds within larger watersheds. See page 67.

Terrestrial Species: Species of wildlife that spend most of their life cycle on land. In North Carolina, groups of terrestrial species include birds, reptiles, amphibians and mammals.

Vernal Pool: See Ephemeral Wetland above.

Wildlife Travel Corridor (Wildlife or Habitat Corridor): An area of land in a relatively natural state that is unimpeded by significant development disturbance, including roads, such that a particular species can travel between core habitats along the corridor. See page 84.

APPENDIX E

RECOMMENDED READING

In addition to the references listed in separate sections of this handbook, a number of other publications can provide more information on a Green Growth approach to planning. Selected references can be found below.

Integrating Conservation Science and Local Planning

Beatley, T. 2000. Preserving biodiversity: Challenges for planners. Journal of the American Planning Association 66 (1): 5 - 20.

Benedict, M.A. and E.T. McMahon. 2006. Green Infrastructure: Linking Landscapes and Communities. Washington D.C.: Island Press.

Broberg, L. 2003. Conserving ecosystems locally: A role for ecologists in Land Use Planning. Bioscience 53: 670-673.

Brown, L. 2008. Plan B 3.0: Mobilizing to Save Civilization. W.W. Norton and Company. Washington D.C.

Cohn, J. P., and J.A. Lerner. 2003. Integrating Land Use Planning and Biodiversity. Washington D.C.: Defenders of Wildlife.

Daily, G.C. and K. Ellison. 2002. The New Economy of Nature: The Quest to Make Conservation Profitable, Island Press, Washington, DC.

Johnson, E.A. and M.W. Klemens, editors. 2005. Nature in Fragments: The Legacy of Sprawl. New York, NY: Columbia University Press.

Environmental Law Institute. 2007. Lasting Landscapes: Reflections on the Role of Conservation Science in Local Planning. Washington D.C.

Esparza, A. X. and G.R. McPherson. 2009. A Planner's Guide to Natural Resource Conservation: The Science of Land Development Beyond the Metropolitan Fringe. New York: Springer.

Hilty, J.A., W.Z. Lidicker, A. Merenlender. 2006. Corridor Ecology: The Science and Practice of Linking Landscapes for Biodiversity Conservation. Washington D.C.: Island Press.

Hitchcox, S. 2001. The Economic Arguments for Conservation. Falmouth, Maine: Maine Audubon.

McKinney, M. L. 2002. Urbanization, biodiversity and conservation. BioScience, 52(10): 883-890.

Michalak, J. and J. Lerner. 2007. Linking Conservation and Land Use Planning: Using the State Wildlife Action Plans to Protect Wildlife from Urbanization. Washington D.C.: Defenders of Wildlife.

Peck, S. 1998. Planning for Biodiversity: Issues and Examples. Washington, D.C.: Island Press.

Pima County, Arizona. 2011. The Economic Benefits of Conservation. In: Pima County. Protecting our Land, Water and Heritage. 1st ed. p. 132 - 137.

What is Happening in Other States?

APPENDIX E

Arizona Game and Fish. [Internet]. Planning for Wildlife. Available from: www.azgfd.gov/w_c/wildlifeplanning.shtml

Austin et al. 2004. Conserving Vermont's Natural Heritage: A Guide to Community-Based Planning for the Conservation of Vermont's Fish, Wildlife and Biological Diversity. Waterbury, Vermont.

Azerrad, J. M., and Nilon, C. H. 2006. An evaluation of agency conservation guidelines to better address planning efforts by local government. Landscape and Urban Planning 77: 255-262.

Georgia Department of Natural Resources, Coastal Resources Division. Green Growth Guidelines. Available from: http://coastalgadnr.org/cm/green/guide.

Maine's Department of Inland Fisheries and Wildlife. 2003. Beginning with Habitat. Available from: www.beginningwithhabitat.org.

Miller, N. A., Klemens, M. W., and Schmitz, J. E. 2005. Biodiversity Conservation through Local Land Use Planning: An Assessment of Needs and Opportunities in the New Jersey Townships of Chester, Lebanon and Washington. Bronx, NY: Metropolitan Conservation Alliance, Wildlife Conservation Society.

