

NATURAL RESOURCES BIODIVERSITY

A. Introduction

When Spanish anchors first dropped into Florida waters nearly 500 years ago, Florida was essentially one large nature preserve that also supported a population of about one million native Americans. Wildlife at this time roamed freely across 35 million acres in search of food, shelter, and water, while individual human settlements covered less area than most modern-day parking lots. The state's road system in pre-Columbian times consisted of narrow foot paths that were used by panthers, bobcats, red wolves, and black bears as frequently as by native Americans, and the few human edifices present quickly gave way to a surrounding landscape consisting of tall, majestic trees, most hundreds of years old, and extensive open prairies and marshes (Cox et.al., 1994).

Florida is widely recognized as one of North America's most important reservoirs of biological diversity. The state's warm climate, ample rainfall, geologic history of multiple sea level fluctuations, diversity of habitats, and close proximity to the tropics create a unique environment that harbors myriad biological rarities. Nearly 700 vertebrate species and 4,000 plant species are found in Florida (Jue et.al. 2001). At least 17% of Florida's vertebrates, 410 invertebrates and about 300 plant species are thought to be endemic (Cox et.al., 1994). This means that they are found nowhere else in the world, which conveys a weighty responsibility: our conservation and management activities are of global importance in efforts to conserve the diversity of life on Earth.

In 1991, plant communities in Alachua County included approximately 150,000 acres of pinelands, 108,000 acres of grassland, 93,000 acres of swamp, marsh and open water, 72,000 acres of hardwood hammocks and forests, and 7,000 acres of sandhill (Elert, 1991). Unfortunately, Alachua County has lost much of its natural habitat to urban, agricultural and industrial development, both before 1991 and in the decade since. Although wetland protection laws passed in recent years have slowed the destruction of wetland habitat, the overall trend still continues in the case of mesic and xeric (upland) habitats.

Natural communities constitute habitat for a large number of wildlife species in Alachua County. Among vertebrate species (mammals, birds, reptiles, amphibians, and fish), there are 417 species native to the area and 21 species that were introduced (EAR, 1998). Representing over 60% of the species of vertebrates identified in the entire state of Florida, the presence of 438 different species in Alachua County represents a high level of diversity reflecting a wide variety of habitat and climatic types in this area. This is a significant natural and recreational resource for the . In addition, terrestrial caves provide important habitat for southeastern bats, and the wetlands and surrounding areas in south Alachua County are critical areas for sandhill crane and the southern bald eagle. Other species in need of habitat protection include gopher tortoise, eastern indigo snake, tiger salamander, limpkin, blackbanded sunfish and the Florida black bear.

Today, many species of wildlife are caught in a state of siege as the habitats needed to sustain their populations rapidly disappear. In just the last 50 years more than 8 million acres of forest and wetland habitats in Florida (about 24% of the state) were cleared or filled to accommodate an expanding human population (Cox et.al. 1994). This area is 16 times larger than our state's largest national forest and exceeds the total land area found south of approximately Port Charlotte. Florida's population exceeded

15 million people in 1999. As Florida's human population continues to grow towards an estimated 20 million residents by the year 2025, increasing demands will be placed on our remaining natural systems, and wildlife populations will be forced into smaller and smaller areas as a result. In an analysis of the country's most endangered ecosystems, Florida was identified as the state most at risk of losing its native habitats (Noss and Peters, 1995).

If diverse wildlife populations are to persist in the face of such sweeping changes, we must conserve a base of habitat that is sustainable far into the future. This habitat base should consist of preservation areas that are publicly owned and managed primarily for natural conditions, but it must also include private lands that allow natural resources to be conserved without sacrificing all private uses of the land. The next decade represents a critical turning point in efforts to conserve habitat for several rare, threatened, and endangered species. If we fail to act now, the chances of successfully maintaining species such as the Florida black bear and others will diminish greatly. Future Floridians will ultimately hold our generation responsible for the manner in which we conserve the species and natural resources that we inherited.

Conservation of habitat is an important part of protecting wildlife. In November 2000, the voters of Alachua County approved a \$29 million bond issue to fund the acquisition of environmentally significant lands for protection as natural areas and open space. Management plans will be developed for natural areas acquired with these funds. Long term management and maintenance of the sites are important in order to ensure that the natural resources and values of these lands are protected and maintained. Dedicated funding sources will be an integral part of providing the necessary maintenance and management of natural areas.

In addition to acquisition programs, the regulatory process plays a vital role and is an important factor in the County's efforts to protect natural areas and maintain the County's natural resources. The destruction and degradation of native vegetation and wildlife habitat through various forms of land alteration, water table lowering, and the quality of water entering these areas are major threats to the County's native vegetation and wildlife populations. Once lost, the plant and animal species diversity, groundwater recharge capacity, recreational and educational opportunities are irretrievable. The decline in health and natural diversity of our natural resources signals the need for continual protection and restoration efforts. Objectives specifically focused on biodiversity and strategic ecosystems seek to protect natural areas and to preserve the diversity of habitats in Alachua County.

B. Importance of biodiversity

1. What is biodiversity?

Biodiversity (biological diversity) is, in essence, the full array of life on Earth. The most tangible manifestations of this concept are the various species of plants, animals, and microorganisms that surround us. Yet biodiversity is more than just the number and diversity of species. The concept also includes the genetic variation within a given species of plant or animal. At a higher level, it includes the natural communities, ecosystems, and landscapes of which species are a part. The concept of biodiversity includes both the variety of these things and the variability found within and among them. Biodiversity also encompasses the processes – both ecological and evolutionary – that allow life on Earth to continue adapting and evolving. The Nature Conservancy describes three of the principal levels of biological organization as species, ecosystems, and landscapes (Stein et.al. 2000).

Species diversity encompasses the variety of living organisms inhabiting an area. This is most commonly gauged by the number of different types of organisms – for instance, the number of different birds or plants in a state, region, or ecosystem. While this is the most easily grasped aspect of biodiversity for most people, it is actually populations or “bands” of species in a geographic area and their interactions that together are the focus of on-the-ground conservation efforts. By extension, this concept includes the interactions of “populations of populations.”

Ecological diversity refers to the higher-level organization of different species into natural communities, and the interplay between these communities and the physical environment that forms ecosystems. Interactions are key to ecological diversity. This includes interactions among different species – predators and prey, for instance, or pollinators and flowers – as well as interaction among these species and the physical processes, such as nutrient cycling or periodic fires, that are essential to maintaining ecosystem function.

Landscape diversity refers to the geography of different ecosystems across a large area and the connections among them. Natural communities and ecosystems change across the landscape in response to environmental gradients such as climate, soils, moisture, or altitude and form characteristic mosaics. Understanding the patterns among these natural ecosystems and how they relate to other landscape features, such as farms, cities, and roads, is key to maintaining such regional diversity.

There is an old saw amongst ecologists that “diversity breeds diversity.” Conservation of biodiversity requires attention to each of these levels, because all contribute to the persistence and variety of life on Earth. More than most people realize, humans rely on wild biological resources for food, shelter, medicine, and essential life processes. Everything, one quickly begins to understand, really IS connected to everything else.

2. Why is biodiversity important?

The importance of maintaining the varied elements that comprise Florida’s biodiversity can be measured along many scales. Foods, medicines, and other products from living organisms are essential to human existence. Genes from wild plants, for instance, allow plant breeders to develop disease resistant crops or increase crop yields, passing along the benefits of biodiversity to farmers and ultimately consumers. In addition, approximately 1,500 new compounds are discovered each year from wild plants, and about 300 of these have potential use in medicine (Cox et.al. 1994). From the most obscure to the most common organisms, surprises abound. A relative of the rare Florida yew, for example, offers the greatest hope of any new discovery in the treatment of certain cancers. In 1960, a child with leukemia had a 1-in-5 chance of remission. Now, thanks to anti-cancer drugs developed from a compound discovered in wild periwinkle plants, the same child's chance of survival has increased to 80% (Myers, 1992).

Biodiversity not only provides direct benefits like food, medicine, and energy; it also affords us a "life support system." Biodiversity is required for the recycling of essential elements, such as carbon, oxygen, and nitrogen. It is also responsible for mitigating pollution and floods, protecting watersheds, and combating soil erosion. A one-acre patch of elm trees produces oxygen, removes carbon from the atmosphere, and captures at least 16 tons of airborne dirt, which rain then washes back to the ground as productive soil (Myers, 1983). Because biodiversity acts as a buffer against excessive variations in weather and climate, it protects us from catastrophic events beyond human control (McNeely et.al. 1990). We have learned that the future well-being of all humanity depends on our stewardship of the Earth. When we over-exploit living resources, we threaten our own survival (National Research Council, 1992).

A diverse natural environment also plays an important economic role. In 1991, recreation associated with wild birds alone generated nearly \$20 million in economic activity and 250,000 jobs in the United States, exceeding many Fortune 500 companies (IAFWA and USFWS, 1995). U.S. parks brought in \$3.2 billion from visitors in 1986 (WRI et.al, 1992). That same year, tourism in Kenya amounted to \$400 million. In that country, the economic value of viewing elephants alone totaled \$25 million in 1989 (Pearce and Moran, 1994). These large economic revenues reflect the high value people place on recreation involving biodiversity.

More than 67% of Florida's residents participated in non-consumptive natural resource activities such as bird watching, nature study, canoeing, and hiking in 1985, contributing \$1.3 billion to the economy (USFWS 1997). In addition, consumptive activities like hunting and fishing contributed about \$3.8 billion, for a combined total of approximately \$5.2 billion. At the time, this was the second largest industry in Florida, and every indication is that this industry has expanded considerably in the years since (Duda, 1987 and Cox et.al. 1994).

Plants, animals, and natural landscapes have beneficial effects on human health and well-being. The conservation of natural areas and wildlife populations provides us with many unparalleled experiences: the sight of a bald eagle soaring above rivers and lakes; the mysterious night sounds of barred owls and limpkins that slip from swamps and sloughs; the pursuit of fish and game in remote wilderness areas; the fresh, clean smell of pinewoods on a spring morning or the sharp, pungent aroma of a rosemary scrub. These and other experiences found only in the natural world quench a deep-seated human thirst for natural aesthetics and renew our links to the world around us. The very things we cherish will be lost if we don't make some hard decisions.

3. Rates of species extinction are unprecedented

Not since the disappearance of the dinosaurs has the rate of species extinction, the most common measure of biodiversity loss, been higher. Harvard biologist E.O. Wilson projects that, within the next 25 years, one of every five species will die out, unknown to our grandchildren (Sierra Club, 1998). Virtually all of the loss is caused by human activities, mostly through habitat destruction and over-hunting. In the contiguous United States, 98% of virgin forests have been destroyed, and 54% of wetlands have been lost (Noss, 1994). Over the past 500 years, 200 species of plants and 71 species and sub-species of vertebrates have become extinct in North America alone; another 750 species are officially listed as endangered or threatened. Unfortunately, only 13% of the approximately 14 million species that inhabit the Earth have been described by scientists (Suplee, 1995). With increasing human pressure on biological resources, rates of extinction can only be expected to accelerate.

In the past few decades, it has become obvious both nation-wide and state-wide that there were dwindling numbers of certain animal and plant populations. In Florida, native species such as the wood stork, the burrowing owl, and the Florida panther have suffered serious population reductions. These species are not the only ones that have suffered, however. Federal and state agencies list 167 species of wildlife and plants in Alachua County as endangered, threatened, species of special concern, or have the potential to be commercially exploited. This includes over 70 species of plants, 100 species of vertebrates excluding mammals, 12 species of mammals, and 38 species of invertebrates (EAR, 1998).

C. Human impacts upon biodiversity

The Nature Conservancy, Sierra Club, and FFWCC describe three overarching reasons for the decline of wildlife populations in Florida (TNC 2000, Sierra Club 1998, Cox et.al 1994). Habitat destruction, degradation, and fragmentation is documented as the foremost cause; the resultant loss of feeding and nesting sites has severely impacted bird and animal populations. Direct exploitation and human, or anthropogenic, disturbances are cited as the two remaining factors. The discussion below is based primarily on reports by The Nature Conservancy, Sierra Club, and FFWCC.

1. Habitat destruction

Habitat destruction and degradation is at least part of the reason why more than 95% of listed species are imperiled nationwide (Flather et.al. 1994). According to the Sierra Club, studies show that logging affects approximately 14-17% of listed species throughout the United States, grazing impacts 19-22%, water development affects 29-33%, recreation affects 23-26%, and mining impacts 14-21% (Sierra Club 1998). In Florida, only a few thousand acres remain of several important natural communities (Cox et.al. 1994). If we are to maintain current diversity, our system of conservation areas must be capable of supporting thousands of species on only a fraction of the original land base.

Loss of habitat is reaching critical proportions in many parts of the state, including Alachua County, for certain species. Two examples of this phenomenon in Alachua County are the red-cockaded woodpecker and the flatwoods salamander. The red-cockaded woodpecker, a federally “endangered” species whose favored habitat is old growth longleaf pine forests, is considered functionally extinct in Alachua County as recently as the 1990s. The lone male animal, under federal permit, was relocated to the Ocala National Forest a few years ago (M. Drummond, 2001). The flatwoods salamander, which uses the same habitat as the red-cockaded woodpecker, was proposed by the US Fish & Wildlife Service for listing as a threatened species as recently as December 1997. Its habitat is longleaf/slash pine flatwoods, which is being lost or degraded by agriculture, urbanization, and plantation pine silviculture, mostly the last.

2. Habitat fragmentation

In addition to outright habitat loss, other problems stem from the fragmentation of our remaining patches of natural habitat. Habitat fragmentation refers to the tendency for remaining patches of habitat to become reduced in size and increasingly isolated from one another as land is cleared. This creates problems since some species range widely and require large tracts of habitat to survive. As patch sizes fall below the minimum areas needed to sustain a breeding population, a species will likely disappear in areas that otherwise have appropriate vegetative conditions (Cox et.al. 1994). As habitat is lost, the remaining patches tend to become farther and farther away from each other. Small habitat fragments also tend to have a greater percentage of edge habitat when compared with larger habitat fragments (see Shafer 1990). Edge habitats near urban and residential areas are characterized by decreased survival and reproduction owing to increased predation, collisions with vehicles, and nest parasitism, as well as fundamental changes in habitat such as species composition and habitat management procedures (Ambuel and Temple 1983, Harris 1984, Janzen 1983, Doren et.al. 1987).

As developments sprout into the rural area and we pave long stretches of our open countryside in order to connect them, wildlife is forced into areas unsuitable for survival. Habitats shrink or are isolated from each other, or in many instances are completely eliminated. Cut off from others of their species, with no place to forage, breed and bring up their young, they simply die. Take, for example, the sandhill crane.

