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ASSESSING THE POTENTIAL OCCURRENCE OF RARE, THREATENED, AND ENDANGERED SPECIES IN THE UPPER ST. JOHNS RIVER BASIN

by

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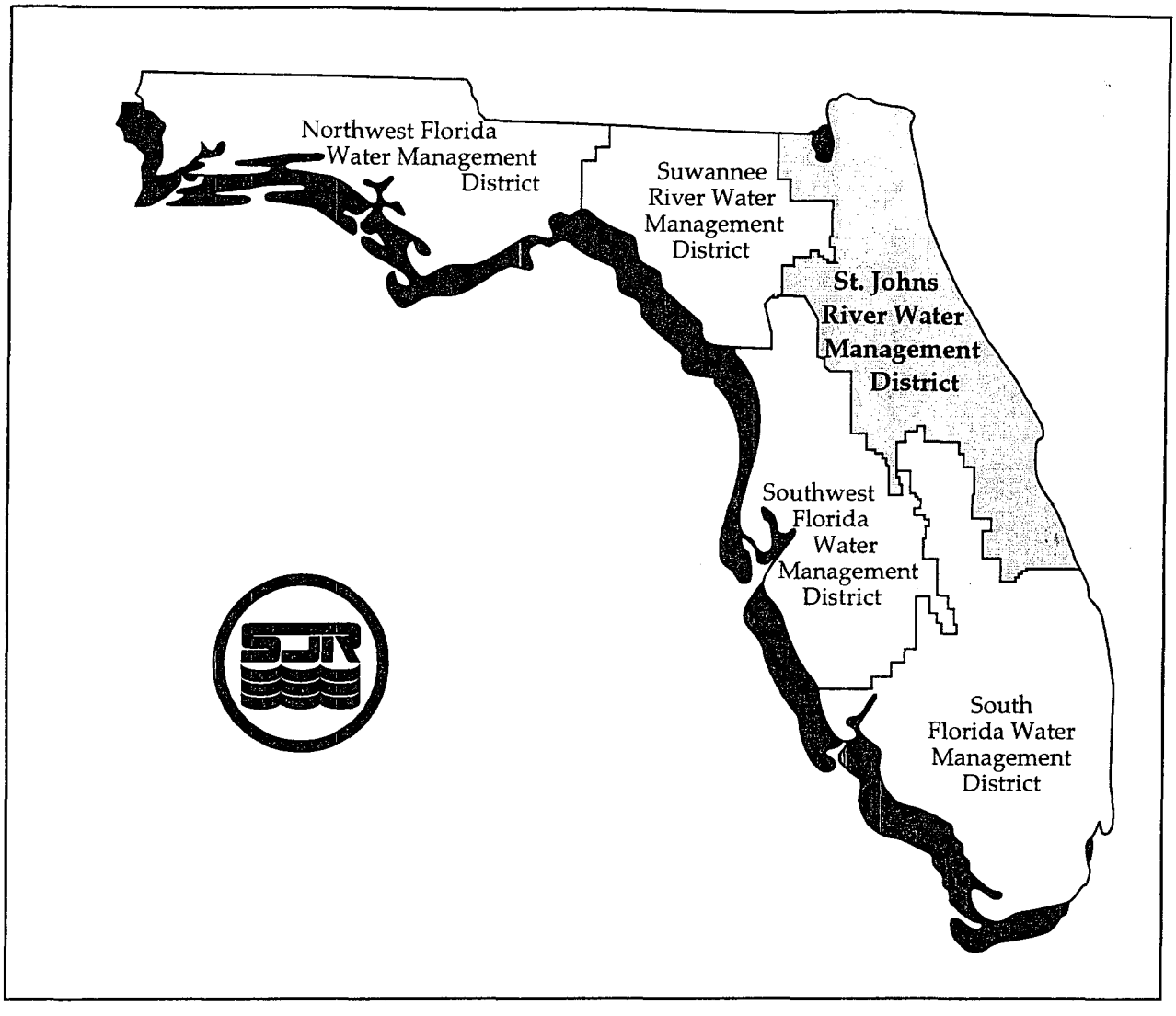

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EXECUTIVE SUMMARY

Since the early 1980s, the St. Johns River Water Management District has been acquiring land and easements in the Upper St. Johns River Basin (USJRB) for flood protection, water quality improvement, and wildlife conservation. As many agricultural areas in the basin are restored, the abundance of wading birds, waterfowl, and other wildlife is expected to increase. Information on the distribution and population status of most plants and animals in the USJRB, especially for listed or rare species, has been lacking. For this study, 29 project areas covering 313,000 acres of the USJRB were ranked by size, diversity of habitats, and the potential occurrence of rare, threatened, or endangered species. These data are critical for the management of the project areas as well as the monitoring of restoration success or ecosystem changes.

The most abundant habitats in the USJRB were freshwater marsh, shrub swamp, open water, forested wetlands, and dry prairies/savannahs. Relatively rare upland habitats were scrubs, hardwood hammocks, and pine flatwoods. Based on literature sources, over 160 rare or listed species potentially occur in the USJRB region including 83 plants, 27 invertebrates, one amphibian, 10 reptiles, 35 birds, and 7 mammals. The U.S. Fish and Wildlife Service or the Florida Fish and Wildlife Conservation Commission consider 41 of these species to be endangered, 42 threatened, and 23 species of special concern, while another 57 are considered by specialists to be rare.

Project areas with the greatest diversity of habitats and potential for rare or listed species included the Lake Poinsett/Canaveral Management Area, Bull Creek Management Area, Seminole Ranch Management Area, Fort Drum Marsh Conservation Area, and St. Johns Marsh Conservation Area. Wet and dry prairies, as well as swamps, flatwoods, and scrubs were among the most favorable habitats for rare species in the USJRB.

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ACKNOWLEDGMENT

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INTRODUCTION

The purpose of this document is to provide a list of endangered, threatened, or rare species that may occur on St. Johns River Water Management District-owned lands in the Upper St. Johns River Basin (USJRB) and identify areas that are most likely to support these species. The various project areas in the USJRB are ranked according to their potential for supporting rare or listed species.

A unique combination of geologic, edaphic, and climatic conditions makes Florida one of the most biologically diverse areas in the United States. Over 2,650 species of native plants, 670 species of vertebrates, and thousands of species of invertebrates are known to occur in the state (Wunderlin 1998; Muller et al. 1989; Millsap et al. 1990). Nearly 6% of the plants, 17% of the vertebrates, and at least 410 species of invertebrates are endemic and occur nowhere else in the world (Wunderlin 1998; Muller et al. 1989). Florida's diverse fauna is supported by 81 recognized natural community types, of which 13 are considered to be endemic (FNAI 1990).

Florida also has one of the fastest growing human populations in the nation, leading to increasing stress on the state's biological resources. Every year, thousands of acres of habitat are lost directly to agricultural and residential development, or become increasingly fragmented and degraded (Cox et al. 1994). Invasion of natural communities by nonnative plants and animals is also a severe problem. As natural areas decline, many of the unique or rare plant and animal species that depend upon them are being driven closer to extinction. The U.S. Fish and Wildlife Service listed 54 plant species and 47 vertebrate species found in Florida as nationally threatened or endangered (FFWCC 1997). At the same time, the state of Florida recognized 413 plant and 110 vertebrate species as being either state-endangered or -threatened or as species of special concern. Additional species would undoubtedly qualify for listing if more were known about their life history requirements or population dynamics. For example, Millsap et al. (1990) reported that 294 (44%) of Florida's vertebrate taxa were probably declining. Of these declining species, limiting factors and population status were only known for 30.

The USJRB provides important habitat for many threatened or endangered species (Cox et al. 1994). The USJRB stretches more than 80

miles from the Fort Drum Marsh Conservation Area in Indian River County north to the Econlockhatchee River in Seminole County (Figure 1) and encompasses over one million acres. The diversity of habitats and species of plants and animals in the USJRB makes it a regional center of biodiversity. Several of the habitats, including floodplain marsh, floodplain swamp, scrub, and blackwater stream, are considered imperiled statewide (FNAI 1990).

The St. Johns River Water Management District (SJRWMD) began acquiring land in the USJRB in the early 1980s with the creation of the Upper St. Johns River Basin Project (USJRBP), a public works flood control project covering approximately 165,000 acres of the headwater marshes of the St. Johns River (Miller et al. 1998). In addition to the USJRBP, other parcels, including agricultural lands adjacent to the river corridor, have been purchased and are being restored. A few parcels have received protection via the purchase of conservation easements by SJRWMD. By 1998, nearly 230,000 acres in the USJRB had been purchased (SJRWMD 1998). Unfortunately, baseline information on the distribution and population status of many listed species is lacking for SJRWMD-owned lands in the USJRB.