Minnesota Department of Natural Resources. 2007. Natural Resource Guide: A Guide to Using Natural Resource Information in Local Decision Making. Available from: www.dnr.state.mn.us/nrig/index.html#

Northeastern Illinois Planning Commission and Chicago Wilderness. 2003. Conservation Design Resource Manual: Language and Guidelines for Updating Local Ordinances. Available from: www.chicagowilderness.org/what-we-do/protecting-green-infrastructure/epdd-resources/conservation-design/

Pima County, Arizona. 2012. Sonoran Desert Conservation Plan. Available from: www.pima.gov/cmo/sdcp/index.html

Saving Special Places [Internet]. 1000 Friends of Florida. [cited 2013 Aug 8]. Available from: www.1000friendsofflorida.org

Strong, K. 2008. Conserving Natural Areas and Wildlife in Your Community: Smart Growth Strategies for Protecting the Biological Diversity of New York's Hudson River Valley. N.Y. Cooperative Fish and Wildlife Research Unit, Cornell University and N.Y. Department of Environmental Conservation, Hudson River Estuary Program. Ithaca, NY.

Washington Department of Fish and Wildlife Conservation. [Internet]. Priority Habitats and Species Program. Available from: http://wdfw.wa.gov/conservation/phs/

Western Governors' Association. [Internet]. Initiative on Wildlife Corridors and Crucial Habitat. Available from: www.westgov.org/initiatives/wildlife

Western Issues: Growth. [Internet]. The Sonoran Institute. Available from: www.sonoraninstitute.org/western-issues/growth-.html

Planning Guidance

Environmental Law Institute. 2003. Conservation Thresholds for Land Use Planners. Washington, D.C.: Environmental Law Institute.

Environmental Law Institute. 2008. Planners Guide to Wetland Buffers for Local Governments. Washington, D.C.: Environmental Law Institute.

McElfish, J. M. 2004. Nature-Friendly Ordinances: Local Measures to Conserve Biodiversity. Washington, D.C.: Environmental Law Institute.

N.C. Wildlife Resources Commission. 2002. Guidance Memorandum to Address and Mitigate Secondary and Cumulative Impacts to Aquatic and Terrestrial Wildlife Resources and Water Quality. Available from: www.ncwildlife.org/Conserving/Programs/HabitatConservationProgram.aspx

N.C. Wildlife Resources Commission. 2012. Conservation Recommendations for Priority Terrestrial Wildlife Species and Habitats in North Carolina. Raleigh, N.C. Available from: www.ncwildlife.org/greengrowth.

Nolon, J. R. 2003. Open Ground: Effective Local Strategies for Protecting Natural Resources: Environmental Law Institute.

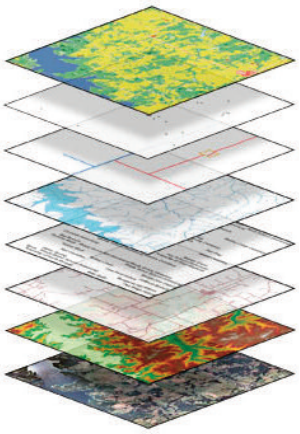
Schwab, J. 2009. Planning the Urban Forest. American Planning Association. Available from: www.planning.org/research/forestry/report.htm

Legal Issues

Environmental Law Institute and Defenders of Wildlife. 2003. Planning for Biodiversity: Authorities in State Land Use Laws. Washington, D.C.

Owens, D. W. 2000. Local government authority to implement smart growth programs: Dillon's Rule, legislative reform and the current state of affairs in North Carolina. 35 Wake Forest Law Review 671.

APPENDIX F
FURTHER GUIDANCE ON CONSERVATION PLANNING



There are a variety of conservation planning resources available with a large selection of map layers that are useful for planning. It would not be practical to include them all in Section 2 of this handbook so we summarize them in this appendix. The tools described here are most relevant for reference and supporting information at the planning stage and not at the level of development design. They contain a wide variety of map layers and analyses not found anywhere else. These resources communicate how important areas are to conserve and why, which can help to justify trying a conservation approach to land use and development in high priority areas.

