

**TOOLS AND TRAINING PROGRAMS FOR INTEGRATING WILDLIFE AND NATURAL RESOURCE CONSERVATION IN LAND USE AND TRANSPORTATION PLANNING IN NORTH CAROLINA**

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**ABSTRACT**

Spread-out development patterns, driven by transportation and land use decisions, are a top threat to wildlife, habitats, and biodiversity in North Carolina, which has more urban sprawl regions than any state (Otto et al., 2002). More centralized development patterns that conserve, buffer, and connect priority wildlife habitats will improve natural resources and biodiversity as well as their benefits including economic vitality and community resilience to climate-related hazards. Access to biodiversity conservation data, information, and conservation planning methods has been identified as a primary need by local land use and transportation planners in NC to reduce development impacts (Miller et al. 2009). In response, the N.C. Wildlife Resources Commission (NCWRC) and the N.C. Natural Heritage Program (NCNHP) partnered to provide local governments with the Green Growth Toolbox (GGT), the NC Conservation Planning Tool, and the NCNHP Natural Heritage Data Explorer. These tools make biodiversity conservation data, information, recommendations and maps accessible to planners and communities through training workshops, online resources, and technical assistance. We will discuss these tools, how they have been implemented by communities, preliminary measures of tool effectiveness and ways to increase effectiveness. We conducted an analysis of GGT workshop evaluations, an online survey, and interviews with planners and use anecdotal observations to gauge preliminary outcomes. An important barrier to implementation of conservation-based development planning identified was the need to inform planning board members and elected officials of the need for conservation-based development and its benefits. Twenty-one GGT workshops have been provided and we have given in-depth technical assistance to 27 communities mostly in priority areas. We have the opportunity to work with an additional 75 interested communities, for which we do not have the resources currently. Local governments have adopted 32 conservation-based plans, incentives, ordinances and practices related to GGT technical assistance. In order to achieve tangible results in terms of changes to ordinances and state transportation policy, there is a demand for more biologists to build relationships with planners and to assist them with conservation planning. Approximately seventy-percent of communities may need some level of additional funding to implement conservation-based planning. Lessons learned and recommendations relate to overcoming challenges to improve the pace and effectiveness of biodiversity conservation through land use and transportation planning. A purpose of this paper is to offer conservation biologists and professionals information to evaluate the potential effectiveness of working proactively with local governments to address development impacts in their region.

## INTRODUCTION

### **The Need to Address Wildlife Habitat and Biodiversity Conservation in Local Land Use and Transportation Planning**

Habitat degradation and fragmentation arising from sprawling development patterns are one of the most significant causes of species imperilment in the United States (Doyle et al. 2001, Ewing et al. 2005, Brown and Laband 2006) and may rival biodiversity loss from global warming (Terando et al., 2014). Conservation of wildlife habitat and natural resources through local planning, incentives and ordinances would no doubt increase the resilience of our communities to global warming and climate change. Over one third of the wildlife species in NC are in decline due in large part to habitat fragmentation and cumulative loss from spread-out development patterns (NCWRC 2015). For example, in addition to exurban development on the edge of cities and towns, rural home development is also one of the leading causes of biodiversity loss, and is the fastest growing form of land use in the U.S. since the 1950s (Hansen et al. 2005). It is also unlikely that there is sufficient funding and time to acquire or place easements on a sufficient land mass to ensure the persistence of many declining species. This has been documented in states with slower growth rates (Gude et al. 2007).

Over the past two decades, North Carolina has been one of the top ten fastest growing states in the nation (US Census Bureau 2010) and contains eight of the top 21 most endangered ecosystems in the US (Noss and Peters 1995). Areas of the state that are highest in biodiversity, species rarity, and endemism rates are also experiencing extensive urban and rural sprawl. In addition, most priority wildlife habitats depend on the natural ecosystem process of fire, such as the longleaf pine ecosystem and many ephemeral wetland types. The ability to conduct prescribed burning is all but lost in exurban and urban areas. The Sandhills and the Southeast Coastal Plain are home to the longleaf pine ecosystem of which only five percent remains (Finch et al. 2012). The Wilmington metropolitan area grew by 40% from 2000 to 2010 (US Census Bureau 2011) and some nearby coastal towns grew at a rate of over 100%. This region ranks among the top 10 most diverse areas in reptiles and birds on the continent (Ricketts et al. 1999). Fayetteville sits at the heart of the Sandhills ecosystem, the third most endangered ecosystems in the US (Noss and Peters 1995), and continues to go through extensive growth with fluctuation in population based on the needs of the U.S. Military. The Southern Appalachians of NC will continue to grow at rates of 12 – 25% to 2030 (North Carolina Office of State Budget and Management 2010). Land development in the Southern Appalachians has outpaced population growth by a factor of ten to one since the 1970s (RENCI 2010). Southwest NC is among the most biologically diverse regions of North America, with over 400 endemic species found nowhere else in the world (Ricketts et al. 1999).

This rapid population growth is fueling patterns of land development that are placing tremendous pressure on the state's wildlife resources. Instead of centralized development in and around city and town centers, many of North Carolina's communities are approving a high density of housing in rural areas and large developments far from towns and cities, which also is more expensive for tax-payers. According to the Environment North Carolina Research and Policy Center for NC, over 100,000 acres of forests and fields were developed each year from 1987 to 2007. Moreover, over 1 acre of land is developed for every one new resident in North Carolina—which means we are developing land much faster than our population is growing (ENCRPC 2007). In the Charlotte region, five times more land is developed and in Raleigh three times more land is developed per person now than in the 1970s (RENCI 2009, RENCi 2012).

Compounding this problem is the “land use planning gap”—or the lack of effective habitat conservation planning information, recommendations, maps, model ordinance language and strategies in land use planning efforts (NCWRC 2015). Numerous reports have called for increased coordination between wildlife agencies and land use planners (Azerrad & Nilon 2006, Defenders of Wildlife 2007, ELI 2007, Miller et al. 2009). However, planners have also indicated that one of the primary challenges they face is

a “lack of conservation experts willing to participate” in the planning process (ELI 2009, Miller et al. 2009).

### **Potential Effectiveness of Tools and Technical Assistance to Address Conservation in Local Planning, Incentives and Ordinances**

To address challenges to ecosystem health posed by development patterns the N.C. Wildlife Resources Commission (NCWRC) and the N.C. Natural Heritage Program (NCNHP) collaborate to provide local governments with the Green Growth Toolbox, the NC Conservation Planning Tool, and the NCNHP Natural Heritage Data Explorer. Together, these tools make biodiversity conservation data, information, recommendations, model language and maps accessible to planners and communities through manuals, training workshops, online resources, and technical assistance.

A long-term measure of effectiveness for biodiversity conservation programs is generally the maintenance and management of relatively unfragmented priority wildlife habitats across landscapes. At the site level, natural areas will be set-aside along streams and wetlands. Natural areas will be large in size and relatively unfragmented on rural development sites and connected to adjacent natural areas. In urbanized areas, riparian forest, floodplains, and wetlands will be conserved and most upland habitat will be developed to promote infill development to discourage sprawl. This will be accomplished only if transportation planning is done in coordination with conservation-based land use planning. Purchase of development rights is suggested to be more effective than land use policy change for biodiversity conservation (Langpap and Wu 2008). However, this conservation tool has yet to be approved by the NC legislature despite being requested by a number of local governments.

Interest in conservation-based planning methods appears to be high among land use and transportation planners and may be relatively high among NC residents. A recent nationwide survey by the Environmental Law Institute revealed that there is currently “high interest in habitat conservation” among land use planners. Moreover, the survey suggested interest is likely to increase (ELI 2009). A statewide survey with responses from 407 North Carolina residents in 2005 revealed that 89% of respondents believed it was important that natural areas and wildlife persist in our state (Responsive Management 2005). Fifty-one counties in NC have conservation or cluster subdivision ordinances. Most conservation subdivision alternative development ordinances require at least 40% open space (NCFS et al. 2011). Through our work with local governments we have seen a high level of interest and a positive regard for wildlife conservation from local planning departments and communities. Programs that aim to inform and assist communities on how to conserve biodiversity through land use and development planning are beginning to be relatively common and show promise. These types of programs exist in at least ten states in the US and are managed by state wildlife agencies, non-government organizations (NGOs), and university extension programs. In addition there is a growing body of literature that shows conservation development is economically beneficial for developers and communities (NCWRC 2013).

