SPIKOWSKI PLANNING ASSOCIATES

1617 Hendry Street, Suite 416
Fort Myers, Florida 33901-2947

telephone: (239) 334-8866
fax: (239) 334-8878

e-mail: bill@spikowski.com
web site: www.spikowski.com

MEMORANDUM

TO: Greater Pine Island Land Use Plan Implementation Committee
FROM: Bill Spikowski
DATE: November 4, 2003
SUBJECT: MEETING OF NOVEMBER 12, 2003

The next regular meeting of the Greater Pine Island Land Use Plan Implementation Committee will be held on Wednesday, November 12, 2003, at 7:00 PM. This meeting will be held at St. John's Episcopal Church at 7771 Stringfellow. The church is immediately north of Flamingo Bay and less than three miles south of Pine Island Center.

There are seven sets of amendments to Lee County's Land Development Code that are required to implement the Greater Pine Island community plan update. At the June 11 meeting we reviewed early drafts of two sets of those amendments, which would implement Policy 14.3.3 on building heights and Policy 14.3.5 on neighborhood connectivity. At the August 13 meeting we reviewed two more sets of amendments to implement Policy 14.1.5 regarding wetland buffers and Policy 14.4.4 regarding signs. On October 8 we reviewed the fifth and sixth sets of amendments, for the 810/910 traffic rules and the Coastal Rural category (except for the restoration standards, which had not yet been drafted).

At the November 12 meeting, we will review revised and expanded drafts for the same subjects that were discussed on October 8: the 810/910 traffic rules and the Coastal Rural category (now including a first draft of restoration standards). Please review these drafts prior to the November 12 meeting so that we can discuss them then; a list of major changes from last month is attached.

The attached drafts follow the same format as the earlier sets: they begin with the full text of the specific policy being implemented, then a summary of which sections of the land development code need to be amended, followed by the actual code text, with proposed new text <u>underlined</u> and existing text that would be repealed ~~struck through~~.

ATTACHMENTS:
List of major changes from October drafts to November drafts
Preliminary agenda for November 12 meeting
Draft minutes from meeting on October 8, 2003
Letter from Bill Spikowski to Barbara Dubin dated October 10, 2003
"Implementing Policy 14.2.2" (3 pages)
"Implementing Policies 1.4.7 and 14.1.8" (13 pages)
MESIC PINE FLATWOODS (from chapter 3 of the Multi-Species Recovery Plan for South Florida, published by the U.S. Fish & Wildlife Service)

Major changes from October draft to November draft

PAGE:	*SECTION:*	*DESCRIPTION OF CHANGE:*
2 of 3	2-48(1-2-3-4)	Clause added to each subsection to clarify that these standards apply to all of Greater Pine Island, not just west of the permanent count station
2 of 3	2-48(2)a	Added size descriptions for "minor rezonings"
2 of 3	2-48(2)b	Clarified language to indicate that adding traffic in the PEAK direction was the standard that proposed rezoning would be measured against
3 of 3	2-48(5)	Added a new final clause requiring proper zoning for any expansions to existing recreational vehicle parks.
3 of 13	34-654	Note#6 changed from January 9, 2003 to "effective date of plan update"
5 of 13	34-655(c)(2)c	Now allows any preserved property that is determined by a permitting agency to be a wetland to be counted as preserved "Coastal Rural" land
5 of 13	34-655(c)(3)	Language added to clarify that noncontiguous "Coastal Rural" parcels can be combined in a development application for density purposes, provided the density on any single parcel does not exceed 1 DU per acre
5 of 13	34-655(c)(5)b	Eliminated language that set minimum lot sizes to be the same as the current zoning district (that subject is now addressed in 34-655(g)(2)). New language has been added that would allow alternate reforestation methods to be considered through the "planned development" rezoning process.
6 of 13	34-655(d)(1)	Added language that allows certain additional land uses in preserved areas (passive recreation up to 2%; lakes up to 5%; agriculture up to 10%)
6 of 13	34-655(d)(2)	Added hydrologic restoration requirements for land being preserved
6 of 13	34-655(d)(4)	Conservation easement language has been revised
6-7 of 13	34-655(d)(5)	Long-term management plan now required for preserve areas
7 of 13	34-655(d)(6)	Added details of how the preserved areas could be owned
7-8 of 13	34-655(e)	This subsection on restoration standards now discusses hydrologic restoration and reintroduction of native trees. Still to be drafted: reintroduction of other native plants, and criteria for determining the success of restoration.
8 of 13	34-655(f)	This new subsection would allow a flatwoods restoration bank to restore large parcels of habitat on Pine Island, with credits for this restoration sold to other landowners who wish to increase their density but not to restore habitat on their own site.
8 of 13	34-655(g)(2)	New language would allow clustered homesites to be developed without rezoning land from its current AG-2 zoning, provided that all preservation/restoration requirements have been met.
8 of 13	34-655(g)(3)	New language would allow local streets to be narrower than the suburban widths now required for new development everywhere else in the county, and would encourage streets to be paved with new types of asphalt or concrete that are porous (in order to reduce surface water runoff).
10 of 13	34-695	Note #5 changed from January 9, 2003 to "effective date of plan update"
11 of 13	34-715	Note #7 changed from January 9, 2003 to "effective date of plan update"

Greater Pine Island
Land Use Plan
Implementation Committee

Wednesday, November 12, 2003, 7:00 PM
St. John's Episcopal Church, 7771 Stringfellow, St. James City

1. Call to order (Chairperson Barbara Dubin)

2. Approval by committee members of minutes from October 8 meeting

3. Discussion of October 10 letter from Bill Spikowski

4. Discussion on implementing Policy 14.2.2 — 810/910 Traffic Rules

5. Discussion on implementing Policies 1.4.7 & 14.1.8 — Coastal Rural

6. Remaining steps toward implementation:
   a. Commercial building design standards
   b. Review of final language for all other policies before formal submittal to Lee County

7. Set date and time for next meeting (7:00 PM on December 10 or January 14)

8. Adjournment

Minutes of Oct. 8, 2003
Greater Pine Island Land Use Implementation Committee Meeting

The meeting was called to order by the Chairperson, Barbara Dubin at 7:05 P.M. at St John's Episcopal Church in St. James City. Attendees were reminded that this meeting was being held in a sanctuary and that people should conduct themselves accordingly. A rollcall of all committee members was then taken. Present were Noel Andress, Phil Buchanan, Bill Mantis and Barbara Dubin. Elaine McLaughlin and Anna Stober were absent. Bill Spikowski, Mohsen Salehi and Jim Mudd were introduced.

The Chairperson then asked for motions to approve the minutes of the previous meetings of April 9, June 11 and August 13, 2003. Phil Buchanan stated that Mr. Setti's name was misspelled in the second paragraph of the April 9 Minutes, and should be corrected. He then made a motion to approve the April 9 minutes, which was seconded by Bill Mantis and approved by the attendees. In the June 11 Minutes Phil asked for removal of the sentence "The DCA must also prove that they were correct in approving the plan." He then made a motion to approve the June 11 Minutes, which were seconded by Noel Andress and approved by the attendees. Mr. Buchanan, in the August 13 Minutes asked for removal of the sentence "It was clarified that one cannot get an agricultural exemption unless the land is under a bona fide agricultural operation." He then made a motion for approval of the August 13 Minutes, seconded by Bill Mantis and approved by the attendees. It was suggested that all future Minutes be signed.

The meeting was then turned over to Bill Spikowski. He gave a short history of Planning on Pine Island. The first time Pine Island was an entity in the Lee County Land Use Plan was in 1984. The first large Pine Island Land Use Plan was approved in 1989 with amendments around 1992, 1993 or 1994. An update was begun in 1999 by the Greater Pine Island Civic Association and other Pine Islanders. It was adopted by the Local Planning Agency, forwarded to the Fl. Dept. of Community Affairs by the Lee County Commissioners and then unanimously approved by the Lee County Commissioners. Since the new plan has been "challenged", it is not presently in effect. There will be an Administrative Hearing between Feb 2-6, 2004. The Administrative Hearing Judge will give his opinion and, if approved, the new plan will go into effect shortly thereafter. Now we are drafting detailed rules for the Plan even though it is not in effect, and may even need to make changes and amendments.

Dan Stevens, a nursery owner who has lived on PI for 31 years totally disagrees with the plan. He never reads the Eagle and did not attend the meetings. In response Phil Buchanan stated that the new plan makes changes to ease up the stringent rules of the 1989 Plan.

Abby Martinez bought 40 acres next to Island Acres and wants to build houses with picket fences, but now "His dreams are gone." Noel Andress stated that he could still divide land into homesites, if he clusters his housing, which is more economically feasible. Buckingham is now considering adopting ideas similar to those in the Pine Island Plan.

Bill Spikowski stated that we got grants from Florida DCA for $10,000, Ordway-Dunn Foundation for $20,000 and from Lee County for $5,000. When we come up with the proposed rules, there will be several public meetings. There are 7 parts to the plan. Tonight we will discuss Traffic (3 pages) and Coastal Rural (10 pages).

TRAFFIC - POLICY 14.2.2 (attached, pages 1-3)

A traffic counter is located in the road next to the Sandy Hook restaurant in Matlacha. The 1989 Plan said the road through Matlacha was already crowded, but not at capacity. There are already 6,000 approved lots and some development orders that have been approved and are active. The new plan will not effect them. The 1989 Plan stated upon reaching 910 there would be no new residential developments (too strict). The new Plan states that in the worst case development should be reduced to 1/3 of the previous density.

Page 1 shows County approved provisions. The 1989 plan stated that there could be no rezonings once the 810 threshold was reached. We surpassed that threshold in 1998. Page 2, (2) a, b, & c show exceptions to the 810 rule under the new Land Use Plan, changes made to ease up on the stringent rules of the 1989 Plan. Do we need to make it more specific or keep it general? Keeping track of peak hour, peak direction traffic count.

Phil Morrison asked if hurricane traffic is important. Bill Spikowski said that we are already in trouble in a hurricane based on peak hour traffic.

Dan Foote asked what 910 peak hour meant. Mohsen Salehi explained the formula for estimating round trip/peak hour traffic and his studies also included peak direction. We reached 810 in 1998 which went into effect in 1999 (upon publication of the traffic count report by Lee County DOT) and will surpass 910 in 2003 by the time the 2003 traffic count report is published (roughly on or about the end of March 2004).

Noel Andress: If subdividing property into more than 4 lots, you must get a development order under standard county rules.

Earl Scott asked if you divide property, what are the implications? Bill Spikowski stated that he would lose his Ag exemption, must put in a new road and would increase his taxes.

Page 3 explains traffic rules. (5) on Page 3 explains the already platted lots on 2 parcels in Cherry Estates. No new lots can be added.

Page 2 (3) a and b discuss how the 910 rule effects Coastal Rural.

Deb Lytle was concerned about wildlife on undeveloped lot/lots in middle of small development. Bill stated that the county was willing to buy wildlife habitat under Conservation 2020.

Dave Lukasek stated that there could be Public Hearings and Rezonings. There was a discussion on rezoning and what is minor? Bill Spikowski said that these regulations could define what minor means.

Matt Uhle asked why the 1/3 density rule was left at the most restrictive level.

Noel Andress stated that if one had 40 acres to divide into 1 acre lots you would need paved streets. Not feasible today – cost prohibitive.

Sally Tapager questioned where traffic counter should be. It is next to Sandy Hook restaurant. Bill explained it has always been there but the new rules would apply to all of Matlacha as well as Pine Island, not just west of the traffic counter.

Bill Spikowski explained "Concurrency". The rules under (2) on page 2 explain exceptions under the new plan, further easing the old 1989 Plan (810 Traffic Rule).

Dan Foote asked about the traffic at the east side of Matlacha. It is not counted by the traffic counter at the Sandy Hook. Mohsen Salehi said the traffic restrictions would probably be more severe if the Matlacha traffic were counted.

COASTAL RURAL POLICIES 1.4.7 & 14.1.8 (attached pages 1-10)

All previously designated rural land plus 157 acres north of Pink Citrus were designated "Coastal Rural" in the new Land Use Plan. Trying for a balance between land owners rights and overall rights of everyone. Can farm and clear. Density will be 1 unit/10 acres. If you restore the land, you can attain 1 unit/acre maximum if you preserve or restore 70% of the land (other attainable densities are on chart on Page 1). Real estate agents say things have changed – land prices have increased since the plan was adopted. It is also costly for sewers.

Noel Andress stated that LDC Code Restoration Amendments have not been formulated. What is included in open space – wooded/natural areas of golf courses, retention ponds, etc.? Most successful development has created open space.

Coastal Rural is a new designation and is only on Pine Island. However, North Fort Myers in some areas and southeast Lee County has a density of 1/10 acres.

Page 2 contains a legal description of Greater Pine Island.

Page 3, footnote (6) John Cammick stated that the date should be changed to the effective date of the new Land Use Plan. There was a consensus to make this change.

Page 4 (b) refers to Table 34-655. More land preserved/restored, more units allowed.

Page 4 – Table. Option A cuts density by 2/3. Options B, C, and D are more lenient.

Under old 910 Rule (10 acres) no new development. Under the new 910 (10 acres) can build at 1/3 density.

Bob Glennon had a question about creating open space. If they preserve the land does it have to have bike paths and preserve areas open to the public? Bill Spikowski stated that it was not public and could be under the homeowners' association. Phil Buchanan talked about a conservation easement. Make sure the terms of the easement are followed.

Noel Andress stated that the IRS does not recognize conservation easements for tax breaks unless a donation is completely voluntary. However, there probably would be a tax reduction by the Lee County tax assessor for the land included in the easement.

Page 6. What happens to land preserved? Can part be a tree farm? At present it must be preserved as native habitat. Restoration can be expensive. Can part of the land be used for farming? This will be discussed next month.

Sherrie Philips asked about wetlands. Bill stated that the density of wetlands was 1 unit/20 acres in 1994, and this density is still in effect.

Phil Buchanan stated that Corps of Engineers wetlands are sometimes uplands. Non-contiguous pieces should be considered.

John Cammick suggested transfers and putting development near the road.

People shouldn't be allowed to transfer melaleuca swamps as if they were natural land.

Bob Glennon said that traffic is growing faster than development. Many people are sightseers. Bill Spikowski stated that inland lots are now more costly. He also said that the Census Bureau does surveys on seasonal use, but the numbers are not reliable. There is no good data on seasonal use.

Phil Buchanan said that better growth figures come from electrical and water hook-ups.

Noel stated that an average of 100 houses have been built per year.

Ed Anderson said that the new Burnt Store extension has brought more people to western Cape Coral and the Pine Island area. "Build a road and they will come."

Sally Tapager said that we could expect the population of Cape Coral to be 200,000 within the next 10 years. We can expect more people on Pine Island too.

In Coastal Rural – single family or multi-family? Bill Spikowski said most is zoned single family.

Noel Andress said the Burnt Store Road will be 4 or 6 laned. There are already large new developments planned for along Burnt Store Road. We must act now to preserve our quality of life.

Deb Lytle asked about the Pine Island Water Company providing water for these developments and about the prospect that all unincorporated areas of Lee County must become incorporated. Bill Spikowski stated that Lee County Commissioners have never shown any interest in incorporating all unincorporated areas and that Greater Pine Island residents own the water company.

Noel Andress pointed out that there is no more capacity at the sewer plant at the present time, but the plant can be expanded if injection wells are completed.

If you have an existing lot that can be built on under the 1989 Plan, it can be built on under the new plan.

Phil Buchanan related that alternatives A&D on the chart on Page 4 are bad. A is too harsh and D is too lenient. The alternative should be B or C.

Bob Glennon asked how the area for Coastal Rural was selected. Bill stated that all rural designated land was selected plus 157 acres north of Pink Citrus because most of it is farm land. Also, there are no active development orders on this land.

Noel Andress stated that the maximum number of people in Lee County under the growth rules will be approximately 1.5 million. There is a maximum of growth and allocation for each county.

Bob Glennon asked about changing the 910 number and how would it effect the density. Bill Spikowski stated that the County's and the Commissioners' credibility would be affected if you change the 910 Rule. When you reach a certain threshold, you can't just raise the number or nobody would believe that the plan will ever be serious.

Noel Andress stated that there is a quota for building in the Florida Keys which is accomplished by a lottery. We didn't want this on Pine Island. Everyone in the planning process is trying to be fair.

The next GPI Land Use Implementation Meeting will be held at 7:00 P.M. on November 12, 2003 at St. John's Episcopal Church. The topic will be conservation/preservation requirements.

The meeting was adjourned at 9:07 P.M. There were 91 people in attendance.

Respectfully submitted,

Barbara K. Dubin

SPIKOWSKI PLANNING ASSOCIATES

1617 Hendry Street, Suite 416
Fort Myers, Florida 33901-2947

telephone: (239) 334-8866
fax: (239) 334-8878

e-mail: bill@spikowski.com
web site: www.spikowski.com

October 10, 2003

Barbara Dubin, Chairperson
Greater Pine Island Land Use Plan Implementation Committee
16185 Bowline Street
Bokeelia, Florida 33922

Dear Barbara:

I have had several requests for clarification of the statements I made at the Greater Pine Island meeting on October 8 that the new plan update, once it becomes effective, would be more favorable to many landowners than the plan that is currently in effect. I would like to explain more fully in this letter.

The 1989 Lee Plan established the 810/910 traffic thresholds for Pine Island Road through Matlacha. The 810 threshold was surpassed beginning in 1998 and since that time has forbidden any rezonings "...which would increase traffic on Pine Island Road." The new plan update, once it becomes effective, would moderate that strict position by allowing several categories of exceptions to this ban on rezonings: "... minor rezonings on infill properties surrounded by development at similar intensities and those with inconsequential or positive effects on peak traffic flows through Matlacha, and ... rezonings for small enterprises that promote the nature and heritage of Greater Pine Island." (SOURCE: Amended Policy 14.2.2) This clearly is more lenient than the current plan.

We expect the 910 threshold to be surpassed either this coming February or the following February. Once that occurs, the existing plan does not permit any further residential development orders, without which new subdivisions cannot be created. This applies to all of Greater Pine Island, not just the rural areas. The new plan update, once it becomes effective, eliminates the ban on residential development orders and replaces it a density reduction that cannot "...be more severe than restricting densities to one-third of the maximum density otherwise allowed on that property." (SOURCE: Amended Policy 14.2.2) Again, while still quite restrictive, this is clearly more lenient than the current plan.

In addition to these new allowances, there are some totally new rules in the plan update. Some, like the restrictions on gating new subdivisions or the new commercial design standards, have not been controversial even with most affected landowners. The one new rule that has become quite controversial is the establishment of the "Coastal Rural" land use category for all of the land that had previously been designated "Rural" plus 157 acres of farmland just south of Bokeelia.

