Conservation Area Land Management

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Facilities, Planning &
Construction Division

UNIVERSITY OF FLORIDA

Executive Summary

The Conservation Area Land Management (CALM) plan documents existing conditions and specifies management activities for Conservation Areas on the University of Florida Campus. These Conservation Areas are defined in the Campus Master Plan as having a Conservation Future Land Use designation. In most cases, the areas are also listed in the 1995 and 2000 Master Plans as Preservation Areas.

The CALM plan serves as the Conservation Element's Data and Analysis that covers Campus Conservation Areas within the Campus Master Plan. Previous Master Plans documented the existence of Conservation Areas, but provided little background information nor guidance for improvements to each of the areas. Therefore, the premise behind this CALM plan was to create a plan that documents existing conditions on campus natural areas and makes recommendations that enhance these special places. Additionally, the plan is intended to demonstrate the University's commitment to preserving and improving campus natural areas.

Beginning in the fall of 2003 an ad-hoc working group of University staff, faculty, students and interested community members conducted tours of 25 campus Conservation Areas and 5 passive recreation areas in order to determine their current state and recommend improvements for each area. From these 30 areas that were visited 22 specific area plans have been developed (passive recreation areas were not included and some Conservation Area were grouped together) that outline issues and strategies for each Conservation Area. The core members of this group included: Paula Fussell, Linda Dixon, Alex Holecek, Chuck Hogan, Marty Werts, Erick Smith, Mark Clark, Tom Walker, Meghan Pressley, Fritzi Olsen, Bruce Delaney, Glenn Ketchum, Mark Brown, Gerald Kidder, Nick Vellis, Clay Montague, and Ann Stolda, although other were involved in individual site visits. The recommendations from this working group formed the foundation of the CALM plan and specific area plans.

The conservation land use designation of the Campus Master Plan's future land use map formed the starting point for remapping all land use categories by identifying and protecting those lands that should not be developed. Remapping efforts were based on up-to-date spatial data that illustrated the inaccuracy of many conservation boundaries that were on the adopted future land use map (areas where land use designations conflict with the underlying use of the land or natural features). This new and more accurate data included wetland boundaries, floodplain boundaries, tree canopy coverage, steep slopes, archeological sites and other natural and anthropogenic features that represent logical separation lines between uses. Thus, using this new data the ad-hoc working group, along with staff, began the remapping efforts with the adopted 2000-2010 boundaries serving as the starting point. Through the work of the Conservation Study Committee (Mark Brown, Sheri Bryan, Peggy Carr; Mark Clark,; Eva Czarnecka, Joyce Dewsbury, Linda Dixon, Paula Fussell, Chuck Hogan, Mark Hostetler, Gerald Kidder, Erik Lewis, Nancy Menzel, Clay Montague, Mackenzie Moritz, Meghan Pressley, Jack Putz, Erick Smith, Nick Vellis, Tom Walker, Marty Werts) these boundaries were revised, with some areas being added and others being eliminated.

Site visits by the working group lead to the observation, in most cases, that Conservation Areas on campus have not been actively managed. Thus, management issues identified by the group included basic problems of erosion, sedimentation, trash, unauthorized parking, invasive non-native plants and lack of amenities for visitors. In order to address these concerns, the working group came up with a number of management activities that have been included within the specific area plans and in the activities spreadsheet. Typical activities that were identified include fencing, educational/interpretive signage, invasive non-native plants management, trail marking, and habitat enhancements (plantings and shelters). Additionally, the working group recognized the importance of several Conservation Areas to support

environmental research / teaching and identified measures that should be taken to enhance these uses and foster multidisciplinary projects where feasible.

Successful performance will be measured by implementation of management strategies, along with changes to baseline conditions herein. Therefore, this plan represents the baseline report for the University's Conservation Areas and will serve as the basis for measuring future improvements, habitat quality and flora and fauna abundance and diversity.

Funding to implement these recommendations will come from a variety of sources including the following:

1. Grants – The University successfully received a grant from the Department of Environmental Protection to eradicate invasive non-native plants in two Conservation Areas. Other grants that could be applied for include stormwater and erosion grants from state and federal agencies, demonstration grants for establishment of best management practices, and wildlife.
2. Capital Improvements Trust Fund (CITF) – The University has requested $500,000 for FY 2005-2006 for management activities detailed in the CALM plan.
3. Division of Academic Affairs – Currently, this Division supports efforts at Seahorse Key and the NATL Conservation Area. This support could be broadened as other Conservation Areas are used as outdoor teaching laboratories that support academic research and teaching.
4. Division of Finance and Administration – This Division, through the Physical Plant Division, currently provides the bulk of maintenance within and around Conservation Areas through mowing, tree planting, fencing, informational kiosks and by limiting vehicular access by unauthorized personal.
5. IFAS facilities – IFAS also provides maintenance to Conservation Areas within and adjacent to its operations through mowing, fencing and by limiting vehicular access by unauthorized personal.
6. Partnerships – Some success has been achieved at improving Conservation Areas with cooperation by the City and Gainesville Regional Utilities. Efforts will be made to build upon these partnerships and gain new partners, particularly in the areas of invasive plant management and stream erosion.
7. Management Endowments – Promote and expand Conservation Area management through securing long-term endowments through charitable giving with the University of Florida Foundation.

Introduction

The Conservation Element for the University of Florida Master Plan serves two purposes. The first purpose is the traditional role within comprehensive plans of inventorying current environmental conditions, or data and analysis, on a campus wide basis and then developing Goals, Objectives and Policies that both maintain good conditions and improve upon those identified as not meeting federal, state, and campus environmental standards. The second purpose is to specifically address each Conservation Area on campus and develop management activities that are tailored to the major issues of each. The following document will outline the latter of these two efforts by giving an overview of Campus natural areas and specific details on each designated Conservation Area.

The 2000-2010 Master Plan contained some inconsistencies between what was considered a conservation land use and what was considered a preservation area. In other words, some areas like the creeks adjacent to Sorority Row, P.K. Yonge and Diamond Village were considered Conservation Areas, but not preservation areas. In other cases, areas considered preservation were placed in the passive recreation land use category (examples Wilmot Gardens, DASH - Handicap course). Similarly, some wetlands and water bodies were not designated as a conservation land use. This plan, as well as the updated Master Plan, will strive to eliminate these inconsistencies and identify management strategies for those places designated as conservation.

Conditions Inventory

Water Resources

The University of Florida's hydrology is unique from much of the State of Florida in that runoff from storm events, irrigation and surficial aquifer seepage all empty into depressions that ultimately recharge the Floridan aquifer. This is in contrast to the more typical view of Florida hydrology, which is generally characterized by surface water that runs into larger bodies of water that in turn flow to the ocean, or by areas of porous soils that allow water to recharge directly to an aquifer. The watersheds of the University are along the Cody Scarp. This scarp marks a geologic transition zone where the clays of the Northern Highlands physiographic province give way to karst prone limestones and sands of the Gulf Coastal Lowlands. Lands to the west of campus (transition area grading to Gulf Coastal Lowlands) are generally characterized as a mixture of sand and unconsolidated clays that allow for the easy downward movement of water to the Floridan aquifer, with very little in the way of surface water drainage features. Meanwhile, lands to the north and east of campus consist of remnants of the Northern Highlands province, which are characterized as poorly drained, low recharge, with significant drainage where water instead of recharging the aquifer makes its way via a series of creeks and rivers into the St. Johns River and ultimately the Atlantic Ocean. The University is in the transition zone between these provinces in a zone called a stream to sink watershed. As the name implies, stream to sink watersheds are where surface water flows down gradient and ultimately ends up in a depression or sinkhole. In the University's case the majority of surface water ends up in one of three depressions or sinkholes – Bivens Arm (Alachua Sink), Surgarfoot Prairie (Haile Sink) or Lake Alice (drainage wells).

Watersheds

<u>Lake Alice Watershed</u>

The Lake Alice watershed (basin) covers about 80% of campus, with approximately 1,140 acres of the basin on campus and an additional 381 acres contributing from off campus. Stormwater, reclaimed irrigation water and surfical aquifer seepage from creeks are the major contributors to the lake, which is the ultimate surface destination of water within the watershed. Historical accounts of Lake Alice show a lively past within the internal campus discourse, were different views on how to manage the lake and watershed have held sway over the years. The first accounts of controversy appear around 1946 –1947 when wastewater was diverted from a sinkhole, Sweet Sink, adjacent to the sewage treatment plant, to Lake Alice. This sinkhole, according to historical accounts, was the outlet for high water in the basin. The basis for the diversion from the sinkhole was that effluent discharges entering the sink were showing up in the city's public supply water system. This diversion of water to the lake led to a major increase in the water entering the lake and to flooding of traditionally non-flood prone areas. The flooding was further compounded by increases in impervious surface, irrigation and cooling waters (historically, Lake Alice was also augmented by the University's water chilling system and by air-conditioning systems that both discharged large amounts of water into Lake Alice. Over the years these non-beneficial uses of water have been taken off line). Many solutions were contemplated, with a final decision reached to allow Lake Alice to hold more water, while also installing two drainage wells that drain when water levels reach a certain elevation within the lake.

