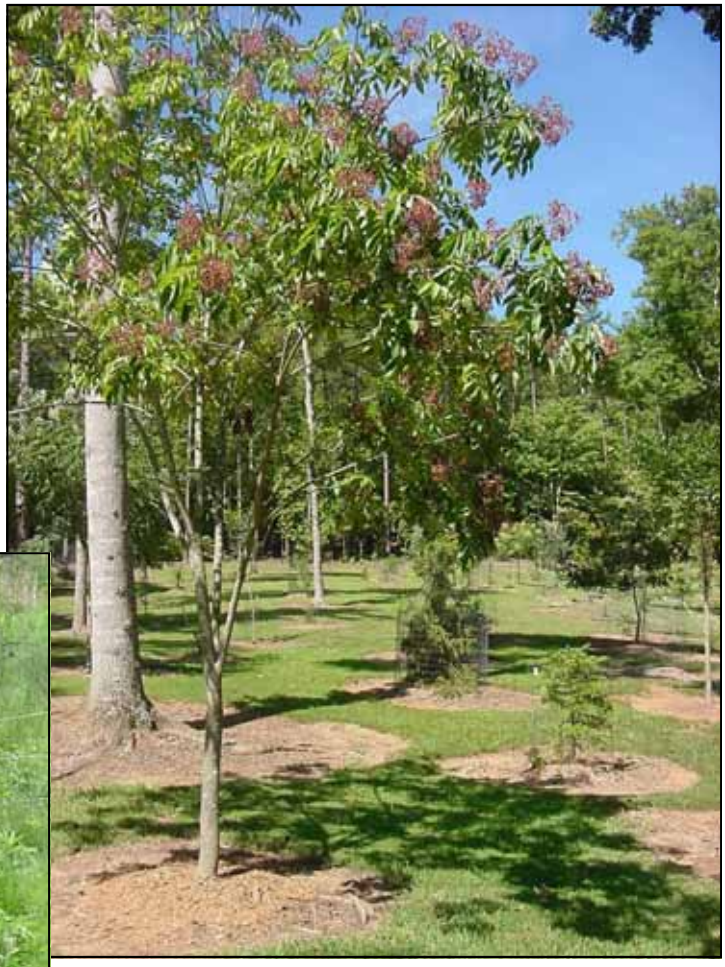
Log cabin on the Breeze Farm, which was protected with an agricultural conservation easement in 2008.

Lewis' Heartleaf Preserve was acquired in 2005.

A conservation easement was granted to Orange County on the Keith Arboretum (near Pickards Mountain) in 2006.



These images represent some of the special places that were protected through Orange County's Lands Legacy Program.

The owners of Fickle Creek Farm protected their farm with a conservation easement in 2007.

BIOLOGICAL RESOURCES

Orange County is home to a wealth of biological resources within a variety of natural communities, from the forested hills known as "monadnocks" (such as Occoneechee Mountain) to the bottomland swamp forests of the Triassic Basin (such as Mason Farm Biological Reserve). Encroaching development, however, can devour valuable natural areas and fragment the landscape, disrupting the ecosystems of native plants and animals. Therefore it is critical for Orange County to monitor the conditions of and protect its most significant natural areas and individual species.

Significant developments in protecting Orange County's biological elements have occurred since the last *State of the Environment* report. Among these was a 2004 update of the county's inventory of natural heritage sites in cooperation with the North Carolina Natural Heritage Program. New to the inventory was the identification of important "macrosites"[4] in less developed areas of the county and the inclusion of some highly important river habitats as new Natural Heritage sites.

Another integral element in the protection of local biological resources is Orange County's Lands Legacy Program. Started in April 2000, Lands Legacy is administered by the Environment & Resource Conservation Department (ERCD). The department works with willing landowners to acquire land or to protect private land through conservation easements. ERCD often collaborates on projects with local land trusts and other conservation partners. Since the Lands Legacy Program was started, Orange County has acquired 977 acres of new land for parks and preserves and protected another 1,550 acres of farmland and natural land with conservation easements. Further information on the Lands Legacy program is given on pages 63 through 65.

The Biological Resources section of this report highlights data from the 2004 natural heritage inventory and reports on the progress made by Lands Legacy and others to protect important resource lands in Orange County. The **Acres of Protected Land** indicator shows the many different types of land protection efforts ongoing in the county. The **Acres of Protected Natural Heritage Sites** indicator is a subset of the protected land figures. This indicator tracks the protection of those lands recognized as highly important natural areas by the North Carolina Natural Heritage Program. The **Prime Forest** indicator displays some of the notable changes in forest cover in the county from 1988-2008. The **Acres within the Present Use Value Program** tracks the amount of land receiving special tax treatment as agricultural, forest or horticultural land. Finally, the **Status of Rare Plants and Animals** presents the current information maintained by the Natural Heritage Program on individual species.

[4] Macrosites are broad, natural habitats with relatively little or no human alteration.

BIOLOGICAL RESOURCES

Acres of Protected Land

Why the indicator was selected

Lands that are protected from future development have both intrinsic value and are community assets that provide innumerable benefits for the people of Orange County. Large, undisturbed, natural areas protect our air and water quality, provide habitat for native plants and animals and serve as recreational and scenic areas for county residents. The most effective method of protecting land for conservation purposes is to acquire it fee-simple, outright (by purchase or donation) or by working with the owners to restrict its future development potential. Conservation easements[5] have been used by several landowners in Orange County to ensure long-term protection of important natural and cultural resources on their property.

How the indicator was measured

ERCD maintains a database of protected lands in Orange County. Table 12 lists the different entities working to protect land over the past few decades and Figure 13 shows the amount of land considered to be permanently or partially protected[6].

The trend in Orange County

IMPROVING

The active collaboration of local governments, residents and non-profit organizations is needed to protect important natural resource lands in Orange County. The County became a full partner in this effort when it established the Lands Legacy Program in 2000. Over the past four years (2004-08) another 2,700 acres were protected, including 189 acres for Eno River State Park, 997 acres by Orange County and 272 acres by Triangle Land Conservancy. An additional 750 acres of prime farmland were protected with conservation easements. In total there are 23,173 acres of protected land in Orange County, which is approximately 9% of the total land area (Figure 12). Currently, 13,023 acres of those protected lands (or 5% of the county) are considered permanently protected. Many important natural and cultural resource lands remain completely unprotected.

Recommendations

To support a sustainable future, Orange County should:

- Revisit the goal of permanently protecting at least 10% of the county's land area (25,600 acres) by the year 2010. Achieving this goal would require an additional 12,700 acres to be protected in the next year. Set new goals for 2015 and 2020;
- Continue to collaborate with its conservation partners (e.g., land trusts, Duke University, UNC-Chapel Hill, State of NC, OWASA) and private landowners to conserve high-priority natural areas and wildlife habitats including rivers and streams, floodplains, steep slopes, prime forests and wildlife corridors; and
- Develop a comprehensive conservation plan for achieving a continuous network of protected open space throughout the county, which addresses a) threats to important natural areas and wildlife habitat, b) connectivity between protected areas, c) coordination with neighboring counties and d) sustainable management of critical natural resources.