The Conservation Planning Atlas and Conservation Blueprint

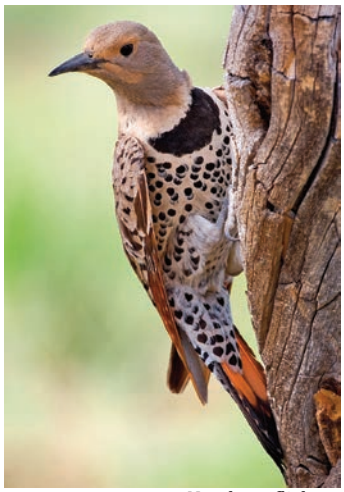
This tool is produced in our region by the South Atlantic and the Appalachian Landscape Conservation Collaborative, part of a network of "LCCs" across North America. The LCCs seek to make natural resource and wildlife conservation more efficient and effective by enhancing collaboration, improving mapping data and measuring the health of our ecosystems over time.

- For areas in the South Atlantic geographic region use the South Atlantic Landscape Conservation Cooperative planning atlas at https://salcc.databasin.org/.
- In the Appalachians use the Appalachian LCC planning atlas at https://applcc.databasin.org/.

Map layers and information include:

The Conservation Blueprint: "The blueprint" depicts and describes areas of highest to medium conservation priority, the amount of various land cover types and what types of wildlife and habitats are most in need of conservation within watersheds.

The Conservation Planning Atlas: The Atlas provides information and maps on basically any natural resource-related topic from economics to water quality. Types of maps and information include urban growth projections, watersheds by length of 303d streams, forest products, areas where priority wildlife species are likely to be found, habitat connectivity, and habitat quality.



NATURE'S PICS *Northern flicker*

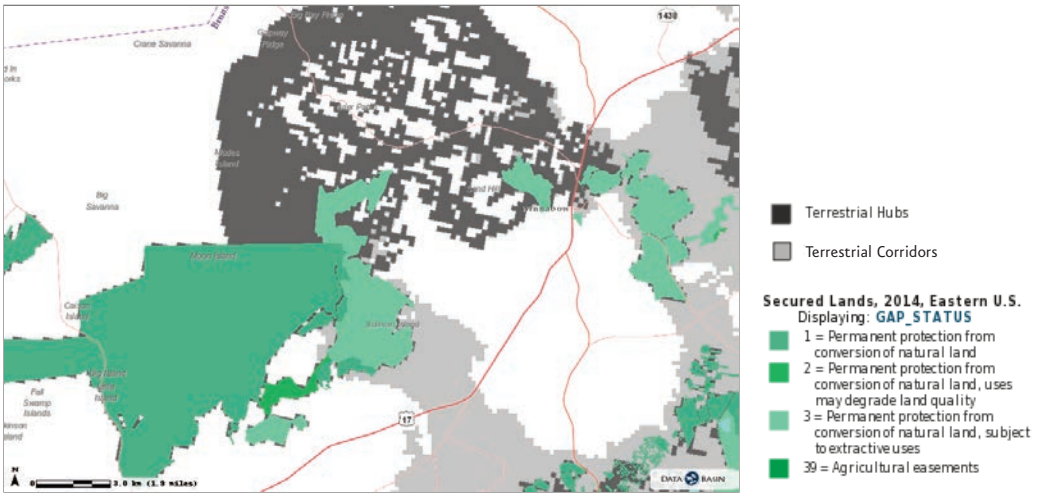
Conservation Opportunity Areas

This resource was produced for the N.C. Wildlife Commission by NC State University. It depicts watersheds by the level of opportunity there is to conserve wildlife Species of Greatest Conservation Need and priority habitats. Areas with more private unprotected land with declining habitat types rank higher in conservation opportunity. Information on the number and types of threats to wildlife and habitats is provided and can help guide decisions on what type of conservation measures to focus on. For example, your community could consider focusing land use or development policies and incentives, on the highest priority habitat types in these high opportunity watersheds. A map of priority habitat types accompanies the opportunity areas map. This habitat map is not based on documented species occurrence and is a predictive model of what type of habitat is likely on the ground. www.ncwildlife.org/plan

