



# A QUICK GUIDE TO COMMUNITY PLANNING FOR GREEN INFRASTRUCTURE

## WHY COMMUNITIES NEED BETTER PLANNING TO CONSERVE TREES AND FORESTS

While we recognize that our forests are important, we might not realize all their benefits. Our economy depends on healthy forests. The forest products industry is North Carolina's top manufacturing industry, employing over 80,000 people. Forests give the state \$6 billion in forest product value and when related benefits are added, the total value to North Carolina's economy is \$28 billion (NC Forest Resource Assessment 2007).

In addition to jobs and products, our forests help us reduce other costs such as drinking water treatment. A survey by the American Waterworks Association found that a 10% increase

in forest cover reduced the chemical treatment costs for drinking water by 20%, reducing costs to consumers.

Conserving our tree cover is critical to building and sustaining wildlife and human communities that are healthy, both ecologically and economically. Research by the non-profit organization, American Forests, has estimated that trees in the nation's metropolitan areas contribute \$400 billion in storm water retention by eliminating the need for expensive storm water retention facilities. In addition, these natural resources are valuable to us in social terms, such as the emotional benefits provided by natural beauty and the open, unspoiled vistas that many people appreciate.

This brochure is excerpted from a longer book [Evaluating and Conserving Green Infrastructure Across the Landscape: A Practitioner's Guide](http://www.gicinc.org/book.htm), 2013 North Carolina edition. To obtain a copy please visit <http://www.gicinc.org/book.htm>

Funding for this project was provided in part through the Urban & Community Forestry Program of the North Carolina Forest Service, Department of Agriculture and Consumer Services, in cooperation with the USDA Forest Service, Southern Region.



*The North Carolina Forest Service is an equal opportunity employer. Its programs, activities and employment practices are available to all people regardless of race, color, religion, sex, age, national origin, disabilities, or political affiliation.*

## FOREST BENEFITS

**Forests are important for both the economy and for healthy communities. They provide:**

- Clean Air
- Clean Water
- Wildlife Habitat
- Forest Products: lumber, food
- Erosion Prevention
- Natural Beauty

## WHAT IS GREEN INFRASTRUCTURE?

Forests can be thought of as part of our green infrastructure. Green Infrastructure includes all our natural resources. It includes all the interconnected natural systems in a landscape, such as intact forests, woodlands, wetlands, parks and rivers, as well as agricultural soils. These natural systems provide us with clean water, better air quality, wildlife habitat and food. We consider them our 'green infrastructure' because they support our existence.

Thinking about our natural resources as 'green infrastructure' enables us to recognize them as a critical part of our life support system. They are 'green' because they are part of the natural environment, and they are 'infrastructure' because they provide those basic services that we all need for healthful and restorative living.

The recognition of the need to plan for conserving our natural resources has led to the field of green infrastructure planning, in which local communities, landowners and organizations work together to identify, design and conserve their land network to maintain healthy ecological functioning. Green infrastructure planning evaluates the types of natural and cultural resources available today and prioritizes those resources that are most important to us, or that best meet our current and future needs.

## OUR FORESTS – OUR GREEN INFRASTRUCTURE – ARE AT RISK

Unfortunately, many of our forests are at risk. Even with new forests being planted and old farm fields changing to tree cover – North Carolina has lost 1.9 million acres of forest land since the mid-1960s. What caused this loss? In a word: development.

North Carolina has 18.1 million acres of forest, which cover 60 percent of the state; 11.3 million acres of that are privately owned. This means that more than half of

Forests also pay us back with improved property values! A study found that large natural forest areas have a greater positive impact on nearby property prices than small urban parks or developed parks, such as play-grounds or skate parks. Homes located within 1,500 feet of natural forest areas enjoy statistically significant increases in property values; on average of greater than \$10,000 more as compared with \$1,214 for urban parks or \$5,657 for skate parks.

North Carolina's forests also support our fish and wildlife by providing key habitats. Larger forests can support a greater diversity of habitat types and thus more wildlife diversity. In general, the larger an intact forested area, the more likely it is to support a greater diversity of species. In order to support a diversity of wildlife, plant and insect species, a good rule-of-thumb for the size of a forest in the eastern U.S. is a minimum interior size of 100 acres, made up of native tree species.