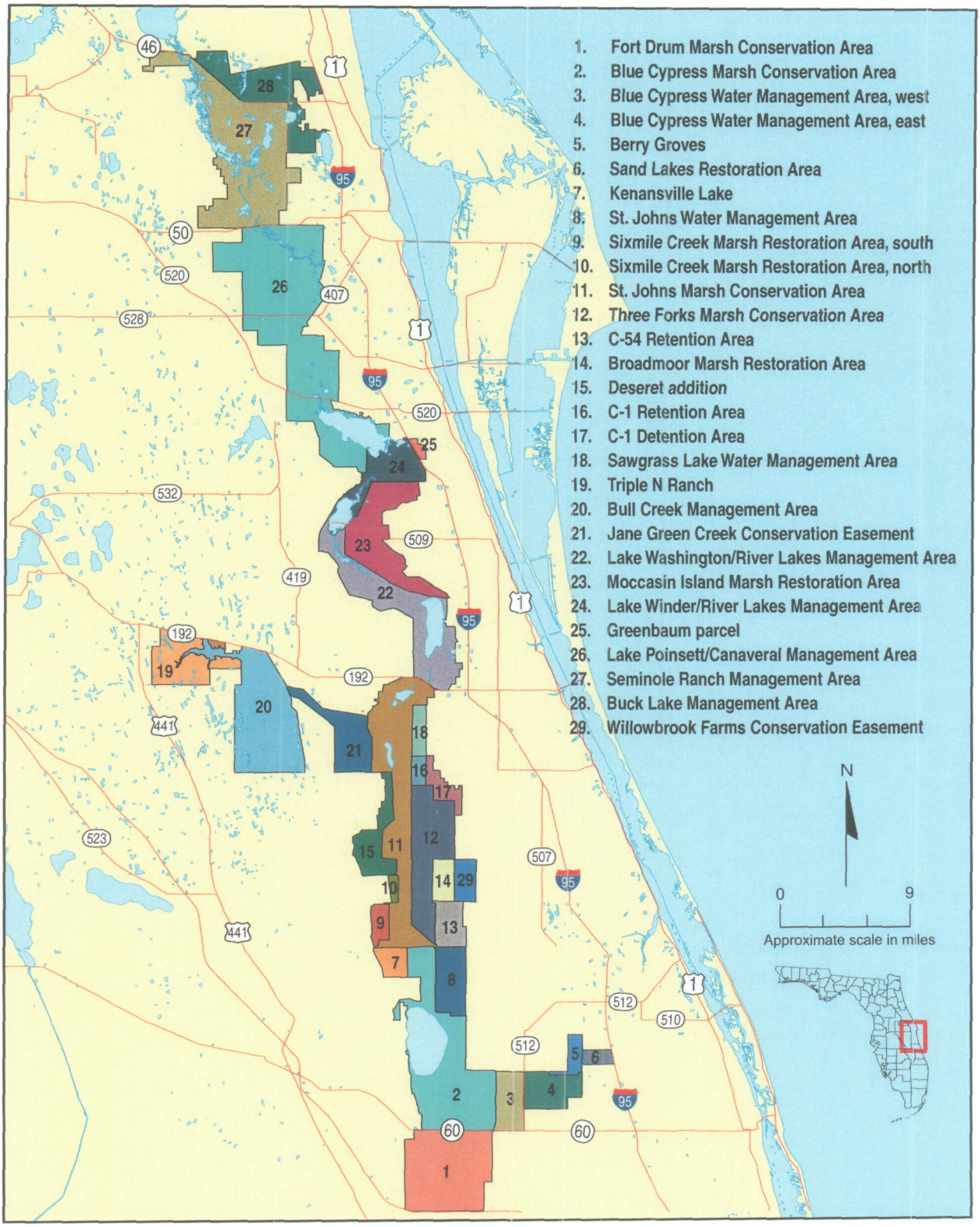


Figure 1. Project areas in the Upper St. Johns River Basin

METHODS

An analysis was performed to determine the distribution and size of the various habitats in the USJRB. Using SJRWMD's geographical information system (GIS) and ARC/INFO software, boundaries of 29 SJRWMD project areas in the USJRB were overlaid onto the 1995 land cover map of the region. The 1995 land cover was then updated using 1998 aerial photographs. Finally, the map was queried for acreage of each type of land cover class in the project area. SJRWMD's GIS land cover layer was interpreted from aerial photographs using a modified version of the FLUCCS classification system (FDOT 1985). Land cover classes used in the GIS analysis were subsequently grouped into 13 major habitat types (Table 1). Minimum habitat extent was set at 5 acres.

A list of endangered and threatened species, species of special concern, and rare plants and animals expected to occur in the USJRB was compiled from literature sources (Coile 2000; Deyrup and Franz 1994; FFWCC 1997; FNAI 1997; Gilbert 1992; Humphrey 1992; Rodgers et al. 1996; Wunderlin 1998). Habitat information for each species was also obtained from the references. These data were entered into a digital spreadsheet for sorting and comparison. A matrix was developed listing the rare species potentially present in the USJRB and the habitats in which they were most likely to occur (see appendix). These habitat preferences were then matched to the GIS results of the distribution of various habitats among the 29 project areas.

To rank project areas in the USJRB for the occurrence of rare plants and animals, a simple method was developed relating property size, number of habitats, and potential number of listed species. The project areas were first categorized by size such that parcels between 1,000 and 5,000 acres were assigned a "1," between 5,001 and 10,000 acres a "2," and so forth. Habitats were similarly classified, so that project areas with one to five habitats present were assigned a "1," five to 10 present a "2," and 10 to 20 present a "3." The potential number of rare species was categorized in the following manner: 0 to 24 species potentially present was given a "1," 25 to 49 a "2," and so forth. For each project area, the scores for size, habitat, and potential species were then added together. The highest total scores indicated the best sites for finding the greatest numbers of rare species.

Table 1. Habitats (land cover classes) mapped in the Upper St. Johns River Basin

Land Cover Class	Description
Agricultural and disturbed land	Lands that have been used for raising crops or that have been highly disturbed by other human activities
Improved pasture	Areas where the land has been cleared of trees and shrubs, tilled, reseeded with nonnative grasses, and periodically improved by mowing, burning, and fertilizer application; primary use is for cattle production
Shrub and brushland	Areas dominated by saw palmettos *(Serenoa repens)*, gallberry *(Ilex glabra)*, wax myrtle *(Myrica cerifera)* and other shrubs and brush. Generally, saw palmetto is the most prevalent plant cover, intermixed with a variety of other woody scrub plant species as well as various types of short herbs and grasses
Dry prairie/savannah	A nearly treeless plain with a groundcover of wiregrass *(Aristida beyrichiana)*, saw palmetto, broomsedge *(Andropogon* spp.*)*, or other grasses, herbs, and low shrubs. Dry prairie/savannah occurs on relatively flat, poorly drained sandy soils and as a result may be flooded for short periods
Pine flatwoods	Pine flatwoods are characterized by a dominant overstory of slash pine *(Pinus elliottii)*, longleaf pine *(Pinus palustris)*, or pond pine *(Pinus serotina)*. Soils are generally sandy with a moderate amount of organic material on the surface. Pine flatwoods are the most widespread natural community in Florida and may occur on well-drained to poorly drained soils. Typical understory plants include saw palmetto, gallberry, and wiregrass. Pine flatwoods may be interspersed with cypress domes and bayheads in wetter areas
Hardwood hammock	Primary species found in the hardwood hammocks include live oak *(Quercus virginiana)*, cabbage palm *(Sabal palmetto)*, southern magnolia *(Magnolia grandiflora)*, and laurel oak *(Quercus laurifolia)*. Palms and ferns usually dominate the understory. Hardwood hammocks are typically found at the wetland/upland interface in the USJRB
Xeric oak	This forest type is usually dominated by turkey oak *(Quercus laevis)*, sand live oak *(Quercus geminata)*, myrtle oak *(Quercus myrtifolia)*, and other scrub oaks. It is prevalent on sites where longleaf pine was harvested, but not replanted, or where fire has been excluded for a long time. This community is characteristic of deep, well-drained, sandy soils
Sand pine scrub	A forest of sand pines (*Pinus clausa*), often with dense clumps of scrub oaks, saw palmetto, or other shrubs dominating the understory. The groundcover is generally sparse, and open patches of barren sand are common. This community generally occurs on extremely well-drained sandy soils
Streams, waterways, lakes, ponds, and reservoirs	Open-water areas
Wet prairie	A herbaceous plant community dominated by grassy vegetation that is distinguished from marshes by a shorter hydroperiod. Dominant species may include sawgrass (*Cladium jamaicense*), maidencane (*Panicum hemitomon*), sand cordgrass (*Spartina bakeri*), spike rush (*Eleocharis* spp.), St. John's wort (*Hypericum* spp.), swamplily (*Crinum americanum*), yellow-eyed grass (*Xyris* spp.), and beakrush (*Rhynchospora* spp.)

Table 1—*Continued*

Land Cover Class	Description
Freshwater marsh	Herbaceous plant communities typically inundated annually for several months. Usually one or more of the following species predominate: sawgrass, cattail *(Typha* spp.*)*, arrowhead *(Sagittaria* spp.*)*, maidencane, buttonbush *(Cephalanthus occidentalis)*, sand cordgrass, bulrush *(Scirpus* spp.*)*, rushes *(Juncus* spp.*)*, and arrowroot *(Maranta arundinacea)*
Shrub wetland	This category encompasses swamps that are dominated by willow *(Salix caroliniana)* and other shrubs
Forested wetland (swamp)	Swamps occupy seasonally flooded soils along stream channels and floodplains or in low, poorly drained basins within flatwoods and other communities. Dominant plants may include cypress, red maple *(Acer rubrum)*, blackgum *(Nyssa biflora)*, and sweet bay *(Magnolia virginiana)*. Cypress swamps in the USJRB usually occur as strands that follow natural drainage systems, such as river channels or lake margins. Bald cypress *(Taxodium distichum)* is often a dominant species in strands, or mixed with, blackgum, ashes *(Fraxinus* spp.*)*, red maple, swamp bay *(Persea palustris)*, and other hardwoods. Pond cypress *(Taxodium ascendens)* is usually the dominant species in isolated heads or domes

RESULTS

A total of 95 different land cover classes were found on the 29 project areas of the USJRB. The 29 areas covered almost 313,000 acres. For the final analysis, the 95 land cover classes were grouped into 13 different habitats (Table 1). The most abundant habitats in the USJRB were freshwater marsh (99,861 acres), shrub swamp (44,013 acres), open water (33,778 acres), forested wetlands (34,888 acres), and dry prairies/ savannahs (27,367 acres). The rarest habitat types included oak scrubs (10 acres), sand pine scrubs (64 acres), hardwood hammocks (5,786 acres), and pine flatwoods (15,512 acres). Significant areas of impacted communities also occur in the USJRB with 12,972 acres of disturbed land, 8,902 acres of improved pasture, and 7,005 acres of shrub and brushland. Land cover maps of all the project areas considered in this analysis are presented in Figures 2–10.

The literature search indicated that 163 rare or listed species may potentially occur in the USJRB (Table 2). The list includes 83 species of plants, 27 species of invertebrates, one amphibian, 10 species of reptiles, 35 species of birds, and seven species of mammals. Forty-one of these species are considered endangered; 42, threatened; 23, species of special concern; and 57, rare (Table 3). Among the upland habitats, dry prairies, pine flatwoods, and scrubs are likely to harbor the greatest numbers of rare species, while wet prairies and swamps are among the most important wetland communities (Table 3).

Project areas with the greatest diversity of habitats (11–13) were the Bull Creek Management Area, Lake Poinsett/Canaveral Management Area, Seminole Ranch Management Area, St. Johns Marsh Conservation Area, Moccasin Island Marsh Restoration Area, and Jane Green Creek Conservation Easement (Table 4). In contrast, Berry Groves, the Sixmile Creek Marsh restoration areas, the St. Johns Water Management Area, the Willowbrook Farms Conservation Easement, the Broadmoor Marsh Restoration Area, the C-54 Retention Area, and the Greenbaum parcel had the lowest diversity of habitats.