The existing "Rural" category limits density to 1 dwelling unit (DU) per acre, which under current agricultural zoning requires 1-acre cookie-cutter lots on paved roads, or 2.5-acre lots on unpaved roads, neither of which are very desirable forms of development. Pine Island already has quite a surplus of large vacant lots without amenities!

For large landowners, perhaps the best news about the new plan is that clustering future residential units on smaller lots would now be possible without even rezoning the land. The bad news is that landowners who don't want to cluster future residential units and would prefer to build on larger lots (and thus consume more land) can build fewer total units under the new plan.

The new clustering allowance is a win for the environment by not converting so much land into residential lots; a win for landowners because development costs for smaller lots are lower than for 1-acre lots; and a win for Pine Islanders who are concerned about traffic on Pine Island Road because some landowners will choose not to cluster and will accept the lower density that would now result from that decision.

Many landowners agree with me that the new "Coastal Rural" rules are on the balance more favorable to them than the previous "Rural" rules and their large-lot agricultural zoning. It is possible that some other landowners have taken the opposite position because the wording I wrote for the new plan describes these rules in negative terms, without articulating the benefits to landowners. The plan states that under "Coastal Rural," the base density is reduced to 1 DU per 10 acres, but landowners have the option to preserve (or restore) various percentages of their land in exchange for the right to increase their density and put their homes on lots that are smaller than a full acre. In exchange for maximum preservation (or restoration) of 70% of their land, a landowner can recover his previous density of 1 DU per acre but place those homes on smaller lots on the remaining 30% of their land.

A real fly in the ointment here, however, is what happens in "Coastal Rural" after the 910 threshold is surpassed. A literal reading of the plan yields the strictest possible interpretation: the sliding scale for preservation/restoration remains, but the scale itself slides, on the low end, from 1 DU per 30 acres (1 per 10 times 1/3) to, on the high end, 1 DU per 3 acres (1 per 1 times 1/3). I believe that the result of this interpretation is too restrictive on "Coastal Rural" landowners. On October 8 I proposed three other potential interpretations that could be placed into Lee County's land development code. None of us know yet which interpretation will be recommended by the Greater Pine Island Land Use Plan Implementation Committee or which will ultimately be adopted by the Lee County Commission, but I hope we find a moderate position on this issue and also on the thorny issue of restoration standards for land that has already been cleared.

Please circulate this letter to anyone who may find it of interest.

Sincerely,

Bill Spikowski

cc: Members of Land Use Plan Implementation Committee

IMPLEMENTING POLICY 14.2.2

RECENT CHANGES TO LEE PLAN POLICY 14.2.2:

POLICY 14.2.2: In order to recognize and give priority to the property rights previously granted by Lee County for about 6,675 ~~6,800~~ additional dwelling units, the county will ~~consider for adoption~~ keep in force effective development regulations which address growth on Pine Island and which implement measures to gradually limit future development approvals. ~~The effect of~~ These regulations will ~~would be to appropriately~~ reduce certain types of approvals at established thresholds prior to the ~~adopted level-of-service standard~~ capacity of Pine Island Road being reached, measured as follows at the permanent count station on Little Pine Island at the western edge of Matlacha:

- When traffic on Pine Island Road ~~between Burnt Store Road and Stringfellow Boulevard~~ reaches 810 peak hour, annual average two-way trips, the regulations will ~~provide~~ restrict~~ions on~~ further rezonings which would increase traffic on Pine Island Road through Matlacha. These regulations shall provide reasonable exceptions for minor rezonings on infill properties surrounded by development at similar intensities and those with inconsequential or positive effects on peak traffic flows through Matlacha, and may give preference to rezonings for small enterprises that promote the nature and heritage of Greater Pine Island.

- When traffic on Pine Island Road ~~between Burnt Store Road and Stringfellow Boulevard~~ reaches 910 peak hour, annual average two-way trips, the regulations will provide restrictions on the further issuance of residential development orders (pursuant to chapter 10 of the Land Development Code ~~the Development Standards Ordinance~~), or other measures to maintain the adopted level of service, until improvements can be made in accordance with this plan. The effect of these restrictions on residential densities must not be more severe than restricting densities to one-third of the maximum density otherwise allowed on that property.

The 810 and 910 thresholds were based on 80% and 90% of level-of-service "D" capacity calculated using the 1965 Highway Capacity Manual, as documented in the 2001 Greater Pine Island Community Plan Update. These development regulations may provide exceptions for legitimate ongoing developments to protect previously approved densities for final phases that have a Chapter 177 plat or site-plan approval under Ordinance 86-36.

SUMMARY OF CODE CHANGES NEEDED TO IMPLEMENT POLICY 14.2.2:

a. "When traffic on Pine Island Road reaches 810 peak hour, annual average two-way trips, the regulations will restrict further rezonings which would increase traffic on Pine Island Road through Matlacha. These regulations shall provide reasonable exceptions for minor rezonings on infill properties surrounded by development at similar intensities and those with inconsequential or positive effects on peak traffic flows through Matlacha, and may give preference to rezonings for small enterprises that promote the nature and heritage of Greater Pine Island." – MODIFY CONCURRENCY REGULATIONS IN 2-48(2) and (4)

b. "The effect of these restrictions on residential densities must not be more severe than restricting densities to one-third of the maximum density otherwise allowed on that property." – MODIFY CONCURRENCY REGULATIONS IN 2-48(3) and (4)
c. "These development regulations may provide exceptions for legitimate ongoing developments to protect previously approved densities for final phases that have a Chapter 177 plat or site-plan approval under Ordinance 86-36." – MODIFY CONCURRENCY REGULATIONS IN 2-48(5)

COMPOSITE CODE CHANGES TO IMPLEMENT POLICY 14.2.2:

CHAPTER 2
Administration
ARTICLE II, CONCURRENCY MANAGEMENT SYSTEM

Sec. 2-48. Greater Pine Island concurrency.

Concurrency compliance for property located in Greater Pine Island, as identified on the future land use map and described in section 34-2 of this code, will be determined in accordance with the level of service and restrictions set forth in Lee Plan policies 14.2.1 and 14.2.2 to the extent the policies provide additional restrictions that supplement other provisions of this article. These policies require the following:

(1) The minimum acceptable level of service standard for Pine Island Road between Burnt Store Road and Stringfellow Boulevard is level of service D on an annual average peak-hour basis and level of service E on a peak-season peak-hour basis using methodologies from the 1985 Highway Capacity Manual Special Report 209. This standard will be measured at the county's permanent count station on Little Pine Island at the western edge of Matlacha and will apply to all of Greater Pine Island.

(2) In addition, when traffic on Pine Island Road at the western edge of Matlacha ~~between Burnt Store Road and Stringfellow Boulevard~~ reaches 810 peak-hour annual average two-way trips, rezonings in Greater Pine Island that increase traffic on Pine Island Road may not be granted. Three types of exceptions to this rule may be considered during the rezoning process:
   a. Minor rezonings on infill properties surrounded by development at similar densities or intensities. A minor rezoning under this exception may not rezone more than 5 acres of land or have a net effect of allowing more than 15 additional dwelling units.
   b. Rezonings that would have inconsequential effects on traffic flows at the western edge of Matlacha during peak periods in the peak (busier) direction, or would have positive effects by reducing trips during those peak flow periods.
   c. Rezonings to accommodate small enterprises that promote the natural features or cultural heritage of Greater Pine Island.

(3) When traffic on Pine Island Road at the western edge of Matlacha ~~between Burnt Store Road and Stringfellow Boulevard~~ reaches 910 peak-hour annual average two-way trips, residential development orders (pursuant to chapter 10) will not be granted for land in Greater Pine Island unless measures to maintain the adopted level of service at the western edge of Matlacha can be included as a condition of the development order. As an alternative to maintaining the adopted level of service, the following options are available to landowners:
   a. Except in the Lee Plan's Coastal Rural land use category, a reduction in residential density on the property for which a development order is sought to one-third of the maximum density

otherwise allowed by the Lee Plan and this code.

b. In the Lee Plan's Coastal Rural land use category, a reduction in residential density on the property for which a development order is sought to the levels in the third column of Table 34-655 (see section 34-655 of this code).

(4) The standards in subsections (2) and (3) will be measured as follows:

a. Traffic counts will be taken from the county's permanent count station on Little Pine Island at the western edge of Matlacha and will apply to all of Greater Pine Island.

b. For purposes of the regulations in this section, the 810-trip and the 910-trip thresholds will be considered to be exceeded once Lee County's Department of Transportation issues its annual Traffic Count Report with data from the preceding calendar year if that data indicates that Annual Average Daily Trips (AADT) multiplied by the percentage for the busiest peak flow (AM or PM) exceeds 810 or 910 respectively. If one or both of these thresholds are exceeded each year, the corresponding restrictions in subsections (2) and (3) will be in effect until the issuance of the next annual Traffic Count Report.

c. A property or portion thereof will be allowed an additional six months after issuance of an annual report indicating that the 910-trip threshold has been exceeded to obtain a development order without the restrictions in subsection (3) if a complete application had been filed for the development order prior to issuance of the report.

1. This allowance does not extend to tracts in phased projects that are reserved for future development.
2. Development orders issued under this allowance cannot be extended or renewed unless they are modified to conform with the regulations in effect at the time the extension or renewal is granted.

(5) The restrictions in subsections (2) and (3) will not be interpreted to affect legitimate ongoing developments whose final phases are already platted in accordance with F.S. ch. 177, provided that no new lots are added and that the number of allowable dwelling units is not increased. These restrictions also will not be interpreted to affect expansions to existing recreational vehicle parks to serve additional transient RVs if such expansions were explicitly approved by Lee County under Ordinance No. 86-36 (see section 34-3272(1)d.) and are properly zoned for this purpose.

IMPLEMENTING POLICIES 1.4.7 & 14.1.8

NEW LEE PLAN POLICY 1.4.7:

POLICY 1.4.7: The Coastal Rural areas will remain rural except for portions of properties where residential lots are permitted in exchange for permanent preservation or restoration of native upland habitats on the remainder of the property. The standard maximum density is one dwelling unit per ten acres (1DU/10 acres). Maximum densities may increase as higher percentages of native habitat are permanently preserved or restored on the uplands portions of the site in accordance with the chart below. Permitted land uses include agriculture, fill-dirt extraction, conservation uses, and residential uses up to the following densities:

Percentage of the on site uplands that are preserved or restored native habitats	Maximum density
0%	1 DU/ 10 acres
5%	1 DU/ 9 acres
10%	1 DU/ 8 acres
15%	1 DU/ 7 acres
20%	1 DU/ 6 acres
30%	1 DU/ 5 acres
40%	1 DU/ 4 acres
50%	1 DU/ 3 acres
60%	1 DU/ 2 acres
70%	1/DU/ 1 acre

NEW LEE PLAN POLICY 14.1.8:

POLICY 14.1.8: The county reclassified all uplands on Pine Island previously designated as Rural to a new Coastal Rural designation on the Future Land Use Map. The purposes of this redesignation was to provide a clearer separation between rural and urban uses on Pine Island, to discourage the unnecessary destruction of native upland habitats, and to avoid placing more dwelling units on Pine Island that can be served by the limited road capacity to the mainland. The Coastal Rural designation is designed to provide land owners with maximum flexibility while accomplishing these public purposes.

SUMMARY OF CODE CHANGES NEEDED TO IMPLEMENT THESE POLICIES:

a. Modify 34-2 – CORRECT THE DEFINITION OF GREATER PINE ISLAND IN 34-2
b. Modify Tables 34-654, 34-695 and 34-715 – PROVIDE NEW FOOTNOTES TO THESE TABLES REGARDING NEW MINIMUM LOT SIZES IN “COASTAL RURAL”
c. Create 34-655 – CREATE A NEW SECTION TO DEFINE THE EFFECT OF THE “COASTAL RURAL” DESIGNATION ON LAND DEVELOPMENT
d. Modify 34-3273 – ADD LANGUAGE THAT ALLOWS CONSTRUCTION OF ONE HOME IN “COASTAL RURAL” ON EACH LOT THAT WAS CREATED PRIOR TO THIS PLAN (WITHOUT SPECIAL RULES FOR PRESERVATION OR RESTORATION)

COMPOSITE CODE CHANGES TO IMPLEMENT THESE POLICIES:

CHAPTER 34
Zoning
ARTICLE I, IN GENERAL

Sec. 34-2. Definitions.

The following words, terms and phrases, when used in this chapter, shall have the meanings ascribed to them in this section, except where the context clearly indicates a different meaning:

...

Greater Pine Island means all of Pine Island, Little Pine Island, West Island, Porpoise Point Island and other small adjacent islands, more particularly described as follows: Sections 25, 26, 35 and 36, Township 43 South, Range 21 East; also Sections 28, 29, 30, 31, 32, ~~and~~ 33 and 34, Township 43 South, Range 22 East; also Sections 1, 12, 24 and 25, Township 44 South, Range 21 East; also, all of Township 44 South, Range 22 East, less Sections 1, 2, 11, 12~~, 13,~~ and 24, and less those portions of Section 13 lying in the City of Cape Coral; ~~and certain portions of Section 24, lying northeast or toward the mainland from Porpoise Point Island;~~ also, those portions of Section 18 of Township 44 South, Range 23 East lying outside the City of Cape Coral; also, all of Township 45 South, Range 22 East, except those portions of Sections 12, 13 and 24, lying on the mainland; also, Sections 1, 2, 3, 4, 5, 9, 10, 11 and 12, Township 46 South, Range 22 East; also Sections 6 and 7, Township 46 South, Range 23 East.

...

[no other changes to section 34-2]

CHAPTER 34
Zoning
ARTICLE VI, DISTRICT REGULATIONS
Division 2, Agricultural Districts

Sec. 34-651. Purpose and intent.

The purpose of the agricultural districts is to provide areas for the establishment or continuation of agricultural operations, with residential uses being permitted only as ancillary to agricultural uses, and to accommodate those individuals who understand and desire to live in an agricultural environment.

Sec. 34-652. Applicability of use and property development regulations.

No land, body of water or structure may be used or permitted to be used and no structure may hereafter be erected, constructed, moved, altered or maintained in the AG districts for any purpose other than as provided in section 34-653, pertaining to use regulations for agricultural districts, and section 34-654, pertaining to property development regulations for agricultural districts, except as may be specifically provided for in article VIII (nonconformities) of this chapter, or in section 34-620.

Sec. 34-653. Use regulations table.

Use regulations for agricultural districts are as follows:

TABLE 34-653. USE REGULATIONS FOR AGRICULTURAL DISTRICTS
[no changes required]

Sec. 34-654. Property development regulations table.

Property development regulations for agricultural districts are as follows:

TABLE 34-654. PROPERTY DEVELOPMENT REGULATIONS FOR AGRICULTURAL DISTRICTS

	Special Notes or Regulations	AG-1	AG-2	AG-3
Minimum lot dimensions and area:	Note (1)			
Minimum lot area:	Notes (2) and (6)			
Interior lot	34-2221, 34-2222	4.7 acres	39,500 sq. ft.	20,000 sq. ft.
Corner lot	34-2221, 34-2222	4.4 acres	33,600 sq. ft.	20,000 sq. ft.
Minimum lot width (feet)		300	100	100
Minimum lot depth (feet)		300	130	130
Minimum setbacks:				
Street (feet)	Notes (3) and (4), 34-2191 et seq., 34-1261 et seq.	Variable according to the functional classification of the street or road (see section 34-2192), but in no case less than 50 feet in the AG-1 district.		
Side yard (feet)		25	15	15
Rear yard (feet)	34-2191 et seq.	25	25	25
Water body (feet):	34-2191 et seq.			
Gulf of Mexico		50	50	50
Other		25	25	25
Special regulations:				
Animals, reptiles, marine life	34-1291 et seq.			
Consumption on premises	34-1261 et seq.			
Docks, seawalls, etc.	34-1863 et seq.	Refer to the sections specified for exceptions to the minimum setback requirements listed in this table.		
Essential services	34-1611 et seq.			
Essential service facilities (34-622(c)(13))	34-1611 et seq., 34-2142			
Fences, walls, gatehouses, etc.	34-1741 et seq.			
Nonroofed accessory structures	34-2194(c)			
Railroad right-of-way	34-2195			
Maximum height (feet)	34-2171 et seq.	35	35	35
	Note: Bonita Beach, Captiva, Estero and San Carlos Islands, Gasparilla Island conservation district, Greater Pine Island and areas within the airport hazard zone have special limitations (see section 34-2175).			
Maximum lot coverage (percent of total lot area)		25%	25% (5)	25%

Notes:

(1) Certain projects in agricultural districts may fall within the density reduction/groundwater resource areas of the Lee Plan. In such areas, additional density and use restrictions are applicable. Permitted land uses in density reduction/groundwater resource areas include agriculture, mineral or limerock extraction, conservation uses, and residential uses at a maximum density of one dwelling unit per ten acres. Individual residential parcels may contain up to two acres of wetlands without losing the right to have a dwelling unit, provided that no alterations are made to those wetlands.

(2) Any lot created in the Rural Community Preserve land use category (as delineated by policy 17.1.3 of the Lee Plan) after July 9, 1991, must have a minimum area of 43,560 square feet excluding all street rights-of-way.

(3) Modifications to required setbacks for collector or arterial streets, or for solar or wind energy purposes, are permitted only by variance. See section 34-2191 et seq.

(4) Special street setback provisions apply to portions of Colonial Boulevard and Daniels Road. Refer to section 34-2192(b)(3) and (4).

(5) For nonconforming lots, as defined in section 34-3271, the maximum lot coverage will be 40 percent.

(6) All lots in the Coastal Rural land use category in Greater Pine Island (as delineated by policies 1.4.7 and 14.1.8 of the Lee Plan) that are created after *[effective date of plan update]* must comply with the additional regulations in section 34-655. Lots created before *[effective date of plan update]* do not need to comply with the additional regulations in section 34-655 (see section 34-3273(a)(3)).

Sec. 34-655. Greater Pine Island.

(a) ***Purpose and intent.*** In 2003 Lee County reclassified most rural lands in Greater Pine Island to a new Coastal Rural designation on the Future Land Use Map. This designation provides landowners with flexibility while accomplishing the following public purposes:

(1) To provide a clearer separation between rural and urban uses on Greater Pine Island;

(2) To discourage the unnecessary destruction of native upland habitats; and

(3) To avoid placing more dwelling units on Pine Island that can be served by the limited road capacity to the mainland.

(b) ***Conversion from rural land uses.*** The Coastal Rural areas will remain rural except for portions of properties where residential lots are permitted in exchange for permanent preservation or restoration of native upland habitats on the remainder of the property. The standard maximum density established by the Lee Plan is one dwelling unit per ten acres (1 DU/10 acres). Maximum densities may increase as higher percentages of native habitat are permanently preserved or restored on the uplands portions of the site in accordance with Table 34-655.