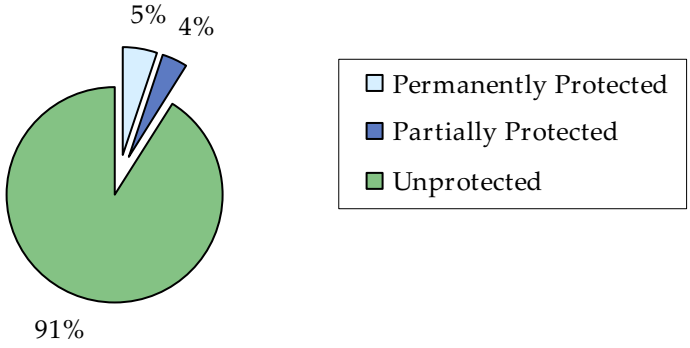
[5] Conservation easements are voluntary, legal agreements between the landowner and a nonprofit conservation organization or a local government. Under the agreement the landowner gives up certain rights to develop the land in the future.

[6] Permanently protected lands are those properties most likely to remain protected from future development. They include all lands protected by conservation agreements (e.g., easements) and lands owned by conserva tion entities. Partially protected lands are intended to remain undeveloped, but lack binding agreements for their permanent protection (e.g., Duke Forest, UNC-Chapel Hill's Mason Farm Biological Reserve and several local government parks and open space properties).

Table 12: Total Acres of Protected Land in Orange County as of 2008

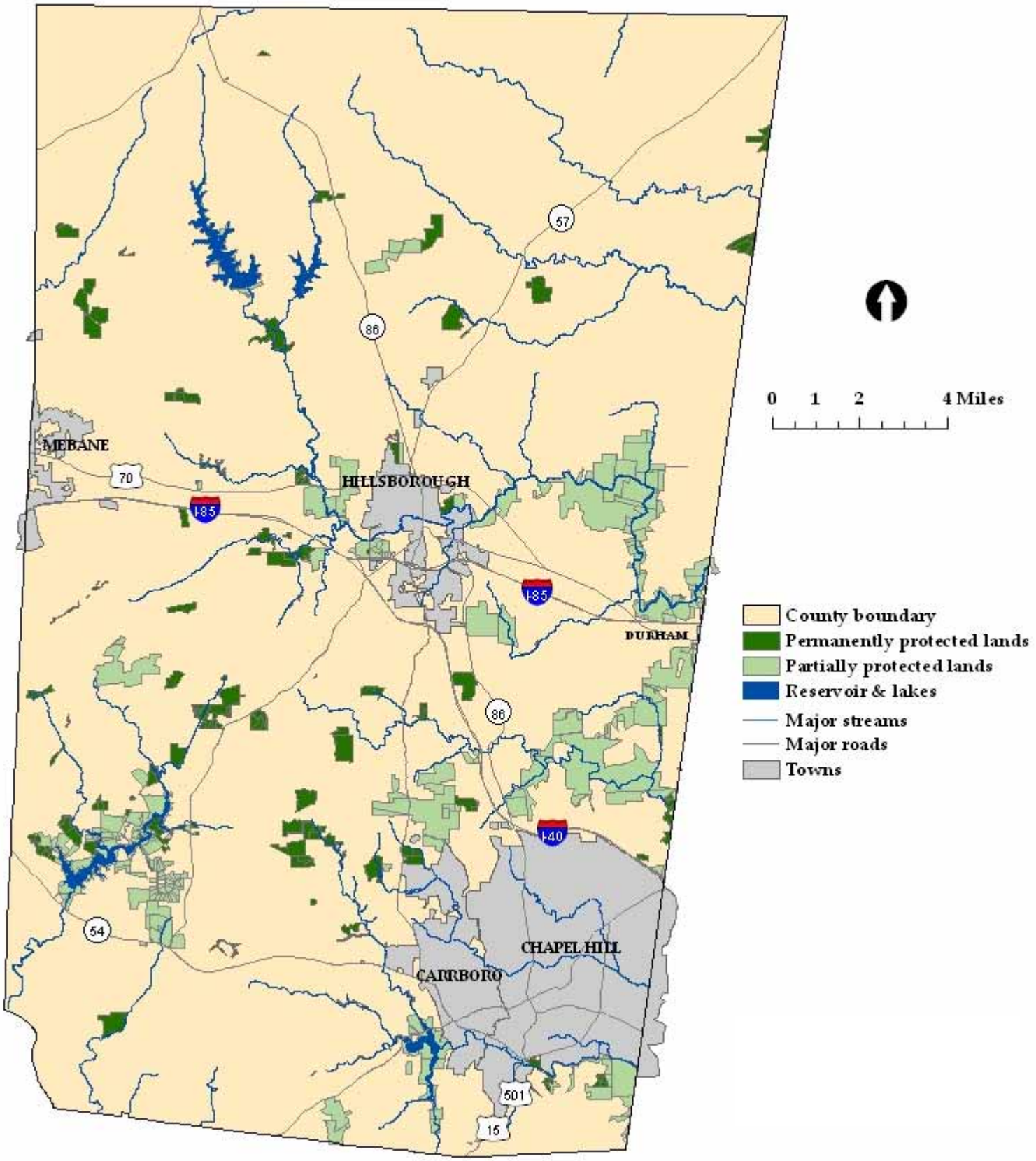
PERMANENTLY PROTECTED LANDS			Acreage by Acquisition Period					
Organization		Protection	Pre-	1981-	1991-	2001-	2005-	TOTALS
Name	Type	Method	1981	1990	2000	2004	2008	
Botanical Garden Foundation	Nonprofit	Fee-simple		17	77			94
		Easement			23		92	115
Town of Carrboro	Local Govt.	Fee-simple				27		27
Conservation Trust for NC	Nonprofit	Easement			143			143
Eno River Association	Nonprofit	Fee-simple			17	28	117	162
Orange County (Lands Legacy)	Local Govt.	Fee-simple			63	135	59	257
		Easement			8	648	791	1,558
Orange Water and Sewer Authority	Utility Provider	Fee-simple	73	1,983	1,300	275	74	3,705
		Easement			164	209		373
Eno River State Park	State Govt.	Fee-simple	800	800	374	1,148	189	3,311
Town of Hillsborough (Reservoir)	Local Govt.	Fee-simple			726			726
Town of Mebane (Reservoir)	Local Govt.	Fee-simple	258					258
Occoneechee Mountain State Natural Area	State Govt.	Fee-simple			96		66	162
Mid-Atlantic Mitigation	For Profit	Easement					30	30
State of NC (NC State University)	State Govt.	Fee-simple				133	136	269
State of NC (Clean Water Management Trust Fund)	State Govt.	Easement					193	193
State of NC (Ecosystem Enhancement)	State Govt.	Easement					221	221
State of NC (Eno River State Park)	State Govt.	Easement				2	4	6
Triangle Land Conservancy	Nonprofit	Fee-simple		5	428	35	262	730
		Easement		9	348	284	10	651
US Army Corps of Engineers	Federal Govt.	Fee-simple	98					98
US Fish & Wildlife Service	Federal Govt.	Easement		45				45
		SUBTOTAL	**1,229**	**2,859**	**3,767**	**2,924**	**2,244**	**13,023**
PARTIALLY PROTECTED LANDS								
Town of Carrboro	Local Govt.	Fee-simple		28	67	1	96	192
Town of Chapel Hill	Local Govt.	Fee-simple	131	152	133	255	4	675
City of Durham	Local Govt.	Fee-simple			11		11	22
Town of Hillsborough	Local Govt.	Fee-simple		52	44		96	192
Draper-Savage Foundation (Moorefields)	Nonprofit	Fee-simple		85				85
Orange County (Lands Legacy)	Local Govt.	Fee-simple	331	33	38	404	147	953
Duke University	Private	Fee-simple	2,419	397	2,175	71	40	5,102
Private Homeowners Associations	Nonprofit	Fee-simple	70	239	562	265	106	1,242
Classical American Homes Preservation	Nonprofit	Fee-simple			263			263
University of NC at Chapel Hill	Public	Fee-simple	200	1,093	90		41	1,424
		SUBTOTAL	**3,151**	**2,079**	**3,383**	**996**	**541**	**10,150**
TOTAL ACRES OF PROTECTED LAND			**4,380**	**4,938**	**7,150**	**3,920**	**2,785**	**23,173**