Based on size, number of habitats, and the number of rare species that may be present, the 29 project areas were classified and ranked from 1 to 11 with respect to their potential to support listed species of plants and

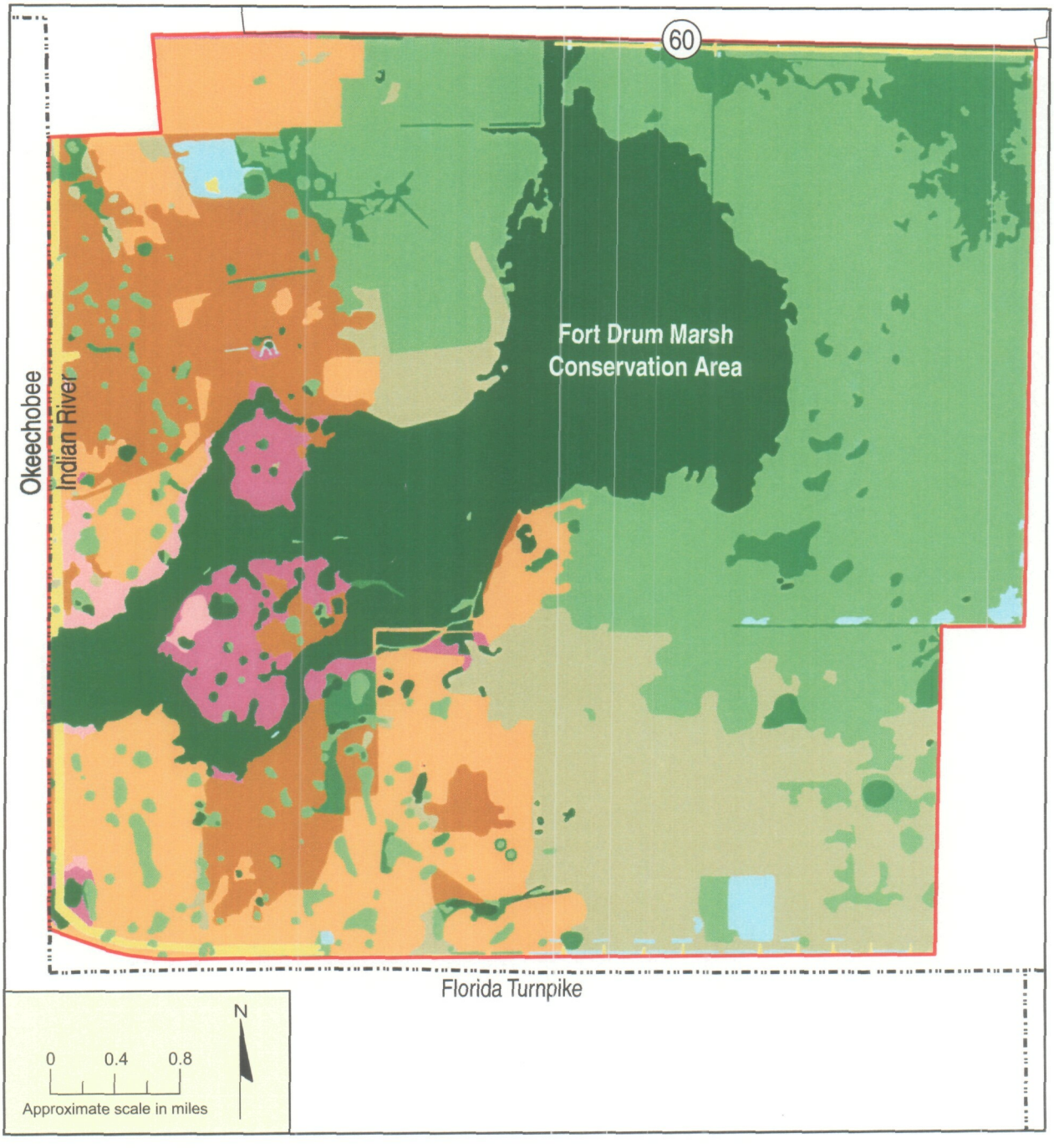


Figure 2. Land use/land cover for the Fort Drum Marsh Conservation Area

Agriculture and disturbed land
Improved pasture
Dry prairie/savannah
Shrub and brushland
Pine flatwood
Hardwood hammock
Forested wetland
Shrub swamp
Freshwater marsh
Wet prairie
Stream, waterway, lake, or reservoir
Project area boundary
County boundary
Road

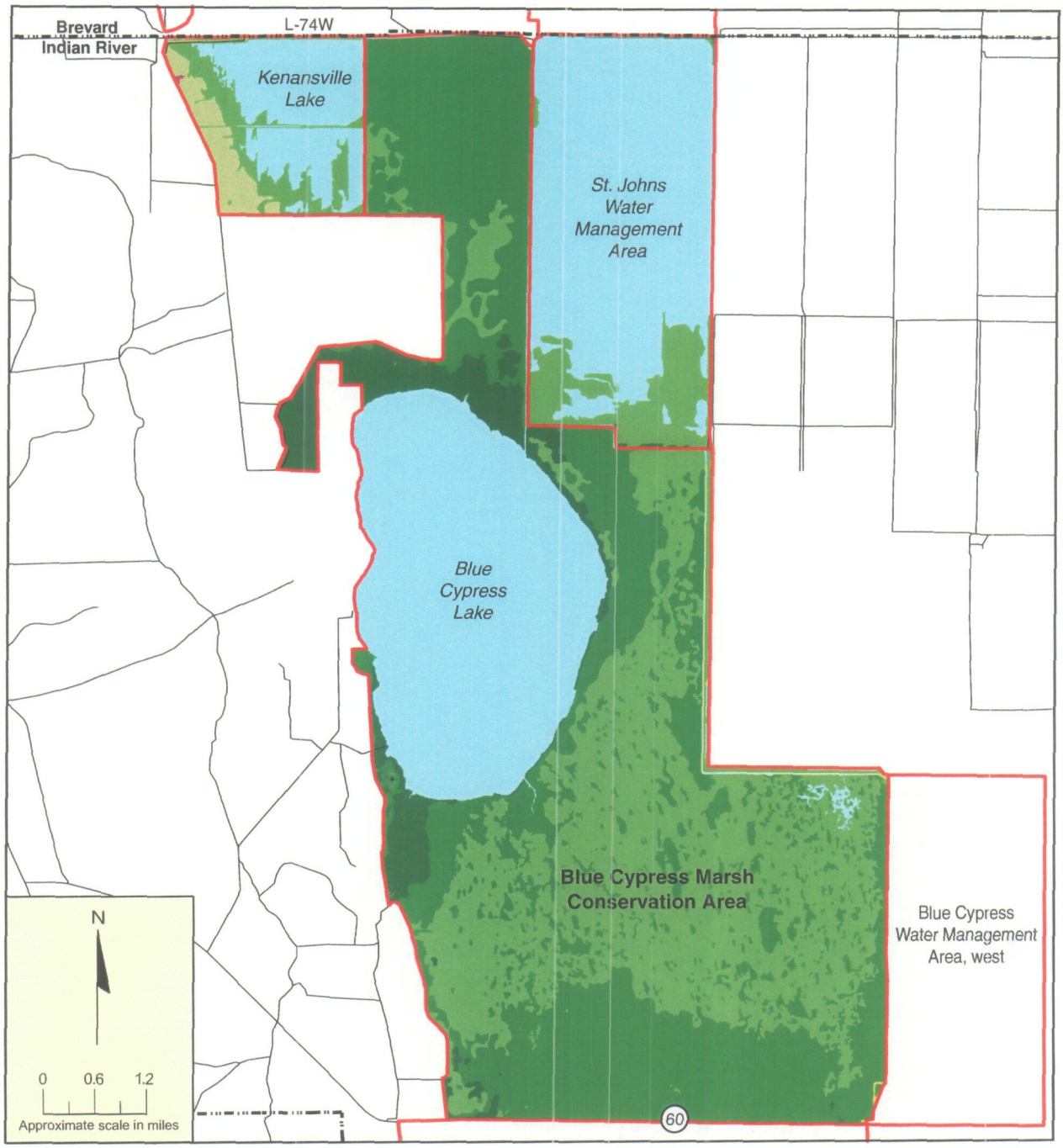


Figure 3. Land use/land cover for project areas within the vicinity of Blue Cypress Lake

Agriculture and disturbed land
Improved pasture
Hardwood hammock
Forested wetland
Shrub swamp
Freshwater marsh
Wet prairie
Stream, waterway, lake, or reservoir
Project area boundary
County boundary
Road

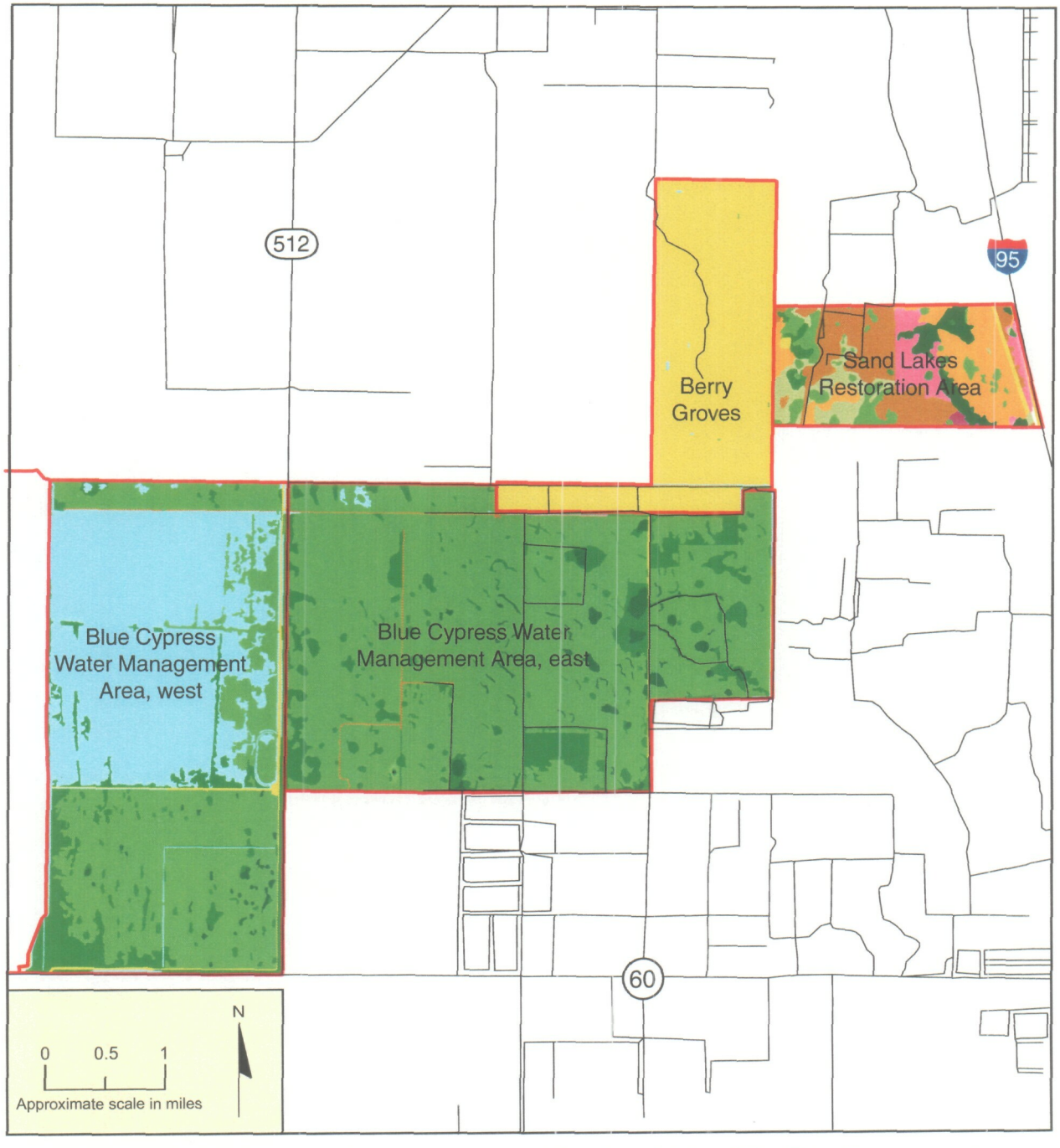
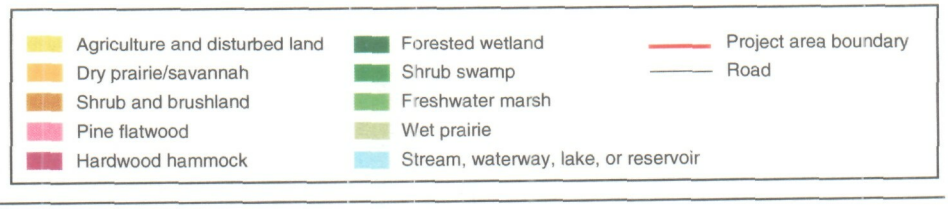


