various species and habitats within our boundaries. We are addressing mostly the vascular plant and vertebrate animal species, making the general assumption that smaller organisms will be "carried along" in whatever preserve network is constructed. For example, a site with unique vascular flora may also harbor an equally unique soil flora and fauna, and if management decisions protect the larger biota, we can hope that the smaller elements are likewise protected.

The natural elements can be divided into 7 basic groups. The first six are:

1. Disjuncts. Species occurring here discontinuous from their centers of distribution. Primarily mountain species, restricted in Orange County to cooler and richer sites. They represent a margin of the species' gene pool; they are susceptible to extinction because of their distance from sources of recolonization. An example: ginseng from the mountains.

2. Species at the edge of their range. Again, they represent a margin of the species' gene pool. An example: marsh rabbit from the coastal plain.

3. Species on the various rare, threatened and endangered lists. Reasons for rarity are various: disjunction, edaphic requirements, or very scattered distribution. An example: smooth coneflower, an open woodland plant of circumneutral soils.

4. Sites with locally unique soils or geology. Sometimes have unusual plant species or associations. An example: Carolina Shagbark Hickory forest on diabase dike at UNC's Mason Farm Preserve.

5. Unique breeding habitats. Amphibians especially require unique hydrologic conditions for breeding. An example: four-toed salamander site at seep on Stony Creek.

6. Sites with habitats and vegetation representative for the region. Often small and secondary, these sites are remnants of the average and common presettlement landscape. An example: Big Oak Woods bottomland forest at UNC's Mason Farm Preserve.

All of the above types are relatively easy to identify, in that they stand out from the background landscape. They are the traditional targets of natural area inventories. They are scattered, rather than connected, throughout the landscape. They usually survive in areas that are difficult to cultivate, and thus have escaped the full intensity of the human disturbance regime.

The seventh type, the landscape matrix, is more enigmatic and broader in scope than the preceding ones. Forman and Godron (1986) describe the matrix as "the most extensive and most connected landscape element type, [which] plays the dominant role in the functioning of the landscape."

Imbedded in this matrix are not only the unique sites described above, but also the 5 acre, 10 acre, or 100 acre units of land that serve as wildlife pools. It is that part of the landscape that serves as habitat for many of the county's species; while rarely pristine, its contribution to the region's species diversity must be assessed. Any site or reserve that we circumscribe with boundaries is connected to the matrix, and biotic activity within the reserve or within the surrounding matrix is related: "The impact of ecological changes within the reserve on wildlife populations depends in part on the amount of change in adjacent areas, and conversely change in adjacent areas affects populations in the reserve" (Kushlan 1979). Each piece of it, taken individually, may seem of little value when compared to the six other element types described above. The matrix can be broken down and classified into secondary woodland, old field pine, riparian strip and other types, but its individual functional characters are difficult to classify.

Ranking species and sites for preservation.

Should we seek to maximize diversity, and try to maintain as many species as possible? This approach asks us to make no judgement about the individual species: weeds are as good as beech trees. Diamond (1976) dismisses this suggestion and says "conservation should not treat all species as equals but must focus on species and habitats threatened by human activities." In ranking species for preservation, we must consider the relative habitat specialization of each taxon, and, especially among animals, the specialization for several different types of habitat (Adamus and Clough 1978). Those species most threatened include (Diamond 1976): 1) those high on the trophic chain; 2) those with a life history as forest interior specialists; and 3) species specialized to depend on patchy resources. For the first group, we can rank species by estimating minimum area based on trophic level and body size (Harris 1984). The third group will need large areas so that sufficient small patches will be available, or alternatively will need specialized management to create these patches (Adamus and Clough 1978; White and Bratton 1980). The forest interior specialists will at the least require sufficient area to be removed from the forest edge, but requirements of that relative size may vary. Janzen (1986) stresses that there are individual decisions to be made for each geographic region: local biologists need to know the life histories and characteristics within their own region. Within Orange County, we can rank species along a gradient of response to human disturbance. For example:

"weedy", edge species:	forest interior sps.:
kudzu	blue cohosh
honeysuckle	ginseng
squirrels	pileated woodpecker
crows	bobcat
high disturbance	low disturbance

The commensal, ruderal, high disturbance species will be with us no matter what measures we take to keep the species that require low disturbance. On the local, county level we should be concerned not only with those threatened and rare species that are on state, federal, and global endangered lists, but also with the low disturbance species that are declining as the county's landscape comes under increased human pressure. For site- specific species, i.e. those found in groups 1 through 6, attention should be directed toward maintaining the unique element found at the site.

Some ideas of preserve design.

Twenty years ago the publication of the theory of island biogeography (MacArthur and Wilson 1967) proposed that islands would contain fewer species per unit area than equivalent-sized areas on the mainland. The analogy was quickly made between oceanic islands and isolated habitat fragments on continental landscapes. Debate about the theory's applicability to nature preserve design has centered around a few questions: what size and shape should those isolates be? Will a single large island reserve support more species than several smaller reserves totalling the same size? And are other factors more critical for preserve design than island biogeography?