They forage (feed) by day in open fields and many of us see them two or three at a time, gracefully stalking their small prey. At night, however, they gather, breed and nest in swampy marshes. Without those areas these birds will not survive.

A regrettably tragic result of this pressure on our wildlife is increased road kill, which has become an increasingly serious threat to wildlife populations in recent years. From 1976 through 1998, for example, nearly 700 bears were killed on Florida's highways. Bear kills have been documented in 45 of the state's 67 counties (FFWCC 1999). That's why we now recognize the need to locate roads to avoid wildlife corridors in the first place. It's also why wildlife crossings are so important on major roads in this County, especially if they cross open land, preservation or conservation lands. The wildlife crossings retroactively installed under US 441 at Paynes Prairie are a good example of the steps that are being undertaken to address this issue in cooperation with the Florida Department of Transportation, Florida Department of Environmental Protection, and other agencies and departments.

3. Direct exploitation

Direct exploitation refers to the use of a wildlife or plant species; for example, hooking gopher tortoises, or harvesting wild orchids. Human disturbances include disturbance of nesting sites. Nest site disturbance threatens the viability of several species of birds, including the bald eagle. Also of significance in Alachua County is the alarming rate of disappearance of bats statewide. Disturbance of roosting sites due to development and vandalism are the greatest threats to Florida's seventeen species of bats. They are one of the most important control factors regarding night flying insects, including many agricultural pests. A single bat can eat up to 3,000 insects in one night (Pasco 2001).

4. Other human disturbances

Other human disturbances include the spread of invasive vegetation; water table reduction (a serious threat to wading bird species such as the wood stork that depend on marshes and seasonal ponds for feeding); fire suppression in habitats such as scrub or scrubby flatwoods, the only habitat in which the threatened scrub jay lives; short-rotation timber management of pinelands that support the red-cockaded woodpecker; and intensive boating in the rivers and lakes in which threatened wildlife dwell.

Wading birds have abandoned many of their former breeding sites within large wetland systems that have been radically altered due to past drainage or flood control practices, or pollution from intensively developed urban and agricultural lands (Sierra Club, 1998). Still other natural habitats have been invaded by non-native plants that often force out native plants species and eliminate appropriate habitat conditions for many native animal species. Endemic species are especially threatened by the invasion of non-native species (TNC 2000).

The suppression of fire has caused the decline of many of our most endangered ecosystems - grasslands, savannas, and open forests. While a commonly held belief is that fire only destroys, in many ecosystems the contrary is true. Fire is actually an integral part of many ecosystems, maintaining natural vegetation. In fact, there are many plant species that require fire to trigger the release of their seeds (Noss and Peters, 1995).

Another problem affecting biodiversity is land management practices on the remaining areas with forest cover. About 35% of Florida's remaining forests are in short rotation, commercial pine plantations. According to the FFWCC, while this management practice is suitable for some wildlife species, it also eliminates many plant and animal species that are normally associated with natural pine forests (Cox et.al.

1994). Numerous studies have demonstrated that dense, intensively site-prepped and managed commercial pine forests are biological deserts when compared to their natural counterparts.

Recreation also takes a toll on wildlife and habitats. Probably the most harmful form of outdoor recreation is the use of off-road vehicles. These vehicles provide access to remote wilderness areas, resulting in the harassment of wildlife and an increase in legal and illegal hunting and trapping. They also result in the killing of wildlife (e.g. crushing of gopher tortoises), acceleration of soil compaction and erosion, pollution of water and air, and destruction of vegetation (Noss and Peters 1995)

D. Status of biodiversity in Alachua County

1. Larger scale: Natural communities

Protecting the full range of biological diversity requires that we have a sound understanding of what ecological systems exist, where they are found, and how they are faring. The following section reviews our current understanding of the ecological diversity within Alachua County and the condition of our ecological resources.

The term "ecological community" refers to an integrated association of plants and animals adapted to and dependent upon a particular environment. In general terms, the natural systems of the County may be divided into three categories: (1) terrestrial, (2) wetland, and (3) aquatic. Each of these categories consists of, and provides habitat for, a wide variety of plants and animals. The natural terrestrial and wetland systems that occur in Alachua County are described below, while aquatic systems are described in the Water Systems portion of the data and analysis. Lists of characteristic plants and animals for each community type are provided in Appendix B. Forests are described as a separate category, as are disturbed/altered communities.

The hierarchical system of classification used is a simplified version of the natural community classification used by the Florida Natural Areas Inventory (FNAI), and includes customized descriptions for Alachua County where available. References used in the compilation of the various community lists and descriptions include Brown and Starnes (1983), Dunn (1982), Duever, et.al. (1987), Florida Natural Areas Inventory (1990), Laessle (1942), Monk (1960, 1965, 1966, and 1968), Pritchard (1982), Snedaker and Lugo (1972), Soil and Water Conservation Society (1989), Golder (1996).

a. Terrestrial/upland communities

The terrestrial communities of Alachua County are those non-wetland, non-aquatic systems that are not subjected to regular and periodic inundation. These upland habitats are dominated by plants that are not adapted to the anaerobic soil conditions imposed by prolonged inundation or saturation. While this includes most of the commercial forest and agricultural areas of the County, the emphasis in this section is on those areas remaining in predominantly native vegetation.

Upland communities provide numerous essentials to the survival of wildlife populations, including food, cover, and nesting habitat. Additionally, terrestrial systems are recognized to provide valuable functions such as, water table and aquifer recharge, wildlife movement corridors, environmental refuges, scientific study, and recreation. Descriptions of these communities are provided in Inset 12.

Inset 12. Upland Communities in Alachua County

Sandhill

When managed with fire, this is a very open, sunny forest of pine and deciduous oak with a grass and wildflower ground cover. Low intensity ground fires occurred naturally every 1 to 3 years before the advent of fire suppression.

The sandhill community occurs on well-drained, deep sands and provides important aquifer recharge sites because the porous sands allow water to percolate rapidly with little runoff or evaporation. Longleaf pine dominates sites that are burned frequently while turkey oak is more prevalent in areas burned less often. The canopy and midstory are relatively open, permitting sunlight to penetrate to the ground. Exclusion of fire promotes the growth of other xeric oaks and the nature of the area changes toward xeric hammock.

The most common variant of this community is dominated by a mixture of longleaf pine, turkey oak and wiregrass. Other trees, only locally prominent, are bluejack oak, sand live oak, sandhill dropseed, blazing star, and bracken fern, and, when fire is not frequent, persimmon.

Characteristic animals include Sherman's fox squirrel, pocket gopher, gray fox, bobwhite quail, Southeastern kestrel (sparrow hawk), red-headed woodpecker, Bachman's sparrow, gopher tortoise, Florida pine snake, and Florida gopher frog.

Sandhill communities are associated with and grade into scrub, scrubby flatwoods, mesic flatwoods, upland pine forest, or xeric hammock.

Sandhill was once abundant in Alachua County, primarily in the southwest. Fire suppression and fragmentation caused by development has severely degraded this habitat throughout its range. Significant remaining tracts have been identified in San Felasco Hammock, Austin Cary Memorial Forest, Morningside Nature Center, Paynes Prairie State Preserve, Oleno State Park, near Watermelon Pond, Kanapaha Prairie, Lochloosa Forest's Palatka Pond tract, and in the vicinity of Moss Lee Lake. Smaller tracts may be found at various locations around the County.

The typical condition in Alachua County now is conversion to a slash pine plantation with remnants of sandhill ground cover flora, a few turkey oaks, and a few gopher tortoises.

Former Sandhill

This sandhill habitat is almost identical to sandhill. It is very open and has most of the same plant species, but has been invaded with water oak, sand live oak, upland laurel oak, and loblolly pine due to fire suppression. When properly managed with fire, this former sandhill habitat will return to the open, sunny sandhill forest of longleaf pine and turkey oak with a grass and wildflower ground cover. Low intensity ground fires occurred naturally every 1 to 3 years before the advent of fire suppression.

Characteristic plants are similar to sandhill with the addition of water oak, sand live oak, upland laurel oak, and loblolly pine.

Scrub

The term "scrub" is normally applied to areas dominated by sand pine or various evergreen trees and shrubs that are adapted to extremely dry conditions. Ground lichens are normally abundant. Herbaceous vegetation is sparse and open patches of barren sand are common.

This community occurs on well-drained, deep sands and burns only infrequently. When a fire does start it is often a crown fire that burns all vegetation to the ground. The heat generated by the fire, however, triggers the release of seeds from the normally closed cones of the sand pine. In addition, many of the shrubs resprout from their root crowns. Because of its loose, easily eroded sands, this is a delicate system that is easily damaged by development and its associated foot and vehicular traffic.

Characteristic animals: spotted skunk, oldfield mouse, Florida scrub jay, rufous-sided towhee, coachwhip, mole skink, and scrub lizard. Other listed animals that occur here are gopher tortoise, Eastern indigo snake, and Florida mouse.

Scrub is associated with and often grades into sandhill, scrubby flatwoods, coastal strand, and xeric hammock.

The scrub community is virtually unique to Florida and is most abundant on the central Florida ridge south of Alachua County. Never a common habitat in the County, it also tends to lack the sand pine canopy so typical of the community further south. There are less than 1,000 remaining acres, with most of these located near Parchman Pond and Prairie Creek. Much smaller tracts can be found at Oleno State Park, Hornesby Springs, Watermelon Pond, and Palm Point Hill.

Xeric Hammock

In general terms, hammocks are woods dominated by broad-leaved, evergreen trees. Xeric hammock is a natural transition from sandhill and scrub habitats in which fire is rare or nonexistent. The canopy varies from open to closed and is dominated by species that are adapted to well-drained, sandy soils but not adapted to fire.

Characteristic plants include sand live oak, saw palmetto, crooked- wood, sparkleberry, beautyberry, scrub beakrush, and bracken fern. Other plants often present include live oak, laurel oak, pignut hickory, magnolia, huckleberry, and deerberry. Herbaceous vegetation is usually sparse and the soil is often covered by a thick layer of oak litter.

Characteristic animals include spadefoot toad and southern hognosed snake. Other animals usually common here include gray squirrel, white-tailed deer, armadillo, Carolina wren, blue jay, and cardinal.

Xeric hammocks often are associated with and grade into scrub, sandhill, mesic hammock or slope forest and, as such, the dividing line is often subtle.

Fire suppression and fragmentation resulting from development are likely serving to increase the acreage of this community in Alachua County. The County's best example is a 240-acre tract in the vicinity of Prairie Creek. Other good examples can be found at Paynes Prairie State Preserve, Oleno State Park, Watermelon Pond, Hickory Sink, Palm Point Hill, and Chacala Pond.

Mesic Hammock/Upland Mixed Forest

Usually called mesic hammock in this area, this is a tall, dense, closed canopy hardwood forest on level to moderately sloping fertile soil. Drainage may range from rather poor to excellent, but there is no flooding. Fire is rare and never intense.

The drier, more sterile areas tend to be dominated by evergreen hardwoods, while the more moist, fertile lands are dominated by deciduous hardwood species. The relatively dense canopy is usually composed of fire-intolerant species such as southern magnolia, live oak, red bay, pignut hickory, American holly, black cherry, pignut hickory, laurel oak, water oak, sweetgum, swamp chestnut oak, white ash, basswood and spruce pine in the overstory, and hop-hornbeam in the understory. Many other plant species are usually present including many kinds of vines such as wild grape, poison-ivy, and Virginia creeper and many shade tolerant herbaceous plants such as violets, spike grass, woods grass, and partridge berry in the ground cover. Loblolly pine is often a common component on disturbed sites.

Common animals include white-tailed deer, armadillo, gray squirrel, wild turkey, pileated woodpecker, red-bellied woodpecker, red-eyed vireo, summer tanager, parula warbler, box turtle, and yellow rat snake.

Mesic hammock often is associated with and grades into upland pine forest, slope forest, xeric hammock or bottomland forest.

While hundreds of small patches of young-growth mesic hammock may be found throughout Alachua County, large old-growth sites are extremely rare. Those found in San Felasco Hammock State Preserve are the best examples. Good examples of this community are at Hornsby Springs, Fred Bear Hammock, Barr Hammock, Buzzard's Roost, Domino Hammock, Kanapaha Prairie, Paynes Prairie State Preserve, Oleno State Park, Serenola Forest, Palm Point Hill, and the Cross Creek area.

Calcarious Mesic Hammock

This comes under the heading of upland mixed forest in the FNAI classification, but is distinct enough in north central Florida to warrant a separate category. The soils are moderately to well drained, sandy with varying amounts of organic matter and sometimes clay, overlying limerock that is near the surface. The forest is a densely shaded hardwood forest of high diversity and usually has a dense and diverse ground cover of herbaceous plants.

Characteristic plants are the same as for upland mixed forest except that laurel oak and water oak are not common and sugarberry, winged elm, shumard oak, and especially redbay are common. Some plants that are largely restricted to this habitat are

soapberry, bluff oak, Florida maple, climbing buckthorn, Godfrey's privet, Carolina buckthorn, silver buckthorn, virgin's bower, and rouge berry.

Sugarfoot Hammock, south of the Oaks Mall, formerly was one of the most diverse, highest quality, old-growth examples of this community in the North-Central Florida region. However, in the 11 years since adoption of the 1991-2011 Comprehensive Plan it has been all but lost to urban development.

Slope Forest

This community, along with mesic hammock, is the most diverse of the upland systems. It is characterized by a dense canopy of mostly deciduous, fire-intolerant hardwoods that occur on steep slopes, bluffs and ravines. While it includes many of the same species that occur in mesic hammock, the densely shaded slopes create cool, moist conditions that are conducive to the growth of some species that are more typical of the Piedmont and Southern Appalachian Mountains such as American beech, red buckeye, sugar maple, bluff oak and basswood.

The soils of slope forests are generally composed of sands, sandy-clays, or clayey-sands with substantial organic matter and, sometimes, calcareous material at the bottom of the slope. Moisture conditions may vary from nearly xeric at the top of the slope to nearly hydric at the foot. As a result of the substantial topographic relief, the soils of this community are subject to erosion. Fire is very rare and never intense.

Characteristic plants are magnolia, beech, spruce pine, shumard oak, water oak, Florida maple, sweetgum and basswood.

Common animals are white-tailed deer, gray squirrel, pileated woodpecker, parula warbler, red-eyed vireo, red-shouldered hawk, and yellow rat snake.

Slope forests often are associated with and grade into upland pine forest or sandhill at their upper elevations, and bottomland forest, seepage slope, or floodplain communities at their lower elevations.