During the years of direct wastewater discharges to the lake, concern was expressed by many campus professionals on the increased nutrient content. It was observed that these nutrients were leading to increased aquatic plant growth and accelerated eutrophication processes within the lake. To deal with the engulfing plant growth of water hyacinths, parrotfeather and coontail, university staff started a maintenance removal program of these plants that is ongoing to this day. Eventually, years later and after much discussion from campus personnel about the impacts that effluent discharges were having on the lake, direct wastewater discharges to the lake were removed.

The current stormwater permit with the St. Johns River Water Management District (SJRWMD) allows the University to increase impervious surfaces within the Lake Alice watershed by an additional 184 acres (as of 7/11/2000) without additional stormwater facilities being built. This permit does not cover added stormwater from offsite sources in the City of Gainesville, nor from roads maintained by the Department of Transportation.

Hume Pond

Hogtown Creek Watershed

The Hogtown Creek Watershed covers the majority of incorporated City of Gainesville, however only 315 acres out of 13,440 acre watershed are present on the main campus. Hogtown Creek, the primary drainage conveyer in the watershed, drains into a depression named Sugarfoot Prairie and ultimately into Haile Sink. The two areas on campus that drain into Hogtown Creek are lands up gradient of Elizabeth Creek that runs though the University Arboretum, near the President's home, and the lands on the western side of campus that drain into the Hogtown Creek Woods area along SW 34th Street.

This watershed, as with much of Gainesville, was urbanized before the era of stormwater management and specifically on-site retention and detention. As a result, the creeks in this watershed suffer from high velocities during storm events, which cause in-stream erosion and lead to down-stream sedimentation that elevates the floodplain, potentially flooding structures. Unlike the Lake Alice watershed, new development within this watershed must be permitted individually with the SJRWMD, which will require the use of on-site retention or detention. Additionally, the University is looking for ways to cooperate with the City to incorporate new stormwater techniques to help ameliorate the downstream impacts of previous development by incorporation of Low Impact Development techniques where practicably feasible.

Bivens Arm Watershed

Bivens Arm Lake is the receiving body of this 2,200 acre watershed, 456 acres of which are on campus. The main tributary to Bivens Arm Lake is Tumblin Creek, which runs though the University's laboratory school P.K. Yonge. This creek empties into a large bottomland hardwood forest near US 441 on the northeast rim of the lake. Before being channelized to accelerate upstream drainage, this wetland forest provided water quality treatment through vegetative uptake of nutrients and metals. Other more intermittent tributaries are present to the north of the lake adjacent to the College of Veterinary Medicine facilities and to the west by IFAS's facilities, crops and pastures. Bivens Arm, like Lake Alice suffers from eutrophication from primarily anthropomorphic sources upstream.

Tumblin Creek is another Gainesville creek that suffers from in-stream erosion and downstream sedimentation. Additionally, the creek is on the Florida Department of Environmental Protections 305 (b) list as not meeting water quality standards, with a water quality rating of poor. The City of Gainesville and the University are exploring cooperative solutions that will help enhance the creek and improve water quality entering Bivens Arm.

Depression Basins (Watersheds)

In the University's Stormwater Management Master Plan a number of smaller watersheds or basins are defined as depressional basins. A depressional basin occurs when all surrounding land flows into a depression. In karst areas (sinkhole areas) these depressions often have an outlet in the form of a sinkhole that drains into an aquifer. However, when groundwater levels are high enough, sinkholes stop being drains and instead act like plugs or in some cases even as discharge points for the aquifer. When this happens the entire depression basin may fill up creating unexpected flooding. If enough water makes it into the system, water will eventually start flowing into an adjacent basin.

In reality, all of the University's watersheds are depression basins, since they all flow into depressions or sinkholes. The Bivens Arm / Tumbling Creek watershed is the only university basin that outlets to an area that can contribute to water that has the potential to make it to the ocean via the surface, but this only occurs during exceedingly heavy rainfall years, when the Floridan aquifer is also full and high.

Sinks, Ponds, Lakes and Creeks
While there are numerous small lakes and creeks on campus, only a few are named. The following list of named waterbodies are present on or adjacent to the main campus - Ocala Pond, Gator Pond, Dairy Pond, Green Pond, Lake Alice, Bivens Arm Lake, Sweet Pond / Sink, SEEP (Stormwater Enhancement Ecological Project), Presidents Pond, Hume Pond, Golf Course Pond, Deer Pond. The only named creeks on campus are Elizabeth, a tributary of Hogtown Creek, and Tumblin that runs through P.K. Yonge and into Bivens Arm.

All campus water bodies play a role in stormwater storage and conveyance. On campus, many ponds and sinks work as storage systems that accept stormwater runoff up to a predetermined elevation where an outlet structure has been placed. When water reaches the specified elevation it will begin to flow into one of these outlets that in turn flow into the University's stormwater system. Meanwhile, creeks act as surface stormwater systems in that they convey stormwater to base elevations within the basin. Additionally, many of the stormwater pipes are routed to drain into the creeks, in many cases contributing significant amounts of the creek's flow.

Natural Communities

The following descriptions of natural community types present on campus are largely taken from the Natural Communities of Florida (FNAI, 1990). While these communities are present on campus they may bare little resemblance to the descriptions that follow in that campus natural communities are generally disturbed by adjacent urbanization, heavy use from university personal and fire suppression.

Basin Marsh
Basin marsh is characterized as an herbaceous or shrubby wetland situated in a relatively large and irregular shaped basin. Basin marshes usually develop in large solution depressions that were formerly shallow lakes. The lake bottom has slowly filled with sediments from the surrounding uplands and with peat derived from plants. Thus, the soils are usually acidic peats. The hydroperiod is generally around 200 days per year. Open areas of relatively permanent water within the marsh, with or without floating aquatic vegetation. They may eventually succeed to Bog, if a muck fire does not reverse succession. Many of the plants and animals occurring in Basin Marshes also occur in Floodplain Marsh, Slough, Swale and Depression Marsh. Large examples of the Depression Marsh, in fact, may be very difficult to distinguish from small examples of Basin Marsh.

Plant Species
Typical plants include common reed, panicum, cutgrass, southern watergrass, pennywort, Spanish needle, redroot, soft rush, American lotus, water primrose, arrowhead, coastal plain willow, saltbush, elderberry, spikerush, knotweed, buttonbush, and dog fennel.

Animal Species
Typical animals include two-toed amphiuma, lesser siren, greater siren, cricket frog, green treefrog, bull frog, pig frog, leopard frog, alligator, eastern mud snake, green water snake, banded water snake, striped swamp snake, black swamp snake, great blue heron, great egret, snowy egret, little blue heron, tricolored heron, bald eagle, and northern harrier.

Bottomland Forest
Bottomland Forest is characterized as a low-lying, closed-canopy forest of tall, straight trees with either a dense shrubby understory and little ground cover, or an open understory and ground cover of ferns, herbs, and grasses. Bottomland Forest occurs on low-lying flatlands that usually border streams with distinct banks, such that water rarely overflows the stream channel to inundate the forest. They also occur in scattered low spots in basins and depressions that are rarely inundated, which allow typical upland species to survive. Soils are generally a mixture of clay and organic materials. The water table is high, but Bottomland Forests are inundated only during extreme floods or exceptionally heavy rains.

Plant Species
Typical plants include water oak, live oak, red maple, sweetgum, loblolly pine, white cedar, cabbage palm, diamond-leaf oak, southern magnolia, loblolly bay, swamp tupelo, spruce pine, American beech, dahoon holly, wax myrtle, swamp dogwood, Florida elm, stiffcornel dogwood, and American hornbeam.

Animal Species
Typical animals include marbled salamander, mole salamander, three-lined salamander, slimy salamander, five-lined skink, ringneck snake, gray rat snake, eastern king snake, cottonmouth, wood duck, red-tailed hawk, turkey, yellow-billed cuckoo, screech-owl, great-horned owl, ruby-throated hummingbird, acadian flycatcher, pileated woodpecker, hermit thrush, cedar waxwing, yellow-throated warbler, opossum, gray squirrel, flying squirrel, raccoon, mink, gray fox, bobcat, and white-tailed deer.