Few would deny that large reserves are needed for low density species such as large herbivores and top predators. Wilcove et al. (1986) point out that large reserves will also serve as pools for immigration to other smaller fragments, and that large preserves are top priority for acquisition because they are more easily eroded in size than smaller ones. Simberloff and Abele (1982) argue that island biogeography does not mandate one large reserve; several small ones may be better, but "in all circumstances maximum total area is probably desirable." Higgs (1981) says that the theory can support either one full-size or 2 half-size islands. Kitchner et al. (1980) propose establishing an "optimum area" above which species richness increases slowly, then distributing these optimum area- sized reserves throughout the landscape to incorporate habitat types "perceived as important to the taxa in question." Several workers address the optimal shape: Diamond (1975) proposes that circular is best, because it minimizes dispersal distance within the reserve and minimizes the proportion of edge to interior. Buechler (1987) says that oblong rather than compact reserves will maximize the perimeter to area ratio, facilitating outflow from the preserve. Blouin and Connor (1985) take an opposite view that "if mechanisms controlling species richness on oceanic islands and isolated patches of terrestrial habitat are the same, then shape is not of major concern in the design of nature reserves."

The issue of size is also important in considering the effect of disturbance on preserves. Simberloff and Abele (1983) predict that the effects of catastrophic disturbance (fire, disease, storms) would be less severe in several small reserves. But, for a large reserve, recolonization from any undestroyed portions would be easier (Pickett and Thompson 1979). Since the nature of and extent of catastrophes is hard to foresee, both arguments can be supported (Higgs 1981). Pickett and Thompson (1979) base their call for large preserves on the concept of minimum dynamic area: "the smallest area with a natural disturbance regime, which contains internal recolonization sources, and hence minimizes extinction." This incorporates not only patch size but also the mobility of the species to be preserved. Reserves lacking such size will need to be managed to mimic the natural disturbance regime and assure a mix of successional habitats needed by the reserve's biota (White and Bratton 1980). Noss (1985, 1987) urges regional preserve managers to incorporate the natural presettlement disturbance process by viewing each preserve in a region as one unit of the total landscape disturbance regime, so that the sum of management techniques can approximate the natural mosaic.

There have been very few suggestions of actual sizes needed, and they have been based on field studies of species (Zeveloff 1983, Kitchner et al. 1981). Jarvinen (1982) supports this method of preserve design: rather than building preserves around island biogeography, we should consider the most extinction-prone organism's characteristics, such as dispersal abilities, genetic and demographic characteristics, and minimum area requirements. In local landscapes where preserves are by this time necessarily small, the issue of maintaining a species' genetic fitness is a difficult one when effective population sizes may have already dropped below the optimum for continued heterozygosity. Minimum population size, especially among animals, is variable and as yet rarely determined, but it is usually more than a few hundred individuals (Soule and Simberloff 1986). Hooper (1971) reviews several alternatives for management of such rare species: 1) do nothing; 2) concentrate large numbers of the species in one area; 3) establish or maintain several different reserves within an area so that gene flow can occur; 4) manage gene flow by transplanting, manipulated crossing, etc.

Corridors and connectivity.

In fragmented landscapes, dispersal (be it gene flow or food foraging) can be partially or totally blocked by distances, or physical or habitat discontinuity barriers between reserves. Reserves of insufficient size to contain large numbers of species could be linked by connecting corridors so that several smaller reserves could function as a larger one, incorporating various habitat types. Since few reserves meet the criteria for the minimum dynamic area of Pickett and Thompson (1979), Noss (1987) proposes that "a system of natural areas, interconnected with each other and integrated with the land use of the surrounding landscape, may provide some of the functions of a minimum dynamic area, such as recolonization sources, gene flow, a mix of habitats in the system as a whole, and alternative refugia for species to escape natural enemies and disturbance episodes."

Several studies have shown that corridors are utilized by birds and small mammals. Chipmunks recolonized small woodlots by way of fencerows (0.5 to 2 km long) in agricultural areas (Henderson et al. 1985). Fahrig and Merriam (1985) compared woodlots completely surrounded by fields with those connected by fencerows, and documented lower population growth rates by immigration in the isolated woods. Wegner and Miriam (1979) studied birds and small mammals in similar terrain and found that they use fencerows between woodlots much more frequently than they travel across open fields. MacClintock et al. (1977) compared the avifaunal composition of a 400 acre "mainland" woodlot with a nearby 35 acre "island" woodlot which was connected by a 15 acre grazed, secondary growth corridor. The avifauna were similar in many respects. They point out that designated preserves in their state (Maryland) had failed to preserve some species that were able to colonize this connected 35 acre wood, and argued that the connecting corridor had facilitated this colonization. Margules et al. (1982) countered that they did not attempt to separate the effects of the corridor from the effects of the close proximity of a major, 10,000 acre forest.

Certainly the effectiveness of a corridor for dispersal will depend upon the dispersal characteristics of each individual organism. However, corridors could be constructed so that a variety of species could use them to some extent (Harris 1984, Forman and Godron 1986, Noss 1987). Forman and Godron describe several types of corridors: 1) line corridors, such as hedgerows or treelines through a field; 2) strip corridors wide enough to maintain interior conditions in their centers; 3) stream corridors, which can double as a strip corridor for the migration of interior species, and even better including upland habitat for refuge in floods; 4) networks in which corridors intersect and anastomose. Noss (1985) combines the ideas of reserve, buffer, and corridor to develop the MUM (multiple use module), which consists of a core preserve surrounded by two zones of buffer, connected to other such buffered core preserves by corridors. He admits that the development and maintenance of such a network requires considerable interagency cooperation.

At their best, corridors would also function as habitat, rather than just as runways between islands of habitat. Small mammals and birds have been observed using hedgerows as an intermediate habitat (Wegner and Merriam 1979) and as breeding grounds even when nearby woodlot also had sufficient breeding ground (Henderson et al. 1985).