*Painted Turtle. Photo Credit: NHP staff*



*Pinebarrens Treefrog. Photo Credit: Steve Hall*

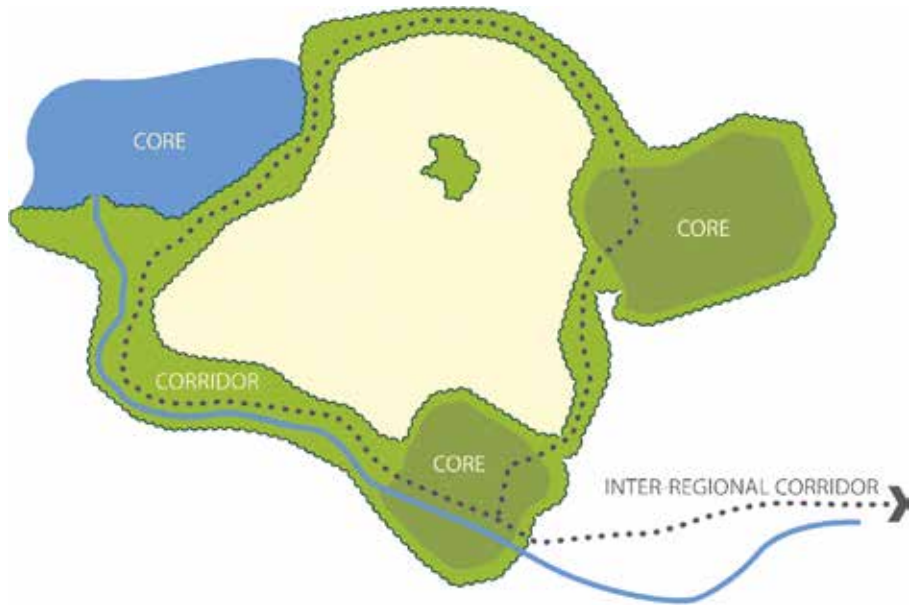
the state's forests depend on the stewardship of private landowners for continued good health (all data cited from NC Forest Service 2013 Briefing Document).

Furthermore, while total acreage is important, the quality and intactness of those forests also matters. Forest fragmentation – breaking forests into smaller areas – remains the greatest threat to southern forests. However, this does not need to continue; there are many things that foresters, planners and individuals can do to prevent forest loss and fragmentation and promote their conservation. The first step is to have a plan!

### A CONNECTED NETWORK ALSO SUPPORTS NORTH CAROLINA'S WILDLIFE

Certain species prefer interior forests – forests that are wide enough to protect them. When these forests are at least 100 acres we call them “cores.” Bird species such as the cerulean warbler or scarlet tanager, or mammals such as the black bear prefer large tracts of undisturbed forest.

In order to preserve healthy natural communities, the landscape should be connected. A key principle is to conserve large blocks of intact habitat that are connected by corridors to allow for species movement. Species use the corridors to forage, nest, breed, and move and disperse between core areas.

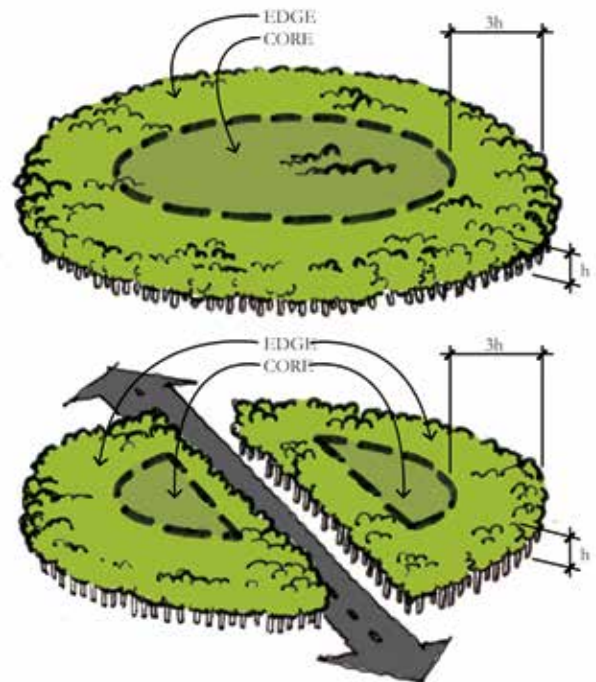


Together these cores and corridors form a green infrastructure network.