Figure 12: Percent of all Land in Orange County that is Protected



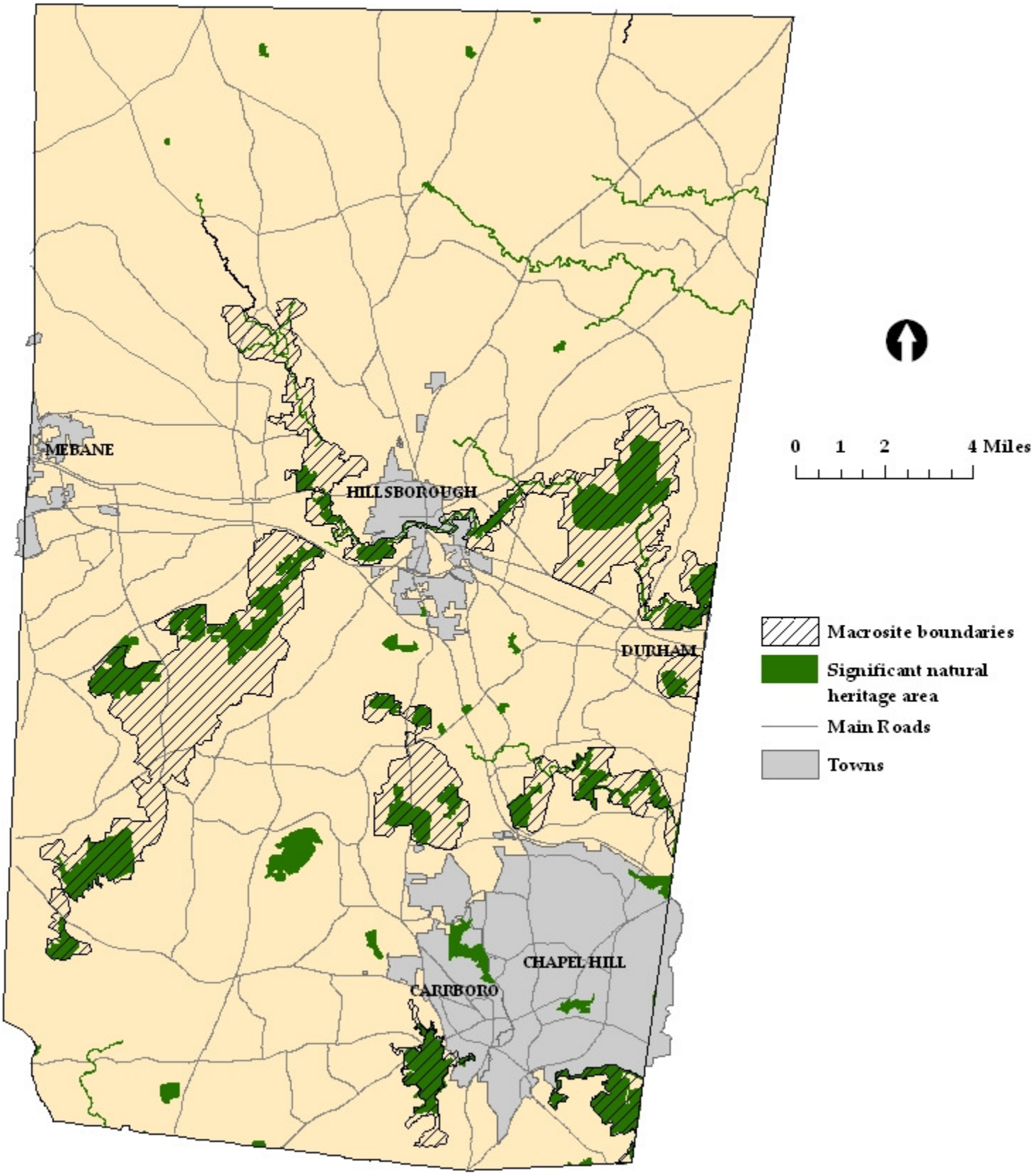
Source: Table 12 and Figure 12 — Orange County ERCD

Figure 13: Protected Lands as of 2008



Source: Figure 13— Orange County ERCD, prepared April 16, 2009

Figure 14: Natural Heritage Sites as of 2008



Source: Figure 14 — Orange County ERCD, prepared April 15, 2009

BIOLOGICAL RESOURCES

Acres of Protected Natural Heritage Sites

Why the indicator was selected

Natural areas provide habitats for native plant and animal species and can also serve as recreational and scenic places for Orange County residents. The first *Inventory of the Natural Areas and Wildlife Habitats of Orange County, North Carolina* was published in 1988. That inventory identified significant natural areas (also known as "Natural Heritage sites") recognized by the North Carolina Natural Heritage Program. Many sites include unique and exemplary habitats that are critical to support rare animals, plants and ecosystems. An update to the 1988 Inventory was completed in 2004, resulting in changes to many site boundaries. Some Natural Heritage sites were reduced in size due to development activities while other sites were enlarged.

Orange County, through its Lands Legacy Program, works with its conservation partners to monitor and protect Natural Heritage sites. Site management is, however, currently beyond the scope of the Program.

How the indicator was measured

Table 13 provides an overview of the Natural Heritage sites that have been permanently or partially protected over time in Orange County. Data were collected from organizations active in land conservation throughout the county. Figure 14 shows where these important Natural Heritage sites are located within the county.

The trend in Orange County

IMPROVING

Since the last *State of the Environment* report (2004), another 700 acres of land within Natural Heritage sites were permanently protected, including natural areas located along New Hope Creek, Bolin Creek, Morgan Creek and the Eno River.

Figure 15 shows that just over half (61% or 6,206 acres) of the county's 10,149 acres of Natural Heritage sites are either permanently or partially protected. Approximately 3,950 acres of these natural areas remain unprotected and at risk to future development.