One of the most comprehensive studies of outcomes from a conservation planning program, the Hudson River Estuary Program in New York, has documented comprehensive results. An eleven year review suggested that local land use planning-related board members and elected officials that participated in the program were more likely to improve land use plans and policies when they were provided with technical assistance and a habitat summary report followed by receiving GIS data or assistance and attending a presentation. Barriers identified by local board and committee members that participated in the program were lack of funding, local politics, and lack of resources for implementation. The number of conservation-based methods that were adopted (n = 228) were 39 ordinances, 43 zoning updates, and 31 purchase of development rights parcels (Allred et al. 2015).

## **GOALS & APPROACH**

### **The Green Growth Toolbox, the NC Conservation Planning Tool, and the Natural Heritage Data Explorer**

The NC Natural Heritage GIS Data, the North Carolina Conservation Planning Tool (CPT) and the Natural Heritage Data Explorer (NHDE), all compiled and coordinated by the NCNHP, are integrated into the NCWRC Green Growth Toolbox (GGT) as a major component of the ‘Conservation Data for Green Growth’, which is comprised of map layers most relevant for use by local governments.

The NC Conservation Planning Tool ([www.conservationtool.nc.gov](http://www.conservationtool.nc.gov)) supports conservation of land and water throughout North Carolina by providing a comprehensive means for sharing the state’s conservation priorities with government and private sector planners to inform decisions and guide conservation efforts statewide. The N.C. Department of Environment and Natural Resources developed the CPT in 2007 with several state natural resource agencies and organizations. The goal of the CPT is to identify, evaluate, and prioritize an interconnected network of the state’s conservation priorities, and to provide information for decisions that consider important natural resources. The CPT consists of a series of assessments that use the best available data and information to show state-level conservation priorities for biodiversity and wildlife habitat, forestry lands, farmland, and open space and conservation lands in the state. Each assessment includes a detailed report, maps and GIS data. The CPT assessments can support development planning that meets the needs of both people and the natural world upon which we depend. Strategic conservation planning enables communities to visualize how natural resources add value, and focus their efforts toward lands with multiple benefits while preserving an interconnected network of healthy ecosystems.

The CPT Biodiversity/Wildlife Habitat Assessment (BWHA), in particular, is an integral component of the GGT. The BWHA shows the state’s conservation priorities for aquatic and terrestrial species and habitats, as well as landscape functions and connectivity. Data inputs include natural heritage natural areas, rare species occurrences, core wildlife habitats and habitat corridors, important aquatic resources (e.g., trout streams, fish habitat, fish nursery areas, high quality and outstanding resources waters), wetlands, and watershed priorities.

The Natural Heritage Data Explorer (<https://ncnhde.natureserve.org>), made publically available in early 2015, is an online map viewer for any internet user, developed by the NCNHP and NatureServe to offer interactive access to the CPT, NCNHP and other conservation data. The NHDE allows users to view, query, and download data. Subscribers can download additional GIS data for rare species occurrences and submit project boundaries to generate reports that summarize natural heritage resources in and near project areas. NCNHP provides two-hour training courses on the NCNHP data and NHDE. The NHDE training can also be provided in GGT workshops for local communities.

Since 2011, the NCNHP has provided one Conservation Planner staff position to support the CPT, NHDE, and NCNHP outreach; this position is also the primary staff who responds to site-specific information requests submitted to the NCNHP statewide.

The Green Growth Toolbox ([www.ncwildlife.org/greengrowth](http://www.ncwildlife.org/greengrowth)) applies the NC Natural Heritage Program’s data, NC Conservation Planning Tool, and NHDE for use in local land use planning. The GGT was developed by the N.C. Wildlife Resources Commission and is a non-regulatory technical assistance tool for enhancing wildlife and habitat conservation in local land use and transportation planning. The GGT is intended to be used by planners, local government boards, communities and developers. It focuses on conservation development incentives and how to remove regulatory barriers to better habitat and resource conservation. All GGT materials and GIS data can be accessed via our website. The Toolbox provides: conservation GIS mapping data from a variety of agencies that can be viewed via the NHDE or

downloaded, a handbook, GGT training workshops, and technical assistance. Technical assistance consists of presentations on the benefits of green growth to land use-decision makers, habitat mapping, recommendations for conservation planning and for enhancing wildlife and resource conservation in plans, ordinances and major developments. The handbook and workshops deliver the following information: 1) the need for wildlife conservation and the economic and societal benefits, 2) how to interpret and use the conservation data in local planning, development design, review processes, 3) Official NCWRC habitat conservation recommendations and 4) methods, model language and case studies from other local government plans, incentives and ordinances for improving biodiversity conservation. NCWRC and the Duke University Nicholas Institute for Environmental Policy Solutions have also created a model conservation overlay district ordinance intended for conservation of the most environmentally sensitive areas (see case study below). The GGT is intended to provide communities with a menu of options to choose from to suit their needs. The GGT can also be used by any biologist or conservation organization in their work to address development impacts. The Toolbox became available to local governments in late 2009 and has had 2 biologists from NCWRC working with and training planners and local governments for 30% to 50% of their time in any one year. One of these biologists also coordinates the program and compiles results. We work regularly with the NCNHP Conservation Planner. The GGT has been promoted by many NCWRC biologists, as well as by a number of conservation organizations, state agencies, and planners. The Toolbox won an Excellence in Wildlife Management Award from the Southeast Section of the Wildlife Society in 2010.

The broad goal of the Green Growth Toolbox is to proactively conserve declining wildlife species and habitats to help prevent federal listing. The more specific goals are to help reduce development encroachment on existing protected natural areas, to help to maintain habitat connectivity across the landscape and to minimize negative development impacts on priority wildlife habitats. It is optimal to permanently conserve viable rare habitats and species via acquisition and not through conservation development methods. However, we will likely not have enough funding to maintain habitat connectivity in priority landscapes or purchase enough priority lands where development pressure is relatively high, without addressing local development planning. Additionally the impetus for the GGT was the realization that it is not possible to conserve terrestrial habitat or wide riparian areas when information is provided at the preliminary development plat review phase; we needed to provide information earlier in the planning process and especially for incentives and ordinances. Thus our approach is generally to work with local governments on conservation planning for their jurisdiction and to inform local land use planning, incentives and ordinances such that ecosystems may be maintained while growth occurs. The primary approach of the GGT is to work with interested communities, planning departments and consultants to achieve meaningful habitat conservation on the ground, especially in high biodiversity areas with moderate to high growth rates ('no regret areas'). The program aims to minimize development 'sprawl' by promoting upland and aquatic habitat conservation and connectivity in rural areas, and by promoting infill in urban and suburban areas. We generally do not focus our time in heavily urban areas, except to promote infill development and the conservation of aquatic and riparian habitats. A secondary focus of the program is to inform the design of large-scale developments where there is a possibility of minimizing significant habitat impacts. We work hand in hand with NCNHP and other partners and due to limited staff capacity. We are embarking on a new approach to increase the number of biologists that communicate with and provide conservation planning recommendations for local governments. We will train more biologists and partners to understand the local land use planning process and to provide technical assistance using the GGT. Biologists could form teams to work with local governments in their regions. GGT workshops can be given by other biologists familiar with the workshop.

Conservation partnerships are essential to building relationships with local governments, remaining aware of local development planning projects and for providing regional GGT conservation data. The partnerships are made up of natural resources agencies and conservation organizations that share information to increase collaboration and reduce duplication of efforts. The Chatham Conservation

Partnership is featured in case studies below. The Sandhills Conservation Partnership has a working relationship with many planning departments and provides regional GGT GIS data. The Cape Fear Arch Conservation Forum meetings are regularly attended by local planners.

In order to connect with local governments, we focus on promoting the economic and societal benefits of green growth, which are significant (NCWRC 2013). The economic implications of conservation-based land use decision making are very important to address because they are of primary interest to developers and decision makers. Our connections with interested planners and local governments happen organically through networking at conferences, meetings and at GGT workshops and even just by email. We do reach out to planners and decision makers in priority regions if needed. We reach out by arranging in-person meetings, which are more effective, and we now focus on providing GGT workshops in counties that wish to partner to host a workshop. This aids in relationship building and helps to share logistics responsibilities.