The northwest part of Alachua County contains the southernmost extension of the slope forest community type. Mill Creek has been identified as the County's best example of this system with tracts of lesser quality in Beech Valley and Rocky Creek.

Upland Pine Forest

Upland pine forest is characterized by rolling hills of widely spaced longleaf or, in previously disturbed areas, loblolly pines, with relatively few understory shrubs and a dense ground cover of grasses (wiregrass is often dominant) and herbs. Characteristic plants also include southern red oak, post oak, mockernut hickory, chinquapin, sassafras, New Jersey tea, yellow hawthorn, and rusty blackhaw. Other common plants include bluejack oak, sand post oak, and a great many herbaceous plants.

Frequent fire (every 3-5 years) is necessary to maintain this community as it reduces encroachment by hardwoods and promotes the regeneration of pines and herbaceous

plants. With protection from fire, this community quickly becomes invaded by laurel oak, live oak, water oak, sweetgum, loblolly pine, and many other hammock species.

The soils of this community type are generally sandy with variable amounts of clay. The presence of clays helps to retain soil moisture, and results in more mesic conditions than might be expected of areas dominated by longleaf pine and wiregrass. For this reason, upland pine forest succeeds to mesic hammock in the absence of frequent fire.

Characteristic animals are the same as for sandhill. Indeed, these two habitats have historically been placed together in one main category called high pine.

While common in the Panhandle and further north, upland pine forest is restricted to Alachua and Marion Counties in peninsular Florida and is disappearing rapidly due to fragmentation and fire suppression. Hickory Sink used to be Alachua County's best example of this community type, but is now largely degraded by conversion to pine plantation. Other degraded remnants can be found in Serenola Forest, Domino Hammock, and Kanapaha Prairie.

Sinkhole

Sinkholes usually are characterized as cylindrical or conical depressions with steep limestone walls. They are most common in karst areas where the underlying limestone has been riddled with solution cavities. When water tables drop, the cavern roof is no longer supported by water pressure and portions of it collapse resulting in the typical cylindrical or conical depression. The organic and mineral debris that collapsed into the cavity often does not completely occlude the sinkhole's connection to the water table. For this reason sinkholes frequently function as aquifer recharge areas.

Some sinkholes do not have exposed limerock, but may have special habitat features, such as a different community of plants than the surrounding landscape or different microclimate. The plant community is often similar to upland mixed forest or slope forest. Those with steep limestone walls often have a very distinct flora of liverworts, mosses, ferns, herbs, shrubs, and hardwood trees (including rare, threatened and endangered species).

The vegetation of sinkholes is partly a reflection of the parent community in which it is found, especially around the rim and on the upper slopes. Additionally, sinkholes often are a refugium for plants not usually found in the parent community because of the moist microclimate provided by down-slope seepage from surrounding uplands and protection from drying winds in the depression. Similarly, sinkholes provide habitat for species of animals such as salamanders and invertebrates that would otherwise not survive in drier communities.

Sinkholes are a common occurrence in Alachua County, particularly in its southwestern half. The Devil's Mill Hopper Geological State Park is the County's best example.

Dry Prairie

Dry prairie is characterized as a nearly treeless, flat plain with a dense ground cover of wiregrass, saw palmetto and various other grasses and herbs. The soils typically are moderately to poorly drained acidic sands overlying an organic hardpan or clayey subsoil. Frequent fires (every 1-4 years) limit recruitment of pines and encroachment by hardwoods.

Some authorities suggest that dry prairie is not a natural community because of the unnaturally high frequency of fire. Other authorities argue that this system may have once been more prevalent than at present. In any case, fire suppression and agricultural conversion is rapidly eliminating this community type. Those acres that remain should be carefully managed as this is the preferred habitat of the Florida burrowing owl, a "Species of Special Concern" in Florida.

Dry prairie is associated closely with and often grades into wet prairie or mesic flatwoods.

While small dry prairie sites are scattered in commercial pinelands and in drier zones surrounding wet prairie, no significant tracts have been identified in Alachua County.

Mesic Flatwoods

Mesic flatwoods are characterized as having a relatively open canopy of pine with little or no understory but a dense ground cover of herbs and shrubs. The two most common variants of this community are the longleaf pine/wiregrass/runner oak association and the slash pine/gallberry/saw palmetto association.

Soils are moderately to poorly drained and consist of acidic sands generally overlying an organic hardpan or clayey subsoil that restricts the movement of water above and below it. Periodic fire (every 1-8 years) both restricts the encroachment of hardwoods and provides a suitable substrate for the regeneration of pines.

Mesic flatwoods are associated closely with and often grade into wet flatwoods, dry prairie, or scrubby flatwoods. The differences between these communities are usually related to small changes in topography. Wet flatwoods occupy the lower, wetter sites while scrubby flatwoods occupy the higher, drier lands.

Typical animals here include black bear, white-tailed deer, cottontail, cotton rat, towhee, yellowthroat, pine warbler, brown-headed nuthatch, black racer, diamondback rattlesnake, and pinewoods tree frog.

Mesic flatwoods once covered much of the northeastern half of Alachua County. Currently, however, most of these natural flatwoods have been converted to pine plantation and associated silvicultural practices have altered the understory vegetation and age structure of the canopy. The trend toward short rotations of planted pine has made these areas unsuitable habitat for certain wildlife species, such as the federally endangered red cockaded woodpecker, that depend upon mature, old-growth pine forests. While many small tracts of this community type may still be found, large, high-quality sites are becoming increasingly scarce due to continued pressure from development and silviculture.

The Palatka Pond area of Lochloosa Forest and Shenks Flatwoods have been identified as the County's best examples. Other, smaller tracts include portions of Austin Cary Memorial Forest, Paynes Prairie State Preserve, San Felasco State Preserve, Hatchett Creek, Oleno State Park, Lake Altho Flatwoods, Millhopper Flatwoods, and Gum Root Swamp.

Scrubby Flatwoods

Scrubby flatwoods are characterized by a canopy of scattered pines above a dense woody shrub thicket growing on a layer of well drained sand that is on top of poorly drained, flat subsoil. The fire cycle of moderate to intense fires varies from every 2 to perhaps every 10 years.

Characteristic plants are longleaf pine, slash pine, sand live oak, myrtle oak, chapman oak, saw palmetto, fetterbush, huckleberry, crookedwood, tarflower, flatwoods pawpaw, scrub hedge-hyssop, and pennyroyal. The vegetation is a combination of plants common to scrub and mesic flatwoods and is often found in the transition area between these communities.

While scrubby flatwoods is not a rare community type in Alachua County, most tracts are small. For example, there are several small, quality tracts at Prairie Creek, Paynes Prairie State Preserve, Oleno State Park, Lochloosa Forest, Austin Cary Memorial Forest, Hatchett Creek, Barr Hammock, and the South Melrose Flatwoods.

b. Wetland communities

Wetlands, like rainforests, are biological motherlodes. They are habitat for a tremendous number of plant and animal species. For instance, they are critical breeding, feeding and overwintering grounds for waterfowl and migratory birds. Nationally, more than half of the animal and one-third of the plant species listed under the ESA are dependent on wetlands (Noss and Cooperrider, 1995). In fact, the massive destruction of wetlands in the U.S. is a primary reason why the whooping crane is so critically endangered. Whooping cranes use wetlands for nesting and foraging. The destruction of the crane's habitat has been so severe that there was only one self-sustaining natural wild population left in this country as of 1998 (Sierra Club, 1998).

Wetlands communities occurring in the County include hydric hammock, wet flatwoods, wet prairie, baygall, seepage slope, bottomland forest, floodplain swamp, strand swamp, basin marsh, basin swamp, bog, depression marsh, and dome swamp. Descriptions of these communities are provided in Inset 13.

Please see the Wetland Ecosystems portion of this data and analysis for more in depth discussion of wetlands functions and values, human impacts to wetlands, wetlands protection strategies, and the interconnections between wetland and upland habitats.

Inset 13. Wetland Communities in Alachua County

Hydric Hammock

Hydric hammock is characterized by a well developed hardwood or cabbage palm canopy with a relatively sparse understory often dominated by bluestem and ferns. It occurs on low, flat, wet sites where limestone may be near the surface.

Soils are usually sands with a high organic content and are often saturated but seldom inundated for long periods of time. Fire is rare in this community because of the normally wet soils and sparse herbaceous ground cover.

This community occurs as patches in a variety of lowland situations, often in association with springs or karst seepage. In coastal counties hydric hammock often occurs in lowlands just inland of the coastal communities. Hydric hammock is associated with and grades into floodplain swamp, strand swamp, basin swamp, baygall, wet flatwoods, coastal berm, maritime hammock, slope forest, or mesic hammock.

Characteristic plants are live oak, water oak, swamp laurel oak, cabbage palm, southern red cedar, loblolly pine, Florida elm, sweetgum, red maple, sugarberry, sweetbay, persimmon, hornbeam, Walter's viburnum, green haw, rattan vine, greenbriar, and trumpet creeper.

Characteristic animals include white-tailed deer, gray squirrel, raccoon, wild hog, wild turkey, swallow-tailed kite, red-shouldered hawk, barred owl, acadian flycatcher, and box turtle.

Alachua County's best examples of hydric hammock are those that lie to the north of Orange and Lochloosa Lakes, including Prairie Creek and Orange Lake Palm Hammock in Lochloosa Forest. Quality tracts may also be found at Paynes Prairie State Preserve, Barr Hammock, and Chacala Pond.

Wet Flatwoods

Wet flatwoods have a relatively open canopy of scattered slash or pond pine trees and/or cabbage palms with either a thick understory and sparse ground cover, or a sparse understory and dense ground cover.

This community usually occurs in nearly flat, poorly drained areas. Soils are commonly acidic sands overlying a hardpan or clay layer. Cabbage palm flatwoods tend to occur in areas underlain by calcareous materials. Frequent fire prevents succession to a hardwood-dominated forest.

Wet flatwoods are associated closely with and often grade into hydric hammock, mesic flatwoods, wet prairie, or basin swamp.

In Alachua County, wet flatwoods dominated by slash pine are relatively abundant. Those dominated by pond pine, however, are scarce. Extensive tracts of any type are not common. As with mesic flatwoods, silvicultural practices have degraded many of these systems. The County's best examples have been identified at Kincaid Flatwoods, Townsend Branch (Mill Creek), and Barr Hammock. Smaller stands are scattered throughout the Hatchet Creek, Gum Root Swamp, Prairie Creek, and Lochloosa Forest.

Wet Prairie

Wet prairie is characterized as a nearly treeless plain with a variable ground cover of grasses, sedges, rushes and herbs. Shrubs such as wax myrtle and groundsel tree may dominate in areas not subjected to frequent fires.

This community occurs in low, nearly flat, poorly drained areas where fire is frequent (every 2-4 years) and soils are seasonally saturated or inundated. Soils are typically sands, often with a substantial clay or organic component.

The most characteristic plant is maidencane, but most karst prairies have been so altered by drainage, fire protection, cattle grazing, mowing, fertilizing, sewage effluent, etc. that a large assortment of native and exotic weedy plants often dominate. Karst prairies usually surround a basin marsh that occupies the center of the basin, whereas flatwoods prairies may or may not have deeper areas of marsh.

Characteristic animals of the prairie include marsh rabbit, round-tailed muskrat, cotton rat, sandhill crane, and Northern harrier (marsh hawk).

Wet prairie is associated closely with and often grades into wet flatwoods, depression marsh, basin marsh, seepage slope, mesic flatwoods, or dry prairie.

Few good quality, undisturbed tracts of this community remain in Alachua County. Pitcher plant prairies are especially rare. Wet prairie is vulnerable to overgrazing by livestock and alterations in hydrologic or fire regimes. The main areas of this community in Alachua County are on the moist parts of karst prairies like Paynes Prairie and Kanapaha Prairie. However, flat, shallow wetlands of herbaceous vegetation in pine flatwoods areas are also included in this category. Under natural conditions, both fire and flooding are frequent.

Baygall

Baygalls usually occur as forested, peat-filled depressions, often at the base of sandy seepage slopes. The dense canopy is composed of evergreen hardwoods dominated by sweetbay, swamp bay, and loblolly bay. Commonly, the understory is relatively open and consists of various shrubs, ferns, mosses and liverworts.

Soils are acidic peats that are saturated for much of the year by down-slope seepage and/or high water tables. Because these systems rarely dry out, fire is rare. When an occasional fire does occur, the bay trees usually resprout and replace themselves.

Baygalls usually occur as small strips and patches associated with and often grading into seepage slope, bottomland forest, or floodplain swamp.

This community occurs in scattered localities in north and east Alachua County. The best examples have been identified along Hatchet Creek. Other good quality baygalls may be found at Paynes Prairie State Preserve, Mill Creek, Barr Hammock, Lochloosa Forest, and Millhopper Flatwoods.

Seepage Slope

Seepage slopes are wetlands characterized as shrub thickets or boggy meadows on or at the base of slopes. They often occur where water percolating through sands encounter an impermeable layer of clay or rock. These communities usually are dominated by hydrophytic shrubs or herbs such as fetterbush, titi, male berry, waxmyrtle, ferns, grasses, and grass-likes. Seepage slopes most closely resemble bog communities but occur on slopes rather than flat land.

Soils are usually acidic, loamy sands with low nutrient availability and are usually saturated (but seldom inundated) by down-slope seepage. Small pools and rivulets are common, however. Fire occurs at irregular intervals in this community. Frequent fires produce a herbaceous seepage slope while occasional fires permit the establishment of woody plants. In the absence of fire, woody plant invaders decrease soil moisture through increased transpiration rates and the site may become more like a baygall community.

Alachua County's best examples occur in the San Felasco Hammock State Preserve and in the vicinity of Mill Creek.

Bottomland Forest

Bottomland forest is a low-lying, closed canopy forest with either a dense shrubby understory and little ground cover, or an open understory and a ground cover of ferns, herbs, and grasses. The canopy typically is composed of a mixture of evergreen and deciduous species that can tolerate only occasional periods of inundation.

Characteristic plants are water oak, swamp laurel oak, spruce pine, loblolly pine, red maple, magnolia, sweetgum, sweetbay, swamp tupelo, Florida elm, swamp dogwood, and hornbeam.

These forests usually occur on low flatlands that border streams. Soils are generally a mixture of clay and organic materials. This community rarely burns as a result of the high humidity maintained beneath the dense canopy.

Bottomland forest is associated closely with and often grades into floodplain swamp, hydric hammock, mesic flatwoods, mesic hammock, slope forest, baygall, or wet flatwoods.

Alachua County's best examples are found in the forests associated with the Santa Fe River. Other, smaller tracts are common along the County's smaller streams.