Figure 4. Land use/land cover for project areas within the vicinity of the Blue Cypress water management areas



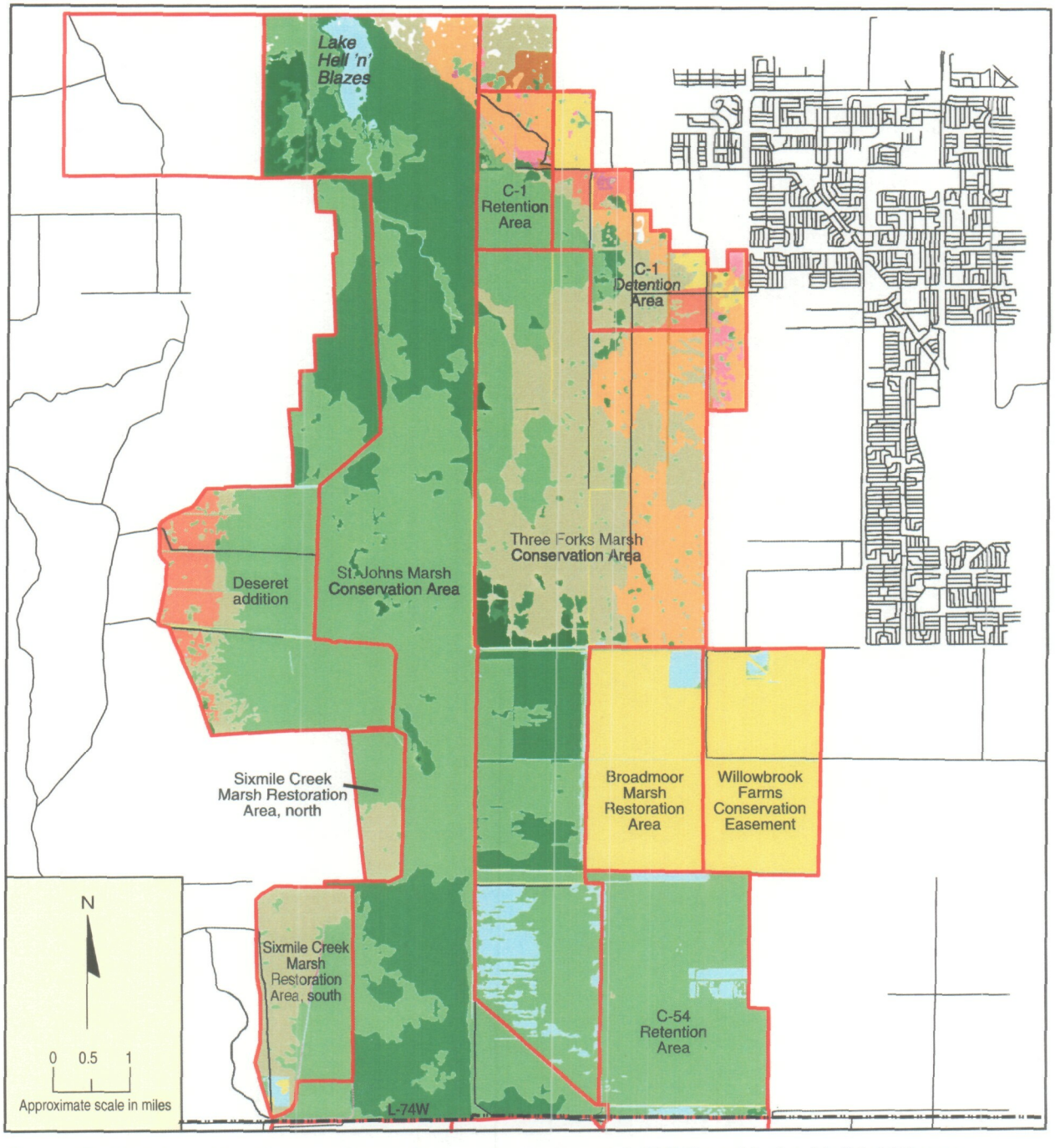


Figure 5. Land use/land cover for project areas between L-74W and Lake Hell 'n' Blazes

Agriculture and disturbed land
Improved pasture
Dry prairie/savannah
Shrub and brushland
Pine flatwood
Hardwood hammock
Forested wetland
Shrub swamp
Freshwater marsh
Wet prairie
Stream, waterway, lake, or reservoir
Project area boundary
County boundary
Road

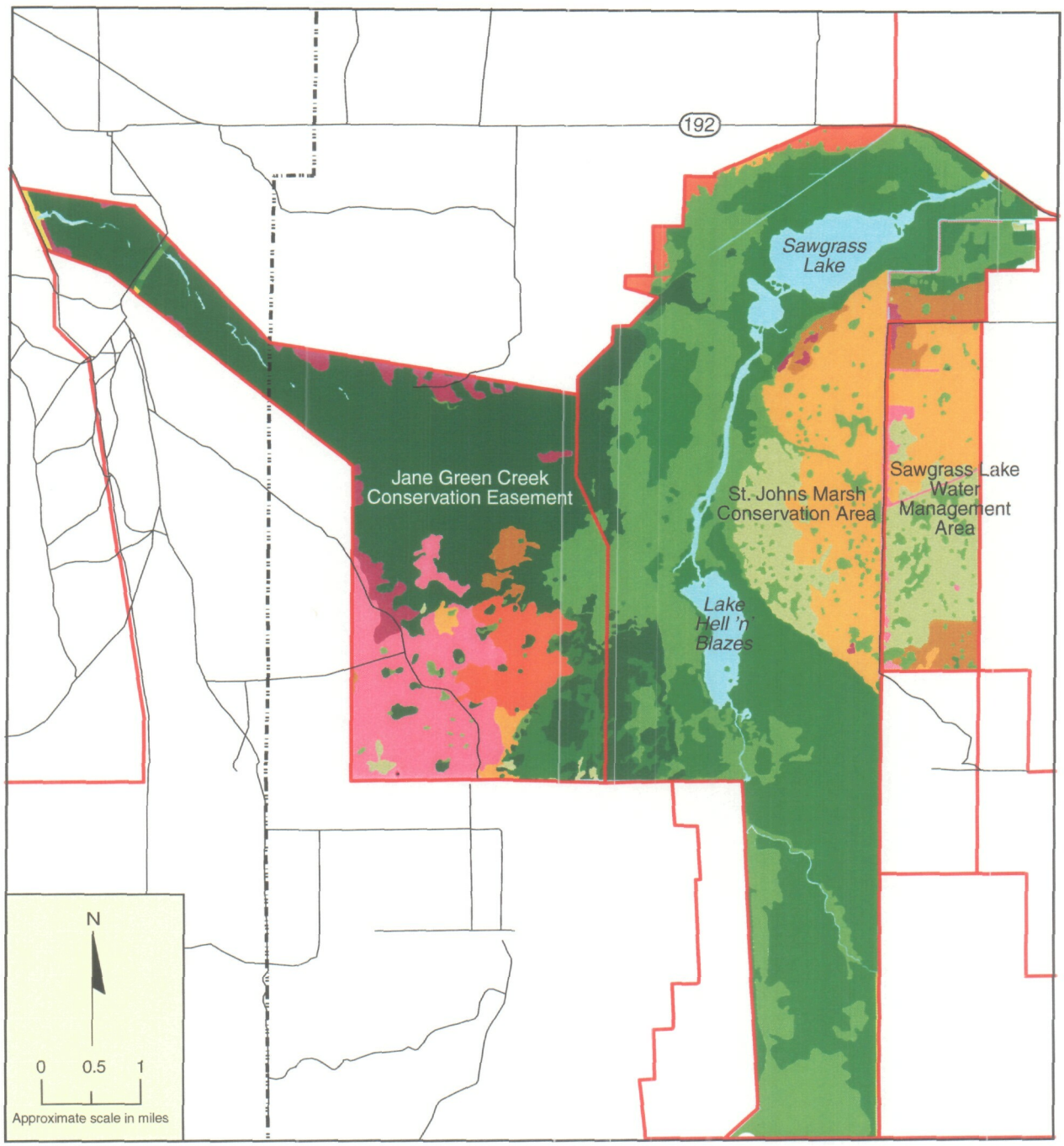


Figure 6. Land use/land cover for project areas between Lake Hell 'n' Blazes and State Road 192

Agriculture and disturbed land
Improved pasture
Dry prairie/savannah
Shrub and brushland
Pine flatwood
Hardwood hammock
Forested wetland
Shrub swamp
Freshwater marsh
Wet prairie
Stream, waterway, lake, or reservoir
Project area boundary
County boundary
Road

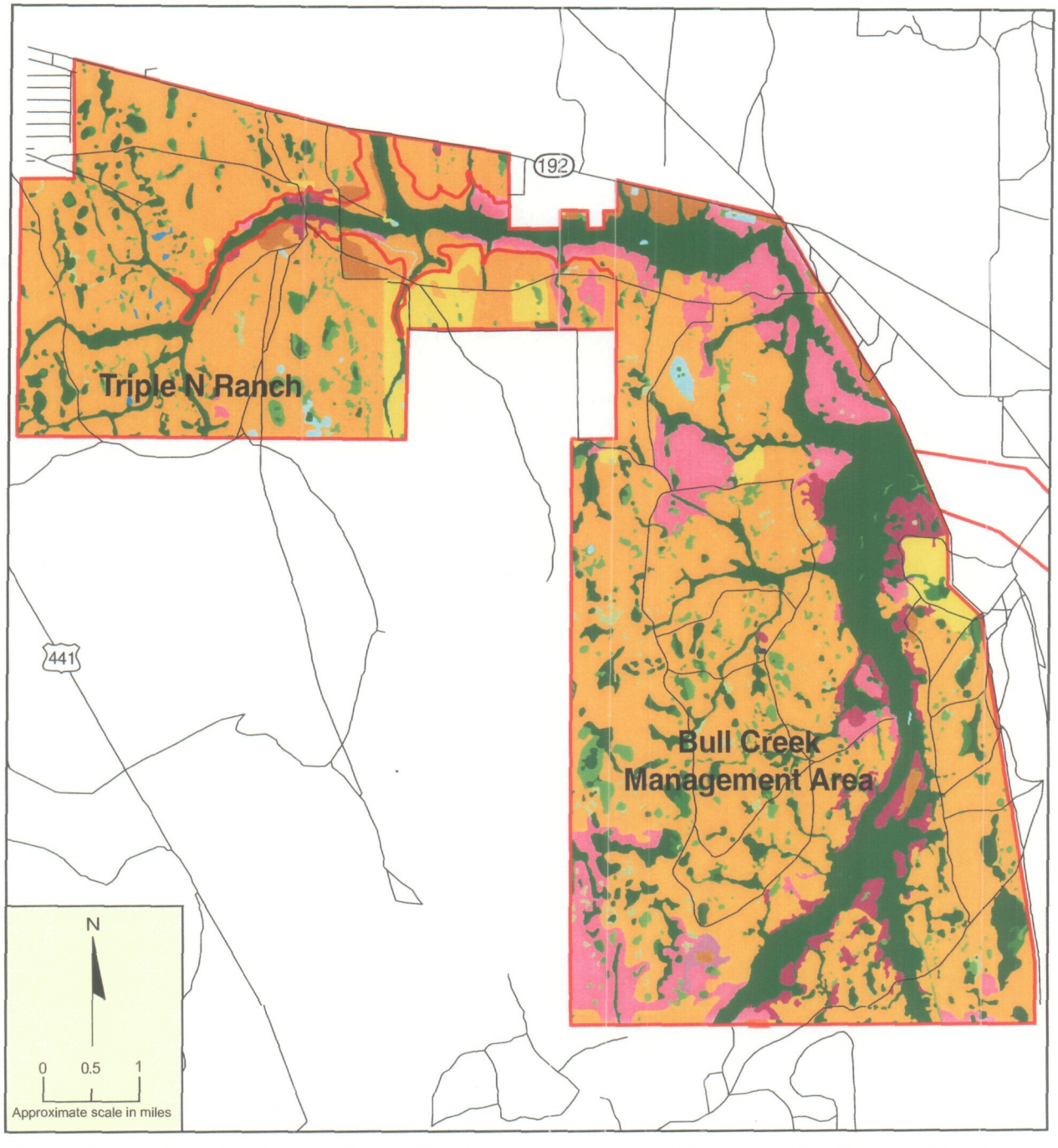


Figure 7. Land use/land cover for the Bull Creek Management Area and the Triple N Ranch