Recommendations

To support a sustainable future, Orange County should:

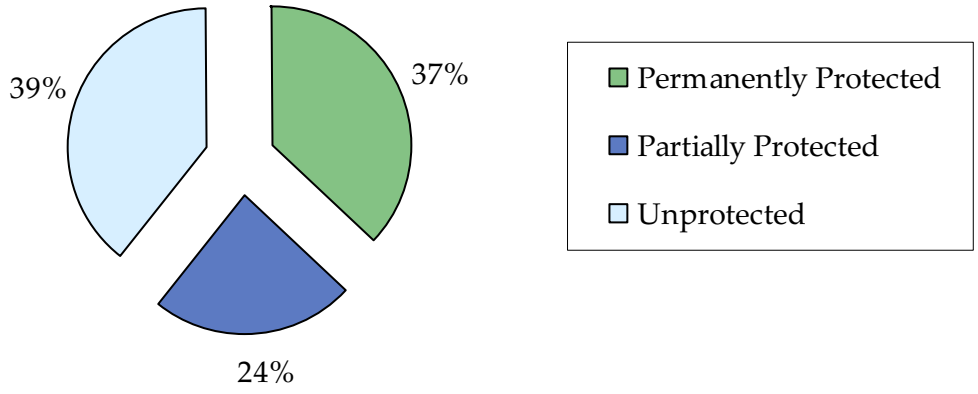
- Ensure that any Natural Heritage sites located on County-owned lands are protected with adequate ecosystem management and stewardship;
- Work with landowners and other partners to protect all Natural Heritage sites of national or state significance;
- Discourage or prohibit development that would cause adverse impacts to Natural Heritage sites; and
- Conduct more frequent updates to the county's inventory of natural areas and wildlife habitat and include previously unexplored areas of the county.

Table 13: Acres of Protected Natural Heritage Sites as of 2008

Permanently Protected Lands		Acreage by Acquisition Period					
Organization	**Type**	**Pre-1981**	**1981-90**	**1991-2000**	**2000-04**	**2005-08**	**TOTALS**
Botanical Garden Foundation	Nonprofit		16	75			91
Conservation Trust for NC	Nonprofit			141			141
Eno River Association	Nonprofit			1		4	5
Orange County (Lands Legacy Program)	Local Government			63	25	1	89
OWASA	Utility	29	984	158	3	12	1,186
Eno River State Park	State Government	579	371	267	595	2	1,814
Occaneechi Mountain State Natural Area	State Government			53		51	104
Triangle Land Conservancy	Nonprofit		5	198	89		292
US Army Corps of Engineers	Federal Government	82					82
	SUB TOTAL	**690**	**1,376**	**956**	**712**	**70**	**3,804**

Partially Protected Lands		Acreage by Acquisition Period					
Owner		**Pre-1981**	**1981-90**	**1991-2000**	**2000-04**	**2005-08**	**TOTALS**
Organization	**Type**						
Town of Chapel Hill	Local Government	3		36	20		59
City of Durham	Local Government			9			9
Town of Hillsborough	Local Government		27	2			29
Moorefields Foundation	Private		4				4
Orange County (Lands Legacy Program)	Local Government	67		63	50	7	187
Duke University (Duke Forest)	Private University	488	92	579	9		1,168
Classical American Homes Preservation Trust	Private			56			56
University of North Carolina at Chapel Hill	Public University	116	722	52			890
	SUB TOTAL	**674**	**845**	**797**	**79**	**7**	**2,402**
TOTAL ACRES OF PROTECTED NATURAL HERITAGE SITES							**6,206**
TOTAL ACRES OF NATURAL HERITAGE SITES IN ORANGE COUNTY							**10,149**

Figure 15: Percent of Protected Natural Heritage Sites as of 2008



Source: Table 13 and Figure 15 — Orange County ERCD

BIOLOGICAL RESOURCES

Prime Forest

Why the indicator was selected

Prime forests are defined as largely undisturbed tracts of hardwood forest and mixed hardwood-pine forest. These types of forests were prominent in the pre-European settlement landscape of Orange County and those that remain provide habitat for many indigenous plant and animal species that are restricted to hardwood forest habitats. In the past 25 years, the county has lost as much as 25% of its prime forest while many other forested areas have become fragmented to the point where they can no longer support or accommodate species diversity[7]. Mature forests dominated by oaks, hickories and other hardwoods are critical habitat for many native species such as the Wood Thrush and the Hooded Warbler. These forests also serve Orange County's human population by improving air quality, water quality and by mitigating flooding.

How the indicator was measured

Orange County first mapped the size and distribution of its prime forest using aerial photographs from 1988. Those data were further refined in 1999 to identify forested lands most suitable as wildlife habitat, defined as hardwood forests larger than 40 acres in land area. Updated versions of digitized forest cover were completed recently using aerial photography from 2003 and 2008. Figure 16 is a qualitative comparison of prime forest cover in 1988 and 2008.

The trend in Orange County

INDETERMINATE

In 1988, Orange County had about 71,000 acres of prime forest (28% of the total land area). New mapping and analysis of prime forest was not sufficiently accurate to estimate the loss of prime forest since 1988 but Figure 16 illustrates gross changes in prime forest cover between 1988 and 2008. Forest loss over this 20-year period has been largely due to commercial timber harvesting and new development.