Though the concept of corridors may be intuitively satisfying, their efficacy is challenged. Say Wilcove et al. (1986): "In terms of linking reserves, the value of corridors per se is debatable...more useful are land practices which allow populations of many target species to exist at least marginally in the surrounding habitat. These populations can then diffuse into the reserves." Simberloff and Cox (1987) point out some costs of corridors: they may transmit contagious diseases, predators, and by concentrating the passage of animals, facilitate poaching. Also, the financial cost of constructing the corridors may be more than it would cost to manage species by moving individuals between refuges.

Some studies of isolated, unconnected systems below "minimum critical size" seem to show that species loss occurs in a predictable sequence, resulting in similar species composition for similar-sized fragments in the same area (Lovejoy and Oren 1981). Interior species are especially affected. Butcher et al. (1981) looked at a 23-year span of bird census data and saw a decrease in interior species over time for avian populations in Connecticut, due to increasing isolation (by increasing fragmentation) from similar forests during that time. Lynch and Whigham (1984) said that these highly migratory species "tended to be most abundant in extensive stands of mature, floristically diverse forest that were only slightly isolated from sources of potential colonists." Galli et al. (1976) found a pattern of interior avian species' size requirements: red shouldered hawks were present only in forests 10 hectares or larger.

The corridors which could facilitate connections between reserves have a problem compounded by their constricted, linear shape: the effect of the edge. We can view corridors as thin forests with two edges (or perhaps even four in stream corridors); if the corridor is wide enough, there will also be an interior with different species composition. Higher species diversity has been demonstrated at the edge for plants (Levenson 1981, Ranney et al. 1981), small mammals (Johnson et al. 1979) and birds (Anderson 1977, 1979, Chasko and Gates 1982, Kroodsma 1982). Levenson (1981) studied 43 isolated woodlots of various shapes in Wisconsin, ranging from 0.03 to 40 hectares. He found that interior plant species, in contrast to edge species, were self-perpetuating only when the woodlot size exceeded 4 hectares. Ranney et al. (1981) report that in 2- to 4-hectare forests, heavy invasion of edge species' propagules slow the rate of interior development. In such small forests, edge species may replace interior species. In avian populations, an edge opens the forest interior to increased predation. Wilcove (1985) found that the faunal edge effect of increased nest predation extended up to 600 meters into the interior. Predation rates were also higher in suburban woodlots than in rural woodlots. Rates of predation were 2% in Great Smoky Mountains National Park, 18% in a 905-hectare forest in Maryland, and 48% in a 283-hectare forest riparian corridor. Gates and Gysel (1978) demonstrated smaller clutch size and higher rates of predation near the field forest edge. By all these measures it seems that the interior of corridors may be a fragile environment, requiring great distance from the edge to be considered viable habitat for interior species.

Corridors in fragmented landscapes are constantly bisected by roads, powerlines, sewerlines, backyards, pastures, and other artifacts of man. It is apparently little understood what effect these breaks have in severing the migration potential of the corridors. Schreiber and Graves (1977) showed that mice and shrews could successfully cross powerline right of ways approximately 50 and 100 meters wide. It is self evident that the barrier effect of these breaks is dependent not only on the species' dispersal method but also in the magnitude of the gap. Some breaks may act as filters which allow some species to cross while others cannot.

While connecting corridors are not a substitute for large reserves, they can enhance survival and recolonization within the overall region. Local extirpation is inevitable for small populations, and recolonization from other nearby or connected areas is facilitated if the habitat is not completely severed between population units (Fahrig and Meeriam, 1985; Harris, 1984; MacClintock et al, 1977).