Depression Marsh
Depression Marsh is characterized as a shallow, usually rounded depression in sand substrate with herbaceous vegetation often in concentric bands. Depression Marshes are similar in vegetation and physical features to, but are generally smaller than, Basin Marshes. Depression Marshes are typical of karst regions where sand has slumped around or over a sinkhole and thereby created a conical depression subsequently filled by direct rain fall, runoff, or seepage from surrounding uplands. The substrate is usually acid sand with deepening peat toward the center.

Plant Species
Typical plants include St. John’s wort, spikerush, yellow-eyed grass, chain fern, willows, maidencane, wax myrtle, swamp primrose, bloodroot, buttonbush, fire flag, pickerelweed, arrowheads, and bladderwort. Larger and more permanent Depression Marshes may have many of the same plants and animals listed as typical of Basin Marshes. However, because of their isolation and small size, many Depression Marshes support a very different assemblage of species than that found in larger, more permanent wetlands.

Animal Species
Depression marshes are considered extremely important in providing breeding or foraging habitat for such species as the flatwoods salamander, mole salamander, tiger salamander, dwarf salamander, striped newt, oak toad, cricket frog, pinewoods treefrog, barking treefrog, squirrel treefrog, little grass frog, southern chorus frog, ornate chorus frog, narrowmouth toad, eastern spadefoot toad, gopher frog, white ibis, wood stork and sandhill crane. Depression Marshes occurring as isolated wetlands within larger upland ecosystems are of critical importance to many additional wetland and upland animals.

Floodplain Marsh
Floodplain marshes are wetlands of herbaceous vegetation and low shrubs that occur in river floodplains, mainly in Central Florida and along the St. Johns, Kissimmee and Myakka rivers, on sandy alluvial soils with considerable peat accumulation. Emergent grasses, herbs, and shrubs that dominate Floodplain

Marshes include sawgrass, maidencane, and buttonbush. Floodplain Marshes are maintained by regimes of fire and water. Fires apparently burn on a one- to five-year basis under natural conditions and maintain the open herbaceous community by restricting shrub invasion; however, severe fires during drought periods will often burn the mucky peat. Floodplain Marshes are flooded with flowing water for about 250 days annually.

Plant Species
Other typical plants include sand cordgrass, dotted smartweed, arrowheads, pickerelweed, reimargrass, spikerush, bulrushes, bladderpod, common reed, coreopsis, glasswort, seashore dropseed, sea purslane, and water primrose.

Animal Species
Typical animals include cricket frog, pig frog, leopard frog, American alligator, eastern mud snake, banded water snake, striped swamp snake, great blue heron, great egret, snowy egret, little blue heron, tricolored heron, black-crowned night-heron, yellow-crowned night-heron, northern harrier, sandhill crane, raccoon, and river otter.

Marsh Lakes
The distinctions between Marsh Lakes and Depression Marshes are quite subtle, because of their successional interrelationships. Depression Marsh is characterized as a shallow, generally round or elliptical depression vegetated with concentric bands of hydrophytic herbaceous plants. Depending upon the depth and slope of the depression, an open water zone with or without floating plants may occur at the center. The open water zone is considered to be a Marsh Lake if it is small in comparison to the surrounding marsh. Otherwise, the system is considered to be a Flatwoods Lake or a Prairie Lake, depending upon the surrounding community. In a Marsh Lake, fire maintains the surrounding open herbaceous community by restricting shrub invasion. The normal interval between fires is 1 to 10 years, with strictly herbaceous marshes burning about every 1 to 3 years, and those with substantial willow and buttonbush having gone 3 to 10 years without fire. Fires during drought periods will often burn the mucky peat and will convert the marsh into a Marsh Lake. The depressions in which Marsh lakes develop are typically formed by solution holes form in the underlying limestone, causing surface sands to slump into a circular depression. Soils in these depressions generally consist of acidic sands with some peat and occasionally a clay lens. Water is derived mostly from runoff from the immediately surrounding uplands. These marshes function as aquifer recharge areas by acting as reservoirs, which release groundwater when adjacent water tables drop during drought periods.

Plant Species
Marsh Lakes are often surrounded by either a sparse, Wet Prairie-like zone or a dense ring of saw palmetto and other shrubs. Typical plants include spikerush, yellow-eyed grasses, St. John’s wort, chain fern, coastal plain willow, maidencane, wax myrtle, water primrose, floating heart, buttonbush, fire flag, pickerelweed, arrowhead, bladderworts, bottlebrush threeawn, toothache grass, star rush, bulrushes, sawgrass, and nut sedge.

Animal Species
Many animals utilize marshes primarily for feeding and breeding areas but spend most of their time in other habitats. Other animals are more dependent on marshes, spending most of their time within them. Typical animals include amphiuma, lesser siren, greater siren, cricket frog, green treefrog, bullfrog, pig frog, leopard frog, alligator, eastern mud snake, banded water snake, green water snake, striped crayfish snake, black swamp snake, American bittern, least bittern, great blue heron, great egret, snowy egret, little blue heron, tricolored heron, green-backed heron, black-crowned night-heron, white ibis, glossy ibis, bald

eagle, northern harrier, king rail, Virginia rail, sora, limpkin, long-billed marsh wren, yellowthroat, red-winged, blackbird, boat-tailed grackle, and Florida water rat.

Mesic Flatwoods

Mesic Flatwoods are more commonly referred to as pine flatwoods (upland pine) and are characterized by their open canopy of widely spaced pine trees with little or no understory, but a dense ground cover of herbs and shrubs. Several variations of Mesic Flatwoods are recognized, the most common associations being longleaf pine - wiregrass - runner oak and slash pine - gallberry - saw palmetto. Mesic Flatwoods occur on relatively flat, moderately to poorly drained terrain. The soils typically consist of 1-3 feet of acidic sands generally overlying an organic hardpan or clayey subsoil. The hardpan substantially reduces the percolation of water below and above its surface. During the rainy seasons, water frequently stands on the hardpan's surface and briefly inundates much of the flatwoods; while during the drier seasons, ground water is unobtainable for many plants whose roots fail to penetrate the hardpan. Thus, many plants are under the stress of water saturation during the wet seasons and under the stress of dehydration during the dry seasons. Another important physical factor in Mesic Flatwoods is fire, which probably occurred every 1 to 8 years during pre-Columbian times. Nearly all plants and animals inhabiting this community are adapted to periodic fires; several species depend on fire for their continued existence. Without relatively frequent fires, Mesic Flatwoods succeed into hardwood-dominated forests whose closed canopy can essentially eliminate the ground cover herbs and shrubs.

Plant Species

Pant species typical of Mesic Flatwoods include longleaf pine, slash pine, wire grass, saw palmetto, gallbery, St. john-wort, dwarf huckleberry, fetterbush, dwarf wax myrtle, stagger bush, blueberry, gopher apple, tar flower, bog buttons, blackroot, false foxglove, white-topped aster, yellow-eyed grass, and cutthroat grass

Animal Species

Typical animals of Mesic Flatwoods include: oak toad, little grass frog, narrowmouth toad, black racer, red rat snake, southeastern kestrel, brown-headed nuthatch, pine warbler, Bachman's sparrow, cotton rat, cotton mouse, black bear, raccoon, gray fox, bobcat, and white-tailed deer.

Seepage Slope

Seepage Slopes are wetlands characterized as shrub thickets or boggy meadows on or at the base of a slope where moisture is maintained by downslope seepage such that the ground is usually saturated but rarely inundated. They generally occur where water percolating down through the sand hits an impermeable layer, such as clay or rock. Seepage Slope soils are acidic, loamy sands with low nutrient availability that are constantly saturated by seepage except during droughts. They are rarely inundated, although small pools and rivulets are common.

Plant Species

Typical plants include pond pine, slash pine, longleaf pine, titi, fetterbush, myrtle-leaved holly, black titi, ale-berry, large gallberry, dahoon holly, gallberry, white cedar, tulip poplar, wax myrtle, odorless wax myrtle, blueberry, dog-hobble, racemed fetterbush, sweet pepperbush, possumhaw, Virginia willow, laurel greenbrier, wiregrass, pitcher plants, beakrush, cutthroatgrass, orchids, cinnamon fern, chain fern, bluestem, yellow-eyed grass, and an array of insectivorous plants. A large number of orchids, insectivorous plants, showy wildflowers and other plant species associated with this natural community are rare or endemic and considered endangered or threatened.

Animal Species
Typical animals include the pine barrens treefrog, squirrel treefrog, ribbon snake, and cottonmouth.