Agriculture and disturbed land
Improved pasture
Dry prairie/savannah
Shrub and brushland
Pine flatwood
Sand pine scrub
Hardwood hammock
Xeric oak
Forested wetland
Shrub swamp
Freshwater marsh
Wet prairie
Stream, waterway, lake, or reservoir
Project area boundary
Road

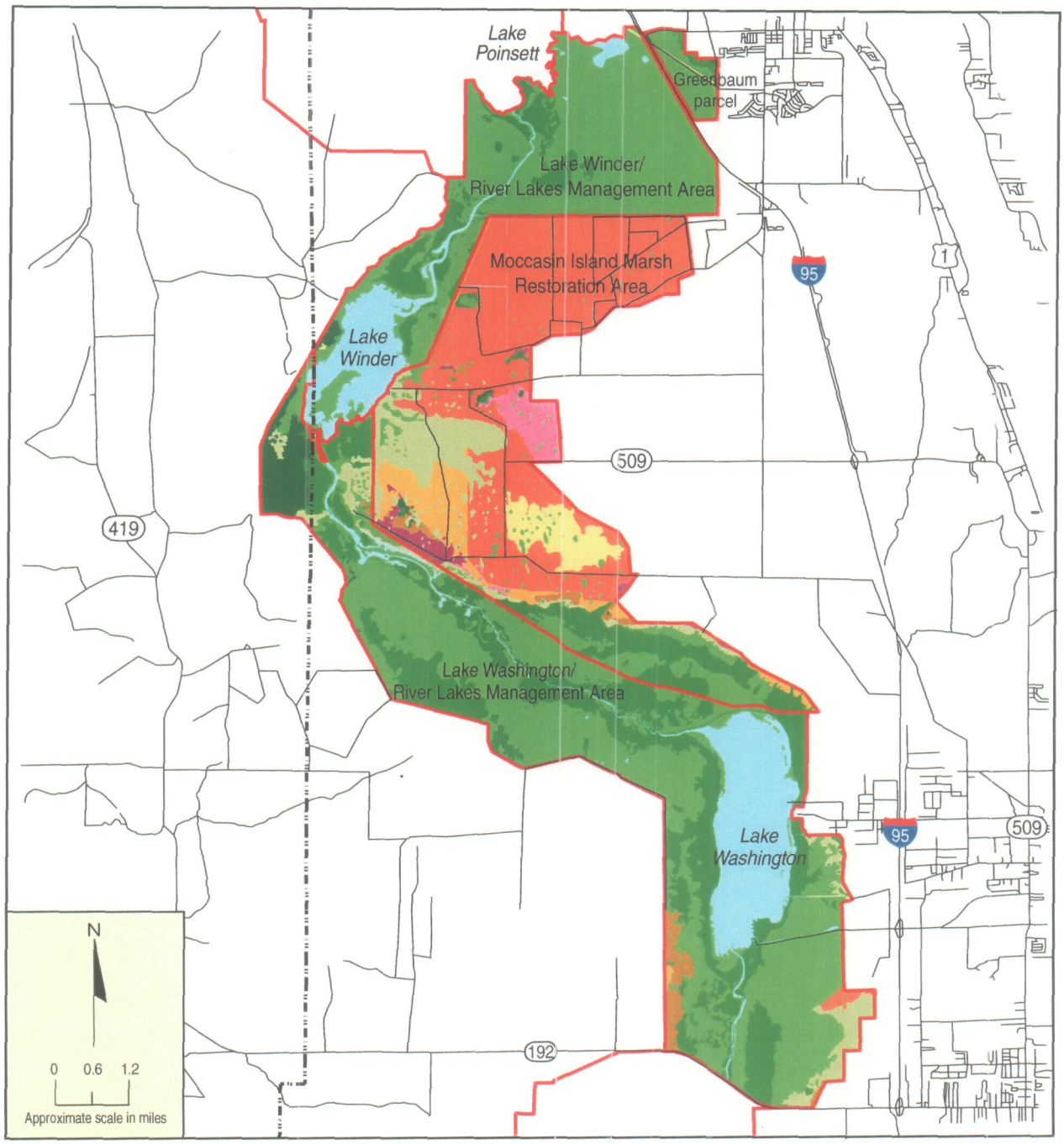


Figure 8. Land use/land cover for project areas between State Road 192 and Lake Poinsett

Agriculture and disturbed land
Improved pasture
Dry prairie/savannah
Shrub and brushland
Pine flatwood
Hardwood hammock
Forested wetland
Shrub swamp
Freshwater marsh
Wet prairie
Stream, waterway, lake, or reservoir
Project area boundary
County boundary
Road

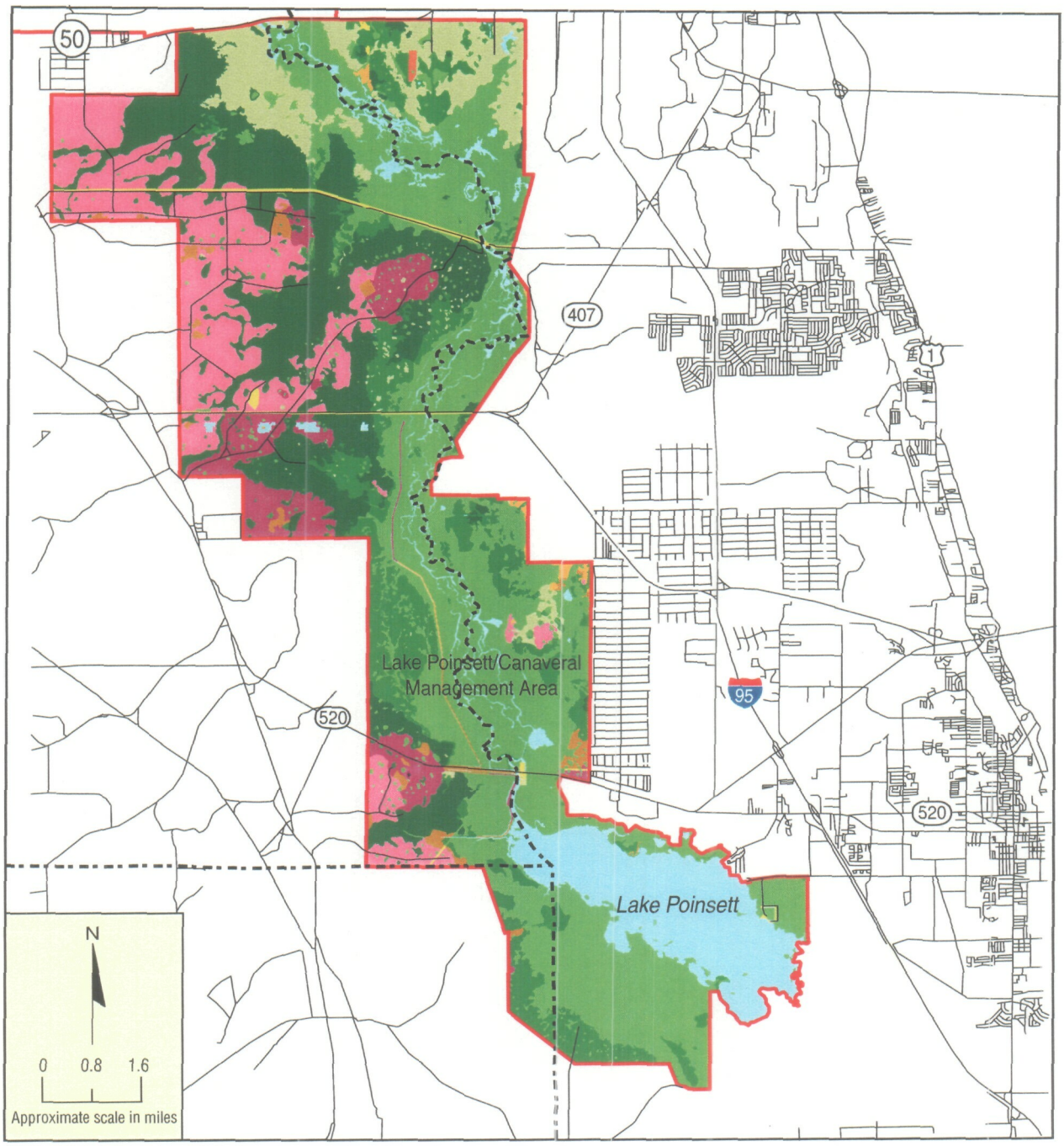


Figure 9. Land use/land cover for the Lake Poinsett/Canaveral Management Area

Agriculture and disturbed land
Improved pasture
Dry prairie/savannah
Shrub and brushland
Pine flatwood
Hardwood hammock
Forested wetland
Shrub swamp
Freshwater marsh
Wet prairie
Stream, waterway, lake, or reservoir
Project area boundary
County boundary
Road