(c) ***Interpreting Table 34-655.*** For purposes of interpreting Table 34-655, the following standards apply:

(1) Table 34-655 contains two columns of adjusted maximum densities:

a. The first density column, titled "If < 910 trips in Matlacha," indicates the adjusted maximum densities that correspond to various levels of uplands preservation or restoration during the time period *before* the restrictions in section 2-4(3) of this code take effect.

b. The second density column, titled "If > 910 trips in Matlacha," indicates the adjusted maximum densities that correspond to various levels of uplands preservation or restoration for the time period *after* the restrictions in section 2-4(3) of this code have taken effect. *[NOTE: four alternatives are shown in this draft for this second density column]*

TABLE 34-655.
ADJUSTED MAXIMUM DENSITY

Percentage of the on-site uplands that are preserved or restored native habitats	Adjusted Maximum Density				
	If < 910 trips in Matlacha:	If > 910 trips in Matlacha:			
		Alternative A:	*Alternative B:*	*Alternative C:*	*Alternative D:*
0% to 4.99%	1 DU/10 acres	*1 DU/ 30 acres*	*1 DU/ 24 acres*	*1 DU/ 17 acres*	*1 DU/10 acres*
5% to 9.99%	1 DU/ 9 acres	*1 DU/ 27 acres*	*1 DU/ 21 acres*	*1 DU/ 15 acres*	*1 DU/ 9 acres*
10% to 14.99%	1 DU/ 8 acres	*1 DU/ 24 acres*	*1 DU/ 18 acres*	*1 DU/ 13 acres*	*1 DU/ 8 acres*
15% to 19.99%	1 DU/ 7 acres	*1 DU/ 21 acres*	*1 DU/ 16 acres*	*1 DU/ 12 acres*	*1 DU/ 7 acres*
20% to 29.99%	1 DU/ 6 acres	*1 DU/ 18 acres*	*1 DU/ 14 acres*	*1 DU/ 10 acres*	*1 DU/ 6 acres*
30% to 39.99%	1 DU/ 5 acres	*1 DU/ 15 acres*	*1 DU/ 11 acres*	*1 DU/ 8 acres*	*1 DU/ 5 acres*
40% to 49.99%	1 DU/ 4 acres	*1 DU/ 12 acres*	*1 DU/ 9 acres*	*1 DU/ 7 acres*	*1 DU/ 4 acres*
50% to 59.99%	1 DU/ 3 acres	*1 DU/ 9 acres*	*1 DU/ 7 acres*	*1 DU/ 5 acres*	*1 DU/ 3.5 acres*
60% to 69.99%	1 DU/ 2 acres	*1 DU/ 6 acres*	*1 DU/ 5 acres*	*1 DU/ 4 acres*	*1 DU/ 3.0 acres*
70% or more	1 DU/ 1 acre	*1 DU/ 3 acres*	*1 DU/ 2.8 acres*	*1 DU/ 2.7 acres*	*1 DU/ 2.5 acres*

(2) The left column in Table 34-655 describes the percentage of on-site uplands that must be permanently preserved or restored as native habitats in order to increase the standard maximum density on the entire property.

a. Land uses are restricted in permanently preserved native habitat in accordance with subsection (d) below, and in restored native habitat in accordance with subsection (e) below.

b. New roads and surface water management systems, including retention/detention lakes, berms, and ditches, may be not be placed in the preserved or restored portion of the on-site uplands except as provided by subsection (d) below.

c. All percentages in the left column in Table 34-655 are based on the acreage of uplands that are designated "Coastal Rural."

1. Lands that are designated "Wetlands" rather than "Coastal Rural" on the Future Land Use Map are not counted either in the base acreage or in the preserved or restored acreage. However, the additional dwelling units that the Lee Plan allows for lands designated "Wetlands" (1 DU/20 acres) may be added to the number of dwelling units allowed for uplands by Table 34-655, provided that the conservation easement described in subsection (d) includes those wetlands.

2. Lands that are designated "Coastal Rural" but which are determined by permitting agencies to be wetlands are counted in the base acreage and may be counted as permanently preserved native habitat or restored native habitat provided that all requirements of this section are met.

(3) Two or more contiguous or noncontiguous "Coastal Rural" parcels may be combined into a single development application for purposes of computing the actual maximum density allowed on those properties. This provision would allow preserved or restored acreage on one parcel to increase the density on another parcel that is included in the same development application. However, the resulting density on any single parcel or on any contiguous parcels may not exceed one dwelling unit per acre (1 DU/1 acre).

(4) The determination of actual maximum densities may be confirmed during the development order process in ch. 10 provided that the proposed development complies with all regulations in this code.

(5) A proposed development that would deviate from this code, except for administrative deviations in accordance with section 10-104, must seek approval through the "planned development" rezoning process prior to obtaining a development order pursuant to ch. 10.

a. Deviations or variances can never be granted to increase the densities in Table 34-655.

b. Example of deviations that can be considered during the "planned development" process include:

1. Permitted uses and property development regulations other than those provided in subsection (f) of this section;

2. Alternative methods of committing to preservation or restoration of native habitat;

3. Substitution of permanent reforestation that doesn't meet all of the requirements of this section for "permanently preserved native habitats" or "restored native habitats."

4. Infrastructure more suited to country living, such as narrower streets, alternative paving materials, stormwater management systems that promote infiltration of runoff, etc.

(d) ***Permanently preserved native habitats.*** For the purposes of this section, "permanently preserved native habitat" means uplands that the landowner guarantees will be preserved as native habitat that will remain permanently as open space, in exchange for increasing the standard maximum residential density on the entire property, with all residential units placed on other uplands.

(1) **Land uses in preserved habitat.** No portion of the native habitats that are counted as preserved for the purposes of Table 34-655 may overlap individual lots or parcels on which development is permitted.
   a. Portions of these native habitats may be used as buffer strips and wooded portions of golf courses provided those areas have a minimum dimension of 25 feet and are protected by the same conservation easement as the remainder of the native habitat.
   b. Permanently preserved native habitat may contain up to the following percentages:
      1. Facilities for passive recreation such as hiking trails, bridle paths, boardwalks, or fishing piers, up to 2% of the preserved or restored area.
      2. Lakes, up to 5% of the preserved or restored area.
      3. Commercial or non-commercial agriculture, up to 10% of the preserved or restored area.

(2) **Hydrologic restoration.** Interruptions of original water flows must be corrected to ensure proper hydrologic conditions for the long-term survival of the permanently preserved native habitat. For instance, ditches or berms that interfere with natural surface and ground water flows must be eliminated (unless mitigation is possible, for instance by placing multiple culverts through berms to restore sheet flows).

(3) **Removal of invasive exotic plants.** The following highly invasive exotic plants must be removed from the area being preserved. Methods to remove and control invasive exotic plants must be included on the development order plans. For purposes of this subsection, invasive exotic plants to be removed include:
   a. Melaleuca, *Melaleuca quinquenervia*
   b. Brazilian pepper, *Schinus terebinthifolius*
   c. Australian pine (*Casuarina* spp.)

(4) **Conservation easement.** The guarantee of preservation must include a perpetual conservation easement granted to a governmental body or agency or to a charitable corporation or trust whose purposes include protecting natural, scenic, or open spaces values of real property, provided that the entity being granted the easement consents to enforce the easement's obligations in perpetuity. This conservation easement must be a right or interest in real property which is appropriate to retaining the land in predominantly its natural forested condition as suitable habitat for native vegetation and wildlife in accordance with this section and which prohibits or limits the activities described in F.S. § 704.06, as such provisions now exist or may be amended. The guarantee of preservation may take a different form if it provides equivalent protection and is approved by Lee County through a deviation in a planned development rezoning.

(5) **Management plan.** The guarantee of preservation must also include a fully funded long-term management plan that will accomplish the following goals for the area being preserved:
   a. The open space must be maintained in perpetuity against the reestablishment of invasive exotic plants and must be kept free of refuse, debris, and pests.
   b. The open space must be managed to maintain a mosaic of plant and habitat diversity typical of the ecological community being preserved. A reference source describing the native habitats found in Greater Pine Island is available in chapter 3 of the Multi-Species Recovery Plan for South Florida, published by the U.S. Fish & Wildlife Service.
   c. If the management plan does not include prescribed burning to mimic

the historic fire regime, the plan must propose an alternative method for selectively thinning flammable understory shrubs.

(6) **Ownership of preserved habitats.** The underlying ownership of these permanently preserved native habitats may be transferred to a homeowners' or condominium association or may be retained by the original landowner or another private party.

a. If the ownership of this land and the management commitments are to be transferred to a homeowners' or condominium association, this transfer must be accomplished through a covenant that runs with the land in the form of, but not limited to, a homeowners' or condominium association or such other legal mechanisms as will guarantee that the permanently preserved native habitats will be managed in accordance with these regulations. Legal documents that provide for the continued management will be accepted only after they are reviewed and approved by the county attorney's office as complying with this section.

b. Alternatively, a landowner who wishes to retain ownership of this land or convey it to a different party must present evidence of a permanent funding source to carry out the management responsibilities, which may include bonds or trust funds sufficient to pay for the ongoing management in accordance with these regulations. Legal documents that provide for the continued management will be accepted only after they are reviewed and approved by the county attorney's office as complying with this section.

(e) ***Restored native habitats.*** For the purposes of this section, "restored native habitat" means uplands that the landowner commits to restoring and permanently preserving as open space in exchange for increasing the standard maximum residential density on the entire property, with all residential units placed on other uplands. The restoration goal is to initiate the re-creation of native habitats that had been typical of Greater Pine Island and to establish conditions suitable to their long-term maturation and regeneration. Restored native habitats must meet all of the requirements of section 34-655(d), plus the following requirements:

(1) **Hydrologic restoration.** In addition to the correction of interruptions of original water flows as described in subsection (d)(2) above, the site's hydrologic regime must be appropriate for the ecological community being restored. A reference source describing the native habitats found in Greater Pine Island and their natural hydrologic conditions is available in chapter 3 of the Multi-Species Recovery Plan for South Florida, published by the U.S. Fish & Wildlife Service.

(2) **Reintroduction of native trees.** Native trees must be planted and must be of species typical of the native habitat being recreated, as set forth in the Multi-Species Recovery Plan. For example, the dominant tree species in mesic pine flatwoods, the most common native upland habitat on Pine Island, will be longleaf and slash pines.

a. Site preparation must include removal of non-native vegetation that will compete with newly planted trees.

b. Trees must be planted in clusters or random patterns rather than rows. Bare-root or containerized seedlings may be planted using standard forestry techniques. The target density of trees is between 50 and 200 trees per acre.

c. Fertilization may be required at time of planting to ensure survival of seedlings. Weed control is required for at least two years after planting.

(3) **Reintroduction of native midstory shrubs and understory plants.** *[add details here]*

(4) **Criteria for success of restoration.** *[add details here]*

(f) ***Flatwoods restoration bank*.** As an additional alternative to restoring native habitats on-site or on contiguous or non-contiguous parcels combined into a single development application, Lee County may adopt an administrative code that sets forth the requirements for a third party to preserve or restore degraded upland habitats on large parcels on Pine Island. Credits for this restoration work could be sold to other landowners in Greater Pine Island who wish to increase their allowable density in accordance with Table 34-655.

(1) The restored land must meet all of the conditions for restored native habitats in subsection (e) in addition to the requirements of the administrative code.

(2) The administrative code will determine the assignment of restoration credits in a manner that is proportional to the ecological value of the restoration. Credits can sold once the restoration has proven successful according to criteria set forth in the code

(3) Lee County will not be involved in any way in establishing the financial value of restoration credits.

(g) ***Development standards.*** If a landowner chooses to increase the standard maximum density of "Coastal Rural" land as provided by this section, the following standards will govern the portion of the property that may be developed.

(1) **General standards:** All requirements of this code remain in effect except as modified through the "planned development" rezoning process or as otherwise provided in this section.

(2) **Permitted uses and property development regulations:**

a. Individual lots that exceed all size and dimensional requirements for lots in an AG-2 zoning district are governed by all regulations for the AG-2 district, including permitted uses and property development regulations.

b. Individual lots that do not meet all size and dimensional requirements for lots in an AG-2 zoning district are governed by all regulations for the RS-1 zoning district, including permitted uses and property development regulations.

c. The portion of the site being preserved will be governed by the standards in this section.

(3) **Infrastructure standards:**

a. Right-of-way and lane widths for local streets may be narrower than the standards set forth in section 10-296 provided the widths are selected in accordance with the criteria in *Traditional Neighborhood Development Street Design Guidelines* or *Neighborhood Street Design Guidelines* (or successor recommended practices) published by the Institute of Transportation Engineers.

b. Dead-end streets are generally not permitted but may be unavoidable due to adjoining wetlands, canals, or preserved areas. When the director deems a dead-end street to be unavoidable, the dead end must be provided with a cul-de-sac that is designed in accordance with these same criteria.

c. Local streets defined by section 10-296 as "Category C" streets may have a wearing surface of porous (pervious) asphalt or concrete, in addition to the other surface options provided in chapter 10. Porous paving can increase the infiltration of stormwater and reduce the need for separate stormwater infrastructure.

(4) **Locational standards:** The following approach and guidelines must be used to determine the best locations for area on the site to be preserved and to be developed:

a. Begin by identifying potential areas to remain as open space: healthy, diverse, or unusual vegetation (such as mature pine trees, oak hammocks, or dense

saw palmetto); listed species habitat; historic/archaeological sites; unusual landforms; wet or transitional areas; etc.

b. Then identify potential areas for homesites: locations near existing developed areas or adjoining existing streets (or logical street extensions); areas with fewer natural resource values; areas that can be served with minimal extensions of infrastructure; areas that would provide views of preserved open spaces; etc.

Secs. 34-656~~5~~--34-670. Reserved.

CHAPTER 34
Zoning
ARTICLE VI, DISTRICT REGULATIONS
Division 3, Residential Districts

Sec. 34-695. Property development regulations table.

Property development regulations for one- and two-family residential districts are as follows:

TABLE 34-695. PROPERTY DEVELOPMENT REGULATIONS FOR ONE- AND TWO-FAMILY RESIDENTIAL DISTRICTS

	Special Notes or Regulations	RSC-1	RSC-2	RSA	RS-1	
Minimum lot area and dimensions:	34-2221, 34-2222, 34-2142					[all other districts remain unchanged]
Single-family detached:	Note 5					
Lot area (square feet)		4,000	43,560	6,500	7,500	
Lot width (feet)		40	100	65	75	
Lot depth (feet)		75	200	75	100	
Duplex: *[no changes required]*						
Two-family attached: *[no changes required]*						
Minimum setbacks: *[no changes required]*						
Special regulations: *[no changes required]*						
Maximum height (feet) *[no changes required]*						
Maximum lot coverage (percent of total lot area) *[no changes required]*						

Notes:

(1) Modifications to required setbacks for collector or arterial streets, or for solar or wind energy purposes, are permitted by variance only. See section 34-2191 et seq.

(2) Special street setbacks apply to portions of Colonial Boulevard and Daniels Road. Refer to section 34-2192(b).

(3) Accessory buildings and uses can be located closer to the front of the property than the main building, but must comply with all other setback requirements for accessory building uses.

(4) No side yard setback required from common side lot line for two-family attached.

(5) All lots in the Coastal Rural land use category in Greater Pine Island (as delineated by policies 1.4.7 and 14.1.8 of the Lee Plan) that are created after *[effective date of plan update]* must comply with the additional regulations in section 34-655. Lots created before *[effective date of plan update]* do not need to comply with the additional regulations in section 34-655 (see section 34-3273(a)(3)).

Sec. 34-715. Property development regulations table.

Property development regulations for multiple-family residential districts are as follows:

TABLE 34-715. PROPERTY DEVELOPMENT REGULATIONS FOR MULTIPLE-FAMILY RESIDENTIAL DISTRICTS

	Special Notes or Regulations	RM-2	RM-3	RM-6	RM-8	RM-10
Minimum lot area and dimensions: Single-family detached: *[no other changes required]* Duplex, two-family, townhouse: *[no other changes required]* Multiple-family: *[no other changes required]* Nonresidential uses: *[no changes required]*	34-1493, 34-1494, 34-2221, 34-2222, 34-2142 Note 7 Note 7 34-713 Note 7	*[no changes required]*	*[no changes required]*	*[no changes required]*	*[no changes required]*	*[no changes required]*
Minimum setbacks: *[no changes required]*						
Special regulations: *[no changes required]*						
Maximum height (feet) *[no changes required]*						
Maximum lot coverage (percent of total lot area) *[no changes required]*						

Notes:

(1) Minimum lot size is 6,500 square feet. However, the maximum permitted density shall not exceed the density permitted for the land use category in which the property is located.

(2) Minimum lot size is 7,500 square feet. However, the maximum permitted density shall not exceed the density permitted for the land use category in which the property is located.

(3) 14,000 square feet for the first two dwelling units plus 6,500 square feet for each additional dwelling unit in the same building.

(4) Modifications to required setbacks for arterial or collector streets, or for solar or wind energy purposes, are permitted only by variance. See section 34-2191 et seq.

(5) Special street setbacks apply to portions of Colonial Boulevard and Daniels Road. Refer to section 34-2192(b).

(6) No side setback is required from common lot line for two-family attached or townhouse.

(7) All lots in the Coastal Rural land use category in Greater Pine Island (as delineated by policies 1.4.7 and 14.1.8 of the Lee Plan) that are created after *[effective date of plan update]* must comply with the additional regulations in section 34-655. Lots created before *[effective date of plan update]* do not need to comply with the additional regulations in section 34-655 (see section 34-3273(a)(3)).

CHAPTER 34
Zoning
ARTICLE VIII, NONCONFORMITIES
Division 4, Nonconforming Lots

Sec. 34-3271. Nonconforming lot defined.

For purposes of this division, the term "nonconforming or substandard lot" means a lot of which the area, dimension or location was lawful prior to the adoption of the ordinance from which this chapter is derived, or the adoption of a revision or amendment of this chapter, and which fails by reason of such adoption, revision or amendment to conform to the requirements for the zoning district in which the lot is located.

Sec. 34-3272. Lot of record defined; general development standards.

For the purposes of this division only, a lot of record is a lot which conformed to the minimum lot size for the use permitted for that lot in its zoning district at such time that the lot was created, but which lot fails to conform to the minimum lot size requirements which are established by this chapter.

(1) For the purpose of this division, a lot is created on such date that one of the following conditions occur:
   a. The date that a deed for the lot is lawfully recorded in the public records of the county;
   b. The date that a subdivision plat has been lawfully recorded in the public records of the county, if the lot is a part of the subdivision;
   c. The date that a site plan for a development was approved by the Board of County Commissioners pursuant to resolution, as long as the development subsequently recorded a subdivision plat that has been approved by the Board of County Commissioners in the public records of the county, if the lot is a part of the subdivision; or
   d. In the case of mobile home or recreational vehicle parks... *[no changes required]*

(2) The remaining lot after condemnation shall be deemed a lot of record in accordance with section 34-3206.