The GGT resource has begun to address the lack of funding for conservation-based planning by creating a pilot cost-share program called Partners for Green Growth (PGG). This program provides a modest amount of funding, usually \$10,000 for each qualifying local government or Council of Government applicant to assist them to evaluate conservation-based planning, incentives and ordinances.

## **METHODS**

This paper combines outcomes during the time of GGT development from 2007 to October 2009, and outcomes after the GGT became available in late 2009 to the present. We have not yet been able to assess the quality of all plans, ordinances, or developments. Also due to the slowdown in development during the recession, we can assess only short-term success. In order to measure true effectiveness we would need to assess species occupancy in habitat conservation areas and measure habitat fragmentation.

To date, we have tracked the number of GGT and NHDE workshop participants and their role in planning, as well as the number and nature of requests for technical assistance. Working with a NCWRC Human Dimensions Biologist, we developed a pre- and post- GGT workshop evaluation (see Appendix A) based on the Likert Scale. For five out of twenty local governments or Councils of Government (CoGs) that we have worked with relatively frequently, we conducted an in person or phone interview (see Appendix B) to assess effectiveness. For the remaining, anecdotal observations are reported. We sent an informal online survey through Survey Monkey™ (Survey Monkey Inc., Palo Alto CA, [surveymonkey.com](http://surveymonkey.com)) in August of 2015 to the NC Planning Listserv, moderated by the UNC School of Government and to participants of GGT workshops (Appendix C) also to assess the use of the GGT.

In order to evaluate the level of effort involved in project outcomes, we rated the level of technical assistance as high, moderate and low. Definitions of these can be found in Appendix D.

## **RESULTS AND DISCUSSION**

To our knowledge to date, the GGT (including the CPT) has resulted in enhanced local government conservation planning and methods, as summarized in Table 1.

Twenty-seven communities have received in-depth GGT technical assistance. Seventy-five communities and councils of government in priority conservation areas have expressed significant interest (but a lack of time) in using the GGT or have requested GGT technical assistance.

**TABLE 1. The GGT has contributed to enhanced conservation measures in plans and ordinances.**

	Adopted (CoG or RC)*	Draft	Level of Technical Assistance**		
			High	Moderate	Low
<b>Green Infrastructure Plan</b>	(2)	0	(2)		
<b>Regional Growth Plan</b>	(3)	1	(1)	(1)	(1)
<b>Land Use or Comprehensive Plans</b>	14	2	9	1	3
<b>Transportation Plans</b>	4	1	3		
<b>Watershed Plans</b>	2 (8)	1	1 (8)		1
<b>Online GIS Mapper</b>	2	0	2		
<b>Rezoning</b>	2	0	1		1
<b>Ordinances (including incentive- based ordinances)</b>	6	7	9	1	1
<b>Highway Bypass</b>	2		unknown		

\* CoG (Council of Government) or regional committee (RC) plans that not yet to our knowledge adopted by a local government are in parentheses.

\*\* Level of technical assistance that was provided by mostly by one biologist or conservation specialist for adopted documents and drafts combined. Numbers in parentheses signify a CoG or regional committee plan.

The GGT has also been used and promoted by the N.C. Department of Transportation (NCDOT), in NC US Military Base Joint Land Use Planning and by the Federal Highway Administration (FHWA).

In addition to the table above the GGT is related to improved local plans and ordinances in other ways. A high level of technical assistance by two NCWRC permit coordinators and two NCNHP biologists, some support from the GGT and funding from the FHWA Eco-Logical grant resulted in changes to the NCDOT Comprehensive Transportation Planning process that could greatly improve conservation outcomes (see case study below). The GGT is also used by two counties and four towns in development and rezoning procedures. The GGT is used by four consulting planners, a number of Councils of Government and previously was used by state government community planners, which significantly reduced the amount of NCWRC staff time needed on projects. Audubon NC Bird Friendly Communities members have worked with two cities on landscaping ordinances that encourage native plants and remove invasive exotic plants from their guidance or requirements. Raleigh Parks and Recreation Department uses the GGT and NCWRC habitat conservation recommendations (NCWRC 2012) for park planning and management.

The main GGT practitioners (two NCWRC and one NCNHP biologist) spent 30% – 50% of their time on the GGT project. From 2010 to 2012 funding from the Wildlife Conservation Society funded three other conservation professionals to spend 40% of their time working with local governments using the GGT. Besides the main GGT practitioners, to our knowledge GGT technical assistance was provided by four biologists in NCWRC and the USFWS for transportation and watershed plans and local stream protection.

### **Green Growth Toolbox Workshops**

NCWRC provided 12 GGT workshops from October 2009 to present. With funding from the Wildlife Conservation Society the NC Coastal Land Trust, Sustainable Sandhills and the Land of Sky Regional Council provided three GGT workshops each from 2010 to 2012. We have recorded 411 first time workshop participants and 45 returning workshop participants. Green Growth Toolbox workshop evaluations were provided to 320 workshop participants and returned by 253 workshop participants (80% response rate), of which 44% had no previous training in natural resources or biology. Further results are described below.

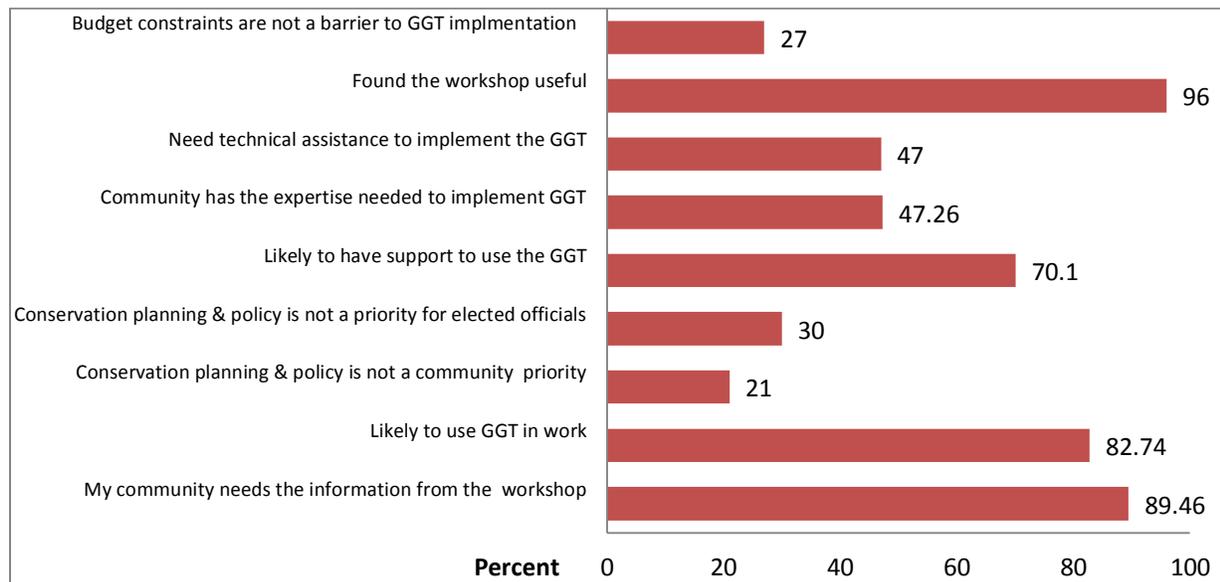
**TABLE 2. Participants in GGT workshops are comprised of most of our target audience. Most 'Others' work in natural resource management and conservation.**

Job	Percent
Elected Officials	3
GIS Specialists	7
Planners	46
Local Government Staff	10
Other	24
Parks and Recreation Staff	3
Planning Board Members	7

Approximately 20% of participants stated that their community’s existing plans, ordinances and development review included measures to conserve fish and wildlife. Motivations for attending the GGT workshop were to learn about the benefits of green growth for people (81%), water quality (75%) and fish and wildlife (74%).

After the workshop, 92% of respondents understood how green growth benefits people and fish and wildlife. Eighty-eight percent understood how to use the conservation data. Regarding the three levels of land use planning the following proportions of participants understood how wildlife habitat can be incorporated into: planning (80.4%), ordinances (72.3%) and development design (83.1%).