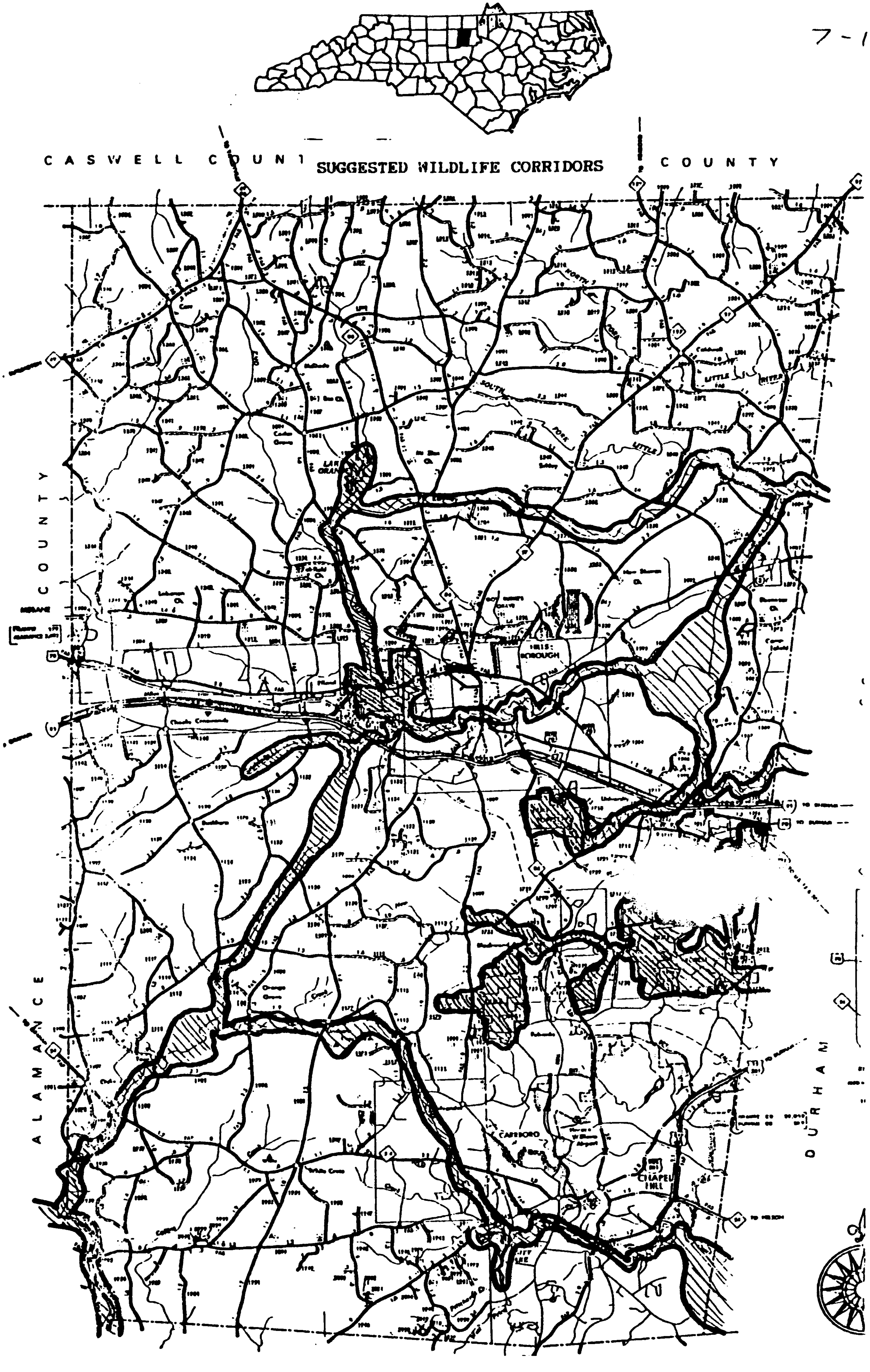
The linear nature of corridors, however, generally limits their ability to serve as refuges in and of themselves. The main problem is the extent of the edge effect in these narrow strips. Where they are wide enough, in effect serving as oblong preserves, the problem is minimal, but even narrow strips are useful to some degree, so long as they are continuous. On the other hand, the utility of even wide connecting links is offset when additional disturbance effects are concentrated within them, such as created by sewer and power lines, and developed or paved greenways. Where such disturbance is present, more land is needed for the wildlife right of way.

Within Orange County, these ideas apply both to small isolated animal populations as well as larger, more mobile groups. Disjunct groups are by definition located too far apart for inter-population movements to be much of a factor; the inability to link such populations by means of dispersal corridors further means that the only conservation option left is to preserve as many and as large populations as possible.

An example of this situation is provided by the relict population of brown elfin butterflies (Incisalia augustus) isolated on the top of Occoneechee Mountain (E06). This animal species is closely tied to the unique pine-oak-heath plant community. The butterfly has been able to survive over thousands of years of isolation due to the extensive amount of heath on this monadnock. Although a remnant of the plant populations can probably be conserved on less space than it currently occupies, this is less likely to be true for the butterfly; the survival of this isolated population into even the next century depends on conserving as much of its habitat as possible.

Red-backed salamanders and Mesomphix snails are also associated with a particular habitat characterized by an unusual plant community, but are not tied to the plants themselves. Like the catawba rhododendrons and other montane plant disjuncts, these animals are probably relicts from the ice-age, surviving only in the coolest and dampest situations within the county. Their populations extend all along the north-facing bluffs, further than limits of the plant members of the community. In considering the amount of space needed for the animals, simply providing protection for the area occupied by the rhododendrons is insufficient.

Still other disjunct animal species are not tied to any distinctive plant community at all, and their preservation depends on determining their spatial requirements directly. This group includes most obviously such species as the Thorey's grayback dragonfly (Tachopteryx thoreyi) and the four-toed salamander (Hemidactylium scutatum), as well as other species inhabiting springs and seeps. Although they are not quite as isolated as the montane disjunct species mentioned above, care must be given to preserving their fragile bottomland habitats: the springs themselves plus migration corridors along brooks and streams. Sewer lines and lowered watertables due to increased well use are major factors limiting these communities. Ground water contamination may become increasingly important as time goes



SUGGESTED WILDLIFE CORRIDORS
CASWELL COUNTY
COUNTY
ALAMANCE COUNTY
DURHAM
HILLSBOROUGH
CARRBORO
CHAPEL HILL

on; these species have evolved within particularly clean aquatic habitats and may be consequently much more susceptible to pollution than other organisms.

For the majority of our wilder and more mobile animal species, large refuges linked by riparian or upland corridor systems offer the best chance for their continued survival in our area. It is not surprising that our best wildlife areas are the UNC Mason Farm Biological Reserve, the Korstian and Blackwood divisions of Duke Forest, and the Eno River State Park. All of these are not only protected from hunting but have enough area, diversity of habitats, and wide connecting corridors to other such areas to have thriving populations of even such scarce, large animals as otters, bobcats, or wild turkeys.

Although these large refuges currently serve as major reservoirs of wildlife in the county, by themselves they are still insufficient to guarantee the survival of wildlife throughout the county, especially given the current rate of urbanization. Other areas, such as Occoneechee Mountain, Pickards Mountain, Poplar Ridge and the hills around Cane Creek Reservoir have the same potential if accorded similar protection, and if included within a network of refuges and corridors might possibly provide enough habitat to allow many of our species to persist into the future.