(3) Lots of record may be developed subject to the following provisions:
   a. All other regulations of this chapter must be met.
   b. No division of any parcel may be permitted which creates a lot with width, depth or area below the minimum requirements stated in this chapter, provided that abutting lots of record may be combined and redivided to create larger dimension lots as long as such recombination includes all parts of all lots, existing allowable density is not increased, and all setback requirements are met.
   c. For mobile home or recreational vehicle lots of record, the following will also apply: *[no changes required]*

(4) The burden of proof that the lot is legally nonconforming, and lawfully existed at the specified date, shall be with the owner.

Sec. 34-3273. Construction of single-family residence.

(a) A single-family residence may be constructed on a nonconforming lot of record that:

(1) Does not comply with the density requirements of the Lee Plan, provided the owner receives a favorable single-family residence determination <u>(also known as "minimum use determination")</u> in accordance with the Lee Plan. Such nonconforming lots are exempt from the minimum lot area and minimum lot dimension requirements of this chapter, and it will not be necessary to obtain a variance from those requirements.

(2) Does comply with the density requirements of the Lee Plan, as long as the lot:
   a. Was lawfully created prior to June 1962 and the following conditions are met:
      1. Lots existing in the AG-2 or AG-3 zoning district require a minimum width of 75 feet, a minimum depth of 100 feet and a lot area not less than 7,500 square feet.

2. Lots existing in any other zoning district which permits the construction of a single-family residence require a minimum of 40 feet in width and 75 feet in depth, and a lot area not less than 4,000 square feet.

b. Is part of a plat approved by the Board of County Commissioners and lawfully recorded in the public records of the county after June 1962.

(3) In Greater Pine Island only, in addition to the options in subsections (a)(1) and (2), one single-family residence may be constructed on a nonconforming lot of record in the Lee Plan's "Coastal Rural" land use category (as delineated by policies 1.4.7 and 14.1.8 of the Lee Plan), provided that:

a. The lot was created before *[effective dat of plan update]*; and

b. The lot would have qualified for a single-family residence determination (minimum use determination) in accordance with the Lee Plan prior to that date.

(b) The use of a nonconforming lot of record for a residential use other than a single-family dwelling unit is prohibited except in compliance with the lot width, lot depth, lot area, and density requirements for the zoning district.

(c) Neither a guest house nor servants' quarters is permitted on a single lot of record less than 7,500 square feet in area, or which is occupied by a dwelling unit or units other than one single-family residence.

(d) Minimum setbacks for structures permitted under subsections (1) or (2) above, are as follows:

(1) Street setbacks must be in accordance with section 34-2192.

(2) Side setbacks must be ten percent of lot width, or five feet, whichever is greater.

(3) Rear setbacks must be one-fourth of the lot depth but do not need to be greater than 20 feet.

Sec. 34-3274. Placement of mobile home or recreational vehicle on lot. *[no changes required]*

Sec. 34-3275. Commercial or industrial use. *[no changes required]*

Mesic Pine Flatwoods

FNAI Global Rank:	**Undetermined**
FNAI State Rank:	**S4**
Federally Listed Species in S. FL:	**9**
State Listed Species in S. FL:	**40**

Mesic pine flatwoods. *Original photograph by Deborah Jansen.*

The mesic pine flatwoods of South Florida are of critical, regional importance to the biota of South Florida. They provide essential forested habitat for a variety of wildlife species including: wide-ranging, large carnivores such as the Florida panther *(Puma (=Felis) concolor coryi*) and the Florida black bear (*Ursus americanus floridanus*); mid-sized carnivores; fox squirrels (*Sciurus niger* spp.); and deer (*Odocoileus virginianus).* They provide tree canopy for canopy-dependent species including neotropical migrants, tree-cavity dependent species, and tree-nesting species. Mesic pine flatwoods are also important as the principal dry ground in South Florida, furnishing refuge and cover for ground-nesting vertebrates as well as habitat for non-aquatic plant life (such as upland perennials and annuals). During the summer wet season, the mesic pine flatwoods of South Florida function as the upland ark for non-aquatic animals. Mesic flatwoods serve as ground bird nesting areas; adult tree frog climbing areas; black bear foraging, denning, and travelways; and essential red-cockaded woodpecker (*Picoides borealis*) foraging and nesting habitat. At the current rate of habitat conversion, the mesic pine flatwoods, once the most abundant upland habitat in South Florida, is in danger of becoming one of the rarest habitats in South Florida. The impact of this loss on wide-ranging species, listed species, and biodiversity in South Florida could be irreparable.

Synonymy

The mesic pine flatwoods association of southwest Florida has been variously recognized and alluded to in the plant community literature. Pine flatwoods were first identified as “pine barrens” by Bartram (1791) in his narrative of Florida travels. The term “flatwoods” was coined by English speaking settlers to describe the absence of topographic relief (Ober 1954). The term “pine flatwoods” was first used in the scientific literature by Laessle (1942).

Following Davis' (1967) mapping of South Florida vegetation communities, the term became standard for South Florida pine forests.

Long (1974) was the first to recognize mesic pine flatwoods as a separate vegetation type, "dry pineland," and considered it a successional stage between wet flatwoods and hardwood hammock. Klein *et al.* (1970) and Wharton (1977) separately map mesic pine flatwoods in their hydrogeologic cross-sections of the plant communities of the Big Cypress and South Florida successional stages. Duever *et al.* (1979) formally used the term "mesic pine flatwoods" and distinguished mesic pine flatwoods from hydric pine flatwoods by differences in understory, with the mesic flatwoods having a saw palmetto (*Serenoa repens*) understory. Based upon a conceptual successional model, Duever *et al.* (1976) indicate that upland pinelands occur in a hydroperiod of from 0 to 40 days and a fire frequency of 3-to 10-year intervals. Subsequent descriptions by Duever *et al.* (1986) describe flatwoods on the basis of hydrology and understory components, recognizing mesic flatwoods.

The Florida Natural Areas Inventory (FNAI) (1989) recognizes mesic flatwoods as flatland with sand substrate, mesic, subtropical or temperate; with frequent fire, and vegetation characterized by slash pine (*Pinus elliottii*) and/or longleaf pine (*Pinus palustris*) with saw palmetto, gallberry (*Ilex glabra*) and/or wiregrass (*Aristida beyrichiana*)or cutthroat grass (*panicum abscissum*) understory. FNAI lists the following synonyms for mesic pine flatwoods: mesic flatwoods, pine savanna, cabbage palm savanna, and pine barrens. The Florida Land Use Classification and Cover System (FLUCCS) (DOT 1985) does not have a specific categorization for mesic pine flatwoods. As defined by FNAI (1989), mesic pine flatwoods could be mapped as any of the following FLUCCS codes: 411 pine flatwoods, 415 longleaf-upland oak, 419 other pine, or 428 cabbage palm. The U. S. Soil Conservation Service (1986) combines mesic pine flatwoods with hydric and xeric pine flatwoods in a "South Florida flatwoods" category. Abrahamson and Hartnett (1990) define the mesic flatwoods as occasionally inundated flatlands with sand substrates, canopies of slash pine, longleaf pine, and/or cabbage palm (*Sabal palmetto*), and understories of mixed shrubs, grasses and forbs, which vary in accordance with fire frequency, and are a gradation between hydric and xeric flatwoods.

All Florida State and Federal regulatory agencies recognize mesic pine flatwoods as uplands for wetland regulatory purposes.

Distribution

Mesic pine flatwoods were historically found in all the counties of South Florida. The largest remaining areas are in south and eastern Sarasota County, Charlotte County, north and southeastern Lee County, on Pine Island in Lee County, western and northeastern Collier County, central Hendry County, western Glades County, southwest and northeast Highlands County, the Green Swamp and southeastern Polk County, the Horse Creek basin of DeSoto and Hardee counties, northwest and east Osceola County, within the Everglades NP in Miami-Dade County, North Palm Beach County, and in three ridges paralleling the coast in western, mid-and eastern St. Lucie, Indian River and Martin counties, respectively (Figure 1). There may be no natural mesic pine

flatwoods remaining outside of public ownership in Broward and Miami-Dade counties. Small areas of mesic flatwoods are located in Monroe and Okeechobee counties. Figure 1 illustrates the distribution of all pine flatwoods in the South Florida Ecosystem, as of 1989 (Cox *et al.* 1997).

The South Florida slash pine is the dominant tree of the South Florida mesic pine flatwoods canopy, south of Interstate 4. The longleaf pine and South Florida slash pine are in mixed dominance north of Interstate 4 in Polk and Osceola counties, and in some areas of Highlands County at higher elevations. The longleaf pine is found in clusters as far south as Charlotte County on the west coast.

Major public holdings of mesic pine flatwoods occur throughout South Florida, in Everglades NP (Miami-Dade and Monroe counties); Big Cypress National Preserve (Collier County); the Florida Panther NWR (Collier County); Corkscrew Swamp Sanctuary (Collier County); Charlotte Harbor State Buffer Preserve (Charlotte County); Charlotte Harbor Flatwoods (Charlotte County); Babcock-Webb WMA (Charlotte County); CREW (Lee, Collier counties); The Savannas (Martin, St. Lucie counties)**;** Picayune Strand (South Golden Gate Estates in Collier County); Myakka State Forest, Myakka River State Park and Myakka Prairie (Sarasota County); Oscar Shearer SRA (Sarasota County); Pinelands Preserve (Sarasota County); Platt Branch Mitigation Park (Highlands County); Hickey Creek Mitigation Park (Lee County); Caloosahatchee River SRA (Lee County); Koreshan State Park (Lee County); Jonathan Dickinson State Park (Martin and Palm Beach counties); DuPuis Reserve (Martin and Palm Beach counties); J.W. Corbett WMA (Palm Beach County); Loxahatchee Slough Natural Area; and Sebastian Creek Buffer Preserve (Brevard and Indian River counties).

Description

Structure

Mesic pine flatwoods (*sensu* Stout and Marion 1993) typically exhibit an emergent tree layer of pines with limbless lower trunks and ground layers of low vegetation. However, physiognomy varies markedly with fire regime and moisture. Pine densities in mesic pine flatwoods can range from sparse to dense depending on fire history, seed predation, and seedling predation. Canopy coverage of mature mesic pine flatwoods can range from 10 to 80 percent in unlogged stands. Pine trees are usually abundant enough to dominate the apparent landscape view and canopy, but canopy densities can vary, dependent upon the degree of fire exclusion (Wade *et al.* 1980).

Vegetative Composition

The mesic pine flatwoods habitat is dominated by a slash pine or longleaf pine overstory with an upland understory. Mesic pine flatwoods are distinct from hydric and xeric pine flatwoods in the tendency toward midstory dominance by saw palmetto and scrub species such as fetterbush (*Lyonia lucida*), tarflower (*Befaria racemosa*), rusty lyonia (*Lyonia ferruginea*), cabbage palm (*Sabal palmetto*), and wax myrtle (*Myrica cerifera*). Impacted mesic pine flatwoods

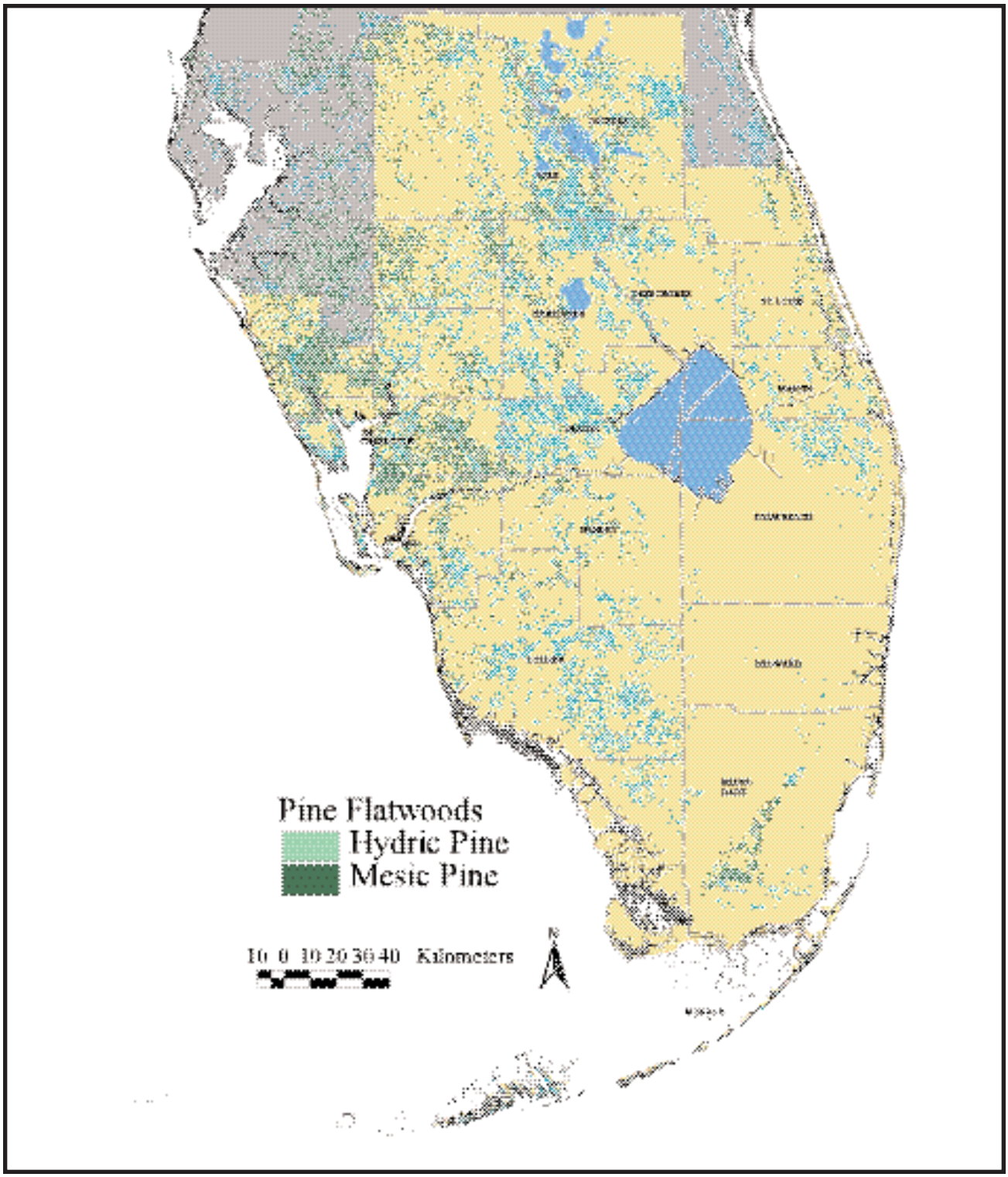

Figure 1. The distribution of hydric and mesic pine flatwoods in South Florida (data from USGS-BRD 1996).

are dominated by the exotic invaders: Brazilian pepper (*Schinus terebinthifolius*), Australian pine (*Casuarina equisetifolia*), downy rosemyrtle (*Rhodomyrtus tomentosus*), ear-leaf acacia (*Acacia auriculiformis*) and melaleuca (*Melaleuca quinquinervia*). Understory includes a wide variety of grasses (*Agrostis*, *Andropogon*, *Aristida*, *Dichanthelium*, *Eragrostis*, and *Panicum* spp., *etc*.), pawpaws (*Asimina* spp.), gopher apple (*Licania michauxii*), legumes (*Cassia*, *Crotalaria*, *Galactia*, *Rhynchosia*, *Tephrosia* spp., *etc*.), milkworts (*Polygala* spp.), blueberries (*Vaccinium* spp.), milkweeds (*Asclepias* spp.), and a wide variety of composites (*Aster, Chrysopsis, Emilia, Eupatorium, Liatris,* and *Solidago* spp., *etc*.).

The taxonomy of the South Florida slash pine has been a matter of significant debate (Small 1913, Little and Dorman 1954, Squillace 1966, Mirov 1967, McMinn and McNab 1971). *Pinus elliottii* var. *densa* is more flood- and drought-tolerant than is var. *elliottii*. Squillace (1966) concluded that the phenotypic plasticity that allows *densa* to accommodate both upland and wetland conditions, fire, and flood is the result of its evolution under the severe environmental factors of South Florida flood and drought that vary from year to year and fluctuate widely over longer time courses.

Mature South Florida slash pine can attain a height of 30 m (110 feet), with a dbh of 40 cm (16 inches) (Duever *et al.* 1976). In an average southwest Florida mesic pine flatwoods, mature trees typically attained 30 to 41 cm (12 to 16 inches) dbh with 23 to 26 m (75 to 85 feet) of height (Beever and Dryden 1998). Growing season is from February to November, with maximum growth rates attained at the spring and autumnal equinoxes (Langdon 1963). The growth rate of South Florida slash pine has been measured in the Corkscrew area of Collier County at an annual diameter at breast height (dbh) increase of 1.15 cm (0.45 inches) per year and an annual height increase of 60 cm (2 feet) per year. The forestry productivity of southwest Florida mesic pine flatwoods for wood products has been recorded at over 27 cords/acre (242 cubic meters/acre) at age 16 (Wade *et al.* 1980). Annual net understory productivity is 140 g/m^2 (1,250 lb/ac) with a litter fall averaging 130 g/m^2/yr (1,160 lb/ac). Decomposition is only 30 percent per year (Duever *et al.* 1976). This results in an annual net accumulation of litter of approximately 90 g/m^2 (800 lb/ac) when fire is excluded. This relatively rapid litter fuel buildup increases the probability of fire ignition and the chance for hot, crowning fires through time.

Longleaf pine and slash pine communities are extremely diverse floristically, and contain several rare and endemic plant taxa, making this one of the most important natural systems in the southeastern United States (Hardin and White 1989). Hardin and White (1989) listed 191 rare plant taxa as occurring in the wiregrass ecosystem; seven of these taxa have been proposed for listing or are currently listed as federally endangered, and 61 are listed as threatened or endangered in three states. The wiregrass ecosystem supports 33 locally endemic plant taxa, all from Florida.

South Florida slash pine and longleaf pine which are growing in normal mesic pine flatwoods conditions and are subjected to fire, typically display: (1) No buttressing of the lower trunk, (2) Fire-darkened or fire-scarred lower trunks, (3) A straight growth form, (4) Little woody debris and needle litter

build-up, and (5) A crowned growth form, with few branches, if any below the top third of the tree.

Long (1974) lists 303 species of plants in the mesic pine forest habitat of South Florida, the third highest plant species diversity of any habitat in South Florida. Presently, 482 plant species (115 monocotyledon, 353 dicotyledon, 3 gymnosperm, and 11 pteridophyte species) have been identified from or are documented as present in the mesic pine flatwoods of southwest Florida. (Beever and Dryden 1998). South Collier County and lower east coast mesic pine flatwoods have more tropical plant species represented in their understory and a different underlying geology, often composed of marl, and oolitic rockland extrusions (Wade *et al.* 1980), when compared to the mesic pine flatwoods of central and western South Florida.