Note also that each core consists of two parts: a central area of undisturbed wildlife habitat, which is surrounded by an edge area that absorbs impacts from outside the core (such as erosion, wind, human intrusion and invasive species). This edge habitat serves as a buffer; protecting the inner core habitat from encroachment. On the following pages we provide the basic concepts for how these habitats protect biodiversity and healthy ecosystems along with common terminology. See the primer on page 4 for more.



Certain species, such as the scarlet tanager, prefer interior forests.



Edge area = Average tree height (h) X 3  
 Core = Total area - Edge area  
 Ideally, Core ≥ 100 acres

## GREEN INFRASTRUCTURE PRIMER – KEY HABITAT TERMS

**Patch:** a relatively homogeneous, nonlinear area of natural cover (such as a forest, desert region, marshland, or grassland) that differs from its surroundings.

**Core:** A core is an area or patch of relatively intact habitat, sufficiently large to support more than one individual of a species. The greater the numbers of interior species present and the greater the diversity of habitats, the more important core preservation becomes.

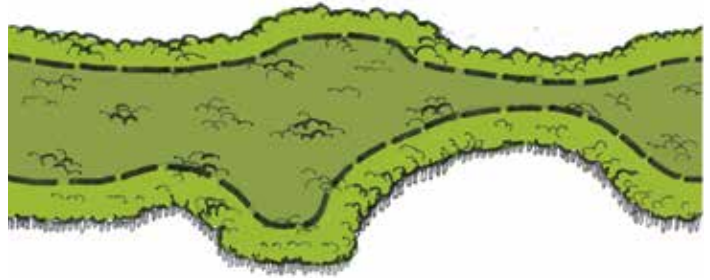
The edge width is determined by taking the average tree height, e.g. 100 feet, and multiplying that value times three. So in the eastern U.S. where average tree heights are 100 feet, the width of the edge is 300 feet. Whatever is leftover equals the interior habitat. Bisecting a core with a disturbance such as a road, creates more edge and less interior habitat needed by many species. This is why bisecting a core should be avoided whenever possible.

**Edge:** The transitional boundary of a core, where the vegetation assemblage and structure differs markedly from the interior, such as forest edges. The structural diversity of the edge (with different heights and types of vegetation) affects its species diversity, as well as the prevalence or abundance of native or invasive species.



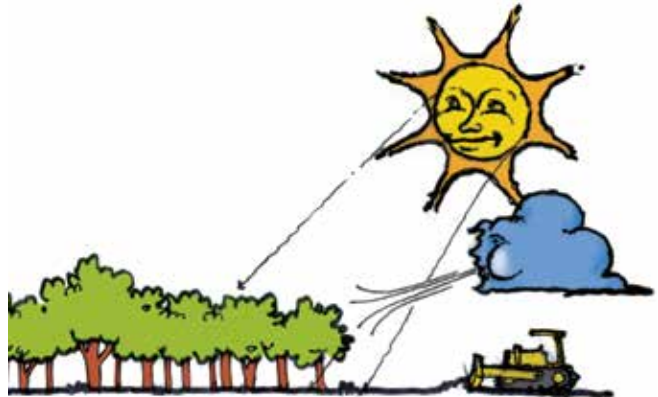
*A hard edge, where the habitat changes abruptly is common along man-made fields. A softer edge can serve as a transitional zone or buffer and may support species specifically adapted to take advantage of edge areas.*

**Corridor:** A more or less linear arrangement of a habitat type or natural cover that provides a connection between cores and differs from adjacent land. Corridors are used by species to move between cores, so they need to be wide enough to allow wildlife to progress across the landscape within conditions similar to their interior habitat. For this reason, it is recommended that these connections be at least 300 meters wide: a central 100-meter width of interior habitat, with a 100-meter edge on either side to protect safe passage and buffer against human intrusion and invasive species. Streams are natural corridors too as long as they are forested on both sides.