Upland Mixed Forest / Mesic Hammock
Upland Mixed Forests are characterized as well-developed, closed-canopy forests of upland hardwoods on rolling hills. Upland Mixed Forests occur on rolling hills that often have limestone or phosphatic rock near the surface and occasionally as outcrops. Soils are generally sandy-clays or clayey sands with substantial organic and often calcareous components. The topography and clayey soils increase surface water runoff, although this is counterbalanced by the moisture retention properties of clays and by the often thick layer of leaf mulch which helps conserve soil moisture and create decidedly mesic conditions.

Plant Species
Common species of this community type include southern magnolia, pignut hickory, sweetgum, Florida maple, devil's walking stick, American hornbeam, redbud, flowering dogwood, Carolina holly, American holly, eastern hophornbeam, spruce pine, loblolly pine, live oak, and swamp chestnut oak, among others. Other typical plants include gum bumelia, hackberry, persimmon, red cedar, red mulberry, wild olive, redbay, laurel cherry, black cherry, bluff oak, water oak, cabbage palm, basswood, winged elm, Florida elm, sparkleberry, Hercules' club, slippery elm, beautyberry, partridgeberry, sarsaparilla vine, greenbrier, trilliums, beech drops, passion flower, bedstraw, strawberry bush, silverbell, caric sedges, fringe tree, horse sugar, white oak, and blackgum.

Animal Species
Typical animals species of the mesic system include slimy salamander, Cope's gray treefrog, bronze frog, box turtle, eastern glass lizard, green anole, broadhead skink, ground skink, red-bellied snake, gray rat snake, rough green snake, coral snake, woodcock, barred owl, pileated woodpecker, shrews, eastern mole, gray squirrel, wood rat, cotton mouse, gray fox, and white-tailed deer.

Xeric Hammock
Xeric Hammock is characterized as either a scrubby, dense, low canopy forest with little understory other than palmetto, or a multi-storied forest of tall trees with an open or closed canopy. Several gradations between these extremes exist. Xeric Hammock is an advanced successional stage of Scrub or Sandhill. The variation in vegetation structure is predominantly due to the original community from which it developed. In all cases, however, the soils consist primarily of deep, excessively-drained sands that were derived from old dune systems. The scarcity of herbs and the relatively incombustible oak litter preclude most fires from invading Xeric Hammock. When fire does occur, it is nearly always catastrophic and may revert to Xeric Hammock into another community type. Xeric Hammock only develops on sites that have been protected from fire for 30 or more years. Xeric Hammocks are often associated with and grade into Scrub, Sandhill, Upland Mixed Forest or Slope Forest.

Plant Species
Typical plants found in Xeric Hammock forest include live oak, sand live oak, laurel oak, turkey oak, blackjack oak, red oak, sand post oak, staggerbush, saw palmetto, sparkleberry, pignut hickory, southern magnolia, redbay, American holly, wild olive, black cherry, fox grape, beautyberry, bluejack oak, Chapman's oak, persimmon, and yaupon

Animal Species
Animals typically found in this community type include barking treefrog, spadefoot toad, gopher tortoise, worm lizard, fence lizard, black racer, red rat snake, hognose snake, crowned snake, screech-owl, turkey, blue jay, eastern mole, gray squirrel, and eastern flying squirrel.

Invasive Non-Native Plants (Invasive)

Management of invasive plants began in Florida in 1899, when the 55th Congress authorized the U.S. Army Corps of Engineers (USACE) through the Rivers and Harbor Act to crush, divert, or remove water hyacinth from access areas of the St. Johns River. In May of 1899, the Florida Legislature prohibited the planting of water hyacinth in waters of the State of Florida. Thus, began Florida's long battle with invasive plants and the beginning of regulations to prevent their expansion. The definition of an invasive species, not necessarily plants, is exotic – a non-indigenous species, or one introduced to this state, either purposefully or accidentally; a naturalized exotic is defined as escaped into the wild where it reproduces on its own either sexually or asexually; while a native is a species already occurring in Florida at the time of European contact (1500).

Policy 2.8 of the Landscape Architectural Guidelines Element of the Campus Master Plan states that it is the intent of the University to remove all non-native invasive plants which are identified on any of the following lists: The IFAS Assessment of Non-Native Plants in Florida's Natural Areas, the Department of Agriculture's "Noxious Weed List", the Department of Environmental Protection's "Prohibited Plant List" and the Florida Exotic Pest Plant Council's "Florida's Most Invasive Species List" from the campus grounds.

Many consider invasive non-native plants a serious threat to native species, communities, and ecosystems. They can compete with and displace native plants, animals, and other organisms that depend on them, alter ecosystem functions and cycles significantly. However, it is also true that many species now considered natives were invaders at some point in the past and that in certain circumstances only these adaptable and hardy species survive. Most land management of Florida natural areas is based on returning ecosystems to a pre-European colonization (1500s) status. Determining what the status was at that time is generally based on either historical documentation such as survey field notes, diagrams and journals or on soil properties that indicate previous land uses and seed sources.

Most of the University's Conservation Areas have been documented to contain invasive exotic plants. In some areas like Wilmot Gardens, these invasive plants have literally overrun the place, changing a camellia memorial garden into an overgrown thicket of vines. Restoration of this and other areas will take active and continuous management. Currently, the University is working on a pilot project with the City of Gainesville to eradicate invasives in Hogtown Creek Woods and in the Natural Areas Teaching Lab. This project is the result of a successful grant application to the Withlacoochee Regional Planning Council. The grant was the number #1 ranked project submitted and was awarded $21,063.13.

Treatment of Invasive Plants

In order to manage invasive non-native plants in Florida natural areas, land managers primarily use herbicides and / or mechanical harvesting to contain and in time eliminate these alien invaders. Other treatments techniques include biological controls, which uses predators of the plants from there native territory to try and contain their expansion and fire management, which can be effective on plants not adapted to fire dominated ecosystems. The following discussion from the Florida Exotic Pest Plant Council on invasive non-native plant control types provides an overview of each treatment technique.

> Herbicidal Control - Many woody plant species can be controlled with herbicides applied in a variety of ways. The most common application methods are foliar spray, stump treatment, basal soil treatment, and basal bark application. In foliar treatments the herbicides are pre-mixed with diluents and sprayed onto the foliage of the plant. Usually the leaves are "sprayed-to-wet" which means applying only enough solution to begin running off the leaf surface. Basal soil treatments

can be used with either liquid or dry formulations. The material is broadcast onto the soil under the canopy of the tree. Rainfall carries the herbicide into the root zone of the plant where it is absorbed by the roots. The basal bark application consists of the herbicide solution being applied, most commonly by back-pack sprayer, in a wide band on the stems of the plants near the base. The material is absorbed into the plant and translocated throughout the plant. Another technique is to treat the stump with a herbicide solution immediately after cutting the tree at or near ground level. There are other application methods such as the “frill and girdle”, and various direct injection techniques for the control of exotic species. However, these methods are not practical for controlling Brazilian pepper. Aerial application of herbicides can be used in areas that are remote or where there are large monotypic stands.

Mechanical Control - Mechanical control is accomplished through the use of heavy equipment such as bulldozers, front end loaders, root rakes and other specialized equipment. The use of heavy equipment is sometimes not suitable in natural areas. Once undisturbed soils have been unsettled, they are susceptible to invasion by invasive exotic pest-plants. Mechanical control is accepted along ditch banks, utility rights-of-way and other disturbed areas. As follow-up, a herbicide application is highly recommended to prevent regrowth from the remaining stumps. Stumps that fail to be chemically treated will resprout and continue to infest natural areas and wetlands.

Biological Control - involves moving host specific natural enemies from the native range of the weed to its introduced range. The goal is to reduce weed abundance to a level that can be tolerated. Biological control does not eradicate weeds. It simply restores a natural balance between the weed and its enemies. Biological control can be self-regulating since the introduced natural enemies often become part of the ecosystem. Biological control is not a quick fix. The period of time between initiation of a weed bio-control program and when the first natural enemy is released is measured in years. Release must be approved by both state and federal agencies. Releases require propagation of large numbers and distribution in the field followed by monitoring to determine whether establishment has occurred and how effective the natural enemies are.

Other - Plants can be stressed, or even killed, by the physical environment. Temperature and salinity variations, water level fluctuations, and the presence or absence of fire are examples of physical conditions that can dictate vegetation patterns. Land managers use many of these natural limiting factors to manipulate the environment for vegetation management. More often than not, however, nature controls these physical changes and the land manager is forced to take a side seat and observe the changes.

Soils

The following soils descriptions are based on information from the Soil Survey of Alachua County (1985) and are found on the University of Florida main campus.