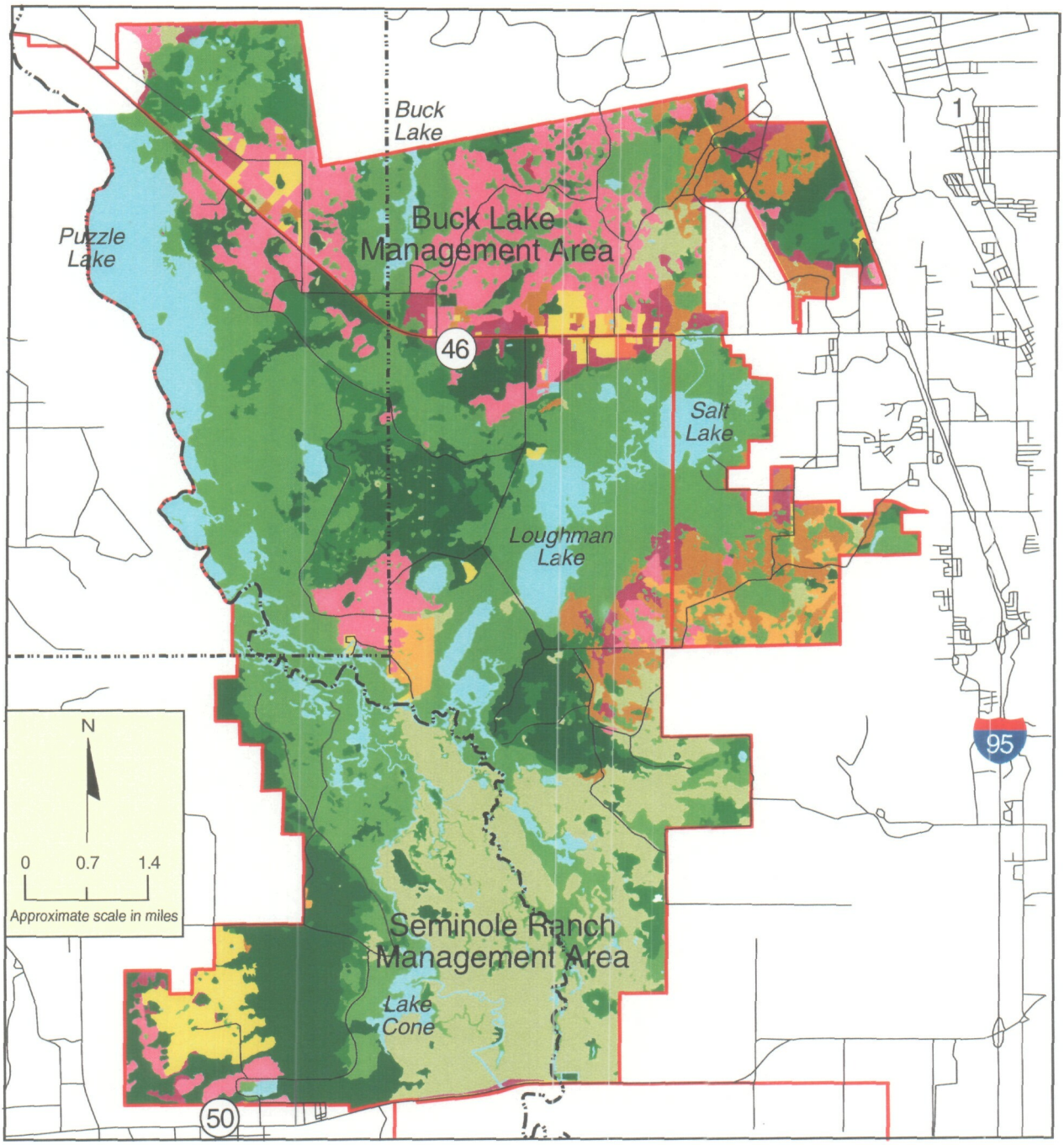


Figure 10. Land use/land cover for the Seminole Ranch and Buck Lake management areas

Agriculture and disturbed land
Improved pasture
Dry prairie/savannah
Shrub and brushland
Pine flatwood
Hardwood hammock
Forested wetland
Shrub swamp
Freshwater marsh
Wet prairie
Stream, waterway, lake, or reservoir
Project area boundary
County boundary
Road

Table 2. Plants and animals having endangered, threatened, rare, or species of special concern status that may potentially be found in the Upper St. Johns River Basin

PLANTS (83 SPECIES)

Endangered Plants

Adiantum tenerum (brittle maidenhair fern)
Asclepias curtissii (Curtis's milkweed)
Asplenium auritum (auricled spleen-wort)
Asplenium serratum (bird's nest spleenwort)
Calopogon multiflorus (many-flowered grass pink)
Centrosema arenicola (sand butterfly pea)
Deeringothamnus pulchellus (white squirrel-banana)
Deeringothamnus rugelii (yellow squirrel-banana)
Dennstaedtia bipinnata (bipinnate cuplet fern)
Dicerandra immaculata (Olga's mint)
Helianthus carnosus (flatwoods sunflower)
Hexalectris spicata (crested coralroot)
Illicium parviflorum (star anise)
Lechea divaricata (spreading pinweed)
Minuartia godfreyi (Godfrey's stitchwort)
Monotropsis odorata (pygmypipes)
Nemastylis floridana (fall-flowering ixia)
Ophioglossum palmatum (hand fern)
Panicum abscissum (cut-throat grass)
Pecluma dispera (widespread polypody)
Pecluma plumula (plume polypody)
Pecluma ptilodon (swamp plume polypody)
Peperomia humilis (peperomia)
Peperomia obtusifolia (Florida peperomia)
Platanthera integra (orange rain orchid)
Schizachyrium niveum (pinescrub bluestem)
Schwalbea americana (chaff seed)
Spiranthes brevilabris (small ladies' tresses)
Stylisma abdita (showy dawnflower)
Tillandsia fasciculata (common wild-pine)
Tillandsia utriculata (giant wild-pine)
Verbena tampensis (Tampa vervain)
Warea amplexifolia (clasping warea)
Warea carteri (Carter's mustard)

Threatened Plants

Andropogon arctatus (pine-woods bluestem)
Calamovilfa curtissii (Curtis's sandgrass)
Coelorachis tuberculosa (piedmont jointgrass)
Conradina grandiflora (large-flowered rosemary)
Garberia heterophylla (garberia)
Habenaria nivea (snowy orchid)
Lechea cernua (scrub pinweed)
Lilium catesbaei (Catesby lily)
Lobelia cardinalis (cardinal flower)
Matelea gonocarpos (angle-pod)
Nolina atopocarpa (Florida beargrass)
Pinguicula caerulea (blue butterwort)
Pinguicula lutea (yellow butterwort)
Platanthera blephariglottis (white-fringed orchid)
Platanthera ciliaris (yellow-fringed orchid)
Platanthera flava (southern rain orchid)
Pogonia ophioglossoides (rose pogonia)
Pteroglossapis ecristata (noncrested eulophia)
Sacoila lanceolata (leafless beaked orchid)
Sarracenia minor (hooded pitcher-plant)
Spiranthes laciniata (lace-lip ladies' tresses)
Spiranthes longilabris (long-lip ladies' tresses)
Spiranthes tuberosa (little ladies' tresses)
Tillandsia balbisiana (reflexed wild-pine)
Zephranthes atamasco (rainlily)
Zephranthes simpsonii (Simpson's zephyr-lily)
Zephranthes treatiae (Treat's zephyr-lily)

Rare Plants

Baptisia perfoliata (catbells)
Cheilanthes alabamensis (Alabama lip fern)
Coelorachis cylindrica (Carolina jointgrass)
Cuscuta exaltata (tall dodder)
Cynanchum northropiae (fragrant swallowwort)
Dicerandra thinicola (Titusville balm)
Dicranopteris flexuosa (drooping forked fern)
Digitaria simpsonii (Simpson's crabgrass)
Eleocharis parvula (dwarf spikerush)
Eleocharis quadrangulata (squarestem spikerush)
Flaveria trinervia (clustered yellowtops)
Hypoxis sessilis (glossyseed yellow stargrass)
Lindera benzoin (northern spicebush)
Orobanche minor (hellroot)
Persea humilis (scrub bay)
Rhynchosia cinerea (brown-haired snoutbean)
Selaginella ludoviciana (gulf spike-moss)
Solidago arguta var. *Caroliniana* (Carolina goldenrod)
Stillingia sylvatica l. Ssp. *Tenuis* (queen's delight)
Trachelospermum difforme (climbing dogbane)
Trichostema setaceum (narrowleaf bluecurls)
Websteria confervoides (algal bulrush)

Table 2—*Continued*

INVERTEBRATES (27 SPECIES)

Endangered Invertebrates

None

Threatened Invertebrates

Odonata

Libellula jesseana (purple skimmer)

Coleoptera

Aphodius troglodytes (gopher tortoise aphodius)
Ataenius sciurus (fox squirrel scarab)
Chelyoxenus xerobatis (gopher tortoise hister beetle)
Copris gopheri (gopher tortoise copris)
Onthophagus polyphemi (gopher tortoise onthophagus)
Trox howelli (caracara trox)

Invertebrate Species of Special Concern

Odonata

Didymops floridensis (maidencane cruiser)
Gomphus cavillaris (sandhill clubtail)
Nehalennia pallidula (Everglades sprite)
Progomphus alachuensis (tawny sanddragon)

Orthoptera

Schistocerca ceratiola (rosemary grasshopper)

Coleoptera

Aphodius aegrotus (small pocket gopher scarab)
Aphodius laevigatus (large pocket gopher scarab)
Peltotrupes profundus (Florida deepdigger scarab)
Hypotrichia spissipes (Florida Hypotrichia)

Diptera

Eutrichota gopheri (tortoise burrow anthomyiid)

Rare Invertebrates

Odonata

Gomphaeschna antilope (taper-tailed darner)

Orthoptera

Melanoplus indicifer (east coast scrub grasshopper)

Coleoptera

Cicindela scabrosa (Florida scrub tiger beetle)
Phyllophaga elizoria (elizoria June beetle)
Phyllophaga elongata (elongate June beetle)
Trigonopeltastes floridana (scrub palmetto scarab)
Ischyrus dunedinensis (scrub ischyrus)

Lepidoptera

Atrytone arogos arogos (arogos skipper)
Atrytonopsis hianna loammi (southern dusted skipper)
Euphyes berryi (Berry's skipper)

AMPHIBIANS AND REPTILES (11 SPECIES)

Amphibian Species of Special Concern

Rana capito (gopher frog)

Threatened Reptiles

Drymarchon corais couperi (eastern indigo snake)

Reptile Species of Special Concern

Alligator mississippiensis (American alligator)
Gopherus polyphemus (gopher tortoise)
Pituophis melanoleucus mugitus (Florida pine snake)

Rare Reptiles

Crotalus adamanteus (eastern diamondback rattlesnake)
Lampropeltis calligaster (mole snake)
Lampropeltis triangulum elapsoides (scarlet kingsnake)
Rhadinaea flavilata (pine woods snake)
Sceloporus woodi (Florida scrub lizard)
Tantilla relicta pamlica (coastal dunes crowned snake)

Table 2—*Continued*

BIRDS (35 SPECIES)

Endangered Birds

Ammodramus savannarum floridanus (Florida grasshopper sparrow)
Falco peregrinus (peregrine falcon)
Grus americana (whooping crane)
Mycteria americana (wood stork)
Picoides borealis (red-cockaded woodpecker)
Rostrhamus sociabilis plumbeus (snail kite)

Threatened Birds

Aphelocoma coerulescens (Florida scrub-jay)
Falco sparverius paulus (southeastern American kestrel)
Grus canadensis pratensis (Florida sandhill crane)
Haliaeetus leucocephalus (bald eagle)
Polyborus plancus audubonii (Audubon's crested caracara)
Sterna antillarum (least tern)

Bird Species of Special Concern

Ajaia ajaja (roseate spoonbill)
Aramus guarauna (limpkin)
Egretta caerulea (little blue heron)
Egretta thula (snowy egret)
Egretta tricolor (tricolored heron)
Eudocimus albus (white ibis)
Speotyto cunicularia floridana (Florida burrowing owl)