Floodplain Swamp

Floodplain swamps occur on frequently flooded soils along stream channels and in low spots and oxbows within river floodplains. Dominant trees are usually bald cypress and blackgum. Species of ash may be locally abundant. Trees in this community are usually swollen at the base or "buttressed" in response to frequent floods and prolonged inundation. The understory and ground cover are usually sparse.

Soils of floodplain swamps are highly variable mixtures of sand, organic, and alluvial material. Sloughs, oxbows and backwaters may accumulate considerable amounts of peat. Fire is rare in this community.

Characteristic plants are bald-cypress, swamp tupelo, water tupelo, pumpkin ash, green ash, cabbage palm, and red maple.

Characteristic animals include beaver, wood duck, barred owl, red-shouldered hawk, and cottonmouth.

Floodplain swamps often are associated with and grade into bottomland forest or hydric hammock.

The forests associated with the Santa Fe River contain Alachua County's best and most extensive floodplain swamps. Other, smaller tracts are common along the County's numerous smaller streams.

Strand Swamp

Strand swamps are shallow, forested, elongated depressions or channels dominated by bald cypress. They are often situated in troughs in a flat limestone plain. Sloughs occupy the lowest area in the system and are usually dominated by a variety of floating and emergent macrophytes.

Soils are peats of varying depths and sand over limestone, and are inundated 200-300 days per year. Fire occurs in the strand swamp only every 30-200 years, yet is essential to the maintenance of the system. Absence of fire leads to accumulation of peat and invasion of broad-leaved hardwoods.

Characteristic plants are bald-cypress or pond-cypress, swamp tupelo, green ash, pumpkin ash, red maple, sweetbay, swamp laurel oak, coastal plain willow, buttonbush, swamp dogwood, and wax-myrtle.

Characteristic animals are raccoon, river otter, white ibis, barred owl, wood duck, and cottonmouth.

Strand swamp is associated with and often grades into bottomland forest or floodplain swamp.

The strand swamp community, while not common in Alachua County, is typified by that along the River Styx.

Basin Marsh

Basin marsh, or prairie, is characterized as a more or less herbaceous wetland located in a large depression. Often, these depressions are former shallow lakes. The vegetation is usually dominated by floating and emergent macrophytes.

Soils are acidic peats that form as shallow lake bottoms slowly fill with sediments from the surrounding uplands and material from decaying vegetation. Basin marshes usually are inundated for 200 or more days per year. Frequent fires maintain the herbaceous community by restricting invasion by shrubs and trees.

Characteristic plants are maidencane, pickerel-weed, saw-grass, cat-tail, primrose-willow, lotus, water-lily, spatter-dock, etc.

Characteristic animals include river otter, raccoon, round tailed muskrat, wood stork, sandhill crane, white ibis, herons and egrets, rails, mottled duck, blue-winged teal, harrier (marsh hawk), snipe, moorhen, purple gallinule, red-winged blackbird, boat-tailed grackle, alligator, striped mud turtle, stinkpot, chicken turtle, green water snake, mud snake, striped swamp snake, pig frog, Florida cricket frog, and a whole host of small fish species such as the mosquito fish, golden top minnow, pirate perch.

Basin marshes are associated with and often grade into wet prairie or lake communities. Because the vegetation is similar, a small basin marsh may be very difficult to distinguish from a large depression marsh.

Basin marshes in Alachua County are generally restricted to its south-central portion and are exemplified by vast areas of Paynes Prairie State Preserve.

Basin Swamp

Basin swamp is characterized as a large, irregularly shaped basin that is not associated with rivers, and is dominated by trees such as blackgum, cypress, red maple and, occasionally, slash pine. Hydrophytic shrubs such as fetterbush and virginia willow commonly grow on "hummocks" at the bases of trees and herbaceous ground cover varies from dense to sparse.

Soils in basin swamps are generally acidic peats, often overlying a clay lens or other impervious layer. The resulting perched water table may act as a reservoir releasing ground water as adjacent upland water tables drop during drought periods. Soils in this community typically are inundated for 200-300 days per year. The frequency of fire varies and, therefore, influences the character of the swamp. Pine-dominated swamps burn frequently, cypress dominated swamps burn only infrequently, and blackgum swamps seldom burn.

Characteristic animals are raccoon, white ibis, barred owl, prothonotory warbler, and cottonmouth.

Basin swamps often are associated with and may grade into wet flatwoods, hydric hammock, or bottomland forest. Small basin swamps may be difficult to distinguish from large dome swamps.

This community is common in the flatwoods of northern and eastern Alachua County.

Bog

Bogs are characterized as shrub-dominated wetlands that most commonly occur in depressions in flatwoods. The vegetation is often dominated by sphagnum moss, fetterbush, large gallberry, titi, waxmyrtle, virginia willow and other hydrophytic shrubs.

Soils are acidic, deep peats that are usually saturated or inundated. At times of high water, the peat and interwoven roots of shrubs may form a floating island in the depression. Occasional fire maintains the shrubby character of the bog. Absence of fire leads to a tree-dominated condition.

Characteristic plants are sphagnum moss, fetterbush, bamboo-vine, loblolly bay, and sometimes slash pine.

Other plants often present are pond-cypress, swamp tupelo, hooded pitcher plant, and tall blackberry.

Bogs are great escape cover for black bears and support some alligators, frogs, crayfish, etc.

Bogs are associated with and often grade into baygall, wet flatwoods, seepage slopes, basin swamp, and bottomland forest.

Small bogs are common components of the flatwoods in the northern and eastern parts of Alachua County. Large ones, however, are rare. One of the best examples of this community in the County is Santa Fe Swamp, the headwaters of the Santa Fe River.

Depression Marsh

Depression marsh is characterized as a shallow, sometimes round depression in a sandy substrate. This community is similar in vegetation and physical features to, but generally much smaller than, basin marsh. Depression marshes are considered extremely important in providing breeding and foraging habitat for a variety of amphibians and wading birds.

This community type is typical of karst regions where sand has slumped around or over a sinkhole and thereby created a shallow, conical depression filled by rainfall, runoff, and/or seepage from surrounding uplands. Soils are usually acidic sands with deepening peat toward the center. Hydroperiods are variable, ranging from less than 50 to over 200 days per year. Frequent fire maintains the herbaceous character of the system by restricting the invasion of shrubs and trees.

Characteristic plants are Virginia chain fern, redroot, maidencane, pickerel-weed, spatter-dock, St. John's-wort, and yellow-eyed-grass.

Characteristic animals include wading birds, softshell turtle, chicken turtle, striped newt, and a host of salamanders, toads, frogs, and tree frogs that use these wetlands for breeding.

These communities often are associated with and grade into wet prairie, seepage slope, wet flatwoods, mesic flatwoods, dome swamp, or bog. Depression marshes are frequently encountered in the flatwoods of northern and eastern Alachua County.

Dome Swamp

Dome swamps are characterized as shallow, forested, usually circular depressions that generally present a domed profile. These communities are usually dominated by a canopy of pond cypress but blackgum and slash pine are also common components. The understory is composed of shrubs growing on "hummocks" at the bases of trees and a sparse to dense ground cover of grasses and grass-like.

Dome swamps typically develop in sandy flatwoods and in karst areas where sand has slumped over a sinkhole. Soils usually are acidic peats overlying sands. Some domes have a clay lens beneath the peat layer. These communities normally are inundated for 200-300 days per year and often function as reservoirs that recharge the aquifer when adjacent water tables drop during drought conditions. Periodic fires are essential for the maintenance of dome swamps as they restrict invasion of broad-leaved hardwoods and the accumulation of peat. Fire frequency is greatest at the periphery of the dome.

Characteristic trees are pond-cypress, blackgum, and slash pine, with some sweet bay, swamp bay, and/or loblolly bay around the edge. Fetterbush is usually the dominant shrub, and Virginia chain fern, redroot, and maidencane are characteristic ground cover.

Characteristic animals include raccoon, green-backed heron, white ibis, yellow-rumped warbler, banded water snake, glossy crayfish snake, black swamp snake, pine woods snake, dwarf siren, striped newt, southern dusky salamander, and little grass frog.

Dome swamps are associated with and often grade into wet flatwoods, mesic flatwoods, wet prairie, or bottomland forest. This community type commonly occurs in the flatwoods of the northern and eastern portions of Alachua County.

c. Forests

Forests occupy approximately 30% of the world's land surface and 30% of the United States. In most regions, forests have more species than any other kind of ecosystem (Noss and Cooperrider 1994). After European settlement of the U.S., forests rapidly began to disappear. By 1980, 85% of the virgin forests throughout the U.S. had been destroyed, with losses estimated at 95-98% in the lower 48 states. Some forest types today represent only a fraction of their former abundance. For example, longleaf pine, which once dominated the uplands of the southeastern coastal plain, have been reduced by 98% (Noss and Cooperrider, 1994). As a result, more threatened and endangered species are associated with forest ecosystems than anywhere else (Flather et.al, 1994).

Conversion of existing pine flatwoods, second-growth forests to managed plantations in Florida is continuing at about 50,000 acres annually (EAR, 1998). It is estimated that there was a 20% loss of this habitat during an eight year survey cycle (Fed. Reg Vol. 62.[241]:65789). The remaining habitat is often fragmented, degraded, or second-growth forests. When 4% of the timberlands in Alachua County have been converted, for example, to new growth or other types of land use, this represents a loss to existing wildlife communities (EAR, 1998). If harvested timberlands are designated as regenerating timberlands, then a slow recovery of wildlife communities may be expected. Future wildlife communities are expected to have different species elements or relationships with potentially some species loss, i.e. rare, threatened or endangered species formerly using mature timberlands.

Studies by the Sierra Club, the University of Florida, and the Southern Forest Resource Assessment document that logging activities can have devastating impacts on wildlife and habitat. Poorly planned clearcuts and logging roads destroy habitat by removing large stands of trees and surrounding habitat. Logging and the construction of timber roads also cause erosion and degrade water quality. In addition, when roads cut through an ecosystem, further habitat degradation and fragmentation results. Finally, the introduction of roads in the wilderness increases the chance of species being hit by cars or killed by legal or illegal hunting or trapping.

Information on forests in Alachua County is available from the United States Department of Agriculture Forest Service (USDA Forest Service) and from the Florida Department of Agriculture and Consumer Services, Division of Forestry (FDACS Division of Forestry). The USDA Forest Service conducts periodic forest surveys in Northeast Florida. These surveys are a continuing, nationwide undertaking authorized by the Forest and Rangeland Renewable Resources Research Act of 1978. The primary objective of these surveys is periodically to inventory and evaluate all forest and related resources to provide a basis for formulating forest policies and programs and for the orderly development and use of the resources. The focus of data collection is on the extent and condition of forest land, associated timber volumes, and rates of timber growth and removals.

Forest lands in Alachua County are mapped and described in the previous sections on upland and wetland communities. Forest lands are classified by the USDA Forest Service based on the species forming a plurality of live-tree stocking. Results of the 1987 survey of the Northeast Florida region, including Alachua County and 20 counties surrounding it, are published in the report entitled Forest Statistics for Northeast Florida, 1987. According to this report, the primary forest-type groups in the region are as follows:

Inset 14. Description of Primary Forest Types in Northeast Florida

Longleaf-slash pine. Forests in which longleaf or slash pine, singly or in combination, predominate. Common associates include oak, hickory, and gum.

Loblolly-shortleaf pine. Forests in which loblolly pine, shortleaf pine, or other southern yellow pines, except longleaf or slash pine, singly or in combination, predominate. Common associates include oak, hickory, and gum. These forests are found in the North Central Florida region, although not in Alachua County.

Oak-pine. Forests in which hardwoods (usually upland oaks) predominate but in which pines account for 25 to 50% of the stocking. Common associates include gum, hickory, and yellow-poplar.

Oak-hickory. Forests in which upland oaks, or hickory, singly or in combination, predominate, except where pines account for 25 to 50%, in which case the stand would be classified oak-pine. Common associates include yellow-poplar, elm, maple, and black walnut.

Oak-gum-cypress. Bottom-land forests in which tupelo, blackgum, sweetgum, oaks, or southern cypress, singly or in combination, predominate, except where pines account for 25 to 50 %, in which case the stand would be classified oak-pine. Common associates include cottonwood, willow, ash, elm, hackberry, and maple.

Elm-ash-cottonwood. Forests in which elm, ash, or cottonwood, singly or in combination, predominate. Common associates include willow, sycamore, beech, and maple.

According to survey data, the longleaf-slash pine forest is the predominant forest type in the County and region, with some concentrations of oak-hickory and oak-gum-cypress forests. Alachua County's distribution of forest types is somewhat less diverse than that of the region, with small or non-existent representation of other forest types found in the region generally.

d. Disturbed/altered communities

Inset 15 provides a brief listing and description of disturbed or altered vegetative communities in Alachua County. Although altered by human activities, and therefore no longer considered natural, these vegetative communities still provide important habitat for many species of wildlife, including certain listed and endemic species described in the next section.

Inset 15. Disturbed/Altered Communities in Alachua Community

Old Field Pine Plantation: Old fields which have been planted with any species of pine.

Old Field Succession Pine: Old fields which have been invaded by volunteer pine or have a mature plantation of pine.

Site Conversion Pine Plantation: Upland habitat such as a hammock or wetlands such as a basin swamp which have been cleared and then planted with pine.

Rough Pasture: This habitat is a pasture which retains some of its native ground cover or which has numerous scattered trees or both.

Improved Pasture: Improved pastures are those which are almost completely covered by exotic grasses and lack significant tree cover.

Cropland: This habitat consists of row crops, freshly cleared land, or fallow fields.

Farm Pond: This is a pond formed by damming a stream or digging.

Active Mining: Any area with active mining.

Mine Pit Lake: A pond or lake in a mine pit.

Low Impact Development: Homes or camp sites which have been allowed to remain wooded are designated low impact.

High Impact Development: Any major alteration or construction.

2. Smaller scale: Species level diversity

a. Vertebrates

The group of animals known collectively as the vertebrates are important elements in the natural ecological systems of Alachua County. Fish, amphibians, reptiles, birds, and mammals make up the vertebrates found here. They show similarities in body structure -- for example, a series of vertebrae that surround a spinal cord and placement of most of the nervous system in the head -- that define them as vertebrates (Romer, 1967). Just like other living organisms, vertebrates show adaptations and specializations to their environment. They play important roles in nutrient cycling, habitat modification, dispersal of plant seeds and control of insect populations, to name a few activities (Willson, 1984).