Apopka Sand (0-5% slope)
This nearly level to gently sloping, well-drained soil is in relatively small areas of the deep, sandy uplands. Slopes are nearly smooth or slightly complex. Typically, the surface layer is dark grayish brown sand about 5 inches thick. The subsurface layer is sand to a depth of 61 inches. In this Apopka soil, the available water capacity is very low to a depth of 61 inches and is medium below. Permeability is rapid in the sandy surface and subsurface layers and moderate in the loamy subsoil. Natural fertility of the soil is low. The organic matter content of the surface layer is usually low. Natural vegetation is turkey, bluejack,

post and sand live oak and longleaf pine. The understory is mostly pineland threeawn, indiangrass, some bluestem, panicum and brackenfern.

Arredondo Fine Sand (5-8% slope)
This sloping, well-drained soil is in small areas on sharp breaking slopes and in relatively large areas on long slopes of the uplands. Typically, the surface layer is dark grayish brown fine sand about 5 inches thick. The subsurface layer is yellowish brown fine sand to a depth of 65 inches. The available water capacity is low in the surface and subsurface layers and medium in the subsoil. Organic matter content is low. Natural vegetation of this soil includes slash and longleaf pine, live and water oaks, hickory and dogwood. The understory is shrubs and native grasses, lopsided indiangrass, creeping bluestem and several varieties of panicum are some of the most common of the native grasses.

Arredondo Urban Land Complex (0-5% slope)
This complex consists of well drained nearly level to gently sloping Arredondo soils and Urban Land. About 50 to 85% of each delineation is open areas of Arredondo soils. These open areas are gardens, vacant lots, lawns or playgrounds. About 15 to 50% of each delineation is urban land. Urban land consists of areas covered with buildings, streets, parking lots, sidewalks and other structures. Typically, the surface layer of Arredondo soils is dark grayish brown fine sand about 6 inches thick. The subsurface layer is brownish yellow to yellowish brown fine sand to a depth of 47 inches. The available water capacity of Arredondo soil is low in the surface and subsurface layer and low to medium in the subsoil. Organic matter content and natural fertility are low. Natural vegetation is slash, loblolly, longleaf pine, live, laurel, water oak, hickory and dogwood. The understory consists of a cover of adapted low growing herbs and shrubs.

Bivans Sand (2-5% slope)
This gently sloping, poorly drained soil is on relatively broad flats and at the base of the rolling uplands. The areas are irregular in shape and range from about 10 to 55 acres. Typically the surface layer is dark gray sand about 6 inches thick. The subsurface layer is gray sand 9 inches thick. This Bivans soil has a perched water table that is in the surface and subsurface layers and the upper part of soil for 1 to 4 months during most years. Surface runoff is moderate. The available water capacity is low to medium. Permeability is moderate to moderately rapid in the surface and subsurface layers. Natural fertility is low to medium. Organic matter content of the surface layer is moderately low to moderate. Natural vegetation is slash, longleaf, and loblolly pines; live, laurel, and water oaks; and sweetgum, hickory, holly and magnolia. The understory is chiefly waxmyrtle, blackberry, greenbrier, bluestem, low paspalum, pineland threeawn, and dwarf huckleberry

Bivans Sand (5-8% slope)
This is a sloping, poorly drained soil on short breaking slopes and along hillsides of the uplands. Typically, the surface layer is dark gray sand about 5 inches thick. The subsurface layer is light brownish gray sand about 5 inches thick. In the Bivans soil, the subsurface layer and upper part of the subsoil are saturated by a perched water table for 1 to 3 months during most years. Permeability is moderate to moderately rapid in the surface and subsurface layers. Natural fertility is low to medium and the organic matter content is moderately low to moderate in the surface layer. Natural vegetation is slash and loblolly pines, live, laurel and water oaks and sweetgum, hickory and magnolia.

Blichton Urban Land Complex (0-5% slope)
This complex consists of poorly drained, nearly level to gently sloping Blichton soils and Urban land. It is irregularly shaped with relatively small areas. About 50 to 85 percent of each delineation is open areas of Blichton soils. These open areas are gardens, vacant lots, lawns and playgrounds. About 15 to 50 percent

of each delineation is Urban land. Urban land consists of areas covered with houses, streets, parking lots, sidewalks, industrial buildings and other structures. Typically, the surface layer of Blichton soils is dark grayish brown sand about 6 inches thick. The subsurface layer is grayish brown to light brownish gray sand about 22 inches thick. In the Blichton soils, the water table is within 10 inches of the surface for about 1 to 4 months during most years. Natural fertility is low. Organic matter content is low to moderate. Natural vegetation is slash, longleaf and loblolly pines, sweetgum, magnolia, hickory, maple waxmyrtle, pineland threeawn and other adapted shrubs and herbs.

Blichton Sand (2-5% slope)
This gently sloping, poorly drained soil is on gently rolling uplands. Slopes are slightly convex. The areas are mostly irregular in shape and elongated and range from 10 to 40 acres. Typically the surface layer is dark grayish brown sand about 6 inches thick. It is about 3 percent nodules of ironstone and fragments and nodules of phosphatic limestone. The subsurface layer extends to a depth of 28 inches. The upper 7 inches is grayish brown sand and it has about 2 percent nodules of ironstone and fragments of phosphatic limestone. In Blichton soil, the subsurface layer and the upper part of the subsoil are saturated by a perched water table for 1 to 4 months during most years. Surface runoff is medium. The available water capacity is low in the sandy surface and subsurface layers and low to medium in the loamy subsoil. Natural fertility is low to medium and organic matter content is moderately low to moderate. Natural vegetation consists of hickory, magnolia, pineland, three awn, slash, longleaf, loblolly pines, sweet gum and bluestem.

Bonneau Fine Sand (0-5% slope)
This gently sloping, moderately well drained soil is in small to relatively large areas on uplands. Slopes are generally convex. Typically, the surface layer is dark gray fine sand about 9 inches thick. The subsurface layer is brownish yellow fine sand to a depth of 29 inches. The Bonneau soil has a water table that is at a depth of 40 to 60 inches for 1 to 3 months and at a depth of 60 to 72 inches for 2 to 3 months during most years. Surface runoff is slow. Permeability is moderately slow to moderate in the upper part of the subsoil and very slow to slow in the lower part. The available water capacity is low in the sandy surface and subsurface layers. Natural fertility is low in the sandy layers and medium in the loamy subsoil. Organic matter content is low to moderately low in the surface layer. The natural vegetation is chiefly slash, longleaf and loblolly pines, laurel, live, water and red oaks and hickory, dogwood and sweetgum. The understory consists of wild grape, American beautyberry and waxmyrtle.

Bonneau Sand (2-5% slope)
This gently sloping, moderately well drained soil is in small to relatively large areas on uplands. Slopes are generally convex. Typically, the surface layer is dark gray fine sand about 9 inches thick. The subsurface layer is brownish yellow fine sand to a depth of 29 inches. The Bonneau soil has a water table that is at a depth of 40 to 60 inches for 1 to 3 months and at a depth of 60 to 72 inches for 2 to 3 months during most years. Surface runoff is slow. Permeability is moderately slow to moderate in the upper part of the subsoil and very slow to slow in the lower part. The available water capacity is low in the sandy surface and subsurface layers. Natural fertility is low in the sandy layers and medium in the loamy subsoil. Organic matter content is low to moderately low in the surface layer. The natural vegetation is chiefly slash, longleaf and loblolly pines, laurel, live, water and red oaks and hickory, dogwood and sweetgum. The understory consists of wild grape, American beautyberry and waxmyrtle.

Kanapaha Sand (0-5% slope)
This soil consists of nearly level to sloping, poorly drained soils that formed in thick beds of sandy and loamy marine deposits. The water table is at a depth of less than 10 inches for 1 to 3 months and at a depth of 10 to 40 inches for 3 to 4 months during most years. Natural fertility is low to medium. Organic matter

content of the surface layer ranges from moderately low to moderate. The natural vegetation is chiefly slash and loblolly pine, water, live and laurel oak, sweetgum and holly. The understory is mostly waxmyrtle, low paspalum, pineland threeawn, longleaf uniola, hairy panicum, fringeleaf paspalum, huckleberry and some bluestems.