A frequent response about what more was needed to implement the GGT was to present to and educate local planning and governing boards and developers. GGT practitioners have only given twelve GGT presentations to seven local government boards and committees. We may need to focus on working more in-depth with fewer communities in order to adequately inform local boards and developers.



**FIGURE 1. GGT workshop evaluations from participants demonstrate a need for the GGT, workshops, technical assistance and funding for local governments.**

### Utility of the Green Growth Toolbox for Local Governments

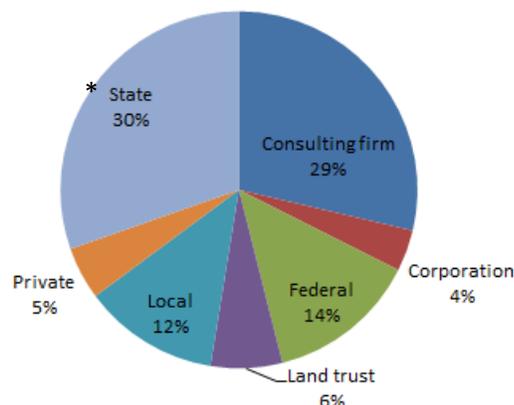
The informal online GGT survey revealed that all aspects of the GGT were useful and that it is likely most important to provide economic benefits information, high quality, accessible conservation GIS data (largely from the NCNHP, CPT and NHDE), the GGT workshop and the GGT handbook and website. Of 82 respondents, 81% were planners, 38.3% of respondents had used the GGT, and 73% had used other conservation planning tools and GIS data. Respondents rated that the following GGT information and resources were the most useful: all topics (36%), economic benefits (46.25%), and links to download or view the conservation data (41.25%), information on how to use the conservation data in development planning (38.75%), wildlife habitat conservation recommendations (33.75%) and conservation based incentives and ordinance methods and case studies (33.75%). From the GGT respondents 75% used the GGT workshop for information, 56.82% used the conservation data, 30% used the wildlife habitat conservation recommendations, and 18% used the benefits information and used the GGT for the purposes of development design and review.

The GGT workshop is one of the most useful aspects of the GGT resource; for promoting the GGT and so that communities can implement green growth practices. In addition to the results above, a recent master’s thesis evaluated implementation of the NC Wildlife Action Plan and GGT by Beaufort, Craven and Carteret Counties and their municipalities. One GGT workshop was held in New Bern in 2011 but no targeted GGT promotion in these counties to date. Heath (2015) found that 11 of 17 local governments interviewed knew of the GGT and that the Town of Beaufort uses it in development planning, Morehead City uses it in their ordinances and the Eastern Carolina CoG uses it in transportation planning.

### Outcomes from the Conservation Planning Tool and Natural Heritage Data Explorer

The CPT has been used in a variety of projects that are documented at [www.conservatool.nc.gov/web/cpt/cpt-usage](http://www.conservatool.nc.gov/web/cpt/cpt-usage).

The level of outreach offered by NHDE trainings is unprecedented for the NCNHP, and training sessions appear to improve understanding of the NCNHP data and how it can be applied. The NHDE report generation feature will benefit users and reduce NCNHP staff time spent on information requests for rare species and habitats in and near development sites. Hundreds of development related projects have already been submitted through the NHDE, reducing NCNHP staff time spent on development review.



\* 11% are NCDOT staff and 8% are NCWRC staff.

**FIGURE 2. From December 2014 and August 2015, the NCNHP trained 293 participants on use of the NHDE and NCNHP data during 25 two-hour in-person training sessions.**

These NHDE results demonstrate the vital importance of collaboration among partner organizations. The NHDE trainings are reaching more private planning firms than the day-long GGT workshops and are promoting the GGT. It is also probably a vital tool to increase the use and understanding of the conservation data by local governments. To offset the costs of providing services the NCNHP may charge fees to nongovernment entities for NCNHP data. Consulting planners do a lot of planning for NC communities. Fees may deter consultants use of the GGT, requiring more NCWRC staff time to be spent working on planning projects.

### **Case Studies of GGT (and CPT) Results**

#### *Interagency Transportation Planning Protocol*

The NCDOT Transportation Planning Branch sought to reduce the length of the transportation planning process, and impacts to natural and cultural resources by improving coordination between natural and cultural resource agencies and planners in advance of project planning and development. In 2012 NCDOT, contracted with the Institute for Transportation Research and Education ITRE to provide assistance in the development of an Interagency Coordination Protocol (ICP) that could be used to support a variety of long range transportation planning processes. This new ICP process provides step by step instructions for a Project Engineer (or Planner) to engage resource agencies and utilize conservation GIS data as a first step during the long range transportation process. The ICP guidance supplements other NCDOT guidance on developing transportation plans and is intended for use all entities participating in the development of a long range transportation plan. The new long range planning process is expected to increase effectiveness significantly because fewer inappropriate alternative routes or widenings will be proposed or evaluated, saving time and resources.

NCWRC Habitat Conservation Program staff and DOT Coordinators and NCNHP participated in many meetings toward the development of the ICP and are committed to assisting in the long range transportation process. FWHA Eco-Logical funding was integral to the ICP outcome. Use of the GGT and CPT data are also recommended in NCDOT's 2014 Bike and Pedestrian Plan.

#### *Durham-Chapel Hill-Carrboro Long Range Transportation Plan*

Two 2-hour conservation data trainings were provided for long-range transportation and land use planners, followed by a moderate level of technical assistance from one NCNHP and one NCWRC biologist. NCWRC provided a GIS analysis of road projects that were within 400 feet of rare species and habitats, and provided a map of the CPT Biodiversity and Wildlife Habitat Assessment that was incorporated into the long range plan. NCWRC and NCNHP submitted joint comments. As a result one major road widening was taken off of the project list due to the presence of rare species and habitats, which clearly demonstrates a direct benefit of using environmental data at the beginning of the planning process.

#### *Model Natural Resources Conservation Ordinance*

The N.C. Wildlife Resources Commission and the Duke University Nicholas Institute for Environmental Policy Solutions authored 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 rarest types of upland wildlife habitats. As such it is written to be applied to major development (not minor subdivisions or single family homes) and requires a site survey. If significant natural resources are found on site only those areas must be set-aside from development. The set-aside area cannot comprise more than 50% of the tract (unless a density bonus is given). Impervious surfaces are also addressed. We worked regularly with the Town of Navassa Planning Board and Planner to develop this statewide model ordinance. It is currently being tailored and evaluated

by the Town of Pittsboro. This model ordinance can be applied as a voluntary option in exchange for a density bonus or other incentive and we are creating another version of the model ordinance with this type of language because mandatory conservation ordinances are usually not practical for communities due to resistance by developers, which we learned by working with Navassa.

### *Chatham County*

We interviewed two county planners as part of this case study. Chatham County helped to develop the GGT, by providing feedback and piloting the GGT workshop. The county is our longest running GGT project beginning in late 2007, before the GGT and workshops were available. As such, this project has had time to demonstrate results and we use this case study as a primary example for model language and processes. Chatham County's plans supported habitat conservation. To update their ordinances to strengthen environmental and ecosystem protections, Chatham County worked closely with biologists from the Chatham Conservation Partnership who provided technical guidance including biologists with NCWRC, Biocenosis, Inc., NCNHP, and USFWS. The conservation GIS data, among other natural were also employed and posted on the Chatham County online GIS map viewer. Technical assistance was provided from January of 2006 through early 2010. The technical assistance and use of the GGT and NCNHP GIS data resulted in science-based incentives and ordinances that were approved in late 2008 and remain in place today despite political changes. The motivation for these ordinance updates was due to the concern of County Commissioners and residents about the rapid pace of development. The following ordinance updates were made:

- Environmental Review - Conservation data from NCNHP and the GGT must be used to identify potential environmental impacts for developments with over 50 lots. Environmental review occurs during the required sketch plan review (before expensive development design).
- For any development, the watershed protection ordinance (Section 304) now requires protection (no development lots or clearing of native vegetation) within the 100 year floodplains, 100 feet on each side of perennial streams, 50 feet adjacent to intermittent streams and around wetlands, and 30 feet on each side of ephemeral streams and around seeps and springs. Streams and wetlands must be field-identified and delineation must follow professional standard best management practices.
- The subdivision ordinance contains an incentive option for conservation subdivisions and guidance from the NCWRC on the design criteria. In exchange for a 10% density bonus the developer must set-aside 40% open space, 80% of which must be natural open space and 38% of which must be in priority wildlife habitats identified in the NC Wildlife Action Plan. Habitat cannot be fragmented on-site and must connect to adjacent natural open space.

