



ANNE OUTLAW

wood thrush chicks

SECTION 1. THE GREEN GROWTH TOOLBOX

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.

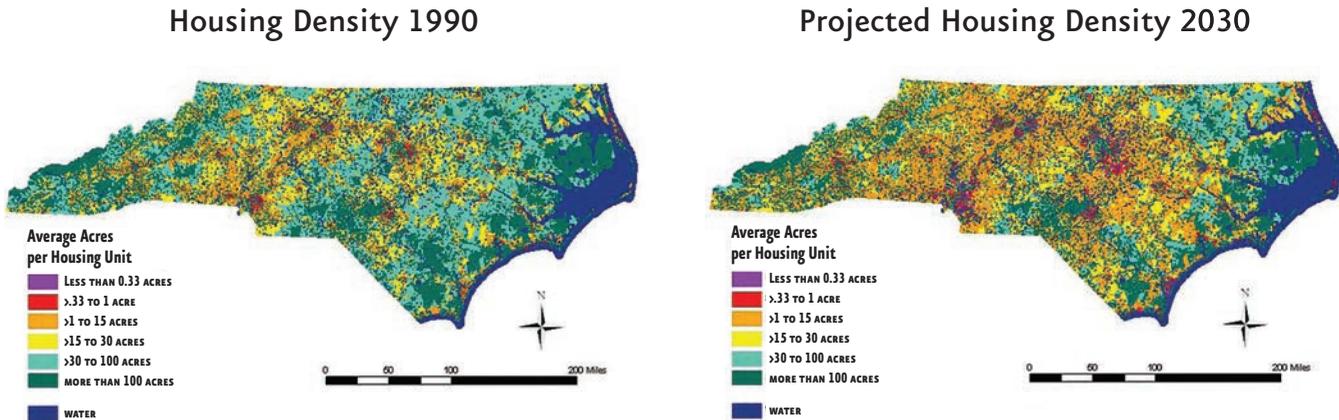


North Carolina has more sprawling development patterns than any other state.¹

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.



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

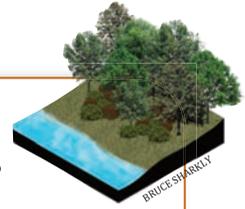
Suburban sprawl is generally defined in the literature as areas with 0.33 to one development unit per acre and where development uses are not mixed. Exurban or rural sprawl is generally defined as having one development unit per one to 20 acres, where farms and forests are converted to low density development 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 year⁸—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



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 Patterns¹²

Habitats are reduced and fragmented by roads and other development.

- 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 eagles¹³ 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.



softshell turtle

DIRK STEVENSON

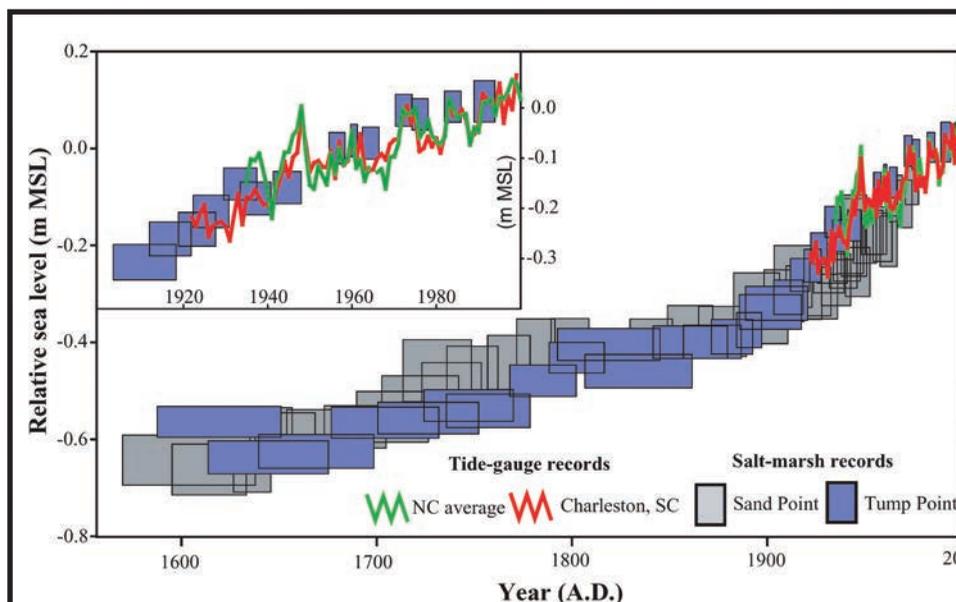
What is prescribed fire?

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.

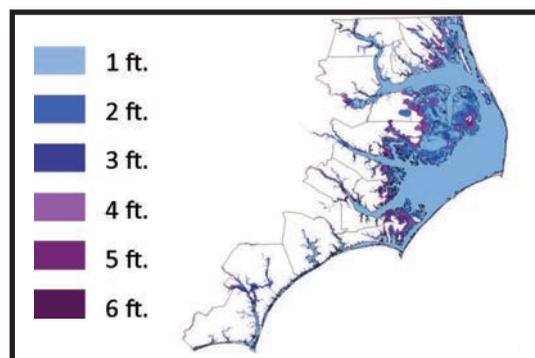


The Increased Need for Safeguards: Climate Change and Sea Level Rise

- 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



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.

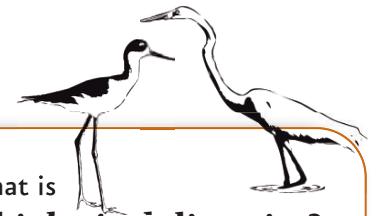
Ten Ways Green Growth Benefits Communities

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



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.

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 versus 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://charmec.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://usbc.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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