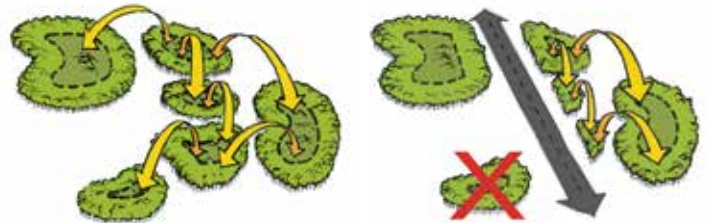
*Corridors should be 300 meters wide to allow at least 100 meters of safe passage in the middle.*

In addition to wildlife movement, corridors allow populations of plants and animals to respond to changes in land cover, surrounding land use and microclimate changes over the long term. The larger a network of interconnected corridors and cores happens to be, the more likely it is that overall species diversity and functioning ecosystems can be maintained amidst a changing landscape. Certain smaller areas can provide 'stepping stones' between



*Effects of sun, wind and human disturbance can cause impacts to the edge area. This disturbed area or edge is not counted as part of the interior of the habitat. The interior is mostly protected from these edge effects.*

cores. A stepping stone may not be large enough to sustain a species on its own, but it is a valuable alternative way to move across the landscape.



*Stepping stones of habitat areas can facilitate animal movement. Roads or other impedences can block them sometimes.*

## GREEN INFRASTRUCTURE PLANNING

Consider creating a green infrastructure plan in your community. In practice, mapping your natural resources as part of a green infrastructure scheme should be focused at the landscape scale, looking across multiple parcels and ownership. Ideally, this occurs before land development begins, which will allow land managers, landowners and planners to consider which areas should be selected for conservation or restoration, in order to provide such ecosystem services as wildlife habitat, recreation areas, stormwater treatment, energy savings, aesthetic values, improved community health and a sustainable economy. This ensures that areas are not cut off, or that ecosystem functions, such as groundwater recharge, are not unintentionally disrupted.

**Ecosystem services are those positive benefits nature provides, that are essential to a community, such as: clean air and water, stormwater remediation, food, energy, recreation and cultural opportunities. Forests provide us all of these services and more!**

Even inner suburbs, towns and cities can contain unique habitats, as well as substantial open spaces. In urban areas, green infrastructure planning focuses on different scales and types of data. It assesses the citywide tree canopy and the condition of public trees, riparian habitats and stream corridors, as well as the trees and streams in a local district, neighborhood or watershed. It looks at where there are connected blocks of habitat, such as large city parks and trail systems, as well as good loca-



*Each development conserved green spaces but did not connect them.*



*These sites maintained connections between them while achieving the same level of development.*

tions for community gardens and opportunities for small-space habitat restoration, plus water features or water infiltration. Most importantly, green infrastructure plans keep habitats connected by planning across the landscape and across parcels.

### Engage stakeholders!

#### This is key to a successful planning process

The first step is to engage stakeholders in deciding which green infrastructure assets are the most important to identify and conserve. Deciding this is a value-driven process. It requires some form of community engagement in order to determine which natural assets to include. For example, while the best available science can tell us the types of habitats that are most

important for wildlife, we must first decide that wildlife conservation is important to us. Furthermore, community support is usually needed for implementation, so establishing goals that meet community needs can be key to ensuring the strategy succeeds.



*Green landscapes support drinking water quality. Photo Credit: Land of Sky Regional Council of development.*

## To Create a Green Infrastructure Plan, Follow These Six Steps:

### Step 1. Set Goals

### Step 2. Review Data

### Step 3. Make Asset Maps

### Step 4. Assess Risks

### Step 5. Determine Opportunities

### Step 6. Implement Opportunities

**1** **Step 1. Set Goals** - What does your community/organization value? What are your priorities? Determine which natural assets and functions are most important to your community.