Of the 482 plant species recorded in literature from mesic pine flatwoods of South Florida, 65 species (13 percent) are typically considered to occur in wetland saturated zones. Four hundred and seventeen species (87 percent) are typically considered upland plants. Twenty-five (5 percent) are exotic, introduced species. These 482 plant species comprise 29 percent of the documented terrestrial flora of South Florida (Wunderlin 1986).

Soils

The mesic pine flatwoods of South Florida are all located in the South Florida Basin of the Floridan Plateau (Vaughan 1910, Chen 1965). The soil types in mesic pine flatwoods generally fall into one of two major substrate sediment groups: limestone rock, and sands (marine terraces) (Duever *et al.* 1986, SFWMD 1980). The soils of the mesic pine flatwoods of South Florida are non-hydric soils as defined by the Florida Association of Professional Soil Classifiers (Carlisle 1990).

Sands are the dominant soil type of South Florida, and of the mesic pine flatwoods in particular. Typical mesic pine flatwoods occur on relatively flat, poorly drained terrain. The soils typically consist of 30 to 91 cm (1 to 3 feet) of acidic sands often over an organic hardpan or clay layer. Cabbage palm-dominated mesic flatwoods occur on more neutral sands (pH 6.0-7.5) underlain by marl or shell. This hardpan can substantially reduce the percolation of water below and above its surface (FNAI 1989).

On the east coast of Florida, when exposed limerock substrate is present, these pinelands are identified as Pine Rocklands.

Wildlife Diversity

The mesic pine flatwoods of South Florida are of critical, regional importance to the biota of South Florida. They provide essential forested habitat for a variety of wildlife species including: wide-ranging, large carnivores such as the Florida panther and the Florida black bear; mid-sized carnivores; fox squirrels; and deer. They provide tree canopy for canopy-dependent species including neotropical migrants, tree-cavity dependent species, and tree-nesting species. Mesic pine flatwoods are also important as the principle dry ground in South Florida, furnishing refuge and cover for ground-nesting vertebrates as well as habitat for non-aquatic plant life (such as upland perennials and annuals). During the summer

wet season, the mesic pine flatwoods of South Florida function as the upland ark for non-aquatic animals. Mesic flatwoods serve as ground bird nesting areas; adult tree frog climbing areas; black bear foraging, denning, and travelways; and essential red-cockaded woodpecker foraging and nesting habitat.

The variety and diversity of invertebrate species utilizing the mesic pine flatwoods as foraging, breeding, and nursery habitat has not been well studied. Species that cause economic damage to pine trees, particularly bark beetles, have been the principle focus of entomological literature in pine flatwoods. A total of 7 phyla, at least 12 classes, and at least 40 orders of invertebrates are observed or documented to occur in the mesic pine flatwoods of South Florida. Dominant taxa, in individual numbers and species diversity, include the arthropods, gastropods, nematodes, rotifers, and protozoans. The most conspicuous taxa are the insecta and arachnida. The most common terrestrial crustacean is the isopod pillbug (Beever and Dryden 1998). Representatives of 20 orders of insects are present in the mesic pine flatwoods of South Florida. The abundance and diversity of insect fauna is related to the variable hydrology, host plant diversity, and microhabitat presence (*e.g.*, fungal bracts, dead trees, hosts for parasites, *etc*.) available in the mesic flatwoods ecosystem.

The myriad of invertebrate species in the mesic pine flatwoods support the vertebrate species. This community is important habitat for a number of common pine flatwoods vertebrate species, including the pine woods tree frog (*Hyla femoralis*), oak toad (*Bufo quercicus*), box turtle (*Terrapene carolina*), eastern diamondback rattlesnake (*Crotalus adamanteus*), black racer (*Coluber constrictor*), brown-headed nuthatch (*Sitta pusilla*), Bachman's sparrow (*Aimophila aestivalis*), pine warbler (*Dendroica pinus*), great horned owl (*Bubo virginianus*), least shrew (*Cryptotis parva*), cotton mouse (*Peromyscus gossypinus*), cotton rat (*Sigmodon hispidus*), and gray fox (*Urocyon cinereoargenteus*) (Layne 1974, Layne *et al.* 1977). Although no mammal is endemic only to the mesic pine flatwoods of South Florida, both Sherman's (*Sciurus niger shermani*) and Big Cypress fox squirrels (*Sciurus niger avicennia*) are closely associated with the open understory provided by fire-maintained mesic pine flatwoods. Three large native mammals that regularly use mesic pine flatwoods are the white-tailed deer (*Odocoileus virginianus*), Florida black bear, and Florida panther (Layne 1974).

To date, field studies and the literature (Beever and Dryden 1998, Cunningham 1961, Duever, *et al.* 1986, Ashton and Ashton 1988, Kale and Maehr 1990, Layne 1978, Myers and Ewel 1990, Soil Conservation Service 1986, Florida Department of Natural Resources 1989, Florida Department Natural Resources 1990) have identified 28 mammal, 116 bird, 29 reptile, and 13 amphibian species from the mesic pine flatwoods of South Florida, including 3 endangered species, 6 threatened species, and 6 species of special concern, and 8 Convention on International Trade in Endangered Species (CITES) species.

Twenty-eight of 32 mammal species known from South Florida are found in the mesic pine flatwoods (Layne 1978, Drew and Schomer 1984). The Big Cypress fox squirrel, Florida weasel *(Mustela frenata peninsulae*), and red fox (*Vulpes vulpes*) have only been observed in Lee and Collier counties (Beever and Dryden 1998). One hundred and sixteen (42 percent) of the 274 bird species known from South Florida (Kale and Maehr 1990) are found in the mesic pine flatwoods (Beever and Dryden 1998). Twenty-nine taxa (54 percent) and 27

species (55 percent) of the 54 taxa (49 species) of reptiles not restricted to coastal waters in South Florida (Duever, *et al.* 1986, Ashton and Ashton 1988), utilize the mesic pine flatwoods as habitat. This includes 20 snakes, 1 turtle, 1 tortoise, and 7 lizards. Reptiles utilize mesic pine flatwoods in both wet and dry seasons, although different species may be present seasonally in different hydrologic conditions (Beever and Dryden 1998).

Thirteen (65 percent) of the 20 amphibian species found in South Florida (Ashton and Ashton 1988) utilize the mesic pine flatwoods habitat for feeding and/or breeding. This includes all of the treefrog and toad species of southwest Florida. The most frequently encountered and abundant amphibians are tree frogs, oak and southern toads, and spadefoot toads (Beever and Dryden 1998).

Wildlife Species of Concern

Federally listed animal species that depend upon or utilize the mesic pine flatwoods in South Florida include: Florida panther, Key deer (*Odocoileus virginianus clavium*), Audubon's crested caracara (*Polyborus plancus audubonii*), Kirtland's warbler (*Dendroica kirtlandii*), bald eagle (*Haliaeetus leucocephalus*), red-cockaded woodpecker (*Picoides borealis*), and eastern indigo snake (*Drymarchon corais couperi*). Biological accounts and recovery tasks for these species are included in "The Species" section of this recovery plan.

The **Florida panther** utilizes mesic pine flatwoods in combination with other forested upland and seasonal wetland habitats. They provide critical foraging, breeding, and wildlife corridor habitat. The documented foraging and breeding territories of the radio-collared Florida panthers, and documented sightings of Florida panther include the large expanses of undisturbed mesic pine flatwoods in the area (D. Maehr, GFC, personal communication, 1991, L. Campbell, GFC, personal communication, 1991). The panther utilizes hydric, mesic, and xeric pine flatwoods, and savanna, hardwood hammocks, and mixed swamp forest. Prey animals, including white-tailed deer (*Odocoileus virginianus*) and feral hog (*Sus scrofa*), utilize the plant diversity of the mesic pine flatwoods for foraging, and the dry cover for the raising of offspring (Layne and McCauley 1976). The prevalence of mesic pine flatwoods on private ranches is thought to be partly responsible for increased deer numbers and deer health, which supports increased Florida panther presence on private lands. Recently burned mesic pine flatwoods provide more prey for panther, and panthers are documented to move toward fires and stay in areas of recent burns (Belden 1986). Panthers require large territories and abundant prey. The mesic pine flatwoods of southwest Florida can provide both these requirements. Additionally, the mesic pine flatwoods and swamp forests associated with natural drainage patterns provide the travel corridors essential to the panther for traveling between the fragmented foraging areas remaining in southwest Florida.

Florida black bear. *Original photograph by Barry Mansell.*

The **Florida black bear** is a forest habitat generalist with seasonal preference for wherever food is most available. Black bears utilize all the natural forested systems of South Florida, with a decided preference for upland/wetland ecotones. Telemetry information, documented sign and sightings of Florida black bear, and periodic road kills all indicate that large, relatively undisturbed mesic pine flatwoods, in combination with other upland forests and the major wetland systems, provide the principal habitat of the black bear in southwest Florida (Brady and Maehr 1985, Maehr 1984, Maehr *et al.* 1988, Land 1994).

Bears are omnivores that feed on readily available food resources. Preferences for berries, insect larvae, the occasional small animal (frogs, mice, *etc*.), eggs, and wild honey can be satisfied in the mesic pine flatwoods environment. Fruits from cabbage palm, saw palmetto, and berry bushes, are consumed on a seasonal basis. Occasionally, young white-tailed deer and wild hog are taken as prey (Williams 1978a).

The southern limit of the **Sherman's fox squirrel** on the west coast of Florida includes the mesic pine flatwoods and riverine hardwood forests of Sarasota, Charlotte and northern Lee counties. Ehrhart (1978) and Kantola (1991) did not include its range to extend into southwest Florida, perhaps because its principal north and central Florida habitat is longleaf pine-turkey oak sand hills, a habitat not found in South Florida to any large extent. In South Florida, the mesic pine flatwoods and mixed flatwood-hardwood riverine forests are important habitats for this fox squirrel subspecies. Sherman's fox squirrels forage on male pine cones in winter and female pine cones during the summer. Acorns from a variety of oaks (live, laurel, and sand live), cabbage palm fruits, bromeliad buds, and insects are also consumed. All of these food sources are available in the mesic pine flatwoods of South Florida. Oak and hardwood hammocks, xeric sandhill ridges, and riverine forests adjacent to mesic pine flatwoods provide additional forage on a rotating seasonal basis. Nesting occurs in mesic pine flatwoods in pines, oak, and cabbage palms.

Big Cypress fox squirrel. *Original photograph by Grant Webber.*

The **Big Cypress fox squirrel** primarily utilizes flatwoods in South Florida. Mesic pine flatwoods understories that are maintained open by fire can provide a good forage for the fox squirrel. The fox squirrel forages on male pine cones in winter, and female pine cones during the summer. Male and female cones from cypress, cabbage palm fruits, bromeliad buds, and acorns are also consumed (Humphrey and Jodice 1991). Mature mangrove forest, oak and hardwood hammocks, and riverine hardwoods adjacent to mesic pine flatwoods provide additional forage on a rotating seasonal basis. Nesting occurs in upland and wetland habitats in pines, oaks, black mangrove, cypress, and cabbage palms; often in bromeliad clumps. The Big Cypress fox squirrel is not observed in pine flatwoods dominated by a thick saw palmetto understory, monocultural dense melaleuca forest, Brazilian pepper forest, Australian pine stands, and man-made habitats that do not possess a superabundance of food. Maintaining large, unfragmented areas of mesic pine flatwood is important to the long-term survival and recovery of this charismatic mammal.

The **Florida weasel** has been recorded in the mesic pine flatwoods of South Florida (Brown 1978c). The species is naturally rare (Brown 1972) and has been, based on records, for the last 100 years. The species also uses hydric and xeric pine flatwoods, cabbage palm and live oak hammocks, and swamps in its range. Surveys for the Florida weasel (Hovis 1993) continue to confirm its rarity.

The **red-cockaded woodpecker** in South Florida utilizes mesic pine flatwoods as nesting and foraging habitat (Beever and Dryden 1992, Duever *et al.* 1986, D. Jansen, NPS personal communication 1991). The territories of red-cockaded woodpeckers in mesic slash pine flatwoods of South Florida are documented to be larger than reported for northern birds (Nesbitt *et al.* 1983, Patterson and Robertson 1981). Of the 123 known red-cockaded woodpecker colonies in southwest Florida, 24 colonies are located in healthy mesic slash

pine flatwoods (Beever and Dryden 1992). Historically, a greater number may have been present in mesic pine flatwoods but loss of habitat to logging and urban and agricultural development severely constrains the availability of mature forests. Subsequent forest regrowth is typically harvested on 20 to 40 year rotations that do not allow the establishment of a mature forest necessary for the creation of start holes and cavities. Fire exclusion, coupled with fast rotation for pulpwood has rendered significant acreages of mesic pine flatwoods unsuitable for use by the red-cockaded woodpecker.

Bald eagles (*Haliaeetus leucocephalus*) utilize the pines of mesic pine flatwoods of South Florida as nest trees, particularly where this community is located adjacent to an estuarine, riverine, or lacustrine foraging area. Large, mature trees capable of supporting the heavy nests are preferred nesting sites. Bald eagles often remain in mesic pine flatwoods year-round. In some areas of South Florida, large groups of eagles soar on thermals during the fall and spring migrations and gather over large pine flatwoods forests inland from the coast (Beever and Dryden 1998). Without large pine trees, eagle nesting would drop precipitously in South Florida.

Audubon's crested caracara have been observed to utilize open mesic pine flatwoods areas in South Florida in Sarasota, Charlotte, DeSoto, Hardee and Highlands counties during cooler months. Caracaras probably approach the mesic pine flatwoods in a coarse-grained landscape approach. Clusters of mesic cabbage palm seem to be important as a focus for this seasonal foraging by this prairie bird species.

The **Florida sandhill crane** (*Grus canadensis pratensis)* prefers wet prairies, marshy lake margins, low-lying pasture, open marsh, and shallow flooded open areas (Williams 1978b). Sparsely canopied mesic pine flatwoods adjacent to ponds and marshes provide nesting and foraging habitat for sandhill cranes and their young throughout the nesting and fledgling period. In contrast, unburned mesic pine flatwoods are not utilized.

The **southeastern American kestrel** (*Falco sparverius paulus)* is a small falcon that utilizes open habitat for foraging and nests in tree cavities, typically abandoned woodpecker holes in pine trees. The kestrel utilizes tall pine trees, often snags, power and telephone poles and wires, and other tall objects. The kestrel feeds on large insects and, occasionally, on small rodents, reptiles, and birds (Wiley 1978). The mesic pine flatwoods of southwest Florida provide shelter, as well as habitat for reproduction and foraging for the kestrel. The observed foraging areas for these birds often extend to adjacent open habitats, such as pasture, both wet and dry prairies, and mowed roadway edges.

The **eastern indigo snake** utilizes a wide variety of habitats in South Florida, including mesic pine flatwoods, tropical hammocks, and xeric areas (Kochman, 1978). Where available, gopher tortoise (*Gopherus polyphemus*) burrows are utilized as shelter. Eastern indigo snakes occur in mesic pine flatwoods in South Florida throughout the year in the moister areas. The abundant amphibian and reptilian fauna of mesic pine flatwoods are important to the diet of this wide-ranging reptile.

The **gopher tortoise** utilizes dry, well-drained soils with areas of open, herbaceous understory (Auffenberg 1978). In South Florida, gopher tortoise burrows typically are found in xeric and mesic coastal ridges of the Silver Bluff terrace, including coastal scrub, dry tropical hammock, live oak hammock, and pine flatwoods. In most of South Florida, these perennially dry habitats exist as islands surrounded by reticulate hydric habitats. The gopher tortoises that utilize natural mesic pine flatwoods often construct wet season burrows in dry, upland ridge islands. In drained mesic pine flatwoods, gopher tortoises construct dry season burrows in the flatwoods. The gopher tortoise forages in both the upland ridge and the adjacent mesic pine flatwoods when water levels recede and throughout the dry season. The gopher tortoise forages on the grasses, herbs, fruits, and berries provided by the understory of fire-maintained mesic pine flatwoods. Gopher tortoise densities in mesic pine flatwoods are limited by the extent of upland suitable for year-round burrow use and the availability of forage.

The **gopher frog** (*Rana capito*) utilizes gopher tortoise burrows, mouse burrows, stump holes, post holes, and crayfish holes in mesic pine flatwoods. In the breeding season, gopher frogs congregate at night in shallow vegetated ponds to breed (Fogarty 1978b). Mesic pine flatwoods ponds provide such breeding habitat at the appropriate time, adjacent to the xeric scrub habitats where adult gopher frogs are found more frequently.

Plant Species of Concern

Federally listed plant species that are reported to occur in mesic pine flatwoods in South Florida include: beautiful pawpaw (*Deeringothamus pulchellus*), and Carter's mustard (*Warea carteri*). Biological accounts and recovery tasks for these species are included in "The Species" section of this recovery plan. Many rare plant species, including ferns, orchids, midstory trees, and herbaceous monocots and dicots are found in mesic pine flatwoods with natural hydrology and fire regime.

Carter's large-flowered flax (*Linum carteri* var. *smallii*) is an annual plant that occurs throughout South Florida in Miami-Dade, Collier, Monroe, Hendry, Martin, Palm Beach, Broward, and Charlotte counties. This species is shade-intolerant and prefers moist but not inudated soils. This variety can be distinguished from the related *L. c*. var. *carteri* by its smooth stems, taller habit, and its overall larger flower petals. *Linum carteri* var. s*mallii* has demonstrated a tolerance to human disturbance by persisting along roadsides. This species is under threat by development of its habitat. This variety is known from fewer than 10 occurrences. The State of Florida has listed *Linum carteri* var. *smallii* as an endangered species.

Coastal vervain (*Verbena maritima*) is a perennial herb that utilizes mesic pine flatwoods on the east coast of Florida. The South Florida counties where it is known include: Miami-Dade, Palm Beach, Indian River, Collier, St. Lucie, Hendry, and Martin. Other counties include: Brevard, Volusia, Flagler, and Levy. This shade-intolerant plant prefers sandy clearings that are maintained by fire and wind. This species is being threatened by development and exotic plant invasion such as by Australian pine (*Casuarina equisetifolia*). The State of Florida has listed *Verbena maritima* as an endangered species.

Ecology

Hydrology

The flat topography, sandy soils, and the seasonal precipitation cycle are the principal influences of mesic pine flatwoods hydrology. The flat topography, a result of Pleistocene geology, creates minimal gradients, resulting in sufficient time for percolation, soil saturation and slow runoff that occasionally creates very poorly defined first-order streams and typically results in sheetflow patterns if water becomes high. Where hardpan is present, water moves slowly vertically relative to horizontal movement, through horizons above and below the hardpan layer. Mesic pine flatwoods soils then become waterlogged and poorly aerated during the rainy season. This results in the saturated soils typical of unaltered, undrained mesic pine flatwoods. During the dry season, high evapotranspiration draws most of the water out of the upper soil horizons, drying them out. Soil moisture becomes depleted in the upper soil layers, above the hardpan, and a persistent drought condition frequently prevails through the dry season. As a result, during the dry season, groundwater is inaccessible for plants that cannot penetrate hardpan (FNAI 1989).