Two out of nine developments have chosen the conservation subdivision option thus far. Planners report that as more developers understand the design and economic benefits more will choose this option more. One site that is over 500 acres set aside over 250 acres in an unfragmented, undeveloped area. The site also protects forested floodplains, and stream and wetland buffers required under their watershed ordinance, as does any development subject to the 2008 watershed protection ordinance. The Planning Department reports that by requiring a sketch plan and the use of standard conservation GIS data and information at the beginning of the site planning process in addition to a community meeting (standard GGT recommendations), this has reduced project approval from a two months to 21 days. Planning staff also report that these procedures have saved a 'tremendous' amount of staff time and that the county and developers are happy with the new ordinance updates. Planning staff have also observed a minimization of costs for development and believe that most houses will likely sell for more money in conservation subdivisions. Research on this would be valuable.

The Chatham Conservation Partnership was formed in 2007, and developed the first comprehensive countywide conservation plan in 2011 to help inform land protection and development decisions in the

county, and to educate citizens (<http://chathamconservation.wikispaces.com/>). The Comprehensive Conservation Plan for Chatham County, NC and the Partnership played a vital role in providing technical assistance. NCWRC and other biologists will need to review significantly fewer development permits.

### *Pittsboro*

Eastern Chatham County, along the Haw River was zoned for rural agricultural use and approximately 7,500 acres of this area was purchased by a major development company. Conservation partners provided developers and the town with the Southwest Shore Conservation Assessment for this area. The town of Pittsboro then updated their land use plan identifying this area for future mixed-use and residential districts with new road projects in October of 2012. The town approved a rezoning of the 7,500 acre area to become a Planned Development District (PDD) to become part of their extra-territorial jurisdiction in May of 2014. The PDD is proposed to house and employ 50,000 additional people or more and will increase the rate of major development in other area of Pittsboro. Pittsboro's land use plan, ordinances and PDD ordinance did not provide strong support for conservation of natural resources or priority habitats within its jurisdiction. This development pressure and the predicted environmental impacts provided an impetus to tailor the NC Natural Resources Conservation Ordinance for the Town of Pittsboro's needs and to provide the town with other natural resource and economic analyses to inform their land use decision making. The project was supported by a USFS Redesign Grant. The grant money was instrumental in getting the Town Commissioners to place priority on conservation planning and policy work. The planning board requested that a stakeholder committee be formed to review and draft natural resource conservation ordinances. A local environmental consultant and NCWRC organized the ordinance review committee, which included the Town of Pittsboro and provided information at their meetings about the NC Model Natural Resources Conservation Ordinance so that the committee could tailor it for Pittsboro. The consultant and NCWRC also provided GIS mapping analyses. The conservation GIS mapping and information relied heavily on the Chatham County Comprehensive Land Use Plan. Presentations on the project were made to various groups and to the town commissioners. The main outcomes of the project were a diverse stakeholder-driven process to develop conservation ordinances for natural resources and tree protection. The draft natural resources conservation ordinance recommended by the stakeholder committee would encourage major developments within a conservation district (also determined by the stakeholder committee, based on all available conservation data) to set-aside 50% of significant natural resources for protection and require natural areas to be unfragmented and contiguous on adjacent tracts. A model tree protection ordinance was developed by the NC Forest Service and Duke University Nicholas Institute for Environmental Policy Solutions and would apply across the entire jurisdiction of Pittsboro. The ordinances are currently being integrated into the Unified Development Ordinance (UDO) update and will then be considered for adoption by the Town Board of Commissioners. Any conservation-based ordinances may be considered for the small area planning required ahead of development approval within the previously approved PDD. The town may also choose to discourage highly impactful land uses within the conservation district. Because these areas are farther from public services this could also save tax payers money.

In areas that are under extreme development pressure, the pressure to rezone especially to a PDD district will probably usually be too high to maintain rural/agricultural districts in those uses. This is unless local governments proactively identify more centralized areas surrounding towns where major development is closer to public services. Some towns do not allow PDDs in their rural agricultural districts. Additionally, changes in agency staff and a lack of communication ahead of the updates to the town land use plan, PDD and other ordinances may have led to missed-opportunities to provide information.

### *Moore County*

The Sandhills Conservation Partnership and NCWRC have worked regularly with Moore County for the last three and a half years. The planning board appears to be continuously improving conservation

measures as opposed to making big changes at once. They report that messaging is very important and recommendations should build upon existing efforts to enhance resource conservation as opposed to focusing solely on the need for additional conservation measures. Wildlife conservation information and the conservation data were featured significantly during their land use plan update committee meetings through presentations and through NCWRC participation in most meetings. The Land Use Plan now contains comprehensive wildlife and ecosystem information and maps. The Land Use Plan Committee created a 'green print' that was comprised of most areas mapped in the CPT Biodiversity and Wildlife Habitat Assessment. The green print was used to identify growth areas in the future land use map. NCWRC staff are currently providing recommendations for the UDO update at the request of the planning department. These recommendations have taken approximately three weeks of staff time for one biologist due to the need to tailor recommendations to function for the specific standards in the UDO, and to save Moore County staff time, as opposed to providing general recommendations. This case study demonstrates the potential need for more specific guidance documents, such as fact sheets for best management practices relating to specific types of land use districts and development standards.

### *Aberdeen*

We interviewed the Aberdeen Planning Director. The Town of Aberdeen provided initial support and input for the development of the GGT. In 2010, their board passed a Resolution of Support for the use of the GGT. The interest the town has in using the GGT came out of a development that built extensively into wetlands and floodplains, which became 'a nightmare' for homeowners. Thus, the planning department uses the GGT to review development plans and presents the conservation data to the board during development review. The planner finds the conservation GIS data very helpful and easy to use, and states that it is important to show the board where habitats exist. Concrete data adds to the legitimacy in decision making. Currently, the Town of Aberdeen requires 20% open space conservation for major development, and they are open to improving ordinances for conservation. The town planner commented that support for the GGT came from the message that conservation can be compatible with development. Without this message, the GGT would not be as accepted by the community (a view shared by most communities we work with). The town identified the need for a NCWRC biologist to attend development review meetings for developments in or near priority conservation areas to answer questions. The town planning director has sent most of their planning staff to GGT workshops. The GGT has been used among other information and policies, to prevent several highly inappropriate developments from being approved, and it has been used to change development designs to reduce impact on natural resources. There have been no challenges or complaints about the use of the GGT by elected officials, developers, or community members. Natural open space connectivity among developments is occurring and no developer has opted for payment –in-lieu of natural recreation space set-aside requirements.

The degree of habitat connectivity achieved through local policies and ordinances should be researched to ensure that a connectivity function is being retained for species that are not adapted to urban environments.

### *Brunswick County*

We have worked regularly with Brunswick County and a planning consulting firm for the last ten months and have not interviewed them. Brunswick County and Oak Island Planning Departments hosted a GGT workshop after attendance of a previous workshop by the Oak Island Planner. This is one function of the workshop; that the workshop can be tailored and provided by NCWRC to specific communities at their request. We believe this will lead to more tangible outcomes than offering workshops in which local planning departments are not involved. After the initial workshop, Oak Island officially requested NCWRC recommendations for its land use plan and ordinance update. Oak Island contains more than 3,000 acres of land rated as an exceptional Natural Heritage Natural Area that is contiguous with other natural areas of the highest quality and rarity rating. They are expecting a population increase of 7,700

people in the next 20 years. Brunswick County immediately started using the conservation data in development and rezoning reviews, and has created its own Conservation Data for Green Growth online GIS map on their GIS webpage. They integrated some support for conservation-based development in their UDO and are crafting a UDO appendix for Exceptional Development best management practices that will center on green growth principles. Through working with Brunswick County, NCWRC connected with a land trust that manages a large conservation easement on a major development where Bachman's sparrows were recently documented. We are now helping to craft a prescribed burning schedule to manage Bachman's sparrow habitat on the site. We have yet to see what the outcome will be from the voluntary and incentive-based ordinances that Brunswick County has developed and if the county would be interested in employing any additional strategies if needed to ensure that high priority areas are not fragmented.