All green infrastructure planning efforts that involve the public must start with the establishment of goals. However, before asking people what their goals are for evaluating an area's natural assets, they may need an introduction on what natural assets are and why cataloging them is important. Green infrastructure planning involves the prioritization of catalogued assets to create a strategy for conserving what is most important. To prioritize, you must have some way of setting aside ideas that are not critical or relevant. The more specific your goals are, the easier that will be. You may want to consider an extensive community engagement process to help shape or update the goals. Order the full guide to learn more.

When you initiate a mapping project, you have a reason for doing so. In a rural area, initial goals might be as broad as, "Identify large, intact habitats that will conserve our region's biodiversity." Or they may be as specific as, "Identify critical natural resources, habitat areas and key viewsheds that can support and sustain a strong, natural resource-based economy."

You will need to determine if your goals can be mapped. To do that, you need to assess what information you already have and what you still need to gather. Keep in mind that the goal is not to put everything on your map, but rather to prioritize. A green infrastructure map – a map of natural assets that support community functions – is most effective as a strategic tool if your natural resources are ranked in terms of importance for achieving your goals.

Ensure that your established goals help point you to what to include on a map. Determine if they can be evaluated spatially (on a map) and whether they can be used to create real on-the-ground actions.

You may want to utilize goals that already exist for the community by consulting existing documents, such as the comprehensive plan or zoning ordinance. Since these have been adopted already, it may make it easier for them to gain acceptance. Another simple way to begin is by asking stakeholders what is important to them.

**2** **Step 2. Review Data** - What do we know or need to know, to map values identified in Step 1?

Once your community, locality, land trust, or other organization has established the purpose of its project (what it is seeking to conserve or restore, and why), the next step is to determine how to implement that purpose. Decide how the available data relate to each of your goals, and how the data can be catalogued, evaluated, prioritized and mapped.

For example, if your community decides that it values clean water, rather than mapping all watersheds, identify and conserve just those with high levels of forest cover and intact stream buffers. This can be mapped in GIS by creating a watershed boundary layer, adding in forest cover and determining the highest value forest cover you desire for a watershed, e.g. at least 70 percent cover overall, with extra buffering for headwater streams.

**3** **Step 3. Make Asset Maps** - Map Your Community's Ecological, Cultural and Economic Assets.

Map your community's highest-valued natural assets that contribute to a healthy ecology and also support cultural and economic values – base this on the goals established in Step 1 and data from Step 2. Once you have brought together all the existing data you want and collected any additional data that matches your goals, it is time to create your natural asset map. Depending on what those goals are, this map might include:

- Large intact forests, native meadows, marshlands.
- Key geological features.
- Farms and farming communities.
- Streams, rivers, wetlands and reservoirs and ground-water recharge areas.
- Recreational areas.
- Historic and cultural features.
- Viewsheds.
- In urban areas: street trees, the tree canopy, parks, community gardens and streams.

The North Carolina Conservation Planning Tool (CPT) provides maps that integrate information from multiple sources and can be used as a starting point to create a green infrastructure plan. You'll need skills to use digital GIS (geographic information systems) mapping. You may also consult with your local Council of Governments for assistance. Four types of maps are available:

- Biodiversity and Wildlife Habitat
- Open Space and Conservation Lands
- Agricultural Lands
- Forestry Lands

The data and maps included in the assessments can be used independently or in combination. By coordinating assessment data, various users can identify lands that provide multiple resource priorities. Go to: [www.conservision-nc.net](http://www.conservision-nc.net)

## 4 Step 4. Assess Risks - What assets are most at risk and what could be lost if no action is taken?

Making a map of your assets is just the first step to conserving those resources. Your mapped assets must be evaluated to determine if they are at risk from roads, redevelopment, dams, or other factors.

'Risk' refers to whether a natural asset is likely to remain intact or not and will help to prioritize which areas to conserve, how to rank them, and what actions may or may not be needed to protect them.

To do this, we need to ask such questions as:

- Which areas are zoned for development and do they overlap key natural assets?
- Which forests and other key natural areas are threatened with fragmentation by roads or subdivisions?
- Are there areas threatened by natural enemies, such as pests or diseases?
- Are there areas at risk from natural disasters, such as extreme floods or wildfires?
- Which streams are likely to be impaired in the future?