Suggested Wildlife Corridors

The map on the following page shows the suggested network of wildlife corridors for Orange County. These "wildlife corridors" are areas that should remain undeveloped in order to function as wildlife habitat, in contrast to "greenways", which are developed specifically for recreational use. Suggested greenways are presented after the discussion of corridors.

The major wildlife corridors that we are proposing follow the drainages of our larger streams. These streams connect to larger wildlife areas:

1) Cane Creek to Haw River and Jordan Lake further downstream

2) Morgan Creek to Jordan Lake

3) New Hope Creek to Jordan Lake

4) Eno River to Falls Lake

5) Little River to Falls Lake

Upland areas that would connect these drainages include:

1) Pickards Mountain (site M01) to connect Cane and Morgan Creeks

2) Crabtree Uplands (site E02) to connect Cane and Sevenmile Creeks

3) Upland area along NC 86 east of Lake Orange, to connect Eno River to Little River via Forrest Creek

4) Upland area north of Buckwater Branch to connect Little River and Buckwater Branch - Eno River

This web of corridors would embrace the following sites or groups of sites that we have identified in our report, thus forming an optimum system of refuge nodes and connecting corridors:

i. Eno River Refuge System

(1) Eno River State Park
(2) Eno River Uplands
(3) Eno River Mesic Slopes
(4) Poplar Ridge
(5) Occoneechee Mountain
(6) Duke Forest along the Eno
(7) Sevenmile Creek
(8) Crabtree Uplands

ii. Little River Refuge System

(1) Forrest Creek Beaver Pond

iii. New Hope Creek Refuge System

(1) Korstian Division and New Ho[illegible] Bottomlands
(2) Currie Hill and Camp Pi[illegible]
(3) Oosting Natural Area
(4) Blackwood Divsion of D[illegible]
(5) Steep Bottom Branch

iv. Morgan Creek Refuge System

(1) Morgan Creek Swamp and Jordan Lake
(2) Mason Farm
(3) Laurel Hill
(4) Morgan Creek Valley
(5) University Lake
(6) McCauley Mountain
(7) Pickards Mountain

v. Cane Creek Refuge System

(1) Haw River
(2) Lower Cane Creek
(3) Reservoir and surrounding slopes
(4) Crabtree uplands and Pickards Mountain

Width of corridors.

We recommend that wherever possible the width of these stream corridors to be 200 meters (100 meters on each side of the stream). This width is based on data given in studies of persistence of forest interior vegetation in isolated woodlots (Levenson 1981) and nest predation (Wilcove 1985) and other studies of corridors and forest edges reviewed above. Levenson (1981) found that in forests less than four hectares in size, plant species of the forest interior were replaced by weedier species of forest edges. A 200 by 200 meter block of forest is four hectares, and thus we recommend that a 200 meter wide strip of corridor be maintained. Wilcove (1985) found that nest predation extended up to 600 meters from the forest edge into the interior. Thus, our 200 meter width is thus offered as a minimum, to be expanded wherever possible around more significant sites. This width should also be considered when providing buffer area around other sites outside of the corridor system.

SECTION 2 EXISTING AND EMERGING CONDITIONS

INTRODUCTION

Demographic and geographic information relating to Carrboro and the Study Area has been reviewed in order to gain an understanding of the nature of current developments and activities in the Study Area. Additionally, various town departments, such as planning, recreation and parks, fire, police, and public works have been consulted in order to better understand the types and sizes of facilities needed to accommodate projected development and population growth in the Study Area. This section is divided into two sub-sections. The first sub-section, *Existing Conditions*, describes natural features, development characteristics, and demographic features which currently exist in Carrboro and the Study Area. The second sub-section, *Emerging Conditions*, describes anticipated changes that would affect natural features, the form and character of development, and demographic features in Carrboro and the Study Area.

EXISTING CONDITIONS

Boundaries of the Study Area

The boundaries of the study area are Carrboro's joint planning jurisdiction line to the north, and Carrboro's Town Limits to the south. The Carrboro/Chapel Hill joint planning jurisdiction line serves as the boundary to the east. It begins north of Eubanks, follows Rogers Road to Homestead, then proceeds southwest on Homestead Road to High School Road and finally turns south and east to the railroad right-of-way. A primary ridge line serves as the northwest boundary line just east of Union Grove Church Road down to Dairyland Road, where the road serves as the boundary heading southeast until it intersects, and Old 86 serves as the boundary then turning southeast and running along Hillsborough Road to Greensboro Street.

NATURAL FEATURES

General Description

The Study Area is fairly rural and undeveloped, although there are several established neighborhoods in the area. It is a typical rural landscape in the Piedmont area of North Carolina, with rolling hills covered by a mixture of heavily wooded areas and open meadows and pastures. The area contains many steep slopes along numerous streams and creeks that flow into the Bolin Creek watershed. Bolin Creek meanders through and generally bisects the study area from the northwest to the southeast.

Carrboro's planning jurisdiction is approximately 12 square miles (7,747 acres) in size and consists of several subareas described in the following table (Table 2-1):

TABLE 2-1 Carrboro Planning Jurisdiction Subareas in Square Miles & Acres

Sub Area	Square Miles	Acres	percent
City Limits	4.3	2,780	36
University Lake Watershed	2.7	1,709	22
Transition Area 1	2.0	1,333	17
Transition Area 2	2.3	1,475	19
ETJ	0.7	450	6
TOTAL	12.0	7,747	

Unique Natural Areas

Unique natural areas are places with an unusual or exemplary biological habitat, geologic feature, or hydrological location. One such location is Meadow Flats, a wetland which reaches from the north into a small portion of Carrboro. Wetlands perform many important functions, such as recharging groundwater, naturally filtering pollutants, and providing cover for wildlife development. Other biologically significant fauna and flora sites in the study area can be found at the northern end of Lake Hogan Farm Road and north of Calvander on Old NC 86. The primary environmentally sensitive area in the study area is the Bolin Creek floodplain. The most environmentally sensitive areas are found along Bolin Creek, its tributaries, and associated floodplains.