Rare Birds

Accipiter cooperii (Cooper's hawk)
Aimophila aestivalis (Bachman's sparrow)
Ardea alba (great egret)
Buteo brachyurus (short-tailed hawk)
Coturnicops noveboracensis (yellow rail)
Elanoides forficatus (swallow-tailed kite)
Elanus leucurus (white-tailed kite)
Falco columbarius (merlin)
Ixobrychus exilis (least bittern)
Laterallus jamaicensis (black rail)
Nyctanassa violacea (yellow-crowned night-heron)
Nycticorax nycticorax (black-crowned night-heron)
Pandion haliaetus (osprey)
Picoides villosus auduboni (hairy woodpecker)
Plegadis falcinellus (glossy ibis)
Recurvirostra americana (American avocet)

Table 2—*Continued*

MAMMALS (7 SPECIES)

Endangered Mammals

Geomys pinetis goffi (Goff's pocket gopher)—probably extinct

Threatened Mammals

Ursus americanus floridanus (Florida black bear)

Mammal Species of Special Concern

Podomys floridanus (Florida mouse)
Sciurus niger shermani (Sherman's fox squirrel)

Rare Mammals

Corynorhinus rafinesquii (Rafinesque's big-eared bat)
Mustela frenata peninsulae (Florida long-tailed weasel)
Neofiber alleni (round-tailed muskrat)

Endangered—Species in danger of extinction. These are generally species whose populations have already declined to such critically low levels, or whose habitats have been so degraded or reduced, that their long-term survival without assistance is questionable.
Threatened—Species likely to become endangered within the near future if current trends continue. This category includes species in which most or all populations are decreasing, species whose populations have been heavily depleted but are not yet considered endangered, and species that still may be relatively abundant but are being subjected to significant adverse pressures throughout their range.
Rare—Species that are not currently endangered or threatened as defined previously, but are at risk because they are found within a limited geographical area or habitat or are sparsely distributed over a more extensive range.
Species of Special Concern—Species that do not fit into the above categories but still warrant concern. These include species which may be abundant, but are especially vulnerable to environmental change and have experienced long-term population declines, or species whose status has a potential impact on endangered or threatened populations of the same or other species outside the state of Florida.

Table 3. Potential number and habitat occurrence of rare plants and animals in the Upper St. Johns River Basin

Group	Status				Total Species	Habitat												
	Endangered	Threatened	Species of Special Concern	Rare		Agricultural and Disturbed Lands	Improved Pastures	Shrub and Brushlands	Dry Prairies/Savannahs	Pine Flatwoods	Hardwood Hammocks	Xeric Oak	Sand Pine Scrubs	Streams and Waterways, Lakes and Reservoirs	Wet Prairies	Freshwater Marshes	Shrub Wetlands	Forested Wetlands
Plants	34	27	0	22	83	1	10	0	35	32	25	15	17	4	19	2	0	11
Insects	0	7	10	10	27	0	1	0	4	4	0	14	16	4	1	1	0	2
Herptiles	0	1	4	6	11	0	1	2	4	4	4	8	9	1	0	1	0	1
Birds	6	6	7	16	35	3	7	0	12	9	5	4	3	13	17	19	8	14
Mammals	1	1	2	3	7	0	0	0	0	4	3	6	4	0	0	2	2	2
Total	41	42	23	57	163	4	19	2	55	53	37	47	49	22	37	25	10	30

Table 4. Distribution and extent (acres) of various habitats in Upper St. Johns River Basin project areas

Project Area	Agriculture and Disturbed Lands	Improved Pasture	Shrub and Brushlands	Dry Prairies/ Savannahs	Pine Flatwoods	Hardwood Hammocks	Xeric Oaks	Sand Pine Scrubs	Streams and Waterways, Lakes and Reservoirs	Wet Prairies	Freshwater Marshes	Shrub Wetlands	Forested Wetlands	Total Project Area Acreage
Berry Groves	1,852		11	5					32		6			1,906
Blue Cypress Marsh Conservation Area	133								6,771	7	9,618	11,088	1,743	29,360
Blue Cypress Water Management Area, east	42		37		11				52		4,626	781	155	5,704
Blue Cypress Water Management Area, west	115		10						2,349		1,969	598	33	5,073
Broadmoor Marsh Restoration Area	2,551								135		55			2,741
Buck Lake Management Area	420		1,705	360	2,897	712			542	444	4,042	1,571	794	13,488
Bull Creek Management Area	355	14	351	10,726	2,349	823	5	64	72	207	683	330	5,779	21,759
C-1 Detention Area	1,000	343	95		152	26			31	618	278	143	20	2,706
C-1 Retention Area	8		19	395	84					49	643	62		1,259
C-54 Retention Area	55								299		3,692	18		4,063
Deseret addition	127	712							38	397	3,784	960	12	6,031
Fort Drum Marsh Conservation Area	372		2,064	2,677	165	553			229	2,670	6,554	1,126	4,243	20,654
Greenbaum parcel, east of I-95	29										482	75	7	592

Table 4—*Continued*

Project Area	Agriculture and Disturbed Lands	Improved Pasture	Shrub and Brushlands	Dry Prairies/ Savannahs	Pine Flatwoods	Hardwood Hammocks	Xeric Oaks	Sand Pine Scrubs	Streams and Waterways, Lakes and Reservoirs	Wet Prairies	Freshwater Marshes	Shrub Wetlands	Forested Wetlands	Total Project Area Acreage
Jane Green Creek Conservation Easement	31	482	120	107	1,383	359			41	44	377	389	4,457	7,790
Kenansville Lake	33					5			1,530	407	583	6		2,565
Lake Poinsett/ Canaveral Management Area	455	38	559	143	5,893	2,280			5,658	3,095	17,541	5,446	9,200	50,308
Lake Washington/River Lakes Management Area	8	97	378	25		9			3,001	825	8,936	5,781	699	19,758
Lake Winder/ River Lakes Management Area	26			7		5			1,608	10	6,246	1,195	62	9,158
Moccasin Island Marsh Restoration Area	725	6,953	206	1,066	516	323			37	1,617	1,211	1,336	45	14,035
Sand Lakes Restoration Area	33		354	322	153	10	5			145	155	42	116	1,335
Sawgrass Lake Water Management Area	10		237	726	117	14				779	247			2,128
Seminole Ranch Management Area	871	34	420	236	1,592	470			4,025	5,564	10,373	2,751	5,280	31,615

Table 4—*Continued*

Project Area	Agriculture and Disturbed Lands	Improved Pasture	Shrub and Brushlands	Dry Prairies/ Savannahs	Pine Flatwoods	Hardwood Hammocks	Xeric Oaks	Sand Pine Scrubs	Streams and Waterways, Lakes and Reservoirs	Wet Prairies	Freshwater Marshes	Shrub Wetlands	Forested Wetlands	Total Project Area Acreage
Sixmile Creek Marsh Restoration Area, north	11									308	406			725
Sixmile Creek Marsh Restoration Area, south	20					60			78	1,066	781			2,005
St. Johns Marsh Conservation Area	184	220	253	1,642	79	79			1,227	598	10,340	8,765	988	24,376
St. Johns Water Management Area	38								5,164		1,040	5	31	6,278
Three Forks Marsh Conservation Area	228		35	2,199		11			731	3,954	4,773	1,444	313	13,688
Triple N Ranch	554		147	6,730	119	32			64	43	396	103	911	9,100
Willowbrook Farms Conservation Easement	2,687					10			52		46			2,795
Grand total	12,972	8,902	7,005	27,367	15,512	5,786	10	64	33,778	22,844	99,861	44,013	34,888	312,994

animals (Table 5). The Lake Poinsett/Canaveral Management Area, Bull Creek Management Area, Seminole Ranch Management Area, Fort Drum Marsh Conservation Area, and St. Johns Marsh Conservation Area are among the largest and most diverse areas. These areas are likely to support many rare species of plants and animals. The Sixmile Creek Marsh restoration areas, Willowbrook Farms Conservation Easement, Broadmoor Marsh Restoration Area, C-54 Retention Area, and Greenbaum parcel received some of the lowest rankings, indicating rather poor potential to support rare species.

Table 5. Project areas in the Upper St. Johns River Basin ranked by their potential to support rare or listed species

Property	County	Acres	Number of Habitats	Potential Species	Size Class	Habitat Class	Species Class	Sum	Final Rank
Lake Poinsett/ Canaveral Management Area	Brevard	50,308	11	123	11	3	5	19	1
Bull Creek Management Area	Osceola	21,759	13	163	5	3	7	15	2
Seminole Ranch Management Area	Brevard, Orange, Seminole, Volusia	31,615	11	123	7	3	5	15	2
Fort Drum Marsh Conservation Area	Indian River	20,654	10	123	5	3	5	13	3
St. Johns Marsh Conservation Area	Brevard	24,376	11	121	5	3	5	13	3
Lake Washington/ River Lakes Management Area	Brevard	19,758	10	119	4	3	5	12	4
Blue Cypress Marsh Conservation Area	Indian River	29,360	6	73	6	2	3	11	5
Buck Lake Management Area	Brevard/Volusia	13,488	10	123	3	3	5	11	5
Moccasin Island Marsh Restoration Area	Brevard	14,035	11	123	3	3	5	11	5
Jane Green Creek Conservation Easement	Brevard/Osceola	7,790	11	123	2	3	5	10	6
Sand Lakes Restoration Area	Indian River	1,335	10	149	1	3	6	10	6
Three Forks Marsh Conservation Area	Brevard	13,688	9	119	3	2	5	10	6
Triple N Ranch	Osceola	9,100	10	123	2	3	5	10	6
C-1 Detention Area	Brevard	2,706	10	119	1	3	5	9	7
Lake Winder/ River Lakes Management Area	Brevard	9,158	8	119	2	2	5	9	7
Blue Cypress Water Management Area, east	Indian River	5,704	7	94	2	2	4	8	8

Table 5—*Continued*

Property	County	Acres	Number of Habitats	Potential Species	Size Class	Habitat Class	Species Class	Sum	Final Rank
Deseret addition	Brevard	6,031	7	82	2	2	4	8	8
Sawgrass Lake Water Management Area	Brevard	2,128	7	110	1	2	5	8	8
Berry Groves	Indian River	1,906	5	85	1	2	4	7	9
Blue Cypress Water Management Area, west	Indian River	5,073	6	56	2	2	3	7	9
C-1 Retention Area	Brevard	1,259	7	86	1	2	4	7	9
Kenansville Lake	Indian River	2,565	6	90	1	2	4	7	9
Sixmile Creek Marsh Restoration Area, south	Brevard	2,005	5	90	1	2	4	7	9
St. Johns Water Management Area	Indian River	6,278	5	54	2	2	3	7	9
Willowbrook Farms Conservation Easement	Indian River	2,795	4	69	1	1	3	5	10
Broadmoor Marsh Restoration Area	Brevard	2,741	3	36	1	1	2	4	11
C-54 Retention Area	Brevard	4,063	4	37	1	1	2	4	11
Greenbaum parcel, east of I-95	Brevard	592	4	42	1	1	2	4	11
Sixmile Creek Marsh Restoration Area, north	Brevard	725	3	47	1	1	2	4	11

Property size classes: 1 = 0 to 4,999 acres; 2 = 5,000 to 9,999 acres; 3 = 10,000 to 14,999 acres; etc.
Habitat classes: 1 = 0 to 4 habitats present; 2 = 5 to 9 habitats present; 3 = 10 to 15 habitats present.
Number of potential species classes: 1 = 0 to 24 potential rare species; 2 = 25 to 49 potential rare species; 3 = 50 to 74 potential rare species; etc.