Examples of Using the Conservation Planning Atlas and Blueprint in Planning

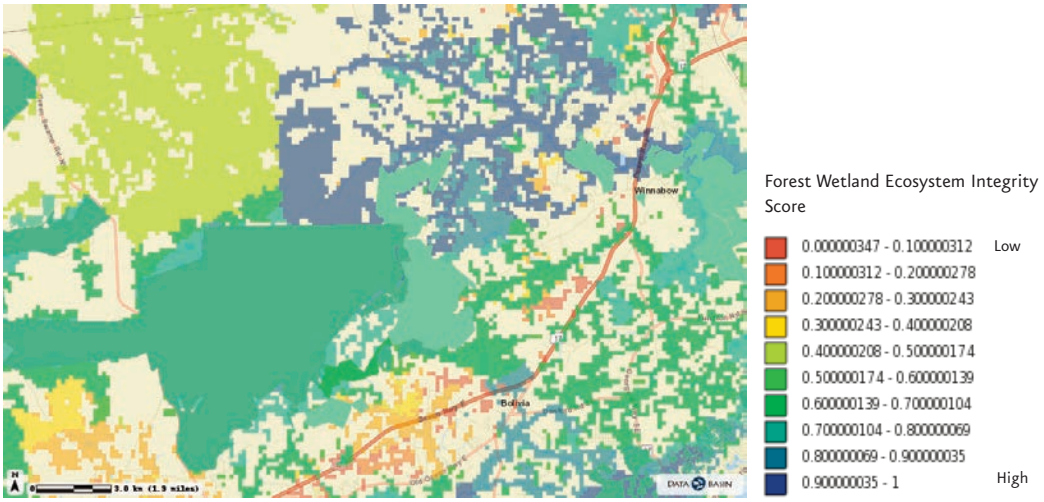
The map layers in the Conservation Planning Atlas and Blueprint differ somewhat by region. Figures 1-3 depict map layers avaliable in the South Atlantic geographic region and figure 4 is for data from the Appalachians. Map layers are constantly being added to the Data Atlas and similar maps to those described here exist or will exist in every region.

FIGURE 1. LIKELY HABITAT CORE AREAS (HUBS) AND HABITAT CORRIDORS



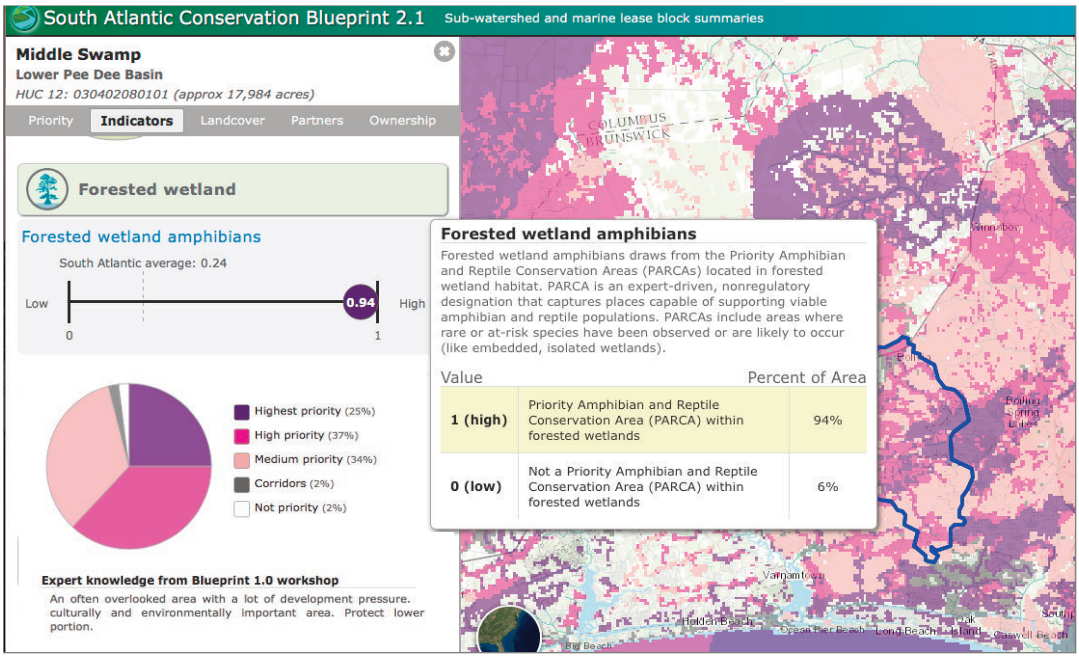
The Conservation Planning Atlas has a number of map layers that depict habitat 'hubs' and corridors, so we do not refer to the exact layer name. The Atlas maps can be searched by keyword to find layers. This image is of central Brunswick County. The layers depict terrestrail habitat hubs of blocks of core habitat of sufficient size and quality to be likely to function as priority habitat. The terrestrial corridors depict landscapes where priority wildlife probably travel between habitat hubs.These areas could be considered appropriate as a rural land use district with low overall density and cluster development in order to maintain habitat and connectivity.