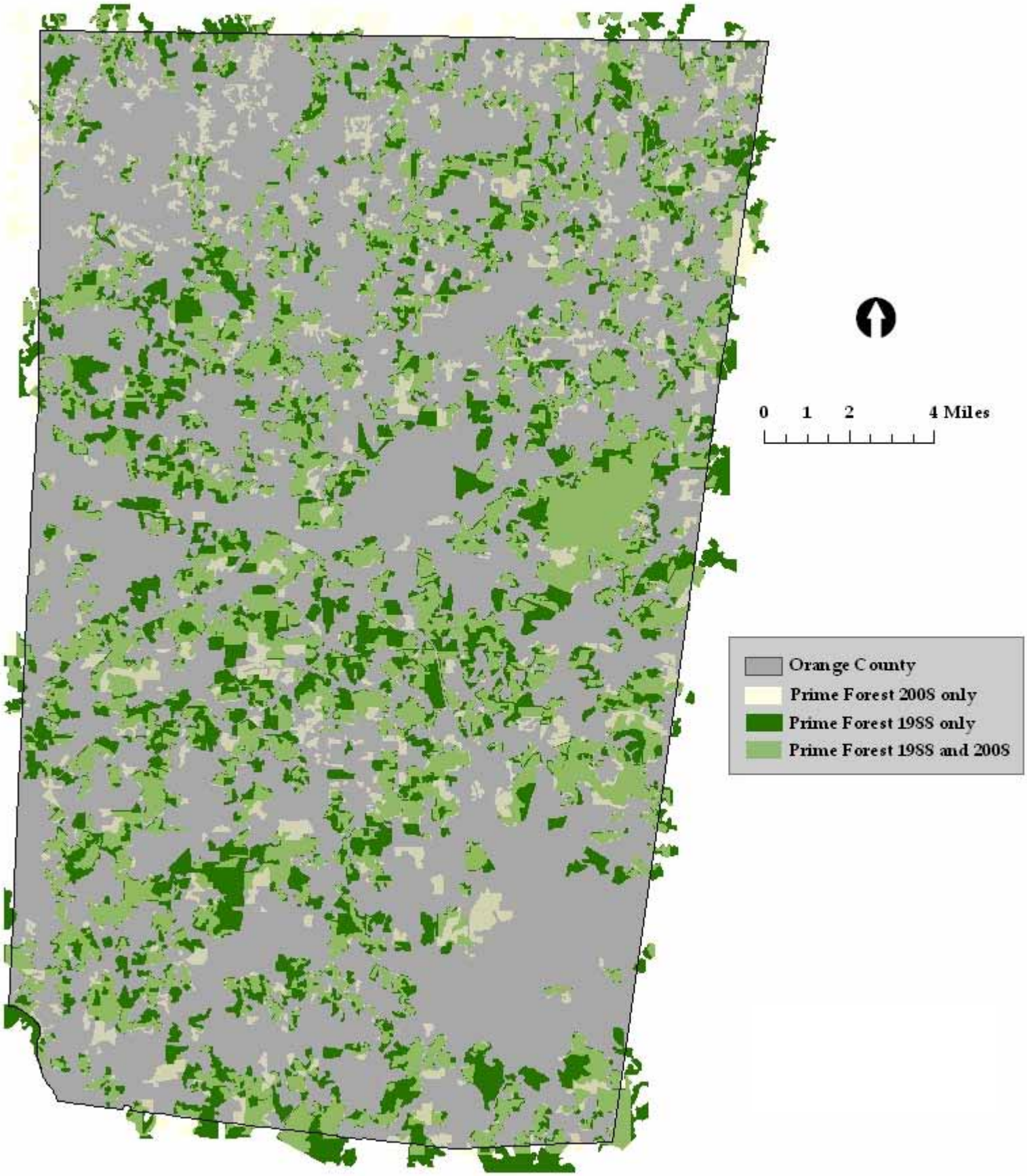
Recommendations

To support a sustainable future, Orange County should:

- Develop a more detailed and consistent methodology for monitoring changes in forest cover throughout the county and specifically the extant of mature hardwood forest;
- Encourage forest best management practices on both public and private land that minimize disruption and fragmentation of intact hardwood forests and harvesting in stream buffers and riparian habitats;
- Intensify efforts to protect significant portions of the remaining hardwood and mixed hardwood-pine forests. Primary means should include conservation easements and outright purchases of land with other partners; and
- Protect connectivity between protected forest tracts and buffer these sites from disturbance-generating activities (e.g., encroachment by invasive plant species and development).

[7] *A Landscape with Wildlife for Orange County, Parts 1 and 2* (Triangle Land Conservancy, 1997 & 1999)

Figure 16: Orange County Forest Cover Change from 1988 to 2008



Source: Figure 16 — Orange County ERCD, prepared May 11, 2009

BIOLOGICAL RESOURCES

Acres within the Present Use Value Program

Why the indicator was selected

The State of North Carolina authorizes Orange County and other local governments to reduce local property tax valuations for land classified as agricultural, horticultural and forestland (NCGS 105-277.2 *et seq*.). Taxing these "working lands" based on the **current** use (e.g., farming) rather than the **potential** use (e.g., residential development) helps to keep the land more affordable and productive. Lower taxes reduces the pressure to sell the land for development. The Present Use Value Program enables landowners to provide essential products for the community while also encouraging the preservation of undeveloped areas in Orange County.

How the indicator was measured

The Present Use Value (PUV) program is administered by the Orange County Tax Assessor's Office, which maintains a database of properties participating in the program. Table 14 lists the number of properties that have been enrolled in the PUV program since 1993. The table identifies land in the three categories—Agriculture, Forestry and Horticulture. A fourth category, *Wildlife Conservation*, was added by the General Assembly in July 2008. Enrollment in the program using the new Wildlife Conservation category will begin in 2010.

The trend in Orange County

DECLINING

Table 14 shows that about 40 percent of the land in Orange County is enrolled in the PUV program. Figure 17 shows that between 1993 and 2008, the acreage enrolled in the Agriculture and Forestry categories decreased (4,000 and 6,000 acres respectively) while the acreage within the Horticulture category increased. Horticulture use makes up only a small portion of the land enrolled in the program (less than 200 acres).

The PUV program provides farm and forest landowners with significant financial incentives to maintain the productivity and the rural nature of important resource lands. In 2002, Orange County supported state legislation that would allow farms and forestland protected by conservation easements to be exempt from having to pay deferred taxes if the land were withdrawn from the PUV program. The N.C. General Assembly enacted that change in 2008.

Recommendations

To support a sustainable future, Orange County should:

- Monitor enrolled lands to ensure their compliance with the PUV program;
- Incorporate the new Wildlife Conservation category in the PUV program and educate the public about this new opportunity; and
- Educate landowners about their eligibility for the PUV program.