CONCLUSION

The USJRB is an ecologically diverse area that may support over 160 rare species of plants and animals, especially birds. Many of these rare species prefer habitats such as scrubs, prairies, and flatwoods, which are also of uncommon or local occurrence in the basin. Due to the varying size and condition of individual habitats in the project areas, particular rare species may or may not be found. For example, grasshopper sparrows are reported to occur in dry prairie habitats. However, due to the condition and isolation of the existing dry prairie in the Bull Creek Management Area, this endangered bird does not occur at this location. Large project areas such as the Lake Poinsett/Canaveral Management Area, Bull Creek Management Area, Seminole Ranch Management Area, Fort Drum Marsh Conservation Area, and St. Johns Marsh Conservation Area have the greatest number of different habitats and thus hold the greatest potential for harboring rare plants and animals. However, areas that are smaller, but relatively rich in natural communities, such as the Sand Lakes Restoration Area, may also be very important for some species.

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APPENDIX—HABITAT PREFERENCES OF RARE PLANTS AND ANIMALS IN THE UPPER ST. JOHNS RIVER BASIN

Table A1. Habitat preferences of rare plants and animals in the Upper St. Johns River Basin

Scientific Name	Status	Habitat												
		Agriculture and Disturbed Land	Improved Pasture	Shrub and Brushland	Dry Prairie/ Savannah	Pine Flatwoods	Hardwood Hammock	Xeric Oak	Sand Pine Scrub	Streams, Waterways, Lakes, and Reservoirs	Wet Prairie	Freshwater Marsh	Shrub Swamp	Forested Wetland
Plants														
Adiantum tenerum	e						1							
Asclepias curtissii	e							1	1					
Asplenium auritum	e						1							1
Asplenium serratum	e													1
Calopogon multiflorus	e				1	1					1			
Centrosema arenicola	e							1	1					
Deeringothamnus pulchellus	e				1	1								
Deeringothamnus rugelii	e				1	1								
Dennstaedtia bipinnata	e						1							
Dicerandra immaculata	e							1	1					
Helianthus carnosus	e				1	1								
Hexalectris spicata	e						1							
Illicium parviflorum	e						1							1
Lechea divaricata	e							1	1					
Minuartia godfreyi	e				1	1								
Monotropsis odorata	e						1							
Nemastylis floridana	e				1	1								
Ophioglossum palmatum	e						1							
Panicum abscissum	e				1	1								
Pecluma dispersa	e						1							
Pecluma plumula	e						1							
Pecluma ptilodon	e						1							1
Peperomia humilis	e						1							1
Peperomia obtusifolia	e						1							1
Platanthera integra	e				1	1					1			
Schizachyrium niveum	e							1	1					
Schwalbea americana	e				1	1					1			
Spiranthes brevilabris	e		1		1	1								
Stylisma abdita	e							1	1					
Tillandsia fasciculata	e						1							1
Tillandsia utriculata	e						1							1
Verbena tampensis	e	1				1	1							
Warea amplexifolia	e								1					
Warea carteri	e							1	1					
Andropogon arctatus	t				1	1			1					

Scientific Name	Status	Habitat												
		Agriculture and Disturbed Land	Improved Pasture	Shrub and Brushland	Dry Prairie/ Savannah	Pine Flatwoods	Hardwood Hammock	Xeric Oak	Sand Pine Scrub	Streams, Waterways, Lakes, and Reservoirs	Wet Prairie	Freshwater Marsh	Shrub Swamp	Forested Wetland
Calamovilfa curtissii	t				1	1					1			
Coelorachis tuberculosa	t										1			
Conradina grandiflora	t							1	1					
Garberia heterophylla	t							1	1					
Habenaria nivea	t				1	1					1			
Lechea cernua	t							1	1					
Lilium catesbaei	t				1	1								
Lobelia cardinalis	t									1				
Matelea gonocarpos	t						1							1
Nolina atopocarpa	t				1	1								
Pinguicula caerulea	t				1	1					1			
Pinguicula lutea	t				1	1					1			
Platanthera blephariglottis	t				1	1					1			
Platanthera ciliaris	t				1	1					1			
Platanthera flava	t				1	1					1			
Pogonia ophioglossoides	t				1	1					1			
Pteroglossapis ecristata	t							1	1					
Sacoila lanceolata	t		1		1	1								
Sarracenia minor	t					1					1			
Spiranthes laciniata	t		1		1	1					1			
Spiranthes longilabris	t		1		1	1					1			
Spiranthes tuberosa	t		1		1	1					1			
Tillandsia balbisiana	t						1	1						1
Zephranthes treatiae	t		1		1	1					1			
Zephyranthes atamasco	t		1		1	1					1			
Zephyranthes simpsonii	t		1		1	1					1			
Baptisia perfoliata	r				1									
Cheilanthes alabamensis	r						1							
Coelorachis cylindrica	r						1							
Cuscuta exaltata	r						1							
Cynanchum northropiae	r				1	1	1							
Dicerancra thinicola	r								1					
Dicranopteris flexuosa	r		1		1									
Digitaria simpsonii	r				1									
Eleocharis parvula	r									1		1		
Eleocharis quadrangulata	r									1		1		
Flaveria trinervia	r		1		1									
Hypoxis sessilis	r				1	1								

Scientific Name	Status	Habitat												
		Agriculture and Disturbed Land	Improved Pasture	Shrub and Brushland	Dry Prairie/ Savannah	Pine Flatwoods	Hardwood Hammock	Xeric Oak	Sand Pine Scrub	Streams, Waterways, Lakes, and Reservoirs	Wet Prairie	Freshwater Marsh	Shrub Swamp	Forested Wetland
Lindera benzoin	r						1							
Orobanche minor	r						1							
Persea humilis	r							1	1					
Rhynchosia cinerea	r							1	1					
Selaginella ludoviciana	r						1							
Solidago arguta var. caroliniana	r						1							
Stillingia sylvatica ssp. tenuis	r							1	1					
Trachelospermum difforme	r													1
Trichostema setaceum	r				1									
Websteria confervoides	r									1				
Total		1	10		35	32	25	15	17	4	19	2		11
Insects														
Aphodius troglodytes	t							1	1					
Ataenius sciurus	t					1		1						
Chelyoxenus xerobatis	t							1	1					
Copris gopheri	t							1	1					
Libellula jesseana	t									1				
Onthophagus polyphemi	t							1	1					
Trox howelli	t		1		1									
Aphodius aegrotus	ssc							1	1					
Aphodius laevigatus	ssc							1	1					
Didymops floridensis	ssc									1				
Eutrichota gopheri	ssc							1	1					
Gomphus cavillaris	ssc									1				
Hypotrichia spissipes	ssc							1	1					
Nehalennia pallidula	ssc											1		
Peltotrupes profundus	ssc							1	1					
Progomphus alachuensis	ssc									1				
Schistocerca ceratiola	ssc								1					
Atrytone arogos arogos	r				1	1								
Atrytonopsis hianna loammi	r				1	1								
Cicindela scabrosa	r								1					
Euphyes berryi	r				1	1					1			
Gomphaeschna antilope	r													1
Ischyrus dunedinensis	r							1	1					
Melanoplus indicifer	r								1					
Phyllophaga elizoria	r							1	1					
Phyllophaga elongata	r							1	1					

Scientific Name	Status	Habitat												
		Agriculture and Disturbed Land	Improved Pasture	Shrub and Brushland	Dry Prairie/ Savannah	Pine Flatwoods	Hardwood Hammock	Xeric Oak	Sand Pine Scrub	Streams, Waterways, Lakes, and Reservoirs	Wet Prairie	Freshwater Marsh	Shrub Swamp	Forested Wetland
Trigonopeltastes floridana	r							1	1					
Total			1		4	4		14	16	4	1	1		1
Amphibians and Reptiles														
Rana capito	ssc							1	1					
Drymarchon corais couperi	t				1	1	1	1	1					
Alligator mississippiensis	ssc									1		1		1
Gopherus polyphemus	ssc							1	1					
Pituophis melanoleucus mugitus	ssc						1	1	1					
Crotalus adamanteus	r		1	1	1	1	1	1	1					
Lampropeltis calligaster	r				1	1								
Lampropeltis triangulum elapsoides	r			1	1	1	1	1	1					
Rhadinaea flavilata	r							1	1					
Sceloporus woodi	r							1	1					
Tantilla relicta pamlica	r								1					
Total			1	2	4	4	4	8	9	1		1		1
Birds														
Ammodramus savannarum floridanus	e				1									
Falco peregrinus	e				1	1					1	1		
Grus americana	e		1		1						1	1		
Mycteria americana	e		1		1					1	1	1		1
Picoides borealis	e					1								
Rostrhamus sociabilis plumbeus	e											1		
Aphelocoma coerulescens	t							1	1					
Falco sparverius paulus	t				1	1								
Grus canadensis pratensis	t		1		1						1	1		
Haliaeetus leucocephalus	t									1				
Polyborus plancus audubonii	t		1		1									
Sterna antillarum	t									1				
Ajaia ajaja	ssc										1	1		
Aramus guarauna	ssc									1		1	1	1
Egretta caerulea	ssc									1	1	1	1	1
Egretta thula	ssc									1	1	1	1	1
Egretta tricolor	ssc									1	1	1	1	1
Eudocimus albus	ssc	1	1		1					1	1	1	1	1
Speotyto cunicularia floridana	ssc		1		1									
Accipiter cooperii	r					1	1	1	1					1
Aimophila aestivalis	r					1								
Ardea alba	r									1	1	1	1	1

Scientific Name	Status	Habitat												
		Agriculture and Disturbed Land	Improved Pasture	Shrub and Brushland	Dry Prairie/ Savannah	Pine Flatwoods	Hardwood Hammock	Xeric Oak	Sand Pine Scrub	Streams, Waterways, Lakes, and Reservoirs	Wet Prairie	Freshwater Marsh	Shrub Swamp	Forested Wetland
Buteo brachyurus	r					1	1	1						1
Coturnicops noveboracensis	r										1			
Elanoides forficatus	r				1	1	1							1
Elanus leucurus	r	1			1		1					1		
Falco columbarius	r	1	1		1	1					1	1		
Ixobrychus exilis	r										1	1		
Laterallus jamaicensis	r										1	1		
Nyctanassa violacea	r									1	1	1	1	1
Nycticorax nycticorax	r									1	1	1	1	1
Pandion haliaetus	r									1				
Picoides villosus auduboni	r					1	1	1	1					1
Plegadis falcinellus	r										1	1		1
Recurvirostra americana	r									1				
Total		3	7	0	12	9	5	4	3	13	17	19	8	14
Mammals														
Geomys pinetis goffi	e							1	1					
Ursus americanus floridanus	t					1	1	1	1				1	1
Podomys floridanus	ssc							1	1					
Sciurus niger shermani	ssc					1		1						
Corynorhinus rafinesquii	r					1	1	1						
Mustela frenata peninsulae	r					1	1	1	1			1	1	1
Neofiber alleni	r											1		
Total						4	3	6	4			2	2	2

Note: e = endangered
r = rare
t = threatened
ssc = species of special concern
1 = preferred habitat