Water depths in mesic pine flatwoods vary throughout the seasonal hydrologic cycle. Extreme ranges are from just below the surface to 2.4 m (8 feet) below ground surface. Typical ranges are from 0.15 m to 0.30 m (6 inches to 1 foot) below ground surface at the height of the wet season to 1.8 m (6 feet) below ground surface in the late dry season. For most of the year, undrained mesic pine flatwoods have water within 1.2 m (4 feet) below the ground surface (Abrahamson and Hartnett 1990).

Fire

The mesic pine flatwoods is a fire climax, hydroperiod-mediated community (Wade *et al.* 1980). In pre-Columbian times, fires probably occurred in the mesic pine flatwoods every 3 to 10 years. Nearly all plants and animals of the mesic pine flatwoods are adapted to periodic fires (FNAI 1989). While natural fires were numerous, the areal extent of any given fire was probably small [10 ha (25 acres) or less]. Most fires occurred at the end of the dry season. This pattern of patch fires creates a mosaic of plant and habitat diversity, as opposed to a monopyric, even-aged plant community. Frequent, low-intensity surface fires generally characterize the fire regime. Historical evidence suggests that a fire frequency of 1 to 3 years is necessary to maintain this community (Ware, Frost, and Doerr 1993). The chances that a severe, crown-killing fire will occur increase as the fire frequency decreases (Christensen 1988).

South Florida slash pine seedlings have a grass stage that, like longleaf pine, greatly increases resistance to fire damage. Fire stimulates slash pine seedlings to sprout, promoting their growth as pioneers of burned land. Adult South Florida slash pines are also more resistant to fire than are northern slash pines (Wade *et al.* 1980, Ketcham and Bethune 1963). South Florida slash pine possesses longer tap roots and smaller needle size than do the northern slash pine (McNab 1965, McMinn 1970).

Much of the variation in community structure of mesic pine flatwoods is probably associated with fire frequency. The longer the period since the last fire, the more developed the understory shrub layer. If the understory is allowed to grow too long without fire, the accumulated needle bed and the height of flammable understory shrubs increases the probability of catastrophic canopy fires (FNAI 1989). If fires are very frequent, slash pine seedling regeneration will not occur, and the mesic pine flatwoods will tend to be dominated by a herbaceous understory of wetland species with clusters of cabbage palms forming a mesic cabbage palm prairie (Wade *et al.* 1980).

Less fire tolerant plant community components have refugia in the deeper waters found in pineland ponds and adjacent cypress strands. With overdrainage, fire refugia are lost. This typically results in decreases in the midstory and tropical components of South Florida mesic pine flatwoods with subsequent losses in plant species diversity. If overdrainage is coupled with too-frequent fire, and a melaleuca seed source is nearby, the mesic pine flatwoods can become dominated by the melaleuca monocultures typical of south Lee and northern Collier Counties (Wade *et al.* 1980).

Without regular fires, mesic pine flatwoods are expected to succeed into hardwood dominated forests with a closed canopy, eliminating groundcover herbs and shrubs (Alexander 1967, FNAI 1989). After approximately 6 to 10 years of fire absence, perennial plants that are normally set back by fire attain larger size. An increase in ground cover results from the presence of fewer, but larger, individual plants. These individual plants are subsequently shaded out by other plant species that would normally be killed by fire. This results in an increase in cover, but a decrease in plant species diversity. In general, fire exclusion from mesic pine flatwoods results in species loss, decreased forage quantity and quality for herbivorous species, and subsequently for their predators, increased danger from wildfires, and decreased pine regeneration (Wade *et al.* 1980).

Mesic pine flatwoods systems that have had hydroperiod drainage and/or fire exclusion, such as Golden Gate Estates in Collier County, appear to accumulate litter loads quickly, resulting in plant diversity degradation to disturbed and exotic-invaded conditions, declines in tree recruitment, and subsequent wildfires (Beever and Dryden 1998).

Status and Trends

Land Conversion/Development

An analysis of vegetation types most impacted by human land conversion indicates that statewide only 36 percent of the pine flatwoods remain (64 percent loss). Interestingly, this is the same proportionate loss as for pine rocklands. South Florida pine flatwoods are among the least protected habitats by the current distribution of public land managed areas with only 9 percent protected. This is proportionately less than for longleaf pine-xeric oak sandhills (14 percent) and sand pine scrub (35 percent); habitats typically advocated for protection as under-represented on preserve lands (Cox *et al.* 1997).

The mesic pine flatwoods of southwest Florida were not a rare habitat historically, occupying approximately 3,078,361 ha (7,606,525 acres) of South Florida pine flatwoods (Davis 1967). Using a conservative estimate that one-third

of these flatwoods were mesic, historically there would have been approximately 1,026,120 ha (2,535,508 acres) of mesic pine flatwoods. As a group, xeric, mesic, and hydric pine flatwoods were reduced to approximately 50 percent of their historic extent by 1970 (Birnhak and Crowder 1974) as a result of agricultural activities, speculative real estate clearing, and urban development. Wade *et al.* (1980) reported that in 1980, pine flatwoods occupied more area in South Florida than any other kind of plant community except the Everglades marsh. By 1989, GFC mapping of South Florida (Kautz 1993) indicated that pine flatwoods had dropped to fifth in areal extent (acres) behind grasslands, cypress swamp, dry prairies, and freshwater marsh. This study indicated that, for the first time, urban areas occupied more acreage in South Florida than did pine flatwoods. By 1989, there were only 2,648,850 ha (6,545,219 acres) of pine flatwoods in the entire State of Florida (Cox *et al.* 1994).

Flatwoods dominated by longleaf pine are part of the larger longleaf pine-wiregrass ecosystem that was once dominant throughout the southeastern coastal plain of North America. The distribution of this ecosystem has been reduced by approximately 85 percent (or by 99.9 percent if old growth examples are included). At the time of European settlement, longleaf pine communities covered at least 24 to 38 million ha; today these communities cover less than 4 million ha, and most of this is second growth and degraded (Noss 1988).

As of 1996, 1,077,279 ha (2,661,919 acres) of South Florida pine flatwoods existed, with 269,345 ha (665,542 acres) present in public managed areas (Cox *et al.* 1997). Based on the 1989 distribution of pine flatwoods in coastal southwest Florida (Collier, Charlotte, and Lee counties) approximately 40 percent was mesic pine flatwoods (Beever and Dryden 1998). This would calculate to 430,912 ha (1,064,767 acres) of mesic pine flatwoods in South Florida in 1996.

If mesic pine flatwoods are not protected, they will be converted to urban, suburban, and agricultural development within a relatively short time period. Habitat destruction of mesic pine flatwoods and adjacent habitats is the primary threat to the Big Cypress fox squirrel (Brown 1973, 1978). Large-scale commercial and residential development of mesic pine flatwoods west of the Big Cypress National Preserve (BCNP) in the Naples area, conversion of mesic pine flatwoods to citrus north of the BCNP, and expansion of roadways through mesic pine flatwoods pose serious threats to habitat quality and quantity for the Big Cypress fox squirrel (Humphrey and Jodice 1991).

Many existing Developments of Regional Impact and other large projects in mesic pine flatwoods demonstrate the anticipated fate of the last extensive forested refuges in South Florida, and the endangered, threatened, and species of special concern that depend upon the mesic pine flatwoods for breeding, feeding, and wildlife corridors.

Hydrologic Alteration

The most common form of hydrologic alteration of mesic pine flatwoods is ditching to lower the annual water table for agriculture or construction. Deeper regional canals, such as those in Golden Gate Estates (Collier County), can lower the water table on a regional scale for the purposes of land development. This widespread practice substantially eliminates normal mesic flatwoods hydrology from large areas of South Florida including large platted

subdivisions in the City of North Port, Port Charlotte, City of Cape Coral, Lehigh Acres, South Fort Myers, Golden Gate Estates, Sebastian Highlands and the older parts of Port St. Lucie.

Another commonly encountered form of hydrologic alteration is small levees or berms created as a byproduct of ditching, placed as part of road or other linear construction to elevate the path above wetland grade, and intentional barriers designed as part of surface water management systems to retain all waters on a site as part of a development process. These permit-required water management structures dam sheetflow, redirect sheetflow into rapid discharge channels or stormwater retention and detention areas. The berms can simultaneously drown upstream mesic pine flatwoods (creating a deeper water wetland type), while denying sheetflow to downstream areas (creating a drier type of flatwoods). These blocks to sheetflow, coupled with inadequate culverting, are often the cause of significant flooding to both natural areas and human property. These structures significantly fragment regional hydrology and alter landscape flow into coastal estuaries.

Other types of hydrologic alterations to mesic pine flatwoods include water table drawdown by wellfields and surface mine excavation. Due to the permeable substrates that underlie mesic pine flatwoods, changes in surficial aquifer levels can rapidly translate into a drop in the water table. Mines and borrow pits, particularly those that operate pumps to accommodate excavation, can lower local water levels within a mesic pine flatwood. Wellfield pumping can, at significant levels of withdrawal, dry out mesic pine flatwoods, changing plant community structure and susceptibility to exotic invasion.

Substrate Disturbance, Exotic Plant Invasion, and Exotic Animals

Mesic pine flatwoods soils tend to be sandy with shallow, if any, organic layers. Productivity export and incorporation appear to be extremely efficient in natural mesic pine flatwoods, since bare, sandy soil surfaces are the norm in undisturbed mesic pine flatwoods systems, indicating that natural systems do not accumulate significant bed loads of litter. Simple physical disturbance of the surface by vehicles, plows, unimproved roads, excavations, exotic animals, fill, excavation, explosions, and seismic testing can leave an area with a slightly different elevation, altered soil nutrients, and different soil horizons that when revegetated, can be sites of weedy or exotic plant establishment. The first entry of exotic plants into a mesic pine flatwood area can often be along jeep trails, along plowed fire lanes, at the toe of fill roadways, along cleared utility easements, around borrow pits, where wild hogs have rooted, and along rock mine survey grid lines.

If substrate disturbance is coupled with fire exclusion and drainage, it is almost inevitable that Brazilian pepper or melaleuca will become established in the mesic pine flatwood. Mesic pine flatwood systems that have had hydroperiod alterations and/or fire exclusion coupled with substrate disturbance, such as Golden Gate Estates (Collier County), appear to accumulate litter loads quickly, resulting in plant diversity degradation with invasion by opportunistic species such as cabbage palm and grape vine, accelerated exotic plant invasion, declines in pine tree recruitment, and increases in wildfire.

Mesic pine flatwoods that are cleared of native vegetation but are not otherwise altered in hydrology or fire-frequency may return to mesic pine

flatwoods floristics, but typically will include exotic plant species in areas of substrate disturbance. Activities that increase the susceptibility of pine flatwoods to invasion by exotic species include rooting by hogs, fire suppression, clearings for wildlife food plots, fire plow lines, and revegetation (Martin *et al.* 1996).

Of the 482 plant species documented or recorded from the mesic pine flatwoods of South Florida, 25 (5 percent) are exotic, introduced species. Most of the introduced species are not invasive under natural hydrology and fire frequency. The principle invasive species include Brazilian pepper, melaleuca, and downy rosemyrtle.

There is some debate concerning the relative habitat values of exotic plant dominated landscape. While the presence of a few individual plants does not constitute a major community threat, solid monocultures have demonstrably negative effects on plant and animal community diversity. When exotics replace natives, plant and animal species that depend upon those natives are similarly impacted. Thresholds are not yet well understood and both under- and over-estimation of exotic plant invasion effects is common.

Exotic animals identified in South Florida mesic pine flatwoods include: wild hog (*Sus scrofa),* armadillo (*Dasypus novemcinctus),* feral dogs, feral cats, coyote (*Canis latrans),* Cuban tree frog (*Osteopilus septentrionalis),* the brown anole (*Anolis sagrei),* other exotic amphibians and reptiles, and red-imported fire ants. Wild hogs and to a lesser extent, armadillos, can change understory composition through substrate disturbance. This can negatively affect listed groundcover plant species and provide opportunities for exotic plant invasion. Feral hog activity kills plants directly, increases soil erosion, and facilitates weed and exotic species invasion (Martin *et al.* 1996). Cuban tree frogs are predators on native, smaller tree frog species and have been demonstrated to displace native species in urban and agricultural settings. Feral cats and dogs have been demonstrated to significantly impact small mammal, ground-nesting bird, and songbird populations in Florida and throughout the United States. Fire ants have become a problem for small animals including ground-nesting birds and some tree-nesting bird and mammal species as well. The effect of coyote on South Florida ecosystems and food webs is currently unknown. There have been various reports of benefits (predation on feral cats and dogs, wild hogs and armadillos) and problems (predation on gopher tortoises and ground-nesting birds, competition with native medium-sized predators). So far no organized strategies to address exotic predators in mesic pine flatwoods have been developed. The spread of exotic animals into native mesic pine flatwoods has been assisted by fragmentation of the landscape by roadways, canals, agricultural and suburban development. It is clear that the greater the amount of developed edge areas relative to core areas of mesic pine flatwoods, the greater the potential for exotic animal invasion of the habitat.

Extractive Land Use

Logging of the South Florida mesic pine flatwoods began in the 1920's and continued through World War II. Following logging, the understory components recovered quickly, depending on the level of altered hydroperiod. Pine recovery was slow in upland areas of mesic pine flatwoods (Wade *et al.* 1980). Several

factors contributed to this pattern: (1) upland pine areas were easier to deforest utilizing early twentieth-century techniques; (2) slash pine has less fire protection in mesic pine flatwood hydrologic conditions than in hydric conditions; and (3) in the absence of fire, the thick cover of saw palmetto reduces slash pine seedling growth and survival in fires.

Mesic pine flatwoods display a resilient recovery from overstory damage due to fire or clearcutting, if the natural hydrology and fire regime are allowed to continue. Recovery is poor when hydrology or ground cover is disturbed. While drainage may result in a shift toward more slash pine density, overdrainage can result in conditions too dry for slash pine establishment and survival in areas of previous slash pine dominance. The result has been an increase in the area of palmetto-dominated prairie from historic conditions prior to logging and drainage (Wade *et al.* 1980).

Overdrainage and pasture conversion has changed the South Florida landscape from pine flatwoods to one dominated by rangeland. Cattle ranching in the South Florida mesic pine flatwoods began immediately with the American settlement of South Florida. Calf raising and associated pasture for stock and dairies continues today, particularly in central South Florida. Drainage for range was a common practice and was encouraged by cooperative extension and farm programs from the 1920s until the 1970s. Following light grazing, the understory components of mesic pine flatwoods recover quickly, depending on the level of altered hydroperiod. Mesic pine flatwoods display a resilient recovery from grazing, if the natural hydrology and fire regime are allowed to continue and exotic, improved pasture grass species are not introduced. Recovery is poor when hydrology or ground cover is disturbed by improved pasture management. Drainage of mesic pine flatwoods has resulted in expansion of improved pasture and decreases in plant diversity, and subsequently wildlife diversity in South Florida. Mesic pine flatwoods converted to improved pasture or subject to high grazing pressure are also very susceptible to exotic invasion by range pests such as the exotic tropical soda apple and cogon grass (FNAI 1989). Management for domestic livestock grazing can result in alteration of soil properties and vegetation structure. In areas that have been grazed for long periods of time, soil becomes compacted, reducing water infiltration and percolation (Myers and Ewel 1990).

Saw palmetto berry gathering for pharmaceuticals has recently become a new extractive use of palmetto understory in mesic pine flatwoods. The effect of hand-harvesting tons of palmetto berries from this system is not currently known. Palmetto berries are important food for many wildlife species, including listed mammal species such as Florida black bear. The saw palmetto is also an important understory component for providing cover for prey species. It is not known if a significant number of berries are being removed, if berry-consuming wildlife is finding sufficient forage, or if berries are germinating sufficiently enough to maintain saw palmetto populations.

Waste Disposal and Nutrient Enrichment Issues

Mesic pine flatwoods are subject to a variety of waste disposal uses in South Florida. Landfills in southwest Florida have been uniformly sited in mesic pine flatwoods (Sarasota, Charlotte, Lee, and Collier counties). This invariably involves complex construction, water management, and containment systems

to prevent leachate discharge to adjacent areas. Such sites can become attractors to species found in mesic pine flatwoods, particularly Florida black bear and bald eagles. This in turn results in nuisance situations, mortality from toxins, unnatural population concentrations, and mortality from exposure to human-dominated landscapes (roadkills, power line collisions, and poaching). Fertilization in pine flatwoods may have drastic effects on these communities because they are naturally low in nutrients, and weedy species are likely to invade following nutrient enrichment (Martin *et al.* 1996). Also, Walker and Peet (1983) reported that an increase in productivity resulting from fertilization should lead to a decline in plant species richness, including a decline in rare plant species richness. It is not known whether fertilization will lead to replacement of rare species by more competitive species able to thrive under fertilized conditions. Fertilization can be carried to the aquatic habitat via runoff (Martin *et al.* 1996).

Most mesic pine flatwoods in South Florida that are accessible by vehicles and not patrolled by public or private on-site managers are subject to extensive dumping of yard debris, construction materials, large objects including vehicles and white goods, chemicals, and basic domestic garbage. This results in direct habitat degradation, exotic plant invasion, and water quality pollution. Dispersed rural and semi-suburban development in mesic pine flatwoods areas of South Florida are typically served by septic tank systems that are designed to leach into drain fields in the permeable sands of the mesic pine flatwoods. During annual wet season high water and other flood events, septic systems become saturated and both surface ground water and surface waters display pollution from fecal coliform bacteria, indicative of waste pollution.

Agricultural lands, including high- intensity cattle operations, display surface water fecal coliform bacteria, indicative of waste pollution from cattle waste. The practice of land spreading sludge from sewage treatment plants and septic systems over rangeland to “enhance” the low nutrient levels of mesic pine flatwood sands introduces nutrients and bacterial contamination into highly permeable and easily leached soils. Agricultural lands adjacent to mesic pine flatwoods also may discharge nitrified runoff to mesic pine flatwoods and other wetlands.

Recreational Damage

The activities of off-road vehicles can significantly alter the substrate of mesic pine flatwoods, altering hydrology and encouraging exotic plant invasion on the disturbed soils. Trash and debris from recreational activity is common on unmanaged areas, including food and beverage packaging, items brought in as targets for shooting, and other discarded items including monofilament, rubber, and plastic products.