Kendrick Sand (2-5% slope)
This gently sloping, well-drained soil is in both small and large areas on the gently rolling uplands. These areas are mostly irregularly shaped or elongated and range from about 20 to 200 acres. Typically the surface layer is dark grayish brown sand about 9 inches thick. The subsurface layer is yellowish brown loamy sand to a depth of 26 inches. In this Kendrick soil, the available water capacity is low in the surface and subsurface layers, medium in the upper 5 inches of the subsoil, and medium to high below this depth. Permeability is rapid in the surface and subsurface layers. Permeability is moderate to moderately rapid in the upper 5 inches of the subsoil, moderately slow to moderate in the next 42 inches, and slow in the lower 17 inches. Natural fertility is low in the sandy surface layer and medium in the loamy subsoil. Surface runoff is moderately slow. Natural vegetation of this soil is chiefly slash, loblolly and longleaf pines, oak, dogwood, hickory, magnolia and sweetgum. The understory consists of several varieties if bluestem, lopsided indiangrass, toothachegrass, hairy panicum, fringeleaf paspalum, briers, creeping beggarweed, eastern bracken, huckleberry, blueberry, greenbrier, and sedges

Lochloosa Fine Sand (2-5% slope)
This gently sloping, somewhat poorly drained soil is in small and large areas on the rolling uplands. Typically, the surface layer is dark gray fine sand about 7 inches thick. The subsurface layer is yellowish brown loamy sand or sand to a depth of 31 inches. This soil has a water table that is about 30 to 40 inches below the surface for 1 to 4 months during most years. Surface runoff is slow. The available water capacity is low to medium in the sandy surface and subsurface layers and medium in the subsoil. The natural vegetation of this soil is chiefly slash and loblolly pines, oak, dogwood, hickory, magnolia and sweetgum. The understory consists chiefly of waxmyrtle, wildgrape, dwarf huckleberry, toothachegrass, several varieties of bluestems, low panicums and creeping beggarweed.

Lochloosa Soil (2-5% slope)
This gently sloping, somewhat poorly drained soil is in small and large areas on the rolling uplands. Typically, the surface layer is dark gray fine sand about 7 inches thick. The subsurface layer is yellowish brown loamy sand or sand to a depth of 31 inches. This soil has a water table that is about 30 to 40 inches below the surface for 1 to 4 months during most years. Surface runoff is slow. The available water capacity is low to medium in the sandy surface and subsurface layers and medium in the subsoil. The natural vegetation of this soil is chiefly slash and loblolly pines, oak, dogwood, hickory, magnolia and sweetgum. The understory consists chiefly of waxmyrtle, wildgrape, dwarf huckleberry, toothachegrass, several varieties of bluestems, low panicums and creeping beggarweed.

Millhopper Sand (0-5% slope)
This nearly level to gently sloping, moderately well drained soil is in small and large irregularly shaped areas on uplands and slightly rolling knolls in the broad flatwoods. Typically, the surface layer is dark grayish brown sand about 9 inches thick. The subsurface layer is sand or fine sand about 49 inches thick. This Millhopper sand has a water table that is at a depth of 40 to 60 inches for 1 to 4 months and at a depth of 60 to 72 inches for 2 to 4 months during most years. Natural vegetation of this soil consists of live laurel, post, water oaks, sweet gum, cherry laurel, hickory, slash and longleaf pines. The understory is chiefly lopsided indiangrass, hairy panicum, low panicum, green brier, hawthorn, persimmon, fringeleaf paspalum, hoary tickclover, dwarf huckleberry, chalky and creeping bluestems and pineland threeawn.

Millhopper Sand (5-8% slope)
This sloping moderately well drained soil is in small areas on narrow breaks and on long slopes of rolling uplands. Typically the surface layer is dark grayish brown sand about 7 inches thick. The subsurface layer is sand about 47 inches thick. This Millhopper soil has a water table that is at a depth of 40 to 60 inches for 1 to 2 months and at a depth of 60 to 72 inches for 2 to 3 months during most years.

Millhopper Urban Land Complex (0-5% slope)
This complex consists of moderately well drained, nearly level to gently sloping Millhopper soils and Urban Land. The areas are irregular in shape and range from about 15 to 250 acres. This complex is within the most urbanized areas. About 50 to 85 percent of each delineation is open areas of Millhopper soils. These open areas are vacant lots or are used for gardens, lawns, parks or playgrounds. About 15 to 50 percent of each delineation is Urban land covered with buildings, streets, parking lots, sidewalks and other structures. Typically the surface layer of Millhopper soils is dark grayish brown sand about 9 inches thick. The subsurface layer is yellowish brown to pale brown sand about 49 inches thick. The available water capacity is low in the surface and subsurface layers and low to medium in the subsoil. Natural vegetation of this unit consists chiefly of live, laurel, post and water oaks, sweetgum, cherry laurel, a few hickory, slash and longleaf pines. The understory is chiefly lopsided indiangrass, hairy panicum, low panicum, greenbrier, hawthorn, persimmon, fringeleaf paspalum, hoary tickclover, dwarf huckleberry, chalky and creeping bluestems and pineland threeawn.

Monteocha Loamy Sand (0-2% slope)
This nearly level, very poorly drained soil is in wet ponds and shallow depressional areas in the flat woods. Slopes are less than 2 precent. Typically, the surface layer is black loamy sand about 12 inches thick. The subsurface layer is light brownish gray sand to a depth of 18 inches. The Monteocha soil has a water table that is within 10 inches of the surface for more than 6 months during most years. Natural fertility is medium in the surface layer and low in the subsurface layer and subsoil. Organic matter content is high to very high in the surface layer. The natural vegetation is chiefly cypress. Some swamp tupelo, pond pine, bay and other water-tolerant hardwoods are in some areas. Water-tolerant grasses grow in a few areas. Most of the areas are still in native vegetation.

Newnan Sand (Flat)
This nearly level, somewhat poorly drained soil is in small to relatively large areas in flatwoods. Typically, the surface layer is dark gray sand about 5 inches thick. The subsurface layer is light brownish gray sand to a depth of 12 inches. This Newnan soil has a water table that is at a depth of 18 to 30 inches for 1 to 2 months during most years and at a depth of 30 to 60 inches for 2 to 5 months. The available water capacity is very low-to-low. Permeability is rapid to a depth of about 12 inches. Natural fertility is low in the sandy upper 56 inches. Most areas are still in natural vegetation, which is chiefly longleaf and slash pines and water oak. The understory is running oak, palmetto, waxmyrtle, huckleberry, brackenfern, blueberry, briars, gallberry, bluestem and pineland threeawn.

Pomona Sand (0-2% slope)
This nearly level, poorly drained soil is in small and large areas in the flatwoods. Slopes are nearly smooth and range from 0 to 2 percent. Typically, the surface layer is very dark gray sand about 5 inches thick. The subsurface layer is sand to a depth of 16 inches. In this Pomona soil, the water table is within 10 inches of the surface for 1 to 3 months during most years. The available water capacity is low to medium in the surface and subsurface layers and it ranges from low to high in the subsoil. Permeability is rapid to very rapid in the surface and subsurface layers. Natural vegetation of this soil is a forest of longleaf and slash

pine. The understory is sawpalmetto, waxmyrtle, gallberry, bracken fern, pineland threeawn, blueberry, huckleberry, bluestem and running oak. Most areas are still in natural vegetation.

Samsula Muck (0-1% slope)
This nearly level, very poorly drained organic soil is in large and small swamps, marshes and ponded areas in the broad flatwoods. Slopes are usually slightly concave and range from 0 to 1 percent. Areas are either circular, irregular in shape, or elongated. Typically, the surface layer is muck about 35 inches thick. The upper 8 inches is very dark brown and the lower 27 inches is very dark gray. The Samsula soil has water at or on the surface for more than 6 months during most years. The water table is within 10 inches of the surface for most of the remainder of the year, except during long extended dry periods. The available water capacity is very high in the organic layer. The natural vegetation of the soil is chiefly cypress, Bay, black gum and swamp maple are in some areas. Water-tolerant grasses are in few areas. Most areas of this soil are still in natural vegetation.

Surrency Sand (Flat)
This nearly level, very poorly drained soil is in ponds and depression areas in the broad flatwoods and in areas of wet prairie on uplands. Typically, the surface layer is black sand about 15 inches thick. The subsurface layer is light gray sand to a depth of 28 inches. This Surrency soil has a water table that is within 10 inches of the surface for about 6 months or more during most years. The available water capacity ranges from low to high in the surface and subsurface layers and from low to medium in the subsoil. Permeability is moderately rapid, to rapid in the sandy surface and subsurface layers and slow to moderately slow in the loamy subsoil. Natural fertility is medium in the surface layer and is low in the subsurface layer and the subsoil. The natural vegetation is chiefly cypress, swamp tupelo, pond pine, bay, and other water tolerant hardwoods are in the same areas. In a few areas water tolerant grasses grow.