### *Harnett County*

We regularly worked with Harnett County in 2011 and have again for the last year. They received Partners for Green Growth funding to incorporate wildlife conservation GIS data and information into their land use plan update. Their updated land use plan will also be the first to use the Fort Bragg Sustainable Growth strategy of which the GGT was a component ([www.landdesign.com/project/fort-bragg/](http://www.landdesign.com/project/fort-bragg/)). In an effort to maintain: water quality, a level of wildlife habitat connectivity, to buffer the base from major development encroachment and to protect prescribed burning on the base, their draft land use plan strongly encourages 'compatible development' that incentivizes conservation of priority wildlife habitats in high growth areas, in the northern part of the county and adjacent to Fort Bragg. The county also created an online natural resources map and education tool to educate residents and decision makers on the need and benefits of priority wildlife habitat conservation. We have been invited to provide recommendations for the planned update of their UDO in the coming year.

### **Additional Planner Interviews**

State government planner, NC Department of Commerce (NCDC no longer provides community planning) – This planner attended one two-hour mini GGT workshop and from that worked with two towns and one county and occasionally with the NC Coastal Land Trust to integrate priority wildlife conservation into two adopted land use plans and one zoning ordinance. Only a low level of technical assistance was required from one NCWRC biologist. A moderate amount of technical assistance was provided by the NC Coastal Land Trust to one town. This is an optimal outcome from our GGT workshop. In the interview, the planner stated that the GGT and conservation data were easy to use and so he did not need much assistance apart from answers to questions. He used the training workshop, the conservation data GIS layers and also found the handbook to be very useful. Once the planner explained to the local boards the importance of wildlife conservation and its benefits, communities were supportive. There were challenges faced to a zoning ordinance update due to push-back from developers. The zoning ordinance established a conservation recreation district that has limited land uses and does not allow major subdivisions. It has an extensive Rural District that also does not allow major subdivisions. These two districts cover most of the areas with the highest biodiversity and habitat quality. The Planned Unit Development (PUD) District can be applied in any district except for the Conservation Recreation District, and encourages conservation of natural areas in statements of intent and by requiring a map of all significant natural areas. Approval of the PUD is conditional and changes by the planning board or board of commissioners can be required for approval. The benefits he saw from the GGT included that it and biologists can be used to educate decision makers. The needs he saw were for more education of residents and developers that focused on the use of case studies. This case demonstrates that interested and creative planners can make a big difference and reduce the workload of GGT practitioners.

The Piedmont Triad Regional Council uses the GGT for local watershed and green infrastructure planning. To date, one watershed and green infrastructure plan has been adopted by a town. These

regional plans act as a guide to local conservation organizations for local water quality and habitat conservation projects. The local governments do not appear to be using plans they have not adopted. The CoG reports that they can implement the GGT without the need for much NCWRC involvement. They find the GGT easy to use and that it contains all the relevant information and resources in one place. They use the GGT handbook extensively for conveying information to local governments and in writing recommendations. They have also used the conservation data for trail planning projects and have used the NCWRC habitat conservation recommendations for growth modeling scenarios. Their interest in the GGT is due to the opinion that it makes sense as an approach to planning. The reason for the lack of local government implementation they believe stems from political opposition, which in turn leads to a lack of support for local planners to implement the GGT. In their opinion, political opposition exists because leaders do not have enough information about the economic benefits of green growth. The needs identified were for more interaction with local governments. Another benefit from the GGT for the CoG is the enhancement of their GIS analyses, which have resulted in awards for CoG staff.

Town near Raleigh – Currently there is a lack of political support for environmental planning and policy. This town received a high level of technical assistance from a federal agency. Green growth principles were supported in the recent update of the land use plan, but the town will probably roll back stream buffer requirements from 50 feet to less. There would be no support for more extensive stream buffers even for endangered aquatic species, unfortunately. Apart from aquatic species conservation there is little documented upland priority wildlife habitat in the town. The one area of town with habitat connectivity is slated for a highway by-pass and landowners would likely sell for development. This case study demonstrates the need for education of community leaders and decision-makers, the need for incentive-based stream protection ordinances and the need to build relationships to assess if communities are willing to conserve wildlife.

### **Motivators for Local Conservation-Based Land Use and Transportation Planning**

Similar to the findings of Brody (2003) a number of case studies above document major motivators for conservation-based planning and information are the pace of development, negative development aesthetics and the need for better development planning.

We have heard informally from other towns and counties that the use of the GGT that the following factors are motivators: aesthetic and economic benefits, protection of farms and forestry and:

- Information for wetland and floodplain protection policies is beneficial due to violation of federal wetlands laws (local governments can require a federal permit for project approval).
- Conservation data helps to lend support to development approval decision making.
- Using the conservation data early in the planning process to prevent delays in development design and speeds up decision making, reducing staff time.

### **The Role of Partners for Green Growth and other Funding**

We received two times the applications for the Partners for Green Growth cost-share funding than we are able to fund for the two years that the program has been available. Applicants reported that crafting the application started a conversation between different branches of local government that drew people's attention to the need for and the benefits of incorporating wildlife conservation in planning. PGG has also led to greater awareness of the GGT, to the point that we may not be able to meet demand for assistance requests. NCWRC and other practitioners will make efforts to be available to provide technical assistance for projects that were not funded. Land use plan update projects are leading to NCWRC providing recommendations for ordinance updates. Three projects (two land use plans and one model ordinance) were funded for the 2014 – 15 cycle and 4 projects (an ordinance review for all municipalities and Cabarrus County, two land use plans with ordinance updates and a greenway blueway plan) were funded

for 2015-16. Partners for Green Growth 2014 applicants stated that this funding was necessary to lend legitimacy and to dedicate staff time for conservation-based planning projects that would involve significant changes. This is likely because making changes to plans and ordinances to enhance resources conservation is a relatively new approach and local governments need time to learn the methods and evaluate their effect for their residents and economy. External additional funding sources appear to be important in achieving outcomes, especially in the role of funding as a means to solidify working relationships with local governments. We found that temporary funding of organizations to provide GGT workshops and technical assistance did lead to results in as much as NCWRC biologists were able to continue working with some of the local governments that had been trained and assisted. However if too few staff remain to pick up projects after the funding cycle closes, then some opportunities go unrealized.

### **Effectiveness: Building Relationships that Lead from Conservation-Based Plans to Incentives and Ordinances**

There are a number of ways to build working relationships with local governments and planners. Providing information and recommendations for land use or comprehensive plan updates can build the relationships needed between biologists and planners and between stakeholders and planners that can then progress to implementing conservation-based ordinances (Bengston et al. 2004, Steelman and Hess 2009). We have also observed this in our projects. There is a need to work with additional communities in priority areas that do not yet support wildlife and biodiversity conservation in land use and transportation plans. However there are many communities in high priority areas that already have conservation-based plans and an interest in further green growth implementation. Due to the pace of development and given limited resources we should consider turning our attention to following through and providing recommendations for incentive and ordinance updates in priority areas. The case studies above demonstrate that there are other ways to build relationships besides plan drafting, such as through networking at conferences and meetings attended by planners and following-up, through the GGT workshops and having communities host a workshop or if there is a well-regarded local 'champion' of the green growth who is involved in planning. Often times the communities that are able to implement conservation planning will approach us, especially if we know planners through previous networking. Due to finite resources we need to carve out time to review plans and ordinances and build relationships in priority areas to be aware, equipped and available to focus on assisting with incentive and ordinance updates. The most concrete outcomes have resulted from being in regular contact with local planners that use the GGT. GGT practitioners need to stay in touch with these planners to provide additional needed recommendations and to measure results.

There are many opportunities to provide information and recommendations to local governments. We have provided technical assistance to 27 local governments. Most of these requested a high level of assistance. Seventy-five communities and councils of government in priority conservation areas have expressed significant interest (but a lack of time) in using the GGT or have requested GGT technical assistance. Fifty-one NC communities have conservation or cluster subdivision ordinances. We receive many assistance and some workshop requests with the visibility afforded by the Partners for Green Growth funding and each time the GGT program sends out email to planners. Usually planning departments want all the information they can have and it is likely that many of these communities would want to increase the effectiveness of incentives in their ordinances to conserve wildlife habitat. The key to being effective is to focus where priority conservation outcomes are most likely to occur. There is a definite demand for more biologists to provide information to local governments in priority areas, especially 'no regret' areas, under growth pressure.