Significant debate is ongoing concerning the impacts of some hunting activities on the wildlife and landscape of mesic pine flatwoods, including where off-road vehicles are used for access and for certain types of hunting where dogs are used.

Management

Management issues for mesic pine flatwoods include consideration of size and fragmentation, fire ecology, hydrology, substrate disturbance, exotic plant invasion, exotic animals, extractive land use, recreational uses, and effects of resource mitigation policy.

Management of Size and Habitat Fragmentation

Management to maintain and restore the high level of biodiversity found in mesic pine flatwoods is best achieved on large, intact, contiguous tracts of land composed of mesic pine flatwoods and of other native habitats. The habitat reticulation of xeric, mesic, and hydric pine with seasonal marsh, ponds, cypress and mixed hardwood swamp strands, and various hardwood and palm hammocks, maintained by fire and a dendritic sheetflow hydrology provides a self-sustaining community diversity that provides niches for innumerable species. Mesic pine flatwoods are not maintainable nor sustainable in small, "postage stamp" isolates that may be cut off from sheetflow hydrology, excluded from fire, subject to substrate disturbance, suffering significant edge effect, and vulnerable to exotic plant and animal invasion.

Managing mesic pine flatwoods is an issue of landscape ecology. Most existing public and private lands with intact, healthy mesic pine flatwoods and healthy biodiversity are large multi-square mile parcels. Current land acquisition and land protection proposals include protection of other existing large parcels, connection of existing and proposed parcels, and expansion of existing parcels to attain larger landscape size. This is functionally necessary to achieve the long-term persistence of the mesic pine flatwoods habitat type in South Florida and to achieve multi-species recovery in South Florida. Wide-ranging animals such as the Florida panther, Florida black bear, red-cockaded woodpecker, migratory birds, eastern indigo snake, and fox squirrel need a variety of connected habitats over a wide area to complete life-cycle needs and maintain viable population levels in South Florida.

Fire Management

Burning to increase value to livestock and wildlife is a well-established practice in mesic pine flatwoods. It has been documented to increase range values and wildlife habitat (Komarek 1963, Stoddard 1963, Lewis 1964, Moore 1972, Hughs 1975). Different burn regimes favor different wildlife species. For example, quail are favored by 2-year rotational burns (Moore 1972) and turkey are favored by 3- to 4-year cycles (Stoddard 1963).

Little is known about the frequency and timing that is most beneficial to most of the rare species or some plant communities. There have been few studies conducted to assess whether early or late growing-season burns are most beneficial to the community. However, early growing-season burns have been recommended over late growing-season burns because: (1) lightning fires in South Florida are most common in early summer (June), and the largest number of acres are burned naturally during late spring and early summer; (2) studies suggest that early growing-season burns are more favorable to growth

and survival of longleaf pine seedlings and saplings than late growing-season burns; (3) early growing-season fires are more detrimental to hardwoods, which compete with pines for establishment (Robbins and Myers 1992).

Additionally, smoke and fire management considerations in South Florida are increasingly dictated by human population safety concerns. These concerns have promoted some winter burn schedules.

Natural fire breaks created by moisture or the lowest impact method (such as foam) should be used whenever possible to contain the fire. However it is usually necessary to prevent the spread of fires into adjacent plant communities, off-site, or roadways; therefore control lines should be established using existing trails, roads, or plow lines. In flatwoods, plow or control lines should be cut by disc to avoid disruption of hydrology (sheetflow). However, these lines may be subject to weedy or exotic plant invasion. Spot fires can be created by dropping plastic balls of potassium permanganate and antifreeze from a helicopter. The small intermittent fires created by this method will burn together before becoming too hot. However, this method may not be appropriate for rare species management because it can create uniform, even, landscapes. (Natural fire moves differently.) Fire should be allowed to spread into ecotones and adjacent wetlands.

It is important to maintain natural South Florida hydroperiods and a diverse fire management schedule to achieve the highest plant biodiversity for the system. Landscape scale burning performed on large areas has also achieved good results and areas are not forced to micro-manage burns.

Hydrologic Management

A commonly encountered form of hydrologic alteration to mesic pine flatwoods is small levees or berms placed across the landscape. Removal or installing multiple culverts in these man-made flow blocks can substantially restore mesic pine flatwoods hydrology while reducing flooding effects on human property.

Management of Substrate Disturbance, Exotic Plant Invasion, and Exotic Animals

Mesic pine flatwoods soils tend to be sandy with shallow, if any, organic layers. Physical disturbance of the surface can leave an area with a slightly different elevation, altered soil nutrients, and different soil horizons that when revegetated, can be sites of weedy or exotic plant establishment. If substrate disturbance is coupled with fire exclusion and drainage, it is almost inevitable that Brazilian pepper or melaleuca will become established in the mesic pine flatwood.

Mesic pine flatwoods that are cleared of native vegetation but are not otherwise altered in hydrology or fire-frequency may return to mesic pine flatwoods floristics, but typically will include exotic plant species in areas of substrate disturbance. Activities that increase the susceptibility of pine flatwoods to invasion by exotic species include rooting by hogs, fire suppression, clearings for wildlife food plots, fire plow lines, and revegetation (Martin *et al.* 1996)

Of the 482 plant species documented or recorded from the mesic pine flatwoods of South Florida, 25 (5 percent) are exotic, introduced species. Most

of the introduced species are not invasive under natural hydrology and fire frequency. The principal invasive species: Brazilian pepper, melaleuca, and downy rosemyrtle are able to persist and spread if hydrology is altered and fire is suppressed. Removal or control of invasive and non-invasive exotic plant species is achievable in the mesic pine flatwoods of South Florida by direct mechanical and chemical control, and restoration of hydroperiod and natural fire regimes. Successful projects on public and private lands utilize multiple strategies with long-term persistent management staffing and removal effort. The causes of alteration to the mesic pine flatwoods that encourage exotic plant invasion spread must be eliminated to achieve long-term eradication. If the causes are not addressed, then control is achievable only with repetitive persistent management. If management is suspended, gains can be quickly lost and exotic plants attain dominance.

Exotic animals known to occur in South Florida mesic pine flatwoods include: feral hog, armadillo, feral dogs, feral cats, coyote, Cuban tree frog, the brown anole, and fire ants. Feral hogs and armadillos can be managed by direct trapping and hunting. An alternative, concurrent strategy includes management for the natural predators of these species. So far no organized strategies to address exotic predators in mesic pine flatwoods have been developed. The spread of exotic animals into native mesic pine flatwoods has been assisted by fragmentation of the landscape by roadways, canals, agricultural and suburban development. It is clear that the greater the amount of developed edge areas relative to core areas of mesic pine flatwoods, the greater the potential for exotic animal invasion of the habitat.

Management for Extractive Land Use

Mesic pine flatwoods display a resilient recovery from overstory damage due to fire or clear-cutting, if the natural hydrology and fire regime are allowed to continue. Recovery is poor when hydrology or ground cover is disturbed.

Current best management practices for logging in the mesic flatwoods of South Florida utilize seed tree cutting strategies, rather than clear-cutting, but have relatively rapid 20- to 30-year rotations that eliminate all but a few of the mature old-growth trees, essential to red-cockaded woodpeckers. Removal of snags also reduces biodiversity in mesic pine flatwoods, as 53 different animal species depend upon the cavities found in the dead trees of mesic pine flatwoods.

Overdrainage and pasture conversion has changed the South Florida landscape from pine flatwoods to one dominated by rangeland. Following light grazing, the understory components of mesic pine flatwoods recover quickly, depending on the level of altered hydroperiod. Mesic pine flatwoods display a resilient recovery from grazing, if the natural hydrology and fire regime are allowed to continue and exotic, improved pasture grass species are not introduced. Recovery is poor when hydrology or ground cover is disturbed by improved pasture management.

Mitigation Policies

The mitigation policies of Federal, State and local regulatory agencies can significantly affect the management of mesic pine flatwoods of South Florida.

Those entities may encourage conversion of flatwoods into wetlands as mitigation for impacts to wetlands. Lower quality wetland preservation and enhancement is often preferred to the preservation of high quality upland habitats, including mesic flatwoods. This conversion of mesic flatwoods to wetlands typically fails because the necessary hydrology for the mitigation site is not achieved.

Restoration Science

To date, there has been no successful creation of mesic pine flatwoods from other landscapes. Successful restorations in existing mesic pine flatwoods have involved exotic plant and animal removal and control, restoration of hydrology, restoration of fire management, and removal of trash and debris.

Literature Cited

Abrahamson, W.G. and D.C. Hartnett. 1990. Pine flatwoods and dry prairies. Pages 103-149 *in* Ecosystems of Florida. University of Central Florida Press.

Alexander, T.R. 1967. A tropical hardwood hammock on the Miami (Florida) limestone-a twenty-five-year study. Ecology 48(5):863-867.

Ashton, R.E., Jr. and P. Sawyer Ashton. 1988. Handbook of reptiles and amphibians of Florida. Part one: The snakes. Part two: lizards and crocodilians. Part three: the amphibians. Windward Publishing Inc. Miami, Florida.

Auffenberg, W. 1978. Gopher tortoise. Pages 33-35. *in* McDiarmid, R.W. ed., Rare and endangered biota of Florida. Volume III, amphibians and reptiles. University Presses of Florida, Gainesville, Florida.

Bartram, W. 1791. "The Travels of William Bartram." M. Van Doren, ed. Dover, New York, 1955.

Beever III, J.W. and K.A. Dryden. 1992. Red-cockaded woodpeckers and hydric pine flatwoods, transactions of the 57th annual North American wildlife and natural resources conference pp. 693-700.

Beever III, J.W. and K.A. Dryden. 1993. The hydric pine flatwoods of southwest Florida, a community profile. Florida Game and Fresh Water Fish Commission, Office of Environmental Services. 119 pp.

Beever, J.W. III and K.A. Dryden 1998. The hydric pine flatwoods of southwest Florida: a community profile update. Office of Environmental Services, Florida Game and Fresh Water Fish Commission.

Belden, R.C. 1986. Florida panther recovery plan implementation--a 1983 Progress Report. Pages 159-172 *in* S.D. Miller and D.D. Everett eds. Cats of the world: biology, conservation and management. proceedings of the second international cat symposium. Caesar Kleberg Wildlife Research Institute. Kingsville, Texas.

Birnhak, B.I. and J.P. Crowder. 1974. An evaluation of the extent of vegetative habitat alteration in South Florida 1943-1970. South Florida environmental projects and. ecology. Report DI-SFEP-74-22. U.S. Department of Interior.

Bradley, J.T. 1972. Climate of Florida. Pages 45-70 *in* Climate of the states. Environmental Data Service, No. 60-8. Silver Springs, Maryland.

Brady, J.R. and D.S. Maehr. 1985. Black bear distribution in Florida. Florida Field Naturalist 13:1-7.

Brown, L.N. 1972. Florida's rarest carnivore. Florida Wildlife 25(11):4-6.

Brown, L.N. 1973. The everglades fox squirrel (*Sciurus niger avicennia*). pp. 222-223 *in* Threatened wildlife of the United States. U.S. Fish and Wildlife Service, Resource Publication 114.

Brown, L.N. 1978a. Mangrove fox squirrel. Pages 5-6 *in* J.N. Layne ed., Rare and endangered biota of Florida. Volume I. Mammals. University Presses of Florida, Gainesville, Florida.

Brown, L.N. 1978c. Florida weasel. Pages 38-39. *in* J.N. Layne ed., Rare and endangered biota of Florida. Volume I. Mammals. University Presses of Florida, Gainesville, Florida.

Campbell, L. 1991. Verbal Communication. Florida Game and Fresh Water Fish Commission, 29200 Tuckers Grade, Punta Gorda, Florida, 33955.

Carlisle, V. 1990. Soil survey procedures and locating soil areas in published surveys, and published soil surveys, maps, and mapping scale. Pages 51-57 *in* V.W. Carlisle, ed. hydric soils of Florida handbook. Florida Association of Professional Soil Classifiers, Gainesville, Florida.

Chen, C.S. 1965. The regional lithostratigraphic analysis of Paleocene and Eocene rocks of Florida. Florida Geological Survey, Geological Bulletin. No. 45., 150 pages.

Christensen, N.L. 1988. Vegetation of the southeastern coastal plain. Pages 317-363 *in* M.G. Barbour and W.D. Billings, eds, North American Terrestrial Vegetation. Cambridge University Press, New York.

Cox, J., R. Kautz, M. MacLaughlin, and T. Gilbert 1994. Closing the gaps in Florida's wildlife habitat conservation system, Florida Game and Fresh Water Fish Commission [GFC].

Cox, J., R. Kautz, M. MacLaughlin, and T. Hoehn 1997. Preservation 2000 Act study, biodiversity conservation analysis.

Cunningham, R.L. 1961. A field list of South Florida birds. The Little River Press, Inc. Miami, Florida.

Davis, J.H., Jr. 1967 General map of the natural vegetation of Florida. Circular S-178, Institute of Food and Agricultural Sciences, Agricultural Experiment Station, University of Florida, Gainesville.

Drew, R.D. and N.S. Schomer. 1984. An ecological characterization of the Caloosahatchee River/Big Cypress Watershed.

Duever, M.J., J.E. Carlson, L.H. Gunderson, and L.C. Duever. 1976. Corkscrew Swamp, a virgin strand, ecosystems analysis at Corkscrew Swamp. Pages 707-737 *in* H. T. Odum, ed. Cypress wetlands. 3rd annual report on research projects. Nov. 1975-Dec. 1976. Center for Wetlands, University of Florida, Gainesville.

Duever, M.J., J.E. Carlson, J.F. Meeder, L.C. Duever, L.H. Gunderson, L.A. Riopelle, T.R. Alexander, R.F. Myers, and D.P. Spangler. 1979. Resource inventory and analysis of the Big Cypress National Preserve. Final report to the U.S. Department of the Interior, National Park Service. Center for Wetlands, University of Florida, Gainesville and National Audubon Society, Naples, Florida.

Duever, M.J., J.E. Carlson, J.F. Meeder, L.C. Duever, L.H. Gunderson, L.A. Riopelle, T.R. Alexander, R.F. Myers, and D.P. Spangler. 1986. The Big Cypress National Preserve. Research report no. 8 of the National Audubon Society. National Audubon Society, Naples, Florida.

Ehrhart, L.M. 1978. Sherman's fox squirrel. pages 17-18 *in* J.N. Layne ed., rare and endangered biota of Florida. Volume I. Mammals. University Presses of Florida, Gainesville, Florida.

Florida Department of Natural Resources [FDNR]. 1989. Collier-Seminole State Park Resource Inventory.

Florida Department of Natural Resources [FDNR]. 1990. SWFAP resource inventory for the Ten Thousand Islands Aquatic Preserve. Computer database dBase III.

Florida Department of Transportation [FDOT]. 1985. Florida land use, cover and forms classification system [FLUCCS].

Florida Natural Areas Inventory [FNAI]. 1989. Natural Communities. *In* Guide to the Natural Communities of Florida.

Fogarty, M.J. 1978b. Florida gopher frog. Pages 5-6 *in* McDiarmid, R.W. ed., rare and endangered biota of Florida. Volume III. Amphibians and reptiles. University Presses of Florida, Gainesville, Florida.

Hardin, E. D., and D. L. White. 1989. Rare vascular plant taxa associated with wiregrass (*Aristida stricta*) in the Southeastern United States. Natural Areas Journal 9:234-245.

Hovis, J.A. 1993. Distribution of the long-tailed weasel in Florida. Florida Field Naturalist 21:101-128.

Hughs, R.H. 1975. The native vegetation of South Florida related to month of burning. U.S. Department of Agriculture. Forest Service research note SE-222. Southeast Forestry Experiments Station, Asheville, North Carolina.

Humphrey, S.R. and P.G.J. Jodice. 1991. Big Cypress fox squirrel. Pages 225-234 *in* S.R. Humphrey ed., rare and endangered biota of Florida. Volume I. Mammals. University Presses of Florida; Gainesville, Florida.

Jansen, D. 1991. Verbal communication, National Park Service, Big Cypress National Preserve, S.R. 110, Ochopee, Florida, 33943.

Kale, H.W. and D.S. Maehr 1990. Florida's birds. Pineapple Press, Sarasota, Florida. 288 pages.

Kantola, A.T. 1991. Sherman's fox squirrel. Pages 234-241 *in* S.R. Humphrey ed., rare and endangered biota of Florida. Volume I. Mammals. University Presses of Florida; Gainesville, Florida.

Kautz, R. S. 1993. Trends in Florida wildlife habitat 1936-1987. Florida Scientist 56:7-24.

Ketcham, D.E. and J.E. Bethune. 1963. Fire resistances of South Florida slash pine. Journal of Forestry 61:529-530.

Klein, H., W.J. Schneider, B.F. McPherson, and T.J. Buchanan. 1970 Some hydrologic and biologic aspects of the Big Cypress Swamp drainage area. U.S. Geological Survey [USGS] Open-File Report. 70003.

Kochman, H.I. 1978. Eastern indigo snake. Pages 68-69 *in* McDiarmid, R.W. ed., rare and endangered biota of Florida. Volume. III. Amphibians and reptiles. University Presses of Florida, Gainesville, Florida.

Komarek, R. 1963. Fire and changing wildlife habitat. Procedings Tall Timbers fire ecology conference [Tallahassee, Florida March 1963]2:35-43.

Laessle, A.M. 1942. The plant communities of the Welaka area with special reference to the correlation between soils and vegetational succession. Biological Sciences Series 4. University of Florida Publication, Gainesville.

Land, E.D. 1994. Southwest Florida black bear habitat use, distribution, movements, and conservation strategy. Final report. study number:7552.

Langdon, O.G. 1963. Growth patterns of *Pinus elliottii var. densa*. Ecology 44:825-827.

Layne, J.N. 1974. The land mammals of South Florida. Pages 386-413 *in* P.J. Gleason, (ed.) Environments of South Florida: present and past. Miami Geol. Soc. Mem. 2.

Layne, J.N. 1978. Sherman's short-tailed shrew. Pages 42-43. *in* J.N. Layne (ed.), Rare and endangered biota of Florida. Volume I. Mammals. University Presses of Florida, Gainesville, Florida.

Layne, J.N. and M.N. McCauley. 1976. Biological overview of the Florida panther. Pages 5-45 *in* P.C.H. Pritchard ed. Proceedings of the Florida panther conference. Florida Audubon Society.

Layne, J.N., J.A. Stallcup, G.E. Woolfenden, M.N. McCauley, and D.J. Worley. 1977. Fish and wildlife inventory of the seven-county region included in the central Florida phosphate industry area wide Environmental Impact Study. U.S. National Technical Institute of Science. PB-287 456, 3 volumes.

Lewis, C.E. 1964. Forage response to month of burning. U.S. Dept. Agriculture, Forest Service, research. note SE-35, 4 pp. Southeast Forest experimental station., Asheville, North Carolina.