Figure 17: Acres of Land in the Present Use Value Program, 1993-2008

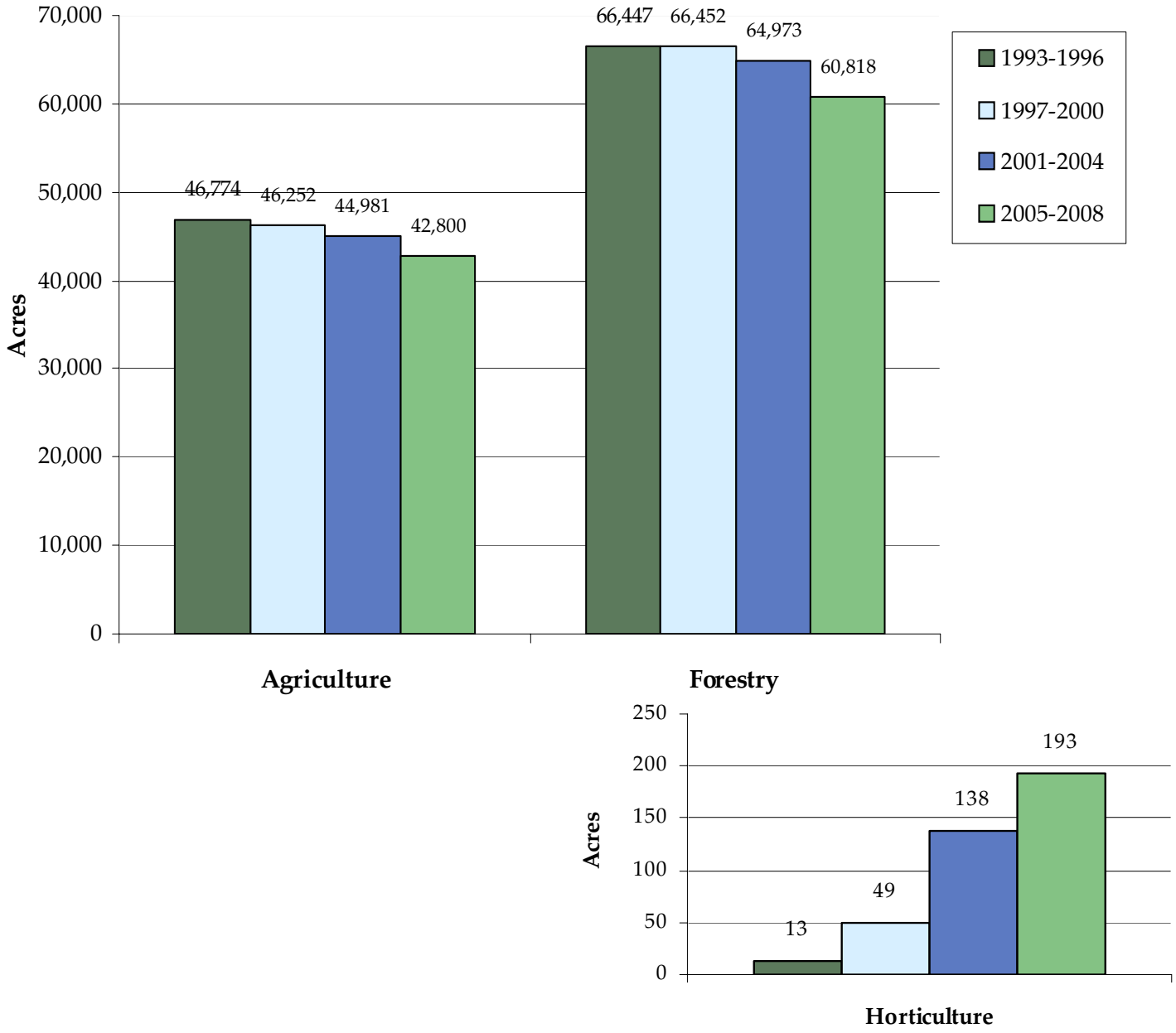


Table 14: Total Acreage in the Present Use Value Program, 1993-2008*

	1993-1996			1997-2000			2001 - 2004			2004-2008**		
Land Use	Number of Parcels	Acreage	% of Total Land	Number of Parcels	Acreage	% of Total Land	Number of Parcels	Acreage	% of Total Land	Number of Parcels	Acreage	% of Total Land
Agriculture	1,676	46,774	18.2%	1,721	46,252	18.0%	1,742	44,981	17.5%	1,799	42,311	16.5%
Forestry	1,931	66,447	25.9%	1,975	66,452	25.9%	2,096	64,973	25.3%	2,224	60,963	23.7%
Horticulture	2	13	0.0%	6	49	0.0%	17	138	0.1%	28	211	0.1%
County Totals	37,906	256,800	44.1%	41,670	256,800	43.9%	45,043	256,800	42.9%	50,969	256,800	40.3%

* Table 14 excludes land in the county that is not measured in acres such as subdivision plots. Some parcels are included in more than one category, such as both agriculture and forestry. The *State of the Environment* 2004 report presented incorrect data for this indicator. The data were corrected for this report. ** These data includes parcels through February 9, 2009.

Source: Figure 17 and Table 14 — Orange County Tax Assessor

BIOLOGICAL RESOURCES

Status of Rare Plants and Animals

Why the indicator was selected

Within an ecosystem there is a complex interrelationship among organisms. The loss of one species (plant or animal) can have a severe impact on the health and survival of other species. When one species is extirpated (eliminated) from a region, there is a loss of biodiversity, which results in a decrease in the number and diversity of species and ecosystems.

How the indicator was measured

The status of rare plants and animals throughout North Carolina is monitored by the North Carolina Natural Heritage Program (NHP). The NHP maintains a current list of important species for each county. The status of Orange County's rare plant and animal species is provided in Table 15.

Federal status is determined by the U.S. Fish and Wildlife Service as required under the federal Endangered Species Act (i.e., species of concern, threatened or endangered). State status is determined by the State Plant Conservation Program and the Endangered Wildlife Program of the North Carolina Wildlife Resources Commission. The far right-hand column of Table 15 (Last Observed) denotes when the species was last documented in Orange County. A **Historic** species was last observed more than 20 years ago. **Current** species have been spotted within the past 20 years. **Obscure** indicates the date the species was last observed is uncertain.

The trend in Orange County

INDETERMINATE (likely declining)

The development of land and its impacts to surrounding natural areas (i.e., habitat fragmentation, increased water runoff and contamination) results in the loss of habitat for native species. Since 2004, NHP has added five new species of nonvascular plants, four invertebrates (one insect and three mollusks) and seven vascular plants to their database of rare plant and animal species. In addition, NHP has reclassified the Carolina Fatmucket mollusk as an Eastern Lampmussel mollusk, removed the Pinewoods Shiner and Lewis's Heartleaf from the database and placed them on their watch list and removed the Small Whorled Pogonia due to lack of information.

Recommendations

To support a sustainable future, Orange County should:

- Support additional fieldwork to document and recommend management strategies to protect rare plant and animal species in the County;
- Understand and communicate that loss of habitat and the spread of invasive species are the major causes of native species extirpation and local extinction. Protect enough land in and around biologically significant areas and enough connections between these areas, to allow for the maintenance of native wildlife and plant populations and their functional relationships;
- Use only regionally native species for landscaping on County property; and
- Develop a method of monitoring non-rare indicator species as a way to measure the "state of biodiversity."

Table 15: Status of Orange County's Rare Plants and Animals as of 2008

	Common Name	Scientific Name	Federal Status	State Status	Last Observed
Assemblage	Colonial Wading Bird Colony	*none*	N	N	Current
Vertebrates	**Amphibians**				
	Four-toed Salamander	*Hemidactylium scutatum*	N	SC	Current
	Neuse River Waterdog	*Necturus lewisi*	N	SC	Current
	Birds				
	Sharp-shinned Hawk	*Accipiter striatus*	N	SR	Historic
	Bald Eagle	*Haliaeetus leucocephalus*	T	T	Current
	Red-cockaded Woodpecker	*Picoides borealis*	E	E	Historic
	Warbling Vireo	*Vireo gilvus*	N	SR	Current
	Fishes				
	Roanoke Bass	*Ambloplites cavifrons*	N	SR	Current
	Carolina Darter	*Etheostoma collis pop*	SC	SC	Historic
Nonvascular Plants	Closter's Brook-hypnum	*Hygrohypnum closteri*	N	SR	Historic
	A Thread Cedar Moss	*Cryphaea nervosa*	N	T	Current
	Hair Claw Moss	*Dichelyma capillaceum*	N	P	Current
	Welch's Fontinalis Moss	*Fontinalis welchiana*	N	T	Current
	A Liverwort	*Plagiochila ludoviciana*	N	T	Current
	Papillose Tortula	*Tortula papillosa*	N	P	Current
Invertebrates	**Crustacean**				
	Carolina Well Diacyclops	*Diacyclops jeanneli putei*	N	SR	Historic
	Carolina Ladle Crayfish	*Cambarus davidi*	N	SR	Current
	Insect		N		
	Golden Banded-skipper	*Autochton cellus*	N	SR	Historic
	Northern Oak Hairstreak	*Fixsenia favonius ontario*	N	SR	Current
	Giant Swallowtail	*Papilio cresphontes*	N	SR	Historic
	Splendid Clubtail	*Gomphus lineatifrons*	N	SR	Obscure
	Mollusk				
	Dwarf Wedgemussel	*Alasmidonta heterodon*	E	E	Current
	Triangle Floater	*Alasmidonta undulata*	N	T	Current
	Brook Floater	*Alasmidonta varicosa*	SC	E	Current
	Atlantic Pigtoe	*Fusconaia masoni*	SC	E	Current
	Yellow Lampmussel	*Lampsilis cariosa*	SC	E	Current
	Eastern Lampmussel	*Lampsilis radiata*	N	N	Current
	Chameleon Lampmussel	*Lampsilis sp.2*	N	SR	Current
	Eastern Creekshell	*Villosa delumbis*	N	SR	Obscure
	Carolina Creekshell	*Villosa vaughaniana*	SC	E	Current
	Green Floater	*Lasmigona subviridis*	SC	E	Current
	Creeper	*Strophitus undulatus*	N	T	Current
	Savannah Lilliput	*Toxolasma pullus*	SC	E	Current
	Notched Rainbow	*Villosa constricta*	N	SC	Current

N = None SR = Significantly Rare SC = Species of Concern E = Endangered T = Threatened P = Proposed