A major challenge to managed growth and conservation in NC are counties that allow high density development in rural areas, either through a PDD overlay or 1 to 2 acre minimum lot sizes. True conservation of a full suite of priority wildlife species is likely best achieved through very low density in rural areas, such as 1 development unit per 30 acres or more (Hansen et al. 2005). We know of only one

municipality in NC that has policies similar to this in the Town of Davidson. These types of rural zoning densities are more common in the western U.S. and we assume are probably not acceptable to most NC landowners. There is a need to develop solutions to the challenge of high density development in rural areas that does not decrease property values. This has been done and is likely best achieved by partnering with real estate experts.

Incentive-based ordinances are more palatable in many cases. In NC, cluster development options coupled with a density bonus in exchange for setting aside large connected natural areas are fairly popular and employed successfully in rural areas (Randolph County) and suburban areas (NE Chatham County) (NCFS et al. 2011). Challenges to the success of conservation subdivision options stems from high densities being allowed in rural areas without sewer service as is the case with Chatham County. This creates an incentive for major development with package sewer plants to build conservation subdivisions which may contribute to urbanization in rural areas. Mandatory conservation subdivisions have been shown to be probably too controversial to recommend unless this is desired by the community.

One of our primary concerns is that implementation of green growth principles in urbanizing areas may actually lead to sprawl, especially when conservation is voluntary, in that incompatible development patterns may surround conservation developments. Incentives may have a variable effect on minimizing biodiversity loss, but if enough habitat conservation is required especially along streams or rivers, and planners monitor development patterns, incentive-based ordinances may be less likely to lead to sprawl. This highlights the need for technical assistance to remain available to communities to encourage a progression of land use policies that will maintain habitat connectivity. There is also a need to assist local governments that use the conservation data to develop stronger incentives or standards for on-site habitat conservation to reduce GGT practitioner staff time needed to provide information for individual development projects.

Common reasons given for not using the GGT are that development growth rates are too slow and that political support would be low due to low growth rates or economic concerns (Heath 2015). We have also observed this and should focus on educating local boards and decision makers in the highest priority, 'no regret' areas that are under growth pressure.

## **Results Tracking**

Local adoption of conservation-based plans and ordinances that result partially from the GGT, or regional and watershed plans that use the GGT, need to be tracked, especially in terms of what measures specifically encourage wildlife and resource conservation, in order to assess effectiveness. This can only be accomplished by communicating with the planners involved in the projects. Practitioners need to devise a simple method to involve local planners in tracking results and for reporting GGT related results. We also need to employ an academic partner to evaluate plan and ordinance quality.

## **CONCLUSION**

Given that many NC planners and planning departments have taken a significant interest in and concrete steps toward improving wildlife and biodiversity conservation through land use and transportation planning we can conclude that biologists play a very important role in improving wildlife habitat conservation by providing conservation planning assistance to local governments in our state. We also wish to convey the crucial role of easy access to up-to-date conservation data, especially through the Natural Heritage Program's data, Conservation Planning Tool and Data Explorer, in conservation planning by local governments.

The case studies presented here (and in the GGT Handbook) demonstrate that incentives and ordinances that have the intention of conserving upland and riparian habitat can be implemented by local

governments in NC and can be effective when properly designed to minimize habitat fragmentation. These habitat conservation incentives and ordinances reduce GGT practitioner staff time that would be needed to review the affected developments. Incentive-based conservation ordinances are particularly popular with local governments and developers in NC and the US. These incentive-based conservation ordinances can conserve more than 50% of natural areas on large tracts in exchange for a density bonus even in rural areas on septic if base density is at least a 3 acre minimum lot size. There are communities in NC that are or were under intense growth pressure that have implemented strong protection measures for streams and upland natural areas that have not caused problems for developers (eg. Chatham County, Town of Davidson and Randolph County). Considering habitat conservation GIS data and information at the beginning of the development process using a sketch plan and community meeting has reduced development approval time by 63% and saved a 'tremendous' amount of staff time, for Chatham County. This benefit was also reported by Oak Island, Brunswick County and Randolph County. Mandatory conservation subdivisions have been shown to most likely be too controversial to recommend unless this is desired by the community.

The Green Growth Toolbox, NC NHP data and CPT are reported by the majority of GGT workshop participants and online survey respondents, to be useful, easy to use and needed by their communities and elected officials. It is effective to provide GGT workshops, especially in developing areas that have a high number of threatened species and habitats. The GGT workshop is the most frequently used GGT resource by local governments in conservation planning and workshops have led directly to plan and ordinance updates that improved support for habitat conservation. However plan and ordinance effectiveness needs to be measured over time. Other components of the GGT are reported as useful by most planners, particularly science-based economic benefits information, access to the conservation data and the GGT handbook. Preliminary evaluation of the NHDE shows that it is likely to greatly increase appropriate use of conservation data in planning and development. The NHDE fills an important gap in the GGT audience in that the brief NHDE training is heavily attended by consultants, who likely cannot attend a full day GGT workshop. Consulting planners, state planners and councils of government trained on the GGT greatly reduced the workload on NCWRC biologists, especially for providing wildlife and habitat conservation information and maps in land use, transportation and watershed plans.

We have an opportunity to work directly with approximately 75 local government entities (planning departments and councils of government) in priority conservation areas with growth pressure, that have expressed significant interest in using the GGT (but a lack of time) or that have requested assistance. We have been able to provide significant GGT technical assistance to only 27 communities. We know of communities that use the GGT without any interaction with NCWRC or NCNHP, such as Morehead City which state they use it in their ordinances. There is a need to find the local governments we are not aware of that use the GGT and to understand what green growth practices they are implementing. Given that a high level of technical assistance is often needed, and that it is necessary to stay in touch with planners over years in order to progress to incentive and ordinance updates, there is a definite demand for more biologists to work with local governments in priority areas, especially 'no regret' areas, under growth pressure. We may also need to provide a brief guide with more specific best management practices for preferred development design to local governments for adoption as an option for developers. This will reduce GGT practitioner work load and encourage conservation practices in planning and development.

Partnerships among state and federal agencies and conservation organizations provide a vital source of support and collaboration to achieve more effective conservation outcomes in land use and transportation planning. The new Interagency Transportation Planning Protocol will greatly reduce the amount of road projects that fragment ecosystems and impact critical habitats by considering conservation data as a first step in transportation planning. Conservation partnerships build relationships with local governments and provide regional habitat maps for the GGT. It is important for biologists and conservation professionals to communicate about local land use and transportation planning projects within their regions and that they

let local planning departments know about the GGT and of any conservation planning resources that they can provide.

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**APPENDIX A: RESEARCH QUESTIONS - GREEN GROWTH TOOLBOX WORKSHOP EVALUATION**

1.) Please indicate how important or unimportant each of the following were in your decision to participate in this workshop. **(Circle one for each item.)**

<b>I am participating in this workshop...</b>	<b>Very Unimportant</b>			<b>Very Important</b>		<b>Unsure</b>
	1	2	3	4	5	
to learn how “Green Growth” practices could benefit people in my community.	1	2	3	4	5	6
to learn how “Green Growth” practices could benefit water quality in my community.	1	2	3	4	5	6
to learn how “Green Growth” practices could benefit fish and wildlife habitat in my community.	1	2	3	4	5	6

2.) Please indicate whether or not the following have occurred in the community in which you work during the past year **(Circle one for each item.)**

<b>During the past year, in your community...</b>	<b>Yes</b>	<b>No</b>	<b>Unsure</b>
has the creation or revision of a land use plan outlined strategies for conserving fish and wildlife habitat?	1	2	6
has the creation or revision of a local ordinance included measures that will conserve fish and wildlife habitat?	1	2	6
have impacts on fish and wildlife habitat been described by staff during the review of one or more development applications?	1	2	6

3.) Which of the following best describes your position? **(Circle one.)**

1. Planner
2. GIS Staff
3. Parks & Recreation Staff
4. Other Local Government Staff
5. Planning Board Member
6. Other Advisory Board Member
7. Elected Official
8. Other (please describe) \_\_\_\_\_

4.) Have you had any formal training or coursework in biology or natural resources management (wildlife or fisheries management, forestry, ecology, environmental planning, etc.)?