Water Resources

The major stream corridor in the study area is Bolin Creek, which continues through Chapel Hill, ultimately flowing into Jordan Lake. Bolin Creek and the numerous smaller stream beds in the study area will significantly constrain development. There are three primary drainage basins in Carrboro: the Study Area is within the Bolin Creek Basin, Central and Southern areas of Carrboro are within the Morgan Creek Basin, and the Upper Morgan Creek basin flows into the University Lake watershed. The Upper Bolin Creek basin is classified by the State as a protected water supply watershed.

Soils and Slopes

Most of the area contains soils that are suitable for development or have moderate constraints. A majority of the study area contains slopes of less than 8 percent, making it quite suitable for development. Slopes of 8 to 15 percent pose moderate development constraints. These slopes are found primarily along Bolin Creek and its tributaries. Slopes between 15 and 25 percent, which are considered to have severe development constraints, are relatively isolated. A few slopes in excess of 25 percent exist in the study area. These slopes are essentially undevelopable. Elevations in the study area range from 500 to 630 feet, with Big Hill (elevation 630 feet), being the highest peak wholly contained within Carrboro's jurisdiction.

Primary and Secondary Conservation Areas

Primary Conservation Areas consist of places identified as regulated wetlands, floodplains and slopes with a grade greater than 25 percent (a 25-foot vertical change or rise for every 100 feet of horizontal run).

Secondary Conservation areas include elements of natural landscape that deserve to be separated from clearing, grading, and development such as: Mature deciduous woodland, prime farmland in fields, meadows and pastures, wildlife habitats/travel corridors, historic/cultural features and scenic viewsheds from public roads across existing fields/meadows/pastures.

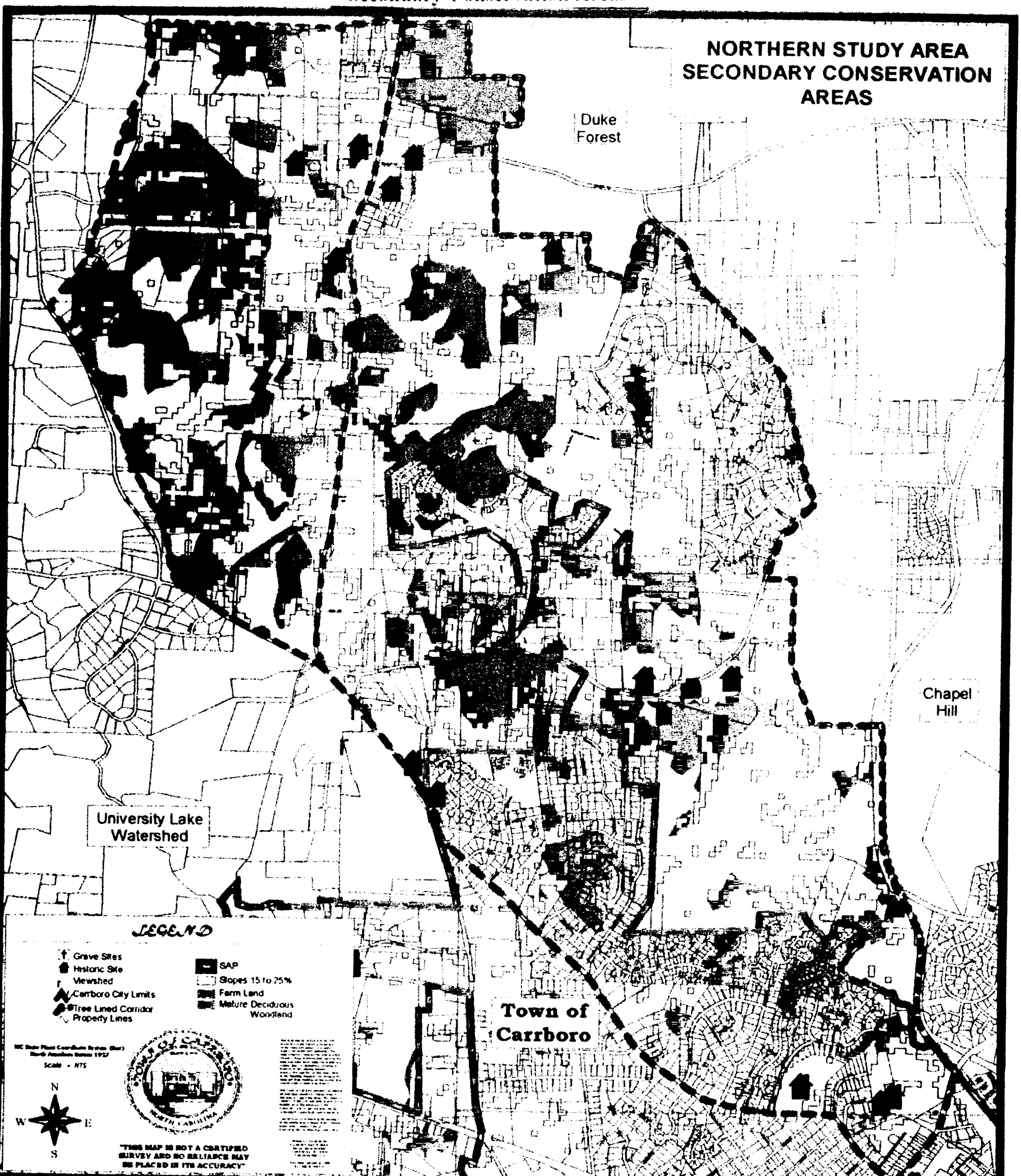
The Primary Conservation Area is shown on Map #3 and the Secondary Conservation Area is shown on Map #4. The following table provides the approximate amount and percentage in each conservation area.