There is an unusually high diversity of vertebrate species in Alachua County, when compared with other land areas in the United States of comparable size. Because of the relatively warm climate and large numbers of wetland habitats, the "cold-blooded" or ectothermic vertebrate groups (fish, amphibians and reptiles) are represented by many species. There is a high diversity of bird species known from Alachua County, in part because of the diversity of habitats and variety of food sources available here in part because migrant birds on their way to South America or the Caribbean pass through the area and in part because there are different species that spend summers here as opposed to those that winter here. Only the mammals are represented by a lower number of species in Alachua County than in other areas of the United States. Heat stress and parasites are two problems that these fur-bearing animals suffer from in Florida, ultimately causing a reduction in mammal species occurrences.

A total of 417 native species and 21 introduced species of vertebrates are listed in Appendix B, making a grand total of 438 species of vertebrates in Alachua County. Several things can be surmised from the relatively high number of vertebrate species in Alachua County. High diversity often results from a wide variety of habitat types and climatic regions in an area (McFarland et al, 1979). Alachua County is characterized by nearly 40 habitat types as defined by the Florida Natural Areas Inventory. Short term and long term fluctuations in rainfall and temperature are characteristic of the climate in this area (Dohrenweld, 1978). All of this points to a complex natural structure of the County.

In addition, the presence of large numbers of species suggests that there are complex relationships between species that enable coexistence to occur (Jameson, 1981). Tight interdependencies exist in the food chain and in habitat utilization. As a consequence, major changes in habitat structure or extent due to urban development will probably have a far-reaching effect on the natural assemblage of species in this area.

Vertebrates represent a natural resource and a recreational resource that is important to the heritage of Alachua County. Birdwatching, hunting and fishing are popular outdoor activities. Resident game and fur bearing mammals are white-tailed deer, gray and fox squirrels, rabbits, red and gray foxes, wild hogs, bobcats, otters, mink, raccoons, opossum, coyote, skink, nutria, beaver and black bears (FGFWFC, 1984). Resident game birds are bobwhite quail and wild turkey. Migratory game birds are ducks, gallinules, coots, snipe, rails, woodcock, crows, mourning and white-winged doves. Reptiles and amphibians that are not listed as endangered, threatened or a species of special concern may also be harvested. Many game fish are found in the waters of Alachua County.

Such uses create a need for management strategies, environmental education and funding for these efforts. Vertebrate wildlife have other values to society as part of the natural heritage, but not all wildlife serve

functions or have values to society. Many exist in a context unrelated to human activities and have value in the simple fact of their existence.

b. Invertebrates

The invertebrate species of Alachua County include numerous varieties of mollusks, crustaceans, arachnids, and insects. Important populations of two notable species, for example, have been documented for the Say's spiketail dragonfly and the Sugarfoot moth fly. Both species have been proposed as candidates for listing at the federal level. Most of the known specimens, and potentially the largest known breeding grounds, of the Say's spiketail dragonfly are located in the Possum Branch of Hogtown Creek drainage in Gainesville. According to the U.S. Fish and Wildlife Service, the Sugarfoot moth fly is known only from two localities: Gulf Hammock in Levy County and Sugarfoot Hammock in Alachua County. The species is believed to be limited to mesic hardwood hammocks.

In addition, the cave systems in the karst region of the County provide very fragile and critical habitat for specialized endemic species of invertebrates. The known cave passages are but a very small fraction of the total. Terrestrial caves are limerock caves above water, often beginning at the bottom at a sink hole, and sometimes leading to aquatic caves. Caves provide specialized and often critical habitat for bats and some specialized invertebrates. Aquatic caves the cave systems that are submerged in aquifer waters. Where the surface of a terrestrial cave meets an aquatic cave system, there are often populations of highly specialized cave dwelling invertebrates.

c. Plants

There are numerous species of plants, grasses, shrubs, vines, trees, and associated vegetation native to Alachua County. These species are discussed in the natural communities section above. In addition, trees native to Alachua County are identified in the Vegetation Management portion of this data and analysis. Besides providing habitat and food for wildlife, vegetation produces oxygen, removes carbon dioxide, absorbs nutrients in waste, purifies the air, and reduces soil erosion. In Alachua County, native vegetation with intact natural soil surface provides the best medium for aquifer recharge, as well as areas which help provide adequate clean water for human and environmental needs. Many species are essential to the integrity and maintenance of the lands they occupy.

Alachua County has a problem with invasive, non-native plants. Invasive species as those plant species that are widespread in Florida and have the established potential to invade and disrupt native plant communities; they are localized but have a rapidly expanding population or have shown a potential to invade and disrupt native vegetation in other areas or other countries with climates similar to Florida. This type of vegetation wreaks havoc upon the delicate balance of resources native communities depend on. For example, an infestation of melaleuca can devastate wetlands by altering the hydrology of the system. Leaf litter from stands of melaleuca may alter the soil topography, creating new tree islands, and may increase the evapotranspiration rate of the area, eventually drying up the wetland. Similarly, many invasive non-natives, while pleasant enough in their homelands, become especially tough to fight in Florida. Once introduced, non-native species of plants spread rapidly to overtake and crowd out native plants, which significantly alters and degrades the natural system.

d. Listed and endemic species

Species of plants and animals that are nearing extinction are generally referred to as rare, threatened or endangered species. They share the common problem of having a low likelihood of surviving into the future. In Alachua County, this includes over 70 species of plants, 100 species of vertebrates excluding mammals, 12 species of mammals, and 38 species of invertebrates. Three tables that identify the endangered and potentially endangered plants and animals of Alachua County are provided in the following pages (See Table 12 for vertebrates, Table 13 for invertebrates, and Table 14 for plants).

Those species that have legal protection are listed by the CITES, United States Fish and Wildlife Service (USFWS), Florida Department of Agriculture (FDA) and Florida Fish and Wildlife Conservation Commission (FFWCC). The species that are thought to be stressed, but have no state or federal protection, are all others on the FCREPA lists, those proposed by Ward and Perkins (W&P), and those listed by the Florida Natural Areas Inventory (FNAI). It is to be expected that the content of these tables will change over time as new information is obtained that suggests the addition, deletion or change of category of a given species. The ultimate authority for rare, threatened and endangered species in Alachua County will be the current lists provided in the above-referenced publications.

Endemic species are those which occur in the County and nowhere else in Florida or the world. Additional recognition of endemic species of Alachua County should be mentioned here. These are the subspecies and races of plant and animal populations that have adapted to the environmental conditions of an area in north-central Florida that are included within the boundary of Alachua County. Some subspecies may be common while others may be rare or threatened. However, by virtue of the fact that these subspecies or races of flora and fauna are endemic to the County and occur nowhere else in Florida or the world, they are vulnerable to population fluctuations. While some of these organisms do not have state or federally regulated protection, they may be tracked by FNAI or listed by FCREPA as species of special concern. Animal species and subspecies endemic, or nearly endemic, to Alachua County are listed in Table 15.

TABLE 12. Threatened and endangered vertebrate species recorded from Alachua County.

ENDANGERED AND POTENTIALLY ENDANGERED VERTEBRATES OF ALACHUA County

SCIENTIFIC NAME	COMMON NAME	CITES	USFWS	FFWCC	FCREPA	FNAI
Fish						
Acantharchus pomotis	Mud Sunfish					S3
Acipenser o. desotoi	Gulf Sturgeon		T	SSC	T	S2
Ameiurus serracanthus	Spotted Bullhead					S3
Umbra pygmaea	Eastern Mudminnow					S3
Enneacanthus chaetodon	Blackbanded Sunfish				R	S3
Micopterus notius	Suwannee Bass			SSC		S2/S3
Awaous tajasica	River Goby				T	S1/S2
Amphibians						
Ambystoma cingulatum	Flatwoods Salamander		T			S2/S3
Ambystoma tigrinum	Tiger Salamander				S3	
Rana capito	Gopher Frog		UR	SSC	T	S3
Notophthalmus perstriatus	Striped Newt					S2/S3
Reptiles						
Alligator mississippiensis	American Alligator	II		T(S/A)SSC		S4
Clemmys guttata	Spotted Turtle				R	S3?
Crotalus horridus	Canebrake Rattlesnake					S3
Drymarchon corais couperi	Eastern Indigo Snake		T	T	SSC	S3
Gopherus polyphemus	Gopher Tortoise		UR	SSC	T	S3
Macrochelys temminckii	Alligator Snapping Turtle		UR	SSC	SU	S3
Pituophis melanoleucus mugitis	Florida Pine Snake		UR	SSC	SU	S3
Pseudemys concinna	River (Suwannee) Cooter		SSC	T	S3	
Stilosoma extenuatum	Short-tailed Snake		UR	T	E	S3
Mammals						
Eptesicus fuscus	Big Brown Bat				R	S3
Lasiurus cinereus	Hoary Bat				R	SU
Lutra canadensis	River Otter	II				
Lynx rufus	Bobcat	II				
Mustela frenata olivacea	Southeastern Weasel					RS3?
Mustela vison mink	Southern Mink				R	S2
Neofiber alleni	Round-tailed Muskrat		UR		SSC	S3
Plecotus rafinesquii macrotis	SE Big-eared Bat		UR?		R	S3?
Podomys floridanus	Florida Mouse		UR	SSC	T	S3
Sciurus niger shermani	Sherman's Fox Squirrel		UR	SSC	T	S2
Sorex longirostris longirostris	Southeastern Shrew				R	S4
Ursus americanus floridanus	Florida Black Bear		UR	T	T	S2

ENDANGERED AND POTENTIALLY ENDANGERED VERTEBRATES OF ALACHUA County

SCIENTIFIC NAME	COMMON NAME	CITES	USFWS	FWCC	FCREPA	FNAI
Birds						
<i>Ixobrychus exilis</i>	Least Bittern				SSC	S4
<i>Ardea alba</i>	Great Egret				SSC	S4
<i>Egretta caerulea</i>	Little Blue Heron			SSC	SSC	S4
<i>Egretta thula</i>	Snowy Egret			SSC	SSC	S4
<i>Egretta tricolor</i>	Tricolored Heron			SSC	SSC	S4
[<i>Egretta rufescens</i>	Reddish Egret		UR	SSC	R	S2]
<i>Nycticorax nycticorax</i>	Black-crowned Night-Heron				SSC	S3?
<i>Nyctanassa violacea</i>	Yellow-crowned Night-Heron				SSC	S3?
<i>Eudocimus albus</i>	White Ibis			SSC	SSC	S4
<i>Plegadis falcinellus</i>	Glossy Ibis				SSC	S2
[<i>Ajaia ajaja</i>	Roseate Spoonbill			SSC	R	S2/S3]
<i>Mycteria americana</i>	Wood Stork		E	E	E	S2
<i>Laterallus jamaicensis</i>	Black Rail				SU	S3?
<i>Rostrhamus sociabilis plumbeus</i>	Florida Snail Kite		E	E	E	S1
<i>Elanoides forficatus</i>	Swallow-tailed Kite		UR		T	S2/S3
[<i>Elanus leucurus</i>	White-tailed Kite				R	S1/S2]
[<i>Caracara plancus</i>	Crested Caracara		T	T	T	S2]
<i>Circus cyaneus</i>	Northern Harrier	II				
<i>Haliaeetus leucocephalus</i>	So. Bald Eagle	I	T	T	T	S2/S3
<i>Accipiter cooperii</i>	Cooper's Hawk				SSC	S3
[<i>Buteo brachyurus</i>	Short-tailed Hawk				R	S3]
<i>Pandion haliaetus</i>	Osprey	II		SSC	T	S3/S4
[<i>Falco peregrinus</i>	Peregrine Falcon	I	E	E	E	S2]
[<i>Falco columbarius</i>	Merlin	II				SU]
<i>Falco sparverius paulus</i>	SE American Kestrel	II	UR	T	T	S3?
[<i>Falco sparverius</i>	American Kestrel	II]
<i>Grus canadensis pratensis</i>	Florida Sandhill Crane	II		T	T	S2/S3
<i>Grus americana</i>	Whooping Crane		XN	SSC	RE	SXC
<i>Aramus guarauna</i>	Limpkin			SSC	SSC	S3
[<i>Recurvirostra americana</i>	American Avocet				SSC	S1/S2]
[<i>Sterna nilotica</i>	Gull-billed Tern					SU]
[<i>Sterna antillarum</i>	Least Tern			T	T	S3]
[<i>Sterna maxima</i>	Royal Tern				SSC	S3]
[<i>Sterna caspia</i>	Caspian Tern				SSC	S2?]
[<i>Rhyncops nigra</i>	Black Skimmer			SSC	SSC	S3]
<i>Speotyto cunicularia floridana</i>	Florida Burrowing Owl			SSC	SSC	S3
<i>Picoides borealis</i>	Red-cockaded Woodpecker		E	T	E	S2
<i>Picoides villosus</i>	Hairy Woodpecker				SSC	S3?
<i>Sitta carolinensis</i>	White-breasted Nuthatch				SSC	S2
<i>Aphelocoma coerulescens</i>	Florida Scrub-Jay		T	T	T	S3
[<i>Dendroica kirlandii</i>	Kirtland's Warbler		E	E	E	S1]
[<i>Helminthos vermivorus</i>	Worm-eating Warbler				R	S1]
[<i>Seiurus motacilla</i>	Louisiana Waterthrush				R	S3]
[<i>Setophaga ruticilla</i>	American Redstart				R	S3]
[<i>Passerulus citrea</i>	Painted Bunting					SU]
<i>Aimophila aestivalis</i>	Bachman's Sparrow					S3

[]= non-resident, visitor to Alachua County

TABLE 13. Threatened and endangered invertebrate species recorded from Alachua County.