1. Yes
2. No

**The rest of the evaluation should be completed at end of the workshop. We will set aside time for you to finish. If you leave early, please fill out the remaining pages and return to the presenter.**

Please indicate the extent to which you agree or disagree with the following. **(Circle one for each item.)**

<b>After participating in the workshop...</b>	<b>Strongly Disagree</b>		<b>Strongly Agree</b>			<b>Unsure</b>
I know how “Green Growth” practices could benefit people in my community.	1	2	3	4	5	6
I know how “Green Growth” practices could benefit fish and wildlife habitat in my community.	1	2	3	4	5	6
I know about conservation data that can be used in my community’s planning efforts.	1	2	3	4	5	6
I know how fish and wildlife habitat can be incorporated into land use planning in my community.	1	2	3	4	5	6
I know how ordinances in my community could be improved to better protect fish and wildlife habitat.	1	2	3	4	5	6
I know how development projects in my community could be designed to better protect fish and wildlife habitat.	1	2	3	4	5	6
The information presented at the workshop is needed in my community.	1	2	3	4	5	6
I am likely to use the information presented at the workshop in my community’s planning activities.	1	2	3	4	5	6

5.) Please indicate the extent to which you agree or disagree that the following will make it difficult to implement “Green Growth” practices in your community. **(Circle one for each item.)**

	<b>Strongly Disagree</b>		<b>Strongly Agree</b>			<b>Unsure</b>
“Green Growth” is not a priority for citizens in my community.	1	2	3	4	5	6
“Green Growth” is not a priority for elected officials in my community.	1	2	3	4	5	6
I do not have enough time to use “Green Growth” practices in my job.	1	2	3	4	5	6
I would not have support from my supervisor to use “Green Growth” practices in my job.	1	2	3	4	5	6
My community does not have the kind of expertise needed to implement “Green Growth” practices.	1	2	3	4	5	6
Legal barriers will make it difficult to use “Green Growth” practices in my community.	1	2	3	4	5	6
Budget constraints will make it difficult to use “Green Growth” practices in my community.	1	2	3	4	5	6
I do not understand how to implement “Green Growth” planning practices in my community.	1	2	3	4	5	6

6.) What resources or technical assistance do you need to implement the Green Growth Toolbox in your community?

7.) In your opinion, was the information in the workshop useful to you? (**Circle one.**)

<b>Not at All</b>				<b>Completely</b>
1	2	3	4	5

8.) In your opinion, was the workshop too short, about right, or too long? (Circle one.)

<b>Much Too Short</b>		<b>About Right</b>		<b>Much Too Long</b>
1	2	3	4	5

9.) In your opinion, was the amount of material covered in the workshop too little, about right, or too much? (Circle one.)

<b>Much Too Little</b>		<b>About Right</b>		<b>Much Too Much</b>
1	2	3	4	5

10.) What was most helpful about the workshop?

11.) What was least helpful about the workshop?

12.) What else can we do to improve this workshop?

13.) Do you have other comments or suggestions?

## **APPENDIX B: GREEN GROWTH TOOLBOX RESULTS INTERVIEW**

1. What plans, policies or developments have made use of Green Growth principles and information from the GGT?
  - a. Are they adopted or are they best management practices / drafts?
2. How did technical assistance play a role? Do you have recommendations for us to enhance technical assistance? Would it help if we could attend more meetings / interact with you or other departments more?
3. How have you used the tools in the GGT?
  - a. Have you used the:
    - i. The training workshop
    - ii. The handbook
    - iii. The Conservation Data
    - iv. The Habitat Conservation Recommendations
    - v. The info and case studies of plans, incentives, ordinances and development design
4. What spurred your / communities interest in using the GGT?
  - a. Development sprawl and impacts on natural areas?
  - b. Water quality?
  - c. Are there particular habitats or species of interest in your community?
5. What challenges have you had to overcome to pass/develop GGT – plan/ordinance/development review procedure?
6. What did you expect from the plan, ordinance or development review procedure?
7. Did the plan, ordinance or development review procedure function as expected? Why or why not?
8. In your conservation planning efforts what has worked and what hasn't?
9. Have you seen positive results for conservation from a conservation-based land use planning project?
10. How has conservation-based planning been received by your advisory and governing boards others? What kind of information is needed to better inform them or gain support?
11. Is there interest in your community in going further to protect natural resources? Would the planning department like more technical assistance and how should we provide this?

12. Have you had push back from stakeholders regarding conservation-based planning or development? If so, what were the issues and how has it affected plans, policies or developments?
13. Has the GGT been used in other types of plans or policies? (ie, transportation, utilities, parks and rec, etc)?
14. Who else do you know of that may be using or could make use of the GGT?
15. Do you have any recommendations to improve the GGT or to enhance its use by communities?

## **APPENDIX C: GGT ONLINE SURVEY THROUGH SURVEY MONKEY™**

Responses can be left blank if they are not relevant and you can then proceed to the next question. Once you exit the survey by clicking the 'done' button you can't come back to edit responses.

\*\*\*\* For those planners that work regularly with biologists through the Green Growth Toolbox, you can skip questions 7 - 9 and thanks for your collaboration! \*\*\*\*

1. Please select your role in land use and development planning: You can select multiple answers.

Local government planner, transportation planner, consulting planner, consulting engineer, realtor, gis staff, parks & recreation staff, other local government staff, planning-related board or committee, elected official, other (please specify)

2. Have you or has your community used the Green Growth Toolbox (GGT)? Yes, No

3. Have you or has your community used other conservation planning tools or environmental GIS data? If so in general what were these and how did you use them?

4. What type of information is most useful to you to enhance wildlife habitat conservation through land use and development planning methods? You can select multiple items.

a) All of these topics, b) Why conservation-based planning is important for people, c) Why conservation-based planning is important for wildlife and biodiversity, d) Economic benefits of conservation-based planning, e) Conservation-based planning methods and example policy information, f) Conservation-based planning case studies from other communities, g) Conservation-based incentives and ordinance methods, h) Conservation-based incentives and ordinance case studies from other communities, i) Conservation-based development design methods, j) Conservation-based development design case studies from other communities, k) Links to view or download the maps of high priority wildlife habitats (conservation data), l) Information explaining the conservation data, m) Information on how to use the conservation data in land use and development planning, n) Wildlife habitat conservation recommendations such as how much habitat to try conserve, o) Other (please specify)

5. (Optional) So that we may follow-up, please provide:

Your contact information including organization and email address.

Contact information for others you know of that use the GGT, such as consultants.

6. If you have used the GGT, what have you used? You can select multiple answers.

- Information from a training workshop
- Technical assistance from NCWRC or other agency
- 10 Benefits of Green Growth literature in Section 1 of the Handbook
- Conservation Data GIS download or links
- Information on the Conservation Data from Section 2 of the Handbook
- Habitat conservation recommendations from Section 3 of the Handbook
- Recommendation for plans from Section 4 of the Handbook
- Recommendations for ordinances from Section 5 of the Handbook
- For the purposes of development design or advising developers of a preferred design
- Other (please specify)

7. If the GGT was used in a plan, please provide the name of the plan. What general information did you include? How do you expect habitat and natural resources to benefit?

8. If the GGT was used in an incentive or ordinance, what type of incentive or ordinance and what updates were made? Please provide the section and title of the ordinance so that we can see what changes were made.

9. If the GGT was used in a development review or design, what was the result? Or when do you expect a result? Please provide the name, location and pin number of the development(s).

10. Has the use of the GGT resulted in the potential for better wildlife habitat conservation in your community in other ways? If so how?

**APPENDIX D. DEFINITIONS FOR THE LEVEL OF TECHNICAL ASSISTANCE (EFFORT)**

A high level of technical assistance was considered as: (1) A working relationship with one or more planners and at least one of the following: providing Partners for Green Growth funding to the jurisdiction, or (2) providing conservation data or other workshop presentation, or (3) providing information to (preferably in person with written materials or presentation) the planning or elected board, and (4) providing a review of planning projects. A moderate level of technical assistance is less than high and more than low. A low level of technical assistance was considered as: (1) providing a GGT workshop only or (2) in combination with providing brief technical guidance information (including presentations) on only one occasion that took less than 6 hours total (including presentation or information preparation and travel time), and or (3) providing technical guidance information that took three hours or less to compile for two or three requests.