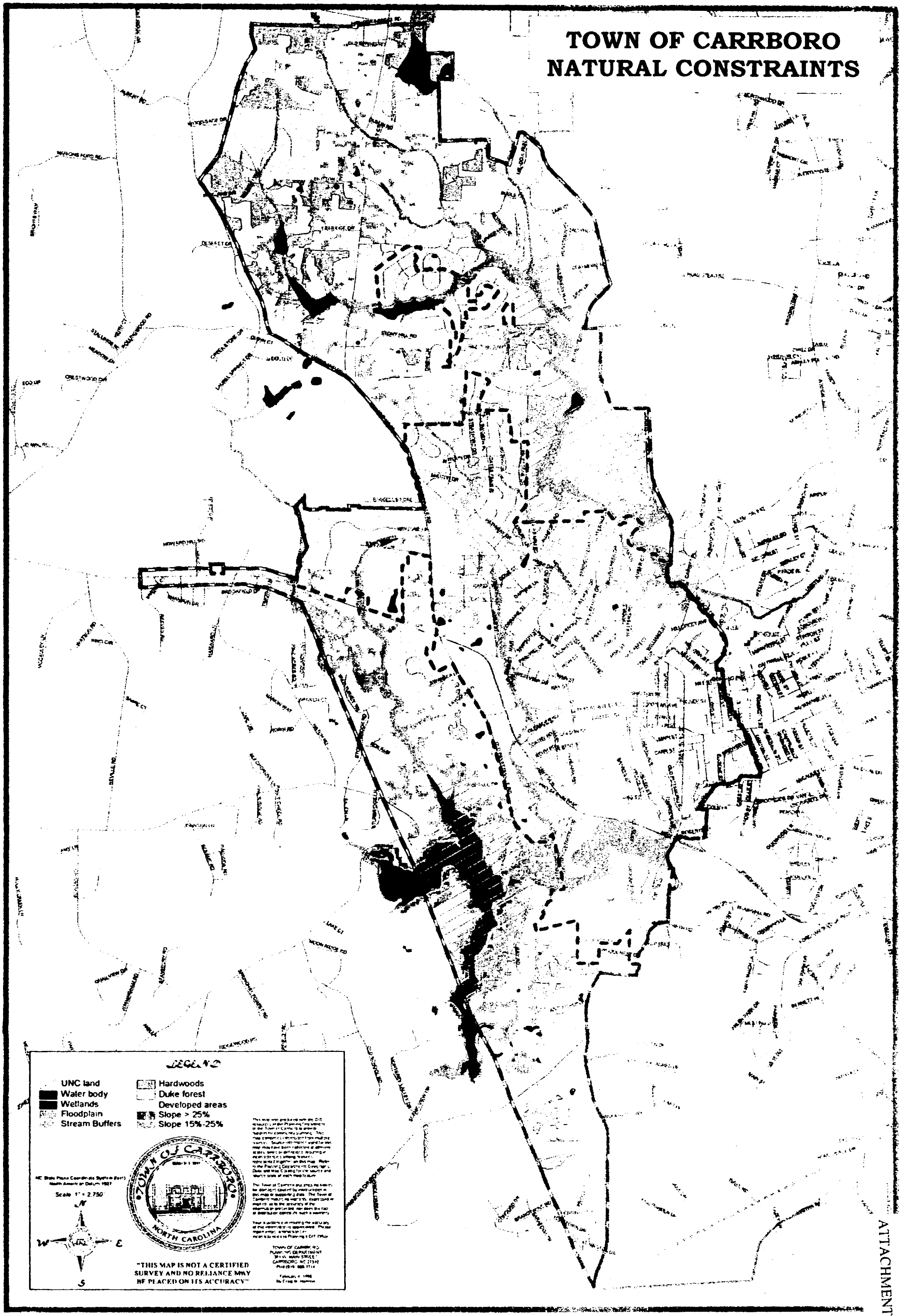
TABLE 2-2 Primary & Secondary Conservation Areas

Small Area Planning	Total Acres	Developed Acres	Undeveloped Acres	Percent Undeveloped
Northern Study Area	3787.05	1645.73	2141.32	57%
* Study Area Primary	423.19	154.91	268.28	13%
Transition Area 1 - Primary	218.23	102.41	115.82	15%
Transition Area 2 - Primary	115.93	25.14	90.79	9%
Study Area in City and ETJ Primary	89.03	27.36	61.67	18%
**Study Area Secondary	1649.39	746.54	902.85	42%
Transition Area 1 - Secondary	593.02	275.17	317.86	40%
Transition Area 2 - Secondary	704.29	299.70	404.59	40%
Study Area in City and ETJ Secondary	352.08	171.68	180.40	52%
*Primary conservation areas consist of: wetlands, flood plains and ground slopes of 25 percent or greater.				
**Secondary conservation areas consist of: mature hardwood forest, prime farm land in fields, meadows, pastures and wildlife habitats and corridors.				
T1 Combined Conservation Areas	811.25	377.58	433.67	55%
T2 Combined Conservation Areas	820.22	324.84	495.38	50%
Study Area in City and ETJ – Combined	441.11	199.04	242.07	70%