ENDANGERED AND POTENTIALLY ENDANGERED INVERTEBRATES OF ALACHUA County

SCIENTIFIC NAME	COMMON NAME	CITES	USFWS	FFWCC	FCREPA	FNAI
Mollusks						
Aphaostracon chalarogyrus	Freemouth Hydrobe				E	S1
Medionidus walkeri	Suwannee Moccasinshell				T	S?
[Pleurobema reclusum	Florida Pigtoe		E		SSC	S?]
Crustaceans						
Caecitotea hobbsi	Florida Cave Isopod				SSC	S2
Crangonyx grandimanus	Florida Cave Amphipod				SSC	S2
Crangonyx hobbsi	Hobbs' Cave Amphipod		UR		SSC	S2/S3
Palaemonetes cummingi	Squirrel Chimney Cave Shrimp		T		E	S1
Procambarus lucifugus alachua	Light-fleeing Cave Crayfish				R	S2/S3
Procambarus pallidus	Pallid Cave Crayfish				R	S2/S3
Remasellus parvus	Swimming Little Florida Cave Isopod				R	S1
Troglocambarus maclanei	North Florida Spider Cave Crayfish				R	S2
Arachnids						
Phidippus workmani	Workman's Jumping Spider				R	
Sphodros abboti	Blue Purseweb Spider				R	S?
Ummidia spp.	Trapdoor Spider				SU	S?
Insects						
Achalarus lyciades	Hoary Edge				R	
Amblyscirtes aesculapius	Textor Skipper				R	
Aphodius aegrotus	Small Pocket Gopher Scarab				SSC	S?
A. haldemani	Scarab Beetle				Elim.	
A. hubbelli	Broadspurred Pocket Gopher Scarab				SSC	
A. laevigatus	Scarab Beetle				Elim.	
A. troglodytes	Gopher Tortoise Aphodius				T	S?
Arenivaga floridensis	Florida Sand Cockroach				R	
Atanius sciurus	Fox Squirrel Scarab				T	S?
Atrytone arogos arogos	Arogos Skipper				R	
Atrytonopsis hianna loammi	Southern Dusted Skipper				R	
Autochton cellus	Golden-banded Skipper				R	
Bolbocerasoma hamatum	Bicolored Burrowing Scarab				SU	S?
Brueelia deficiens	Florida Scrub Jay Louse				T	S?
Cerotocanthus aeneus	Shining Ball Scarab				SU	S?
Cernotina truncona	Florida Cernotinan Caddisfly				R	S2
Cicindela scabrosa	Florida Scrub Tiger Beetle				R	S?
Copris gopheri	Gopher Tortoise Copris				T	S?
Cordulegaster obliqua fasciata	Arrowhead Spiketail				R	
Cordulegaster sayi	Say's Spiketail		UR		T	S1/S2
Didymops floridensis	Maidencane Cruiser				SSC	S4
Dromogomphus armatus	Southeastern Spinyleg				R	S3
Esthiopterum brevicephalum	Florida Sandhill Crane Lice				T	S?
Eucanthus alutaceus	Mat Red Globe Scarab				SU	S?
Euphyes dion	Dion's Skipper				R	

ENDANGERED AND POTENTIALLY ENDANGERED INVERTEBRATES OF ALACHUA County

SCIENTIFIC NAME	COMMON NAME	CITES	USFWS	FFWCC	FCREPA	FNAI
Euphyes dukesi	Duke's Skipper				R	
Everes comyntas comyntas	Eastern Tailed Blue				R	
Gomphaeschna antilope	Taper-tailed Darner				R	S4
Gomphus cavillaris	Sandhill Clubtail				SSC	S4
Gruimenopon canadense	Florida Sandhill Crane Lice				T	S?
Heleonomus assimilis	Florida Sandhill Crane Lice				T	S?
Hydroptila berneri	Berner's Microcaddisfly				Elim.	
Hypotrichia spissipes	Florida Hypotrichia				SSC	S?
Incisalia nippon nippon	Eastern Pine Elf				R	
Lestes inequalis	Elegant Spreadwing				R	S2/S3
Mycotrupes gaigei	Scarab Beetle				R	S?
Nemopalpus nearcticus	Sugarfoot Fly				SU	S?
Neurocordulia obsoleta	Umber Shadowfly				SU	S1
Nymphalis antiopa antiopa	Mourning Cloak				R	
Onthophagus polyphemus	Gopher Tortoise Onthophagus				T	S?
Peltotrupes profundus	Scarab Beetle				SSC	S?
Pholisora catullus	Common Sooty Wing				R	
Phyllophaga clemens	Clemens' June Beetle				SU	
Phyllophaga elongata	Elongate June Beetle				R	S?
Phyllophaga skelleyi	Skelley's June Beetle				R	
Progomphus alachuensis	Tawny Sanddragon				SSC	S4
Poanes viator zizaniae	Wild Rice Skipper				R	
P. yehl	Southern Swamp Skipper				R	
P. zabulon	Zabulon Skipper				R	
Polyergus sp.	Slave-making Ant				SU	
Polygonia comma	Comma Anglewing				R	
Pomeius verna	Little Glassy Wing				R	
Serica delicatula	Delicate Silky June Beetle				SU	S?
Serica pusilla	Pygmy Silky June Beetle				SU	S?
Satyrrium liparops	Striped Hairstreak				R	
Satyrodes appalachia appalachia	Appalachian Eyed Brown				R	
Tachopteryx thoreyi	Gray Petaltail				R	S3
Triaenodes florida	Florida Triaenode Caddisfly				R	S1
Trigonopeltastes floridana	Scrub Palmetto Scarab				R	S?

TABLE 14. Threatened, endangered, and commercially exploited plants recorded from Alachua County.

Scientific Name	Common Name	FFWCC
<i>Adiantum tenerum</i>	brittle maidenhair fern	E
<i>Andropogon arctatus</i>	pinewood bluestem	T
<i>Asplenium monanthes</i>	San Felasco spleenwort; single sorus spleenwort	E
<i>Asplenium pumilum</i>	dwarf spleenwort	E
<i>Asplenium verecundum</i>	delicate spleenwort	E
<i>Athyrium filix-femina</i>	southern lady fern; lowland lady fern	T
<i>Blechnum occidentale</i>	sinkhole fern	E
<i>Brickellia cordifolia</i>	Flyr's brickell-bush	E
<i>Bumelia anomala</i>	Clark's buckthorn; silver buckthorn	E
<i>Bumelia lycioides</i>	buckthorn; mock-orange; ironwood; shittim-wood	E
<i>Callirhoe papaver</i>	poppy mallow	E
<i>Calopogon multiflorus</i>	many-flowered grass-pink	E
<i>Carex chapmanii</i>	Chapman's sedge	E
<i>Cheilanthes microphylla</i>	southern lip fern	E
<i>Cleistes divaricata</i>	spreading pogonia; rosebud orchid	T
<i>Coelorachis tuberculosa</i>	Piedmont jointgrass; Florida joint-tail	T
<i>Ctenium floridanum</i>	Florida toothache grass	E
<i>Epidendrum conopseum</i>	green-fly orchid	C
<i>Forestiera godfreyi</i>	Godfrey's privet	E
<i>Hexalectris spicata</i>	crested coralroot; brunetta	E
<i>Lilium catesbaei</i>	southern red lily	T
<i>Listera australis</i>	southern twayblade; double-leaf orchid;	T
<i>Litsea aestivalis</i>	pond-spice; pondspice; pond bush	E
<i>Lobelia cardinalis</i>	cardinal flower	T
<i>Lycopodium cernuum</i>	nodding club-moss; staghorn clubmoss;	C
<i>Malaxis unifolia</i>	green adder's-mouth	E
<i>Matelea floridana</i>	Florida spiny-pod	E
<i>Matelea gonocarpos</i>	angle-pod	T
<i>Matelea pubiflora</i>	sandhill spiny-pod	E
<i>Osmunda cinnamomea</i>	cinnamon fern	C
<i>Osmunda regalis</i>	royal fern	C

Scientific Name	Common Name	FFWCC
Pecluma dispersa	widespread polypody	E
Pinguicula caerulea	blue butterwort	T
Pinguicula lutea	yellow butterwort	T
Platanthera blephariglottis	white-fringed orchid; plume-of-Navarre	T
Platanthera ciliaris	yellow-fringed orchid; orange plume	T
Platanthera cristata	crested fringed orchid	T
Platanthera nivea	snowy orchid	T
Pogonia ophioglossoides	rose pogonia; crested ettercap	T
Polygonum meisnerianum	Mexican tear-thumb	E
Pteroglossaspis ecristata	wild coco; non-crested eulophia	T
Pycnanthemum floridanum	Florida mountain-mint; horsemint	T
Rhapidophyllum hystrix	needle palm; blue-palmetto; vegetable porcupine	C
Rhododendron canescens	pink azalea	C
Rhus michauxii	Michaux's sumac; false poison sumac	E
Salix floridana	Florida willow	E
Sarracenia minor	hooded pitcher-plant; rain-hat trumpet	T
Spiranthes brevilabris	ladies'-tresses	E
Spiranthes ovalis	lesser ladies'-tresses	E
Spiranthes tuberosa	little pearl-twist; little ladies'-tresses	T
Stenorrhynchos lanceolatus	leafless beaked orchid	T
Thelypteris reptans	creeping fern; walking wood fern	E
Tipularia discolor	crane-fly orchid; elfin spur	T
Triphora trianthophora	three-birds orchid; nodding etter-cap; nodding pogonia	T
Zamia	coontie; wild sago	C
Zephyranthes atamasco	rain-lily; atamasco lily; Easter-lily	T
Zephyranthes treatiae	Treat's zephyr-lily; Florida Easter-lily	T

Table 15. Animal species and subspecies endemic, or nearly endemic, to Alachua County*

Fish	<u>Common Name</u>	<u>End. Status</u>	<u>Fed/State Status</u>
Jordanella floridae	Flagfish	1	N/N
Opsopoeodus emiliae peninsularis	Pugnose Minnow	1	N/N
Micropterus salmoides floridanus	Largemouth Bass	1	N/N
Amphibians			
Notophthalmus perstriatus	Striped Newt	2	N/N
Pseudobranchius striatus axanthus	Narrow-striped Dwarf Siren	1	N/N
Acris gryllus dorsalis	Florida Cricket Frog	2	N/N
Pseudacris nigrita verrucosa	Florida Chorus Frog	1	N/N
Reptiles			
Chelydra serpentina osceola	Florida Snapping Turtle	2	N/N
Deirochelys reticularia chrysea	Florida Chicken Turtle	1	N/N
Eumeces egregius onocrepis	Peninsular Mole Skink	1	N/N
Kinosternon baurii palmarum	Striped Mud Turtle	2	N/N
Kinosternon subrubrum steindachneri	Florida Mud Turtle	1	N/N
Nerodia fasciata pictiventris	Florida Water Snake	2	N/N
Ophedrys aestivus carinatus	Rough Green Snake	1	N/N
Pseudemys nelsoni	Florida Red-bellied Turtle	2	N/N
Pseudemys concinna suwanniensis	Suwannee Cooter	1	N/SSC
Pseudemys floridana peninsularis	Peninsular Cooter	1	N/N
Regina alleni	Striped Swamp Snake	2	N/N
Stilosoma extenuatum	Short-tailed Snake	1	C2/T
Tantilla relicta neilli	Central Fla Crowned Snake	1	N/N
Terrapene carolina bauri	Florida Box Turtle	2	N/N
Birds			
Grus canadensis pratensis	Florida Sandhill Crane	2	N/T
Mammals			
Cryptotis parva floridana	Florida Least Shrew	2	N/N
Lasiurus cinereus	Hoary Bat	2	SU/N
Mustela frenata olivacea	Southeastern Weasel	2	S3
Myotis austroriparius	Southeastern Bat	2	N/N
Neofiber alleni	Round-tailed Muskrat	2	C2/N
Podomys floridanus	Florida Mouse	1	C2/SSC
Sciurus niger shermani	Sherman's Fox Squirrel	1	C2/SSC
Ursus americanus floridanus	Florida Black Bear	2	C2/T

* Summary Report on the vascular plants, animals and plant communities endemic to Florida. 1989. FGFWFC Non-game Wildlife Program. Tech. Rep. No. 7

1 = endemic
 2 = nearly endemic
 T = Threatened
 SSC = Species of Special Concern
 C = Candidate for federal listing
 N = No specific status

E. Protecting biodiversity

1. Federal and state protections

A series of state, federal and international laws has been created in an attempt to protect and preserve threatened and endangered species. Each law includes a list of species faced with extinction, rulings as to how these species and their habitats must be treated and penalties for non-compliance with the law. The federal Endangered Species Act was enacted in 1973. The Convention on International Trade of Endangered Species (CITES) was signed in 1975. Florida's rulings came just a few years later. The Preservation of Native Flora of Florida Act was passed in 1978. The Florida ruling on endangered and threatened species of animals was enacted in 1979. Each state ruling is accompanied by species lists, designations of levels of endangerment and each has been amended at least once since its approval.

In the United States there are several categories to describe the level of endangerment of a species, also called its status. Endangered, threatened, rare, species of special concern, commercially exploited, under review, and status uncertain are but a few of the possible listings. Chapter 68A of the Florida Administrative code, current through January 1, 2000, designates 40 species of wildlife as endangered, 27 species as threatened and 50 as species of special concern.

Endangered means a species which is so few or depleted in number or so restricted in range or habitat due to any man-made or natural factors that it is in imminent danger of extinction. Both the manatee and the Florida panther are among the 40 species on this list.

Threatened means a species which is facing a very high risk of extinction in the future. The Florida sandhill crane, Florida scrub jay, the red-cockaded woodpecker and Florida black bear are four species of the 27 on this list.

Species of special concern are those which are facing a probable risk of extinction in the future. The gopher tortoise, the osprey, and whooping crane are among this group.

These definitions suggest that a species may undergo a change in status, depending on changes in population structure, population sizes and/or changes in environmental conditions. These species will not survive without our attention.

2. Listing process

The processes by which a species is judged to be legally endangered, threatened, commercially exploited or of special concern are similar among the different levels of government. Sufficient data must be presented to a governing body to show that an insufficient number of individuals exist in a particular species to ensure survival. The actual numbers that define endangerment may be different among the species, depending upon characteristics such as reproductive rates (i.e., how many strong, viable organisms can be produced).

The determination of endangerment may also vary among different legislative levels depending on the scale that is used. For example, bald eagles are more abundant in Florida than they are in most of the rest of the United States. By Florida law the species is given a threatened status, whereas by U.S. law it is an endangered species. The problem of consistently identifying species status is not unique to the state or

federal level; there are species that, within Alachua County, are endangered but are classified at a lower level on a statewide or federal basis.

The official "listing" of a species involves a long process of proposals and reviews. Typically, the first information suggesting that a species is potentially endangered comes from an academic, research or conservation group. Such a group might make observations about the species and submit a proposal to the government to include the new species on official lists. In such a case, the species is listed as "Under Review". The listing process can take years before a final decision is made. During that time, the species may receive little or no protection and may be further disturbed.

A statewide inventory of potentially endangered species was initiated in 1975 by the Florida Committee on Rare and Endangered Plants and Animals (FCREPA), an academic group. This group publishes lists and species accounts of the organisms that are considered to be in peril in Florida. The lists include more species than the state or federal lists because the process was based on academic evaluation not hindered by legal delays. In addition, the Florida Natural Areas Inventory (FNAI) maintains a geographical and biological data base on known occurrences of rare species, including all federal- and most state-listed species. These lists are valuable planning tools to predict occurrences of environmentally sensitive areas that may require careful management or special attention.

3. Species v. ecosystem protections

Traditionally, wildlife conservation has focused on species. The Florida Fish and Wildlife Conservation Commission was given the mandate to protect endangered, threatened and species of special concern. It seems a reasonable approach, but is it the best approach?