In the future, zoning can be reviewed, land may change ownership, natural events such as floods or tornadoes can alter landscape conditions, populations may increase or decrease, and localities may have more or less money to spend on roads, land acquisition and conservation easements. Thus, it will be important to update maps and data along the way.

## 5 Step 5. Determine Opportunities - Based on those assets and risks you have identified, which ones could or should be restored or improved?

Determine opportunities to protect or restore your assets based on the risks identified. Consider which areas need attention soonest. This may also point to areas that are more appropriate for development, either because they do not contain rare or unique natural assets, or because they could provide recreation and other benefits to residents.

Once assets most at risk have been identified, rank them – to prioritize those natural assets that should be preserved or restored. Map opportunities and draft strategies to conserve the prioritized areas. Strategies should be based on their importance and whether they take advantage of key opportunities.

Here are some things to consider:

- Which are the top five/ten areas of forest or woodland that are most threatened, or that offer the most value for forestry, recreation and wildlife habitat? Specify why.
- Which are the top waterways to preserve, and why?
- What are the top geological features and viewsheds that need to be preserved, and why?
- Which historical landscapes are most important and most under threat?
- What recreational areas are of most value and are most threatened?

## 6 Step 6. Implement Opportunities - Include natural asset maps in both daily and long-range planning, such as park planning, comprehensive planning and zoning, tourism development and economic planning.

Once you have evaluated and mapped your community's natural and cultural assets, it is time to utilize this information as part of everyday planning and conservation work. It is likely that, unless you take some action, your assets will decrease over time. The single greatest threat to large intact forests in the southern U.S is fragmentation caused by roads, buildings and other disturbances (USDA Southern Research Station). And, left uncontrolled, it will get worse. But this fragmentation could be avoided by careful planning to prevent bisecting critical natural areas that may be serving key purposes that should be recognized. The North Carolina Green Growth Toolbox offers many ideas as well as training workshops. Go to: [www.ncwildlife.org/Conserving/Programs/GreenGrowthToolbox.aspx](http://www.ncwildlife.org/Conserving/Programs/GreenGrowthToolbox.aspx)



### Forest Management Planning

A green infrastructure plan should also consider how to promote large and connected forests. A strong timber economy helps ensure that land remains in forest use, so continuance of forestry is one way to protect forested lands. If working lands become less profitable, they may be converted to other uses. Individual forest landowners can ensure the long-term health of their forests through better forest stewardship. Having a forest management plan is one way to better conserve a forest. It can include goals for wildlife conservation, water protection and harvesting (if that is desired). Forests may need better management to find and remove invasive plant species, such as tree of heaven, or pests such as the emerald ash borer. Tools for Managing Your Rural or Urban Forest can be found at [www.ncforests-service.gov](http://www.ncforests-service.gov)

### Comprehensive Planning

Local governments may undertake comprehensive planning, which can include key resources and plans for future development. While comprehensive plans typically identify growth areas or new transportation corridors, it is important that they also focus on natural resources and important landscape features. Adding green infrastructure maps and plans as part of your plan can ensure that landscape functions are protected. For example, the Land of Sky Regional Council created green infrastructure maps and then applied them to Gro Western North Carolina (GroWNC), in order to develop future scenarios for development and conservation.

In addition, review your county's existing comprehensive plan to determine whether it includes key information about green infrastructure, such as: water resources (rivers, lakes, wetlands, bays); significant forests; dune systems; and agricultural soils. It also needs to include specific statistics and goals, such as how much area is in forest, where is it at significant risk, and what goals the locality has for its protection or restoration.

Foresters can provide planners with key facts and data about local forests, as well as areas that may be especially at risk from wildfires. Planners can help foresters better understand the added risks to forests from new transportation plans, development or zoning changes that may affect forest health or economic potential.

To learn more about the ideas in this brochure and the many benefits of evaluating and conserving your green infrastructure, order a copy of the 135-page *Evaluating and Conserving Green Infrastructure Across the Landscape: A Practitioner's Guide*. It can be obtained by visiting <http://www.gicinc.org/book>