SOURCE: Town of Carrboro, Planning Department & Orange County Land Records, 1997

MAP #4:
Secondary Conservation Areas





ATTACHMENT 9

ATTACHMENT 10

A LANDSCAPE WITH WILDLIFE FOR ORANGE COUNTY

Livy Ludington

Steve Hall

Haven Wiley

TRIANGLE LAND CONSERVANCY

1997

A LANDSCAPE WITH WILDLIFE FOR ORANGE COUNTY: A Summary

Three centuries ago the hills and river bottoms of Orange County were covered with extensive hardwood forests. These forests provided habitats for most of the County's native species of wildlife. Today much of Orange County is dominated by agricultural and urban habitats created by humans, and the wildlife familiar to most people are the species that have adjusted to these environments. Nevertheless, most of Orange County's native wildlife still depends on large areas of continuous undisturbed hardwood forests in order to survive. Large areas are important because many species inhabit the forest interior.

> Hardwood forests provide habitat for wildlife, clean water, flood control, quiet retreats, and, not least of all, the characteristic vistas of Orange County.

Species that we will lose unless we protect these forests include Scarlet Tanagers, Hooded Warblers, Whip-poor-wills, Pileated Woodpeckers, Red-shouldered Hawks, Wood Ducks, Bobcats, Flying Squirrels, River Otters, Box Turtles, and Marbled and Spotted Salamanders, and many others. In addition to habitat for wildlife, these forests provide clean water, flood control, quiet retreats, and, not least of all, the characteristic vistas of Orange County.

Using the most recent complete aerial photography (1988), we identified all areas in Orange County with predominantly hardwood forests, mixed forests, and pine forests. Forests greater than 40 acres in size were further divided into those that were largely undisturbed by human activities, those slightly disturbed, and those significantly disturbed.

The forests important for wildlife are hardwood and mixed forests at least 40 acres in size with no or with only slight disturbance by human activities. In 1988 these prime forests covered nearly 90,000 acres of Orange County, although most of this acreage was in tracts less than 100 acres in size. Building permits issued between 1988 and 1996 show that at least 10% of these forests have been lost or reduced in size in the past nine years.

The remaining prime forests, together with the significant natural areas identified in the *Inventory of Natural Areas and Wildlife Habitats in Orange County* (1988), constitute Core Areas in a landscape with wildlife in the future. To prevent the fragmentation of forests, the landscape must also include **buffers and connections** between the Core Areas. Forested river corridors are particularly important. We should act now if we want to keep forests and native wildlife for the future.

There is no single way to protect and rehabilitate Orange County's forests and river corridors. It will take different approaches in different situations. It will take the efforts of many citizens and businesses, as well as local governments. The Orange County Board of Commissioners will need clear and fair policies for development and conservation and must take steps to set priorities for the Core Areas identified in this study. We should not take our Whip-poor-wills and Box Turtles for granted. Unless we plan for a Landscape with Wildlife in the future, we will lose our chance.

10-3

IDENTIFYING CORE AREAS FOR WILDLIFE IN ORANGE COUNTY

Many significant natural areas in Orange County have been identified previously in The Inventory of Natural Areas and Wildlife Habitats of Orange County (1988). These areas are crucial to any plan for keeping healthy populations of forest-inhabiting animals and birds. The present inventory complements this earlier one by collecting new information about the status of hardwood forests in the county. The high-priority sites identified in 1988 overlap partially with the remaining large tracts of prime forest identified in the present inventory. Together these sites constitute the Core Areas for a landscape with wildlife, Map III (Core Areas in a Landscape With Wildlife, page 18). All are worth protecting.

Some, but not all, of these sites are currently protected in the Eno River State Park, Duke Forest, and the N. C. Botanic Garden's Mason Farm Biological Reserve. Plans are in progress to protect a few others, notably Occoneechee Mountain. Eno River State Park, Duke Forest and Mason Farm Biological Reserve all continue across county boundaries (the latter adjoins the New Hope Gamelands) and are thus components of a regional landscape with wildlife.

Some identified natural areas include hardwood forests that are too small to support area-sensitive species, although they might nevertheless have great importance for other scarce plants and animals. Some protected forests are rapidly becoming islands within a context of human-dominated lands and without connections to other forested lands.

These Core Areas, however, are not enough to assure that the native forest-inhabiting wildlife of Orange County can persist. Some identified natural areas include hardwood forests that are too small to support area-sensitive species, although they might nevertheless have great importance for other scarce plants and animals. Some protected forests are rapidly becoming islands within a context of human-dominated lands and without connections to other forested lands.

Essential parts of any plan for wildlife are buffers and connections between the Core Areas. Map IV (Buffers and Connections in a Landscape With Wildlife, page 20) shows that 500-foot buffers are sufficient to unite large tracts of nearly continuous prime forest in Orange County. Although not included on this map, pine forests can also provide corridors for movement and repopulation by animals in hardwood forests. Pine forests also make good buffers for hardwood forests, and eventually, provided they are left undisturbed, they will become hardwood forests. In Orange County, tracts of hardwood forests that retain their connections and proximity to each other are essential components of a landscape with wildlife.