Habitat is a place containing everything needed for each plant and animal to live there and to reproduce. This place is most often named for the dominant vegetation present. An example would be pine flatwoods. Many species move around throughout their life, alternating between two or more habitats, and depend on all to survive.

If a species has become endangered, what actually happened first? With rare exception, if the species is suffering, it's the habitat that has been compromised. If we protect the habitat, we preserve the wildlife. Even our most ambitious biodiversity conservation law, the Endangered Species Act, takes an incremental, species by species approach to conservation. A species must be judged to be in danger of extinction throughout all or a significant portion of its range, or of becoming in danger of such extinction, to qualify for protection efforts. Even then, the efforts to protect such species are often narrowly focused on that species without broader consideration of the natural system of which it is a part. The net result has been a steady accumulation of species listed as endangered or threatened, a proliferation of species specific recovery plans, and a growing backlog of unmet demand for conservation action. Putting an end to the ever growing list of endangered and threatened species will require new, more comprehensive approaches to the problem.

A wealth of information is now available about those species that are at greatest risk and therefore are in need of concerted conservation attention. But conservation must occur within the context of the ecosystems on which these species depend. It is no accident that habitat destruction is the leading cause of species endangerment. The limitations of species-by-species approaches to conservation have become painfully apparent over the past few decades. While species-level conservation will remain an essential protection strategy, ecosystem scale conservation is increasingly viewed as an important complement.

4. Local strategies: Alachua County

Until 1991 there was essentially no protection of upland natural communities because such communities had not been mapped and were not identified for protection during the development process. It is therefore impossible to quantify impacts to these resources from development, agricultural conversion, and other activity prior to this time. The 1991 Comprehensive Plan adopted, for the first time, some measure of protection for specific communities identified as significant according to a 1986 inventory of uplands in Alachua County. Through the mid-1990s, policies required an assessment of the site at time of application for development, and clustering of permitted development on the non-sensitive portions of the site or, if necessary, on no more than fifty percent of the sensitive portions. Activities not requiring a permit and activities conducted without the benefit of a required permit could still not be monitored before the fact. The continued applicability of these policies came into question in 1996, when a second inventory was completed that was broader in scope and included several new properties.

Although Alachua County has adopted development regulations that include provisions for the protection of eagles and eagle habitats, other species listed by Cox et al. (1994) remain unprotected. Because Alachua County has lacked an overall plan for conservation, attempts to protect resources and habitat have been hit and miss, leading to fragmentation and lack of continuity among existing conservation areas. The County has relied almost exclusively on the state of Florida to implement any conservation efforts and acquire any sensitive lands. Instead of identifying areas for acquisition for resource and habitat protection over the years, Alachua County has chosen to negotiate with each development separately in a piecemeal fashion. The result? Small pockets of acreage, scattered throughout the County, unimproved and not maintained due to budgetary constraints.

In the 1991 Comprehensive Plan, natural communities were addressed in fragmented fashion as uplands, wetlands, wildlife habitat, and other specific resource types. A significant opportunity to revise and integrate currently fragmented County policy in this area is afforded by the 1996 completion of a follow-up ecological inventory of the County. This comprehensive inventory evaluated all privately-owned significant natural ecological communities, both upland and wetland, remaining throughout the County. It offers the opportunity to address multiple County objectives relating to uplands, wetlands, surface water, groundwater, forest resources, floodprone areas, wildlife habitat including listed species habitat, cultural resources, and other resources through a carefully crafted program to protect these resources by acquisition, incentives, public-private partnership efforts, and land development regulations.

New policies in the Conservation and Open Space Element establish an integrated approach to the protection of natural communities and their associated values in Alachua County. Associated values include not only habitat protection and wildlife diversity, but also protection of wetlands function, floodplain function, water quality protection, aquifer recharge, protection of listed species, recreation values, and protection of cultural values, including historic, archaeological, and paleontological. Significantly, all of these values come together in protection of viability of natural communities. The County is in the process of carefully crafting a new program to protect these resources by identification of these resources, acquisition, incentives, public-private partnership efforts, and regulatory mechanisms to protect them.

a. Identification

Science is the basis on which a good conservation program is built. There are naturally occurring ecological areas that can be identified by scientific criteria. A County needs a map that identifies the communities "strategic" lands. Land may be important for a variety of reasons. It may be important for species habitat or functioning farmland with high-value crops. The criteria can vary - and should be defined by any conservation program. Alachua County provides criteria for significant habitat and listed species habitat under Objective 4.9, and for strategic ecosystems under Objective 4.10.

In 2001, the Defenders of Wildlife published a report that addresses the importance of incorporating habitat and ecosystem protection in Florida law. The report, Protecting threatened ecosystems through Florida's growth management system, identifies the Gaps reports, the Statewide Greenways project, and FNAI, supplemented where available with water management district and County data, as the "best available existing data" (p.28) on habitat and ecosystems in Florida. These are used to map important components of biodiversity in Alachua County and are discussed in Inset 16.

The maps in the Conservation Element series are intended to provide guidance to decision makers involved in public land acquisition, land use planning, development regulation, and other conservation efforts. The maps represent our best estimate of those lands within Alachua County that require some form of conservation to ensure that biodiversity is maintained for future generations. However, the maps represent only a snapshot of conservation needs at one time. As a consequence, some areas identified for protection may already be in public ownership or may no longer support the habitat features or species predicted to occur there. The maps have not been incorporated into policy or regulation as inviolate zones in which no development may occur. Rather, the maps are to be used as a layer of information when decisions are made concerning land acquisition, land use planning, and development regulation.

New data are continually being added to the project database as new parcels of land come into public ownership, new records of the locations of listed species become available, and more up-to-date vegetation maps are created. As a result, the latest versions of the project maps actually reside in the computer. Before using the maps in this Element for detailed management decisions, users should contact the ACEPD for the latest information.

Inset 16: Maps of Important Components of Biodiversity in Alachua County

Gaps Reports

The FFWCC in 1994 published a report entitled, Closing the Gaps in Florida's Wildlife Habitat Conservation System, which provides information for the County in a state and regional context. The project was supplemented in 2000 with Habitat Conservation Needs of Rare and Imperiled Life in Florida, and expanded in scope from focal species to all listed species identified of concern by various experts.

Strategic Habitat Conservation Areas

The Gaps project recognizes that Florida's growth management laws, passed in the 1980s, have not provided enough protection for the state's diverse wildlife and habitat, especially with respect to essential upland systems. The Gaps project describes habitat areas in Florida that should be conserved if key components of the state's biological diversity are to be maintained. It recommends that 4.82 million acres, or approximately 13% of the land area in Florida, be designated as Strategic Habitat Conservation Areas to meet minimum conservation goals. These areas are considered essential to providing some of the state's rarest animals, plants, and natural communities with the land base necessary to sustain populations in the future.

The species and habitats considered in 1994 are only a small subset of the total biodiversity of Florida. The improved maps of potential habitat developed in the 2000 report, in combination with the maps of potential habitat developed in the 1994 report, allow for a more detailed assessment.

An assessment of important habitat types was made by reclassifying the gap analysis map overlays depicting species richness. More than 84% of the remaining acreage of the sandhill community type coincides with potential habitat for greater than 10 rare species. This community type is thus a top conservation priority almost anywhere it occurs in Florida.

A similar cross-tabulation was made using the species richness map and a map of physiographic regions. Over 24% of the remaining acreage of the Central Florida ridges and uplands region contains greater than ten rare species. Yet, the percentage of conservation land in this region, at approximately 14%, is much less than the statewide average of approximately 21%.

Biodiversity Hot Spots

The Gaps project also generated a separate set of maps, referred to as Regional Biodiversity Hot Spots which convey more detailed information on the known locations of as many components of biological diversity as possible, regardless of whether or not they fall within proposed SHCAs, to help meet the need for conservation information at regional and local levels.

Gaps emphasizes that the importance of conserving locally valuable resources cannot be overstated. Not only do natural areas significantly enhance the quality of life and ameliorate the urban environment, but they can also play a key role in enhancing the overall security of rare plants and animals by helping to maintain a broad geographic distribution of populations.

The map identifies three broad categories of Class 1, Class 2, and Class 3 areas based on the number of focal species that would likely find appropriate habitat conditions in the area. Class 1 lands depict areas where habitat conditions for 3-4 focal species likely occur; Class 2 lands show areas where habitat conditions for 5-6 focal species likely occur; and Class 3 lands show areas where habitat conditions for 7+ focal species likely occur. Class 1 lands are often large forested tracts that have varying degrees of natural quality. Although the number of listed species protected by Class 1 lands may be relatively low, these forest areas often serve vital functions when viewed from a regional perspective. They help buffer more pristine natural areas from encroaching urban and residential development, provide dispersal areas between nature preserves, and maintain air and water quality. In some cases, they may be crucial to species existence.

Class 2 and 3 areas generally provide habitat for wide-ranging habitat generalists as well as species with more specific habitat requirements. Many are absolutely critical to maintaining viable populations of several rare species.

Some highlights for Alachua County include forested areas along the Santa Fe River. Rare species recorded within 100 m of the Santa Fe include canebrake rattlesnake, Suwannee cooter, and Suwannee bass. Portions of wetlands in south Alachua County are included as SHCAs for Florida sandhill crane, southern bald eagle, and several rare wading birds (wood stork, little blue heron, great egret, yellow crowned night heron, and tricolored heron). Terrestrial caves are included as SHCAs for southeastern bats. Other species are listed by major drainage basins.

- Paynes Prairie: round-tailed muskrat, limpkin, gopher tortoise, eastern indigo snake, tiger salamander, and virgin's bower.*
- Levy and Kanapaha Prairies: fox squirrel, southeastern American kestrel, limpkin, gopher tortoise, Florida pine snake, and eastern indigo snake.*
- Orange and Lochloosa lakes: Florida black bear, osprey, limpkin, gopher tortoise, eastern indigo snake, and blackbanded sunfish.*
- Newnans Lake and Lochloosa Creek: southeastern weasel, fox squirrel, osprey, limpkin, gopher tortoise, short-tailed snake, spotted turtle, flatwoods salamander, striped newt, and loose-coiled snail.*

Map 39 identifies FFWCC Biodiversity Hot Spots in Alachua County.

Florida Ecological Network

In 1998, the FDEP funded and prepared, in conjunction with the Florida Greenways Coordinating Council, a report entitled "Connecting Florida's Communities with Greenways and Trails." The Florida Statewide Greenways System Planning Project was the result of that endeavor. The Greenways System Planning Project identifies and recommends for conservation specific areas in the Greenways system known as the "Statewide Ecological Network." The lands identified in the Ecological Network contain many of the same lands identified as SHCAs in the GAPS Report, omitting some areas outside of greenway corridors. The Executive Summary of the Greenways System Planning Project states that the purpose of the Ecological Network is for protection of an integrated state reserve system that could effectively conserve Florida's biological diversity and other important land resources.... into an updated and completely linked reserve system of statewide significance. The Executive Summary goes on to recommend: "It is essential that the Ecological Network be incorporated into the planning process...." pp. 12-13.

The primary purpose of the Greenways project was to identify lands for acquisition, and the report did not deal with matters of growth management or regulation. However, the science behind the Ecological Network shows that, as with the GAPS Report, there is a compelling state interest in preserving those specifically identified areas critically necessary for providing the minimum protection to enable the survival of Florida's major ecosystems and biological diversity.

The Greenways project goal was to use a regional landscape approach to design an ecologically functional Statewide Greenways System that: (1) conserves critical elements of Florida's native ecosystems and landscapes, (2) restores and maintains essential connectivity among diverse native ecological systems and processes, (3) facilitates the ability of these ecosystems and landscapes to function as dynamic systems, and (4) maintains the evolutionary potential of the biota of these ecosystems and landscapes to adapt future environmental changes. This is a cooperative effort of the University of Florida, Florida Department of Environmental Protection, Florida Greenways Commission, and Florida Greenways Coordinating Council.

Map 40 identifies lands within the Statewide Ecological Network in Alachua County.

More information may be found at the Florida Greenways and Trails Council Web site: <http://www.geoplan.ufl.edu/projects/greenways/greenwayindex.html>

Florida Natural Areas Inventory (FNAI)

The Florida Natural Areas Inventory (FNAI) is a private, non-profit program affiliated with the Nature Conservancy and the FDEP. The inventory collects, interprets, and distributes ecological resource information critical to the conservation of Florida's heritage. FNAI maintains a scientific database of more than 26,000 occurrences of rare plant and animal species and high quality natural communities through the state. Started in 1981, the inventory is now well known as the best single source of ecological resource information. FNAI maintains geographic and literature databases to document the status of hundreds of species of flora and fauna. FNAI's effort is a critical one to the conservation of these species and the maintenance of Florida's biological diversity. But the FNAI data, although excellent, is incomplete. Due to lack of coordination between state and local agencies and more so between public and private entities, there are species sightings and public and private conservation lands not listed in the database. Despite FNAI's shortcoming, their two field guides on rare plants and rare animals are valuable tools.

FNAI has developed a map of potential natural vegetation by interpreting recent aerial photography collected by FDOT. Areas of conservation interest (ACIs) were further categorized using 3 criteria: category A lands were natural lands that contained FNAI occurrence records and had been visited by FNAI personnel; category B lands were natural areas that appeared to have high quality conditions in aerial photos, but were not actually visited by FNAI personnel; category C lands appeared to have natural features, but the quality of sites could not be easily determined by aerial photography.

See Map 41 for Areas of Potential Conservation Interest in Alachua County.

County-wide Ecological Inventories

A 1987 inventory of natural ecological communities in Alachua County was conducted by KBN Engineering and Applied Sciences, titled Final Report: Comprehensive Inventory of Natural Ecological Communities in Alachua County. This report identified, generally mapped, and ranked the most important natural upland communities based on a set of factors including vulnerability, rarity, connectedness, completeness, manageability, and potential for nature-oriented human use. Study shortcomings included exclusion of wetland communities, which are intertwined with upland communities in many cases, and generalized mapping, which precluded identification of areas for potential protection on a parcel basis. Because of these shortcomings, there was an expressed need to conduct a follow-up inventory on a more detailed basis.

Privately-owned natural areas were identified in a follow-up inventory of natural ecological communities was performed by KBN, A Golder Associates Company, titled Alachua County Ecological Inventory Project, November 1996. The purpose of the study was to identify, inventory, map, describe, and evaluate the most significant natural biological communities, both upland and wetland, that remain in private ownership in Alachua County and make recommendations for protecting these natural resources. Forty-seven discrete project areas were identified, mapped and ranked for significance using criteria based on vegetation value (species diversity, presence of exotic species), endangered species habitat value (plants and animals), wildlife habitat value generally, hydrology (Floridan aquifer recharge potential; surface water and surficial aquifer resource protection, and flood protection), landscape ecology (community diversity, ecological quality, community rarity, and functional connectedness), and management potential.