FIGURE 2. FOREST WETLAND ECOSYSTEM INTEGRITY



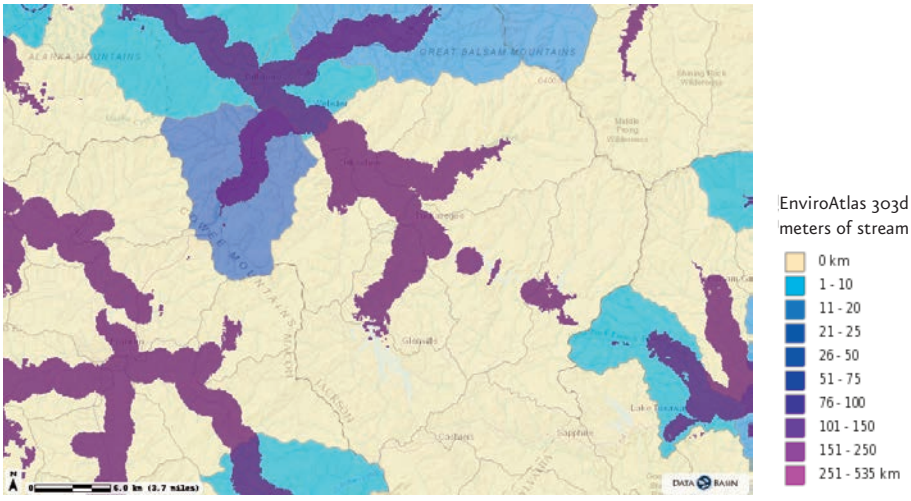
The Conservation Planning Atlas also includes maps that are based on analyses of habitat types from satelite imagry and measures of habitat quality. This information can offer support for justifying the need consider conservation-based planning practices in certain areas.

FIGURE 3. THE CONSERVATION BLUEPRINT



The Conservation Blueprint provides an estimate of conservation priority and indicators that show the percent of area of priorty habitat types within watersheds. For example, in the map above 94% of the area of the watershed outlined in blue is estimated to be forested wetland habitat that would support priority amphibian and reptile species. Twenty-five percent of this watershed is considered to be highest priority and 37% is high conservation priority. The map is based on expert opinion and interpretation of habitat types from satelite data.

FIGURE 4. WATER QUALITY AND PRIORITY STREAMS



The purple areas on this map are streams where hellbender salamanders are known to occur or are likely to occur. The blue map layer shows the distance of streams within watersheds that are on the 303d list of impaired waters. Stream restoration and protection in watersheds in blue will increase protection for hellbenders. Watersheds without 303d streams are high priority for water quality protection as well since it is more effective to protect unimpaired streams than to allow impacts and try to restore streams later.