Urban Land Millhopper Complex (0-2% slope)
This complex consists of Urban land intermixed with nearly level areas of Millhopper soils. The areas are irregular in shape and range from 15 to 200 acres. About 50 to 85 percent of each delineation is Urban land. This Urban land consists of areas covered with buildings, streets, parking lots, sidewalks, and other structures. About 15 to 50 percent of each delineation is open areas of Millhopper soils. These open areas are vacant lots, lawns, parks, or playgrounds. The Millhopper soils of this complex have a water table at a depth of 40 to 60 inches for 1 to 4 months and at a depth of 60 to 72 inches for 2 to 4 months during the whole year. The available water capacity is low in the surface and subsurface layers and low to medium in subsoil. Permeability is rapid in the surface and subsurface layers, and it is slow to moderate in the subsoil. Natural fertility is low. Organic matter content is low to moderately low in the surface layer. Natural vegetation of Millhopper soils consists chiefly of live, laurel, post, and water oaks; slash and longleaf pines; sweetgum and cherry laurels. A few hickory trees are in these areas. The understory is chiefly lopsided indiangrass, hairy panicum, low panicum, green brier, hawthorn, persimmon, fringeleaf paspalum, hoary tickclover, dwarf huckelbery, chalky and creeping bluestems, and pineland threeawn.

Wauchula Urban Land Complex (0-2% slope)
This complex consists of poorly drained, nearly level Wauchula soils and urban land. Slopes range from 0 to 2 percent. Typically, the surface layer of Wauchula soils is black to dark gray sand about 8 inches thick. In the Wauchula soils, the water table is within 10 inches of the surface for about 1 to 3 months during most years. Natural fertility and organic matter contents are low. Permeability of the sandy surface and subsurface layers is rapid. The natural vegetation is slash and longleaf pines. The understory is palmetto, gallberry, waxmyrtle, pineland threeawn and other adapted shrubs and herbs.

Wauchula Sand (0-2% slope)

This complex consists of well drained nearly level to gently sloping Arredondo soils and Urban Land. About 50 to 85% of each delineation is open areas of Arredondo soils. These open areas are gardens, vacant lots, lawns or playgrounds. About 15 to 50% of each delineation is urban land. Urban land consists of areas covered with buildings, streets, parking lots, sidewalks and other structures. Typically, the surface layer of Arredondo soils is dark grayish brown fine sand about 6 inches thick. The subsurface layer is brownish yellow to yellowish brown fine sand to a depth of 47 inches. The available water capacity of Arredondo soil is low in the surface and subsurface layer and low to medium in the subsoil. Organic matter content and natural fertility are low. Natural vegetation is slash, loblolly, longleaf pine, live, laurel, water oak, hickory and dogwood. The understory consists of a cover of adapted low growing herbs and shrubs.

Zolfo Sand (0-2% slope)
This nearly level, somewhat poorly drained soil is on slight rises of the flatwoods and in the rather broad transitional areas between the rolling uplands of the western part of the county and the flatwoods of the eastern part. Slopes are nearly level and range from 0 to 2 percent. Areas are irregular in shape. Typically, the surface layer is dark gray sand about 8 inches thick. The subsurface layer is sand and extends to a depth of 60 inches. The Zolfo soil has a water table that is at a depth of 24 to 40 inches for 2 to 6 months during most years. Surface runoff is slow. The available water capacity is low to medium. Natural fertility is low. Natural vegetation of this soil is slash and longleaf pines and water, laurel and live oaks. The understory consists of waxmyrtle, sumac, gallberry, palmetto, pineland threeawn, bluestem, carpet grass and panicum.

Federal, State and Regional Environmental Standards and Regulations

Federal – Environmental Protection Agency – Clean Water Act
The Federal Clean Water Act of 1972, 33 U.S.C., created much of the basis for today's environmental regulatory framework for development. This legislation gives the U.S. Environmental Protection Authority (EPA) the responsibility for setting national water quality standards to protect public health and welfare, while giving states the job of determining how best to meet those standards. In Florida, the Florida Department of Environmental Protection and Florida's five water management districts administer the implementation and enforcement of the Act, with some oversight maintained by the EPA. By addressing both point and non-point source pollution these agencies both monitor water quality and implement rules that will improve impaired waters.

Under the Clean Water Act (CWA), states are required to develop lists of pollutant-impaired waters. As described in subsection 303(d) of the CWA, impaired waters are those that do not meet water quality standards that states have set for them. For those waterbodies that are listed, the states must develop Total Maximum Daily Loads (TMDLs) of pollutants.

State – Department of Environmental Protection
A number of State laws govern environmental protection within the State of Florida. Most of these laws are administered by the Florida Department of Environmental Protection, with some delegation of responsibilities given to water management districts and local governments.

The 1999 Florida Watershed Restoration Act authorizes the Florida Department of Environmental Protection to create the 303(d) list, which is currently based on the state's 1996 305(b) Water Quality Assessment Report. The "305(b) report" uses a watershed approach to evaluate the state's surface waters and ground waters. This report and list identify "impaired" water segments, with the four most common water quality concerns: coliforms, nutrients, turbidity, and oxygen demanding substances. Listed water segments are candidates for more detailed assessments of water quality and, where necessary, the development and implementation of a TMDL. TMDLs take into account the water quality of an entire water body or watershed and assess all the pollutant loadings into that watershed, rather than simply considering whether each individual discharge meets its permit requirements. The management strategies that emerge from the TMDL process encompass approaches such as regulatory measures, best management practices, land acquisition, infrastructure funding, and pollutant trading. They also include an overall monitoring plan to test their effectiveness.

Historically the 305(b) report and 303(d) list have been managed and reported as separate documents. However, in 2002 the EPA recognized that water quality monitoring and data analysis (under 305(b)) are the foundation of water resource management decisions (using 303(d)). Thus, EPA and its partners are developing a consolidated 305(b)/303(d) assessment approach called, "Consolidated Assessment and Listing Methodology" (CALM), which aims to help states improve the accuracy and completeness of 303(d) lists and 305(b) report.

The FDEP 2002 305(b) Report lists Bivens Arm – Tumbin Creek watershed with poor water quality that does not meet its designated use as Class III water, while both Lake Alice and Hogtown Creek watersheds meet their designated use and are listed as having good water quality. However, the 303(d) list is currently based on the 1998 305(b) list, which lists Tumblin Creek, Hogtown Creek, and Lake Alice as potentially impaired waters.

Regional – St. Johns River Water Management District

The environmental resource and surface water permitting program (ERP –Florida Administrative Code - 40C) of the St. Johns River Water Management District regulates the storage of surface waters, stormwater discharge and wetland resource permitting programs on the University's main campus. Environmental resource permitting is a tool for managing the effects of land use changes on water quantity, water quality, and wetland habitat. The program includes permit application review, compliance activities, outreach to the regulated public, and rule development. Monitoring and research activities that focus on discharges of surface water from agricultural areas also fall under the program. In addition, the program provides for collection of data on wetlands and completion of periodic assessments of wetland status and trends. All building on campus is required to be addressed under an ERP permit.

Archeological Sites - Division of Historical Resources, Department of State

The University of Florida and the Division of Historical Resources (DHR) within the Department of State have signed a Programmatic Memorandum of Agreement (MOA) pursuant to Section 267.061(2), Florida Statutes. Under this agreement, the University identified and mapped known and high probability archeological sites. The University has agreed to take specific actions outlined in the MOA, before commencing maintenance, construction and development activities that may affect known and probable archaeological sites within the confines of campus.

Campus-wide Goals and Best Management Practices

Public Participation

In 2003-2004 an ad-hoc group of interested faculty, staff, students and community stakeholders participated in site tours of all of the University's natural areas lead by staff of the Facilities, Planning and Construction Division. The purpose of the tours was to engage interested people from different backgrounds into coming up with creative ideas for management, improvements and alternative uses for all existing and potential natural areas. The following discussion on goals and best management practices is largely derived from the collaboration that resulted. Specific recommendations from this working group are to be found within the specific area plans.

Stormwater

Erosion and sedimentation are two of the primary concerns that are common to many of University's Conservation Areas. Since the Lake Alice watershed covers 80% of campus, Conservation Areas within this area are perhaps of most concern. This is in part due to the fact that Lake Alice has been designated as this watershed's retention pond. The current permit with the St. Johns River Water Management District (SJRWMD) allows the University to increase impervious surfaces within the watershed by an additional 184 acres (as of 7/11/2000) without additional stormwater facilities being built. While this allows the University to maintain a compact core of buildings without large areas dedicated to stormwater treatment, it also leads to an exacerbation of creek erosion and downstream sedimentation to a system that already has fairly severe problems. Thus, even though the SJRWMD's permit does not require additional stormwater treatment until the threshold is tripped, degradation to these conveyance systems would be reduced if retention / detention and other runoff management techniques were accommodated within the watershed wherever possible.