Detailed summaries for each site identified and discussed (1) bio-community types, acreage, and quality within the project area; (2) presence and quality of connections to other project areas; (3) site boundary conditions; (4) geologic/hydrologic features; (5) wildlife habitat value; (6) habitat value for listed species; (7) presence of exotic species; (8) restoration and management potential; (9) recommended conservation strategies; and (10) comprehensive plan considerations. A set of site evaluation scores on the ranking criteria was also included with each site summary. The broad scope of the study precluded very detailed site assessments of each site; however, the data and analysis contained in the study is the most comprehensive and extensive information available on the remaining natural areas in the County.

See Map 42 for areas identified in the Alachua County Ecological Inventory Project.

Water Management District Land Use Cover Data

In 1995, to develop a baseline database of wildlife habitat in the entire State, each of the water management districts in Alachua County mapped natural systems and land use cover utilizing GIS analysis of LANDSAT imagery. Map 43 depicts this Landsat data. Areas of significant habitat are mapped where known. However, such areas are difficult to detect on aerial imagery and must, in all cases, be confirmed through site-specific ground-truthing.

FFWCC Habitat Cover

In 1995, the Florida Fish and Wildlife Conservation Commission published coverage of habitat types throughout the state. This provides another useful means to help identify significant habitat in Alachua County. See Map 44 for FFWCC habitat coverage of Alachua County.

b. Acquisition

The best means of preserving natural communities is public acquisition by entities dedicated to protecting the natural functions and conditions of the land. Presently, the primary protection afforded natural communities in Alachua County is through public ownership and management of natural areas as preservation lands. In Alachua County, most public acquisition of land has been by the state or the water management districts since 1990. We still lag behind other neighboring counties, as well as other counties within the region, on conservation purchases. However, with recent voter approval of Alachua County Forever, and aggressive pursuit of jointly funded projects with state, water management district, and local partners, our citizens hope to increase the acreage of environmentally significant lands that are protected for future generations. See the Conservation Strategies portion of this data and analysis for further discussion of this topic.

The advantages of land acquisition programs include paying private land owners rather than regulating land owners or losing habitat, and providing the greatest assurance that ecosystems and wildlife habitat will remain protected into the future. However, the amount of money presently available is insufficient to purchase all areas necessary to conserve the County's biological diversity. Therefore, other complementary strategies are necessary.

c. Regulations

Alachua County will employ a course filter/fine filter approach to conservation that recognizes the complementary nature between ecosystem scale and species scale efforts. Biodiversity policies under Objective 4.9, and wetland policies under Objective 4.7, address protection of upland and wetland habitat generally, as well as the protection of habitat for listed species. Policies for strategic ecosystems under Objective 4.10 are geared to protection at a larger geographical scale. Treating ecological communities – unique assemblages of plants and animals – as targets of conservation efforts provides a means of extending protection efforts to the full array of species, known and unknown, charismatic and obscure. Ecosystems, however, are more than the sum of their parts. Taken as a whole, an ecosystem reflects the complex interactions and mutual dependencies of the biological inhabitants and physical processes within it. For this reason, ecological communities are also worthy of being targeted for conservation in their own right.

Managing for community diversity is a complement to, rather than a replacement for, species-level management. This has been referred to as applying a course management filter (Barnes 1999). The idea is that if we maintain intact functioning ecological communities, the species living in those communities will thrive. It has been estimated that 85-90% of all species can be protected using this course filter approach.

Some suggest that we should focus our species-level management on “keystone” or “umbrella” species. Keystone species are organisms that are disproportionately important compared to their biomass in the community. Umbrella species (like the black bear) are often charismatic species that have large ranges and act as a “flagship” or “symbol” for conservation. These species require vast amounts of habitat in which to live. The argument is that by managing for these species, we can include, by default, less “charismatic” species in the large reserves.

Unfortunately, this approach does not always work, particularly for endemic plants that have a unique and restricted range, and we need to apply a fine filter approach (managing for individual species) in

managing rare or unique species that do not fall under the “umbrella” or “keystone” species of the community management approach. Perhaps the newest element is understanding how these layers fit together to form a landscape.

The time has come to carefully examine traditional management and move to a more holistic management. We must look at the social and economic needs of our citizens and try to provide these within the ecological capabilities of that area. If we accomplish this, the more we can pull everything together, and the more sustainable our ecosystems will be. Managing at the broader, landscape scale is the most reasonable scale for integrating diverse and sometimes competing resource values, for maintaining and conserving biodiversity, and for managing habitats including timber harvesting.

As part of the course filter/fine filter approach, Alachua County aims to protect landscape level resources under policies associated with strategic ecosystems, greenways, and habitat connectivity. Concurrently, the County will protect smaller scale resources as significant uplands and wetland habitat, and species level resources under policies associated with listed species habitat. The purpose of the County’s efforts is to identify and protect natural systems and the systems that comprise them before they are in the “emergency room” at the brink of crisis, when they can still be preserved for the future in healthy form.

Strategic ecosystems

Policy 3.3.1 includes strategic ecosystems within the primary conservation category in recognition of their ecological value, uniqueness and particular sensitivity to human impacts. Strategic ecosystems are defined as outstanding examples of ecosystems that are intact or capable of restoration and that require conservation or management to maintain important reserves of biodiversity at landscape, natural community and species specific levels. Strategic ecosystems are generally greater than 20 acres in size and contain one or more of the natural ecological communities described above. The natural resources that comprise strategic ecosystems are identified through means including, but not limited to: the FFWCC’s “Closing the Gaps in Florida’s Wildlife Habitat Conservation System” (1994), as supplemented with “Habitat Conservation Needs of Rare and Imperiled Life in Florida” (2000); FDEP’s “Statewide Ecological Network,” contained in The Greenways System Planning Project (1998); the Florida Natural Areas Inventory; and Golder’s “Alachua County Ecological Inventory Project” (1996).

In order to plan for the protection of strategic ecosystems, policies under Objective 4.10 call for special area plans to be developed in cooperation with landowners prior to development activities within the system. These resource-based plans will establish specific guidelines and management strategies that protect the integrity of the ecological unit. In follow-up to the Comprehensive Plan update, the County will develop a work program for conducting these special area plans.

If an applicant seeks development prior to the County’s creation of a special area plan for a particular strategic ecosystem, the applicant may conduct a comparable study at the applicant’s expense. Alternatively, if the applicant demonstrates that the ecological integrity of the strategic ecosystem will be sufficiently protected, the applicant may proceed according to the clustering provisions in policies under Objective 6.2 of the Future Land Use Element. Clustering shall be required so that at least 80% of each strategic ecosystem is preserved as undeveloped area.

Existing cluster and planned development regulations will need to be revised to update their applicability and provide regulatory flexibility which facilitates planning across multiple parcels and enhances long-term protection of strategic ecosystems.

The County will work with owners of agricultural and silvicultural lands to retain the ecological value and ecological integrity of strategic ecosystems through management plans and incentives. The County has committed to facilitating landowner participation in forestry certification programs, land acquisition programs, and federal and state cost-share conservation programs. Please see the discussions on Agricultural and Silvicultural Practices, as well as Conservation Strategies, for further details.

Listed species habitat

Listed species habitat is also categorized as a primary conservation area, indicating its relative importance in terms of needed protections. Policies 4.9.4 through 4.9.8 address regulatory protections of listed species habitat and coordination with appropriate management agencies.

Depending on the degree of the threat to a species' survival, various steps may be taken to protect the remaining habitats and populations of endangered biota. These include outright preservation of a threatened or sensitive habitat, and strict regulation of the removal of members of the affected populations. In less serious instances, important habitats may be protected to lesser degrees, with the exploitation of these habitats moderated. Designations such as rare, species of special concern and status uncertain alert local agencies to potential problems of land management, and should be heeded. Because of the difficulties associated with managing endangered or threatened species and their essential habitats, it is wise to take a conservative course of action when dealing with a species that is now declining in number.

Significant habitat

Significant habitat is defined as contiguous stands of natural upland plant communities which have been documented to support, and which have the potential to maintain, healthy and diverse populations of plants or wildlife. Policy 3.1.2 includes significant habitat in the secondary conservation category in recognition that these habitat areas are more pervasive than strategic ecosystems or listed species habitat.

The County will protect significant plant and wildlife habitat in accordance with policy 4.9.2. . A minimum of 25% of the significant habitat that occurs on site must be protected as conservation or preservation areas.

The County will require development in areas known to have particular value for wildlife to be carefully planned and, where possible, located so that the value of the habitat for wildlife is maintained. The County will require adequate buffer zones between construction activities and significant wildlife resources, including both onsite habitats that are purposely avoided and significant habitats that are adjacent to the project site, in order to avoid the degradation and disruption of critical life cycle activities such as breeding and feeding.

In addition, the County will support efforts to avoid the net loss of important wildlife habitat where practicable. Important habitat and habitat components include nesting, breeding, and foraging areas, important spawning grounds, migratory routes, migratory stopover areas, wildlife movement corridors, and other unique wildlife habitats critical to protecting and sustaining wildlife populations. In cases where habitat loss cannot be avoided, the County shall impose adequate mitigation for the loss of wildlife habitat that is critical to supporting special status species and/or other valuable or unique wildlife resources. Mitigation will be at sufficient ratios to replace the function, and value of the habitat that was removed or degraded. Mitigation may be achieved through any combination of restoration, conservation easements, and/or mitigation banking. Conservation easements must include provisions for maintenance

and management in perpetuity. The County will recommend coordination with the U.S. Fish and Wildlife Service and FFWCC to ensure that appropriate mitigation measures and the concerns of these agencies are adequately addressed.

Policy 4.10.8 calls for the County to implement an ordinance that specifically addresses the preservation of strategic ecosystems, significant plant and wildlife habitat, habitat corridors, and vegetative communities, to provide a regulatory framework for the policies described above. Biodiversity cannot be protected by laws alone, but as we enter the next millennium, the rules of society must better reflect environmental values and necessities.

Resource protection standards provided in policies under Objective 3.6 apply to all of these resources. In addition, if development or land use change is proposed, the applicant will be required to conduct a natural resources inventory, pursuant to policy 3.4.1. In order to protect plant and wildlife habitat generally, prior to approval of discretionary development permits, the County requires, as part of any required environmental review process, a biological resources evaluation of the project site by a qualified biologist. The evaluation shall be based upon field reconnaissance performed at the appropriate time of year to determine the presence or absence of significant resources and/or special status plants or animals. Such evaluation will consider the potential for significant impact on these resources and will either identify feasible mitigation measures or indicate why mitigation is not feasible.

Many conservation areas are protected through non-public processes, such as the dedication of conservation easements, designation of conservation areas on plat maps, and as regulated and monitored mitigation areas.

d. Stewardship

Working partnerships

Ecosystems management is a dynamic process and requires a strategy that develops, enhances, and protects the ecological and socioeconomic values of the resources while maintaining private ownership. When landowners combine their private values with responsible stewardship, a landscape-level private stewardship plan can work. Without communication, coordination, and cooperation, it is impossible to know what your neighbors are doing and to engage in long-term planning.

The County will encourage private landowners to adopt sound wildlife and management practices, as recommended by the FFWCC and the U.S. Fish and Wildlife Service. Truly turning around the problem of protecting listed species on private lands will require a fundamental shift in how they are perceived by private landowners. Listed species are now often perceived as a net liability, something that may interfere with economic use of the property. What is needed are incentives that can turn the presence of these species into an economic asset.

Loss of biodiversity is a difficult problem to tackle. It is the ultimate, measurable result of many interacting and mutually reinforcing factors. A successful approach to biodiversity conservation must therefore be integrated.

Forest conservation strategies

Forest conservation strategies include Silvicultural Best Management Practices (2000), published by FDACS, which provide minimum standards necessary for protecting and maintaining the state's water

quality as well as certain wildlife habitat values during forestry activities. BMPs were first established in the mid-1970s in response to the Federal Clean Water Act of 1972 and are periodically revised. Revisions in 1993 included additions addressing water resource features such as sinkholes, smaller lakes, canals, and wetlands; some attention to wildlife habitat values; and an expanded version of Special Management Zones. However, many of the relationships between silviculture activities and impacts to natural resources have not been well quantified. Consequently, periodic BMP compliance surveys conducted by FDACS, which generally report a high level of compliance, cannot be readily evaluated in terms of impacts on natural communities. The Silvicultural Best Management Practices Manual was revised most recently in 2000 to address non-flowing wetlands. Please see the Agricultural and Silvicultural section for more discussion of this topic.

As urbanization reduces and fragments some forest areas, the remaining large forest tracts on public and private lands may increasingly contribute to the conservation of many sensitive wildlife species. Given the importance of landscape structure in determining the suitability of habitats in urban and agricultural areas, maintaining habitat connectivity can enhance ecosystem function in these areas.

Agricultural land is often interspersed with woodlots and other forest habitat. Habitat connectivity, which is often provided by vegetated fencerows, greatly influences the presence of birds and other species in agricultural areas. Isolated forest habitats can serve as ecological traps for some species by focusing populations in small areas along with a high concentration of nest predators.

Eco-tourism

Eco-tourism is one area in which resource protection interests and economic development interests can overlap. Land held in either public or private ownership can be opened to public use and enjoyment in a way which preserves its resource values while providing recreational, educational, cultural, and entertainment values to people. A sensitivity analysis should be conducted to determine what resource values are represented in each designated natural area and how sensitive each of these areas is to human disturbance.

One key element in a resource protection program which has been gaining popularity in the North Central Florida region may be local resource tourism built around recreational trails. Developments demonstrating the draw of these features are the Suwannee River Bicycle Tours, the first year-round bicycle touring company in the state (based in White Springs, now known as Suwannee Bicycle Association, a nonprofit), and the Florida state bicycling program, located within FDOT. Travel and tourism writer Herb Hiller, who writes for numerous magazines and developed both programs listed above, describes heritage tourism as a way of maintaining habitat for wildlife while keeping a sense of original Florida alive for the rest of us.

The linking of greenways and trails can serve both to create a recreational network and to link wildlife habitats within counties, regions, and the state. In so doing, it can also create a critical connection between tourism as an economic sector and tourism as a way to stimulate a shared sense of who we are together in this state. The State Office of Greenways and Trails, located in the Florida Department of Environmental Protection, is currently developing and testing a cost-benefit decision model to assist communities in evaluating the relevant costs and benefits associated with five types of greenways and trails - ecological, recreational, historic/scenic, transportation-bases, and multi-purpose.

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