Table 15 continued: Status of Orange County's Rare Plants and Animals, 2008

Vascular Plants	Southern Anemone	*Anemone berlandieri*	N	SR	Current
	Bradley's Spleenwort	*Asplenium bradleyi*	N	SR	Current
	Prairie Blue Wild Indigo	*Baptisia minor*	N	T	Obscure
	American Barberry	*Berberis canadensis*	N	SR	Historic
	American Bluehearts	*Buchnera americana*	N	SR	Historic
	Douglass's Bittercress	*Cardamine douglassii*	N	SR	Obscure
	Bush's Sedge	*Carex bushii*	N	SR	Current
	Wood's Sedge	*Carex woodii*	N	SR	Historic
	Piedmont Horsebalm	*Collinsonia tuberosa*	N	SR	Historic
	Creamy Tick-trefoil	*Desmodium ochroleucum*	SC	SR	Historic
	A Witch Grass	*Dichanthalium annulum*	N	SR	Historic
	Eastern Shooting Star	*Dodecatheon meadia* var *meadia*	N	SR	Historic
	Smooth Coneflower	*Echinacea laevigata*	E	E	Historic
	Eastern Isopyrum	*Enemion biternatum*	N	SR	Historic
	Godfrey's Thoroughwort	*Eupatorium godfreyanum*	N	SR	Historic
	Large Witch-alder	*Fothergilla major*	N	SR	Current
	Pondberry	*Lindera melissifolia*	E	E	Historic
	Southern Loosestrife	*Lysimachia tonsa*	N	P	Historic
	Heller's Rabbit Tobacco	*Gnaphalium helleri* var *helleri*	N	SR	Historic
	Crested Coralroot	*Hexalectris spicata*	N	SR	Current
	Earle's Blazing Star	*Liatris squarrulosa*	N	SR	Historic
	Glade Milkvine	*Matelea decipiens*	N	SR	Historic
	Sweet Pinesap	*Monotropsis odorata*	SC	SR	Current
	Yellow Giant-hyssop	*Agastache nepetoides*	N	P	Current
	Grey Dogwood	*Cornus racemosa*	N	P	Current
	Narrow Leaf Aster	*Symphyotrichum laeve* var *concinnum*	N	P	Historic
	Smooth Blue Aster	*Syphyotrichum laeve* var *laeve*	N	P	Historic
	Wiry Panic Grass	*Panicum flexile*	N	SR	Historic
	Glade Wild Quinine	*Parthenium auriculatum*	N	SR	Historic
	Buttercup Phacelia	*Phacelia covillei*	SC	T	Current
	Purple Fringeless Orchid	*Platanthera peramoena*	N	SR	Current
	Indian Physic	*Porteranthus stipulatus*	N	SR	Historic
	Torrey's Mountain-mint	*Pycnanthemum torrei*	SC	SR	Current
	Water-plantain Spearwort	*Ranunculus ambigens*	N	SR	Historic
	Michaux's Sumac	*Rhus michauxii*	E	E	Historic
	Pursh's Wild-petunia	*Reullia purshiana*	N	SR	Historic
	Southern Skullcap	*Scutellaria australis*	N	SR	Historic
	Shale-barren Skullcap	*Scutellaria leonardii*	N	SR	Current
	Appalachian Golden-banner	*Thermopsis mollis sensu stricto*	N	SR	Historic
	Glade Bluecurls	*Trichostema brachiatum*	N	SR	Historic
	Chapman's Redtop	*Tridens chapmani*	N	P	Historic

N = None SR = Significantly Rare SC = Species of Concern E = Endangered T= Threatened P = Proposed

Significantly Rare—indicates the need for population monitoring and conservation action for species not currently listed as Endangered, Threatened or Special Concern. *Species of Concern*—species for which there was some evidence of vulnerability but for which there were not enough data to support listing as Endangered or Threatened. *Endangered*—a species that is in danger of extinction throughout all or a significant portion of its range. *Threatened*—a species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range. Source: Table 15 — NC Natural Heritage Program.

BIOLOGICAL RESOURCES

Emerging Concern: Land Application of Biosolids

What are Biosolids?

The U.S. Environmental Protection Agency (EPA) defines sewage sludge as "*the solid, semi-solid, or liquid residue generated during the treatment of domestic sewage in a* [wastewater] *treatment* [facility]." Biosolids are produced from sewage sludge, primarily by reducing the level of living pathogens (i.e. live viruses, bacteria, protozoa and helminth worms) with anaerobic digestion in combination with heat. Although the terms biosolids and sewage sludge are often used interchangeably, biosolids are only that portion of sewage sludge that has undergone adequate treatment to permit their application to land. The EPA's Standards for the Disposal of Sewage Sludge "the *503 Rules*" define two classifications of biosolids based on pathogen content:

1. ***Class A*** biosolids, which have been treated to reduce pathogens to a very low level such that access to application sites does not need to be limited. They are the highest quality material with few regulatory constraints affecting their use. Treatments to produce Class A biosolids generally do not affect the content of metals or organic chemicals in the biosolids; however, Class A biosolids must meet one of the following pathogen reduction requirements:
    - The density of fecal coliform bacteria in the biosolids must be less than 1,000 most probable numbers (MPN) per gram of total solids on a dry-weight basis, or
    - The density of Salmonells species bacteria in the biosolids must be less than 3 MPN per gram of total solids on a dry-weight basis.

2. ***Class B*** biosolids have been treated to a lesser degree, to reduce pathogens to a level that is safe for application on land with an initial period of limited public access following the application. The pathogen content of Class B bio solids has been significantly reduced but this content does not need to be at very low levels. For this reason Class B biosolids have additional land use restrictions and land management practices where applied and are restricted to private agricultural land, forest lands, reclamation sites and other areas where there is limited potential for public exposure.

The most cost effective and most common means of biosolids disposal is land application (other common disposal options include incineration or solid waste landfill disposal)[8]. In North Carolina, State-level regulations and a State-level permitting process (managed by the Division of Water Quality within the N.C. Department of Environment and Natural Resources), are intended to reduce environmental and public health risks associated with the land application of biosolids. The degree of biosolids treatment determines the level of restrictions required during and after the land application process.

Biosolids and Orange County Land

Land application is a biosolids disposal technique widely used in Orange County with over 3,000 acres permitted to receive this waste material from OWASA, Hillsborough, Mebane, Durham, Cary and Burlington wastewater treatment facilities (refer to Figure 18 for a map of active application sites in Orange County). There are additional sites throughout the county that were formerly used for biosolids disposal and are now considered inactive sites (labeled as 'inactive sites' in Figure 18). Preliminary data compiled by the UNC-CH School of Public Health indicates that permitted application sites in the county are receiving upwards of 17 million gallons of biosolids per year, which equals an average rate of 5,000 gallons per acre per year.

In December 2006, the Orange County Health Department contracted with the School of Public Health to complete a pilot study of biosolids application sites and methods of measuring potential effects of these sites on public health and the environment. Past drought conditions and difficulty receiving landowner permission to sample on private property have presented significant challenges and caused delays in completing this study.

[8] EPA Biosolids information page http://www.epa.gov/OW-OWM.html/mtb/biosolids/index.htm#pubs.

Due to the additional expense of treating sewage sludge to Class A standards, not all wastewater treatment facilities applying biosolids to Orange County lands are producing Class A biosolids, thus the majority of biosolids being spread in Orange County are Class B. Therefore, carefully managed land application practices and isolation controls are critical to reduce the risk of adverse human health and environmental effects during and after land application of this waste material.