In order to reduce stormwater runoff and improve water quality in campus natural areas, new technologies should be incorporated into future building sites that will retain and percolate water. Additionally, areas being retrofitted must be looked at as opportunities to incorporate stormwater treatment into landscaping, contouring and paving. Many of the ideas being looked at come from the field of Low Impact Development (LID). This field looks for small ways to incorporate stormwater retention into building and landscaping, depressions, and multifunctional design. Some examples of LID include grassy swales, bio-retention areas, permeable pavement and grading to reduce runoff.

LID Practice	**Lower Post Development CN**	**Increased Time of Concentration**	**Retention**	**Detention**
Grade slope		X		
Increase roughness		X		
Grassy Swales		X		X
Vegetative filter strips	X	X	X	
Disconnected impervious surface	X	X		
Reduce curb and gutter	X	X		
Rooftop storage		X	X	X
Bioretention	X	X	X	
Revegetation	X	X	X	

The above chart illustrates the reduction in stormwater that can be achieved from different LID approaches (CN = runoff curve number).

This example illustrates a bio-retention (rain garden) stormwater treatment in a parking lot.

Another approach that uses the traditional stormwater pond design with an ecological design twist is a large scale bio-retention area, which is a BMP that should be considered in developing areas of campus. This approach to stormwater retention can be found currently at the Stormwater Ecological Enhancement Project (SEEP), adjacent to the Performing Arts parking lot and the Natural Areas Teaching Lab (NATL) Conservation Area. The retention pond was originally constructed in 1988 as a typical wet retention pond with a flat bottom and no attention paid to plant species diversity. In 1995, an initiative to redesign the basin into a more ecologically sensitive manor that befitted its placement next to the NATL was initiated. This redesign's primary goal, as articulated by its designers, was to increase the diversity of flooding depths and frequency of flooding that will occur, since this is the primary factor regulating species composition in a wetland. To do this, two depressions (one 4-feet, the other 5-feet deep), were dug at the southeastern end of the pond providing a deep, open-water habitat. At the north end a low berm was constructed to temporarily impound 80% of the entering stormwater. This forebay provides the first phase of treatment and was planted with species known to take up heavy metals and remove nutrients. Water from the forebay is then slowly released, first flowing through an area planted to resemble a bottom-land hardwood swamp, moving into a shallow freshwater marsh and then entering the deep-water ponds. The basin was planted with species that resemble those found in wetlands of North Central Florida.

The expected benefits of this type of retention are species diversity, wildlife habitat, aesthetics, water quality, and research potential. All of these benefits have been proven to be correct at the SEEP, however one issue remains that has not been adequately studied. This issue is the potential effects that these ponds have on wildlife, and particularly federally listed species. Since stormwater ponds are designed to treat the noxious constituents found in run-off, they are laden with metals, pesticides and fertilizers all of which can prove harmful to wildlife. The main species of concern that use ponds for foraging are wading birds, such as the federally listed Wood Stork. At present little research has been conducted on what the long-term impacts are on these species from utilizing stormwater detention, roadside swales, and ecologically enhanced ponds. Arguments can be made that these species will utilize wet retention ponds regardless of whether they have been ecologically enhanced, however it is equally likely that by enhancing them the probability of more productivity (more food) will encourage increased use. Thus, while it is hoped that these ponds are the panacea that is a win-win, additional research is sorely needed.

Pre-SEEP (looking north) – Cattail dominated SEEP (looking south) – Variety of plant species

Fire Management

Many areas now listed as Conservation Areas on campus would look and function in a dramatically different way, if not for the prevention of fire. The most pre-dominate systems in campus natural areas are thick, hardwood-dominated forests that are not considered fire dependent systems. However, some of these forested areas would have had a thinner tree canopy, different vegetative dominance and more abundant understory without fire suppression. Currently, the only Conservation Area that is fire maintained is the Natural Areas Teaching Lab. This area is maintained by various departments' staff that study the effects of burning on flora and fauna and what is needed to bring back a system to pre-suppression conditions. In practice, the reality of trying to use fire as a widespread management tool in urban settings like the University is generally considered by land management professionals as un-manageable and cost prohibitive, due to concerns of smoke on roads and people, along with the liability potential if a burn escapes into adjacent areas. Therefore, while it is recognized that burning is a very important tool in Conservation Area preservation and restoration (maintenance), it is also recognized that given the urban setting of many of campus's Conservation Areas that active fire management is unlikely. Locally, the City of Gainesville has come to similar fire management conclusions on their Bivens Arm Nature Park, which they manage chemically and mechanically, rather than with fire (Bivens Arm Nature Park, 2002).

Mowing

Throughout campus, many areas have been traditionally mowed to give a neat and orderly appearance. While this has been the traditional approach, there are some areas where mowing is not necessary and by eliminating some of these areas, the University may save time, money, and energy while enhancing wildlife habitat. In fact, quite often the use of infrequent mowing, decorative fencing and planting of wildflowers can be done in such a way that it both enhances habitat and is aesthetically pleasing. Additionally, in some areas a less frequent mow schedule versus an all out ban on mowing may be more appropriate. As with all operational decisions there are a number of factors that must be considered, before deciding which areas are appropriate for non-traditional approaches. The balance between aesthetics (form) and function will always have to be determined on a case-by-case basis. Public education can improve the acceptance of strategic no-mow areas by explaining the benefits of this approach and recognizing the areas as wildlife habitats

Mowed to the water's edge

Fenced off natural area – no mow area

Habitat Enhancement

One of the consistent recommendations of the ad-hoc working group of interested faculty, staff, students and community stakeholders that visited all of the campus natural areas was to enhance habitat wherever practicable. Some of the ideas for enhancement forwarded by the group included: nesting boxes for birds, bat houses, planting of wildflowers for bees and butterflies, removal of invasive non-native plants, and the planting of shrubs and trees that are important to local fauna. Some of these recommendations (bird and bat boxes, invasive plant removal) have been specifically carried forward in the specific area plans that follow, while others (planting of trees and shrubs) are noted here as an advisory note for those implementing this plan to always consider the potential to incorporate wildlife friendly planting wherever possible.

Public Use

Conservation lands on campus differ in their potential to accommodate use by the campus community and general public. Some areas are primarily wetland floodplains that without clearing and elevated boardwalks would be inaccessible to most potential users. Other areas have a fair degree of slope that would not be accessible to most people without improvements. If improvements were not made unrestricted access would lead to erosion and disturbance of the natural area. However, some campus Conservation Areas do not have these access limitations and this is where public access improvements will need to be prioritized.

While not specifically identified in the land use designation, the management approach of each Conservation Area will generally fit into one of the three following broad categories – Nature Park, Academic Preserve and Nature Preserve. The Nature Park management approach is where public use is encouraged and physical improvements will be targeted to enhance the visitation experience. Examples of Conservation Areas that fit into the Nature Park category are McCarty Woods, Bartram-Carr Woods and Reitz Ravines. Academic Preserve is the designation that fits Conservation Areas where the basic focus is on the research of natural processes, in these areas teaching and research are encouraged and public use is prohibited or discouraged. The NATL is the obvious example of this category. Improvements and accessibility will be determined by the types of research and teaching being conducted and its compatibility with public use. The final category, Nature Preserve, is reserved for wetland areas, areas of steep slope and areas with known or probable listed species. In these areas physical improvements will be limited to habitat and hydrologic restoration, with public use discouraged. While each Conservation Area will be identified with one of these primary management approaches, there are some Conservation Areas that will contain a combination of these approaches. Presumably, all Conservation Areas will be used to some degree for academic purposes. An example of a Conservation Area that fits into all three categories is Lake Alice. Portions of Lake Alice are very accessible and public use is warranted, many areas within are used for teaching, while some areas are wet and inaccessible where public use should be discouraged. Each specific area plan will identify which management approach best fits the Conservation Area.

One goal of this plan is to identify and prioritize Conservation Areas that need improvements in order to direct use to the proper locations, make it more accessible, while addressing the Americans with Disabilities Act requirements. Basic improvements that have been identified include designating trails, sitting areas, and informational kiosks. Additionally, discrete signage should be placed along trails pointing out unique features and providing information unique to each area. Sensitive areas of steep slope and unique vegetation should be identified and restricted with natural barriers placed where possible (fencing where not).

Additionally, access and use of Conservation Areas should be restricted to practices consistent with preservation of each natural area. Typical uses are passive in nature and include walking, jogging, wildlife observation, educational uses, and biking limited to designated trails. Other proposed uses that are not entirely consistent with preservation of natural areas should not be allowed, unless approved by the Lakes, Vegetation and Landscape Committee and Senior Administration.