Orange County is the only county in North Carolina that maintains local oversight of biosolids application activities. In the early 1990s, the Orange County Board of Health implemented additional recommended practices and reporting requirements for several types of wastewater disposal, including the disposal of biosolids in the county. Initial inspections of biosolids application sites and practices, which were completed by the Orange County Environmental Health Services staff, revealed regular non-compliance with the permitted application procedures. Some of the utilities which generate biosolids continue to be reluctant to report their disposal activities in the county: thus their level of compliance with County and State regulations remains unknown[9].

Ongoing Concerns and Recommendations

A 2005 report from the N.C. Department of Health and Human Services discussed the risks to human health from biosolids and recommended that the State enact additional protective measures governing the land application of biosolids. These recommendations were based on reported health and odor complaints, identified groundwater contamination in areas of biosolids application and a review of current scientific studies of potential health effects related to the land application of biosolids. These recommendations include:

- Establishing a monitoring requirement for wells located in the vicinity of land application sites.
- Increasing (doubling) the current application setback distance requirements from adjacent properties.
- Developing a surveillance program to determine adverse health effects in humans and animals living near application sites.
- Develop specific environmental siting criteria, based on current scientific information, to control the location of application sites.

While several organizations have identified an extensive list of organic and inorganic pollutants found in biosolids, current EPA regulations require the State to monitor for only nine inorganic metal pollutants. In addition, there are currently no monitoring requirements to determine exposure levels to humans or grazing animals in and around application sites nor to monitor for the presence and concentration of pharmaceutical, organic, or inorganic wastewater contaminants in surface water, groundwater, or air in the vicinity of the disposal sites.

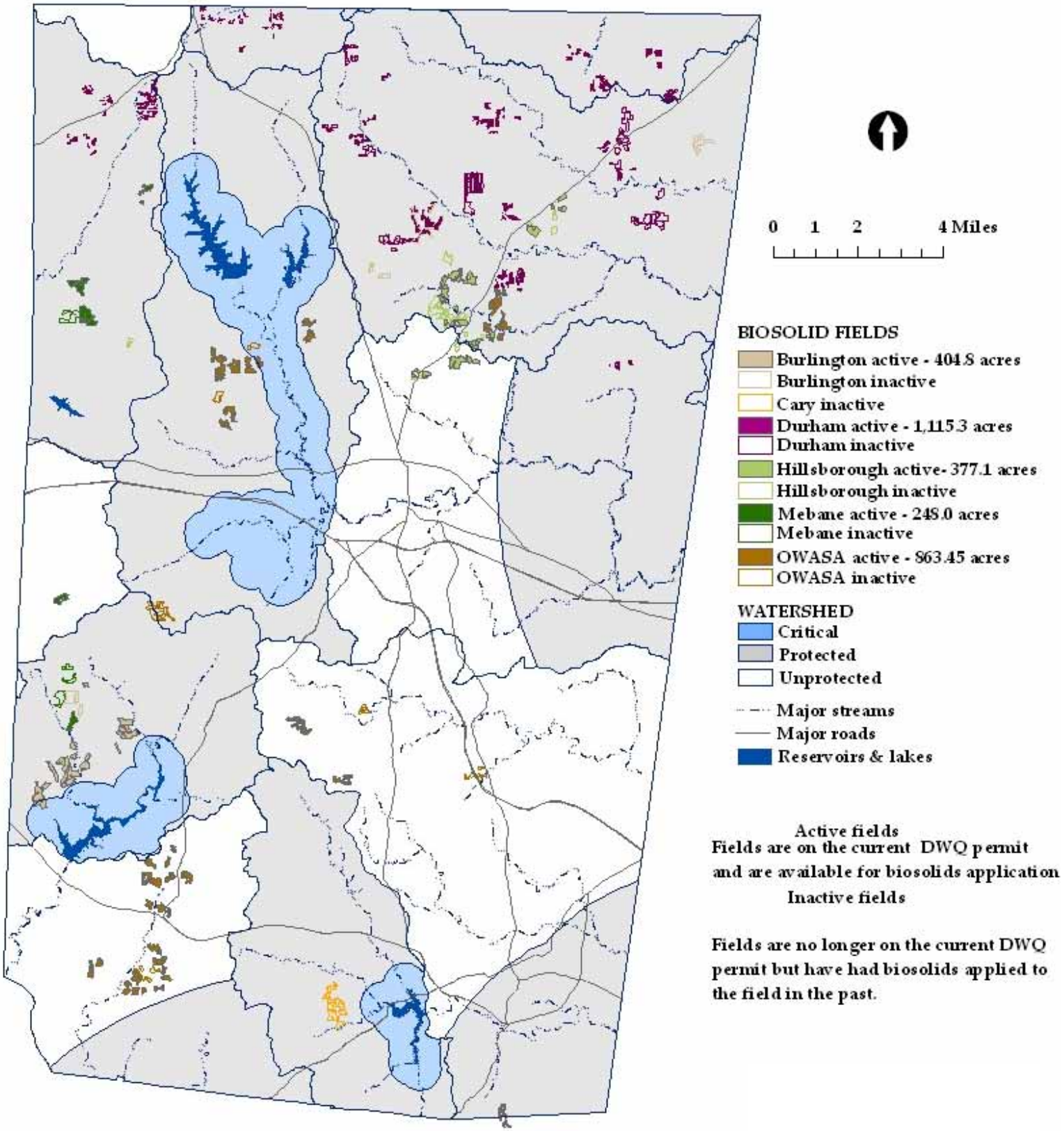
In an April 2009 memorandum, the CFE recommended to the Orange County Board of County Commissioners the formation of a multi-disciplinary task force to examine the environmental and public health issues related to biosolids application in the county. The following issues are of particular interest to the CFE and are recommended for further evaluation:

- The human health and environmental risks associated with the unknown composition and concentration of contaminants in biosolids being applied to land in Orange County.
- The lack of public information/notification for sites where biosolids are being applied.
- The question of whether N.C. counties should have the authority to apply additional controls and land use restrictions to sites receiving biosolids. Currently the biosolids application permitting process is governed by the State and the State's standards supercede County zoning regulations and protective practices.
- While the County's watershed zoning regulations prohibit the disposal of sewage sludge in critical areas of protected watersheds, due to a difference between the State's and the County's definition of these areas, lands are currently permitted to receive biosolids within portions of the County's critical areas of protected watersheds. Land application restrictions within these watersheds and critical areas are important to protect these sources of drinking water.
- Collins Creek is the only stream located outside of the urban areas of Chapel Hill and Carrboro which has recently been classified as 'impaired water' by the N.C. Division of Water Quality. This stream is located in a watershed that contains land permitted to receive biosolids. It is important to determine if biosolids are contributing to the decline of water quality in this stream.

[9] Orange County Health Director Memorandum regarding the Biosolids Program in Orange County (March 2008)

[*] Additional information on current research related to the chemical composition of sewage sludge and biosolids can be found at the EPA's website. The 2009 Targeted National Sewage Sludge Survey Report is located at http://www.epa.gov/waterscience/biosolids/tnsss-overview.html.

Figure 18: Biosolids Application Sites as of 2008



Sources: Figure 18 — Orange County ERCD and Environmental Health Department, prepared May 28, 2009