Little, E.L., Jr. and K. N. Dorman. 1954. Slash pine (*Pinus elliottii*) including South Florida slash pine, nomenclature and description. U.S. Forest Service Southeast Forest experimental station.

Long, R.W. 1974. The vegetation of southern Florida. Florida Scientist 37 (1):33-45.

Maehr, D.S. 1984. Distribution of black bears in eastern North America. Procedings eastern workshop black bear. 7:74.

Maehr, D.S., J.N. Layne. E.D. Land, J.W. McCowan, and J. Roof. 1988. Long distance movements of a Florida black bear. Florida Field Naturalist 16:1-6.

Maehr, D.S. 1991. Verbal communication. Florida Game and Fresh Water Fish Commission, 566 Commercial Boulevard, Naples, Florida, 34104.

Martin, C.O., Fischer, R.A., Harper, M.G., Tazik, D.J., and Trame, A. 1996. Regional strategies for managing threatened and endangered species habitats: A concept plan and status report, technical report SERDP-96-1, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

McMinn, J.W. 1970. Optimum depth and season for direct seedling slash pine in South Florida. U.S. Department of Agriculture, Forest Service research note SE-73. Southeast Forest Experimental Station., Asheville, North Carolina.

McMinn, J.W. and W.H. McNab. 1971. Early growth and development of slash pine under drought and flooding. U.S. Department of Agriculture, Forest Service research note SE-89. Southeast Forest Experimental Station, Asheville, North Carolina.

McNab, W.H. 1965. Response to drought and flooding of two varieties of slash pine in South Florida. M. S. thesis (unpublished), University of Florida, Gainesville.

Mirov, N.T. 1967. The genus *Pinus*. Ronald Press, New York.

Moore, W.H. 1972. Managing bobwhites in the cutover pinelands of South Florida. *In* first national bobwhite quail symposium proceedings 1972:56-65. Stillwater, Oklahoma.

Myers, R.L., and Ewel J.J. 1990. Ecosystems of Florida. University of Central Florida Press, Orlando, Florida.

Nesbitt, S.T., A.E. Jerauld, and B.A. Harris. 1983. Red-cockaded woodpecker summer range sizes in southwest Florida. Pages 68-71 *in* proceedings of the red-cockaded woodpecker symposium II, Florida Game and Fresh Water Fish Commission.

Noss, R.F. (1988). The longleaf pine landscape of the southeast: Almost gone and almost forgotten, Endangered Species Update 5(5):1-8.

Ober, L.D. 1954 Plant communities of the flatwoods forests of the Austin Cary Memorial Forest. M.S. thesis (unpublished), University of Florida, Gainesville.

Patterson, G.A. and W.B. Robertson, Jr. 1981. Distribution and habitat of the red-cockaded woodpecker in Big Cypress National Preserve. South Florida Research Center report T-613. 137 pages.

Robbins, L.E. and Myers, R.L. (1992). Seasonal effects of prescribed burning in Florida: A review. Tall Timbers Research, Inc., miscellaneous publication no. 8, Tallahassee, FL.

Small, J.K. 1913. Flora of Miami. Published by the author. New York.

Soil Conservation Service [SCS]. 1986. 26 ecological communities of Florida.

South Florida Water Management District [SFWMD]. 1980. Water use and supply development plan, Vol. IIIC-lower west coast. South Florida Water Management District.

Squillace, A.E. 1966. Geographic variation in the slash pine. Forestry Science Monographs 10.

Stoddard, H.L., Sr. 1963. Bird habitat and fire. Second annual procedings. Tall Timbers fire ecology conference. Tallahassee, Florida. March [1963] 2:163-175.

Stout, I.J., and Marion, W.R. 1993. Pine flatwoods and xeric pine forests of the Southern (lower) Coastal Plain. Pages 373-446 *in* W.H. Martin, S.G. Byce, and A.C. Echternacht, eds., Biodiversity of the southeastern United States. John Wiley and Sons, Inc., New York.

United States Geological Survey-Biological Resources Division [USGS-BRD]. 1996. Classification of 1993/94 Landsat TM imagery. Florida Cooperative Fish and Wildlife Research Unit, University of Florida; Gainesville, Florida.

Vaughan, T.W. 1910. A contribution to the geological history of peninsular Florida. Carnegie Institute Washington, Publication 133.

Wade, D., J. Ewel, and R. Hofstetter. 1980. Fire in South Florida ecosystems. U.S.Department of Agriculture. Forest Service general technical report SE-17.

Walker, J., and R.K. Peet. 1983. Composition and species diversity of pine-wiregrass savannas of the Green Swamp, North Carolina, *Vegetatio* 55, 163-179.

Ware, S., C. C. Frost, and P. Doerr. 1993. Southern mixed hardwood forest: The former longleaf pine forest. Pages 447-493 *in* W. H. Martin, S. G. Boyce, and A. C. Echternacht, eds., Biodiversity of the southeastern United States: lowland terrestrial communities. Wiley, N.Y.

Wharton, C.H., 1977. Forested wetlands of Florida--their management and use. Final report to Division of State Planning. Center for Wetlands, University of Florida, Gainesville. DSP-B CP-19-77.

Wiley, J.W. 1978. Southeastern American kestrel. Pages 32-34 *in* H.W. Kale II ed., Rare and endangered biota of Florida. Volume II. Birds. University Presses of Florida, Gainesville, Florida.

Williams, L.E. 1978a. Florida black bear. Pages 23-25 *in* J.N. Layne ed., Rare and endangered biota of Florida. Volume I. Mammals. University Presses of Florida, Gainesville, Florida.

Williams, L.E. Jr. 1978b. Florida sandhill crane. Pages 36-37 *in* H.W. Kale II ed., Rare and endangered biota of Florida. Volume II. Birds. University Presses of Florida, Gainesville, Florida.

Wunderlin, R.P. 1986. Guide to the vascular plants of central Florida. University Presses of Florida.

Restoration of Mesic Pine Flatwoods

Restoration Objective: Maintain the structure, function, and biological composition of hydric pine flatwoods, and increase the spatial extent of protected pinelands in South Florida.

Restoration Criteria

South Florida can contribute to the preservation of regionally significant aquifer recharge and fish and wildlife habitat values by preserving mesic flatwoods. The conservation and recovery of listed plant and animal species, wide-ranging species, neotropical birds, and large complexes of isolated and ephemeral wetlands will be accomplished by the preservation and restoration of this community.

The restoration objective will be achieved when: (1) the mesic pine flatwoods habitat is preserved through land acquisition or private landowner cooperative agreements, consistent with the GFC's "Closing the Gaps in Florida's Wildlife Habitat Conservation System," the Florida Panther Habitat Preservation Plan (South Florida Population), the Game and Fresh Water Fish Commission's Preservation 2000 Act Study (Biodiversity Conservation Analysis), current State/Federal land acquisition proposals (including CARL, SOR, *etc*.), other Federal listed species recovery plans, and regional wildlife habitat protection plans; (2) degraded areas are identified and restored to suitable hydric pine flatwoods habitat; (3) hydrology, fire and exotic plant management is regionally applied to restore and maintain regional plant and animal biodiversity; (4) the geographic extent of mesic pine flatwoods in South Florida is identified; and (5) the integrity of the habitat is maintained by proper South Florida management practices.

Community-level Restoration Actions

1. **Identify the extent of remaining mesic pine flatwoods habitat in South Florida.** Although the existing GIS, aerial photograph, and ground-truthed land cover information is available for this community throughout South Florida, a comprehensive regional analysis has not been conducted.

    1.1. **Detail the geographic extent of mesic pine flatwoods in South Florida.** This task should integrate existing GIS and other databases on land cover, soils, and hydrology, to correctly identify and separate mesic pine flatwoods from other pine flatwood and wetland types in South Florida**.** GIS typically cannot differentiate mesic from hydric flatwoods, resulting in an overestimate of the prevalence of mesic pine flatwoods.

1.2. **Update the GIS database for mesic flatwoods to monitor cumulative impacts.** As areas of mesic pine flatwood are converted to other land uses, changes should be mapped to identify cumulative habitat loss.

1.3. **Identify old-growth mesic flatwoods in South Florida.** Old-growth mesic pine flatwoods have the potential to sustain rare plant and animal communities. These areas provide unique habitats that are not replaceable within short time spans.

2. **Preserve remaining areas of mesic pine flatwoods.** Direct loss of habitat resulting from land conversion, habitat degradation, and fragmentation continues unabated in South Florida. However, many of the best remaining areas of intact mesic pine flatwoods have been identified for land acquisition.

2.1. **Complete purchase of the following CARL projects:** Allapattah Flats (Martin County), Atlantic Ridge Ecosystem (Martin County), Belle Meade (Collier County), Cape Haze/ Charlotte Harbor (Charlotte County), Charlotte Harbor Flatwoods (Charlotte County), Corkscrew Regional Ecosystem Watershed (Lee, Collier counties), Fakahatchee Strand (Collier County), Hall Ranch (Charlotte County), Ocaloacoochee Slough (Hendry, Collier Counties) Pal-Mar (Palm Beach, Martin Counties), Save Our Everglades-South Golden Gates Estates (Collier County), Sebastian Creek (Indian River, Brevard counties), South Savannas (Martin, St. Lucie counties), Lykes Brothers/Palmdale (Glades County).

2.2. **Complete purchase of the following Save Our Rivers projects:** Corkscrew Regional Ecosystem Watershed (Lee County), and Loxahatchee Slough (Palm Beach County).

2.3. **Develop additions to existing Federal and State land acquisition proposals in areas identified as GFC strategic habitat conservation areas and in the 1990 statewide charrette, including the following:** Estero Bay Watershed, South of Corkscrew Road, east of I-75 (Lee County); West and East of Burnt Store Road (Charlotte and Lee counties), North of Cape Coral (Lee County): east of the Babcock-Webb WMA (Charlotte County); Picayune Strand in North Golden Gate Estates (Collier County); North of Belle Meade (Collier County), South and East of Myakka Prairie (Sarasota County); Between Oscar Shearer SP and Pinelands Preserve (Sarasota County); East of the Southwest Florida International Airport (Lee County); North of Immokalee Road (Collier County); the Imperial River drainage (Lee County), areas along Horse Creek (Hardee and DeSoto counties), Brushy Creek (Hardee County), the Peace River (Hardee and DeSoto counties), the Green Swamp (Polk and Osceola counties), northern Palm Beach County and western Martin County.

2.4. **Implement cooperative habitat preservation programs with private landowners.** Much of the mesic pine flatwoods habitat is in private ownership and many private landowners may not choose to participate in fee-simple land acquisition projects (Lykes Brothers/Palmdale -Glades County). Protection through alternate methods may conserve important ecosystems by providing landowners with economic incentives and promoting good stewardship by ensuring that landowners view habitat as an asset, not a liability.

2.5. **Support and implement cooperative regional greenways programs with landowners and other agencies.** Greenways planning has successfully developed cooperative, local conservation plans that will maintain, establish, and manage landscape connections between important resource areas.

2.6. Target agency policy or proposed projects under review by COE, Water Management District, and DEP that degrade or eliminate mesic flatwoods habitat. Mesic flatwoods and other pinelands have declined in areal extent and patch size in South Florida because of characterization as non-jurisdictional and suitable wetland creation areas for on-site and off-site mitigation.

2.6.1. Stress avoidance of impacts of this habitat type as a regional permitting concern. Both consultants and permitting entities need to be educated on the importance of this habitat to regional wildlife.

2.6.2. Require type-for-type on- and off-site wetland mitigation when avoidance and minimization criteria have been exhausted. Both consultants and permitting entities often assess credit mitigation on the basis of the wetland depth, not the landscape importance or biodiversity value. This results in conversion of mesic flatwoods to wetland systems and on-site conversion of mesic flatwoods to ponds or pooled wetlands that often kill pine trees.

2.6.3. Examine federal nationwide and State and Federal general permit and permit exemptions to assess impacts on mesic pine flatwoods habitat. Piecemeal development and speculative land clearing in urbanizing areas under agricultural exemptions appears to exacerbate loss of pinelands in the South Florida Ecosystem.

2.7. Protect natural communities from point source and non-point source pollution.

2.8. Use existing regulatory mechanisms to protect mesic pine flatwoods by identifying their contribution to the function of adjacent wetlands and wetland-dependent species.

2.9. Promote protection of mesic flatwoods by encouraging local government resource planning, including identification of the importance, location, and areal extent in local government comprehensive plans.

3. Manage/enhance mesic pine flatwoods on public lands.

3.1. Develop/identify effective habitat management techniques to maximize the biodiversity of the mesic flatwoods community. South Florida mesic pine flatwoods may benefit from alternate management practices that are sensitive to hydrology, climate, and subtropical vegetation. Standard "southeastern" prescribed fire management, employed in the South Florida Ecosystem, may lower biodiversity of plant and animal species. Diversification of management techniques may increase biodiversity.

3.2. Implement or ensure continuance of habitat management on public lands. State and Federal land managers are faced with funding deficits that prevent or reduce management actions. Perpetual funding sources for staff and equipment should be secured.

3.3. Coordinate land management practices between public land managers. Management of mesic flatwoods on a landscape scale will benefit listed species, particularly wide-ranging species, game species, and neotropical migrants.

3.4. Establish management partnerships with private landowners. Successful fire management and hydrological practices can continue to be supported by or expanded to private lands to achieve a higher level of plant and animal diversity in

the South Florida Ecosystem. For some listed species, including the Florida panther and red-cockaded woodpecker, management partnerships may be critical to the regional South Florida recovery.

3.5. Create, maintain, or restore important habitat linkages. Public landowners should coordinate land acquisition and habitat management activities to ensure the protection of large, contiguous tracts of land that include a mosaic of native habitats, including mesic pine flatwoods. The maintenance of regional refugia for wide-ranging species such as the Florida panther or red-cockaded woodpecker may not be sufficient to protect these species in a developing landscape.

3.6. Identify and disallow incompatible public uses that degrade mesic pine flatwoods. Incompatible public uses that disrupt hydrology, prevent fire management, pollute, encourage exotic plant or animal invasion, overharvest resources, harvest resources too frequently, or destroy habitat beyond the ability for effective management should be identified and eliminated.

3.7. Monitor compatible adjacent land uses to protect mesic pine flatwood ecological function. Secondary and cumulative impacts to public lands can result from adjacent development, including loss of habitat, wildlife-endangering litter, chemical discharges, dumping, enhancement of exotic plant and animal invasion, prevention of fire management, alteration of adjacent hydrology, and noise/light pollution.

3.8. Encourage maintenance and recovery of natural ecotones. Ecotones are important elements of any natural landscape but may be overmanaged or eliminated by "restoration" efforts. Fire breaks and roads should be placed well away from ecotones. Ecotones that been degraded by existing roads and fire breaks should be restored.

3.9. Control exotic plants and animals.

3.10. Prevent collecting of rare plant species such as bromeliads on public lands. Discourage collecting of rare plant species on private lands.

4. Restore mesic pine flatwoods habitat where feasible.

4.1. Identify locations of mesic flatwoods habitat that can be restored.

4.2. Restore the natural seasonal hydroperiod and fire regime of mesic flatwoods communities. The natural South Florida pattern of fire occurrence and seasonal hydrology has contributed to the third highest plant species diversity of any community in South Florida and has resulted in this community being the dominant component of the South Florida upland landscape essential to wide-ranging wildlife.

4.3. Restore sheetflow hydrologic conditions by restoring the regional landscape to natural contour. Much of South Florida has been significantly altered by public and private drainage projects that have resulted in both overdrainage and flooding of natural systems. Where possible, off-site, regional hydrological restorations may be necessary to restore mesic flatwoods function. Areas where restoration should occur include the South Golden Gate Estates and Camp Keais Strand in Collier County, the Estero Bay watershed in Lee County, and the Babcock-Webb WMA in Charlotte County, Loxahatchee Slough in Palm Beach County, and the Charlotte Harbor Flatwoods CARL project in Lee and Charlotte counties.

4.4. Re-establish important habitat linkages by constructing wildlife crossings. A wide variety of development and linear infrastructure projects fragment mesic pine flatwoods. Future design and retrofit/rebuild of these projects should include

undercrossings, overpasses and other features that reduce wildlife mortality and preserve hydrology, and increase connectivity with adjacent habitat.

4.5. Enhance and manage pinelands containing beautiful pawpaw. Prevent habitat damage by off-road vehicle use, over-grazing by cattle and hogs, or over-collection.

4.6. Encourage mitigation banks that restore and enhance mesic pine flatwoods.

5. Identify, acquire and manage mesic flatwoods for the conservation of wide-ranging state and federally listed species. The preservation of pinelands, including mesic pinelands, is critical to the recovery of the Florida panther, Florida black bear, red-cockaded woodpecker, bald eagle, eastern indigo snake, Florida sandhill crane, Big Cypress fox squirrel, Sherman's fox squirrel, and southeastern American kestrels, as well as neotropical migrants.

5.1. Complete purchase of and manage mesic flatwoods in the Belle Meade and South Golden Gate Estates CARL projects for regional protection of Florida panther, Florida black bear, eastern indigo snake, Big Cypress fox squirrel, Florida sandhill crane, and other wildlife.

5.2. Complete purchase of and manage mesic flatwoods in the coastal areas to augment neotropical migratory bird migration and bald eagle foraging and nesting activities, including at the Charlotte Harbor Flatwoods and Cape Haze/Charlotte Harbor Buffer CARL projects, and Pine Island.

5.3. Complete purchase of and manage mesic flatwoods within Priority I and II areas identified in the Florida Panther Habitat Preservation Plan.

5.4. Complete purchase of and manage mesic flatwoods on the east coast for a diverse assemblage of non-game species, including at the Pal-Mar, Atlantic Ridge Ecosystem, Loxahatchee Slough, and Allapattah Ranch CARL projects.

5.5. Determine if old-growth mesic pinelands support red-cockaded woodpecker clusters. Red-cockaded woodpeckers nest and roost in cavities that are typically are excavated in old-age living pines if available. Study the utilization of mesic pine flatwoods by red-cockaded woodpeckers, including development of landscape-scale management recommendations for the recovery of this species in South Florida**.**

5.6. Manage pinelands on public lands in southwest Florida to expand occupation by red-cockaded woodpeckers. The large contiguous public preserves that begin in the Picayune State Forest (Belle Meade and South Golden Gate Estates) and extend east and north the Fakahatchee Strand, Florida Panther NWR and Big Cypress National Preserve should be managed as a larger ecological reserve to improve and augment the existing red-cockaded woodpecker population in southwest Florida.

5.7. Exclude fire from identified areas of mesic flatwoods that include understory thickets of tall thick palmetto to provide resting and denning cover for panthers.

5.8. Prioritize the protection of coastal mesic flatwoods as bald eagle nesting habitat, and neotropical migratory bird habitat. Bald eagles prefer nest and perch sites on the largest and tallest trees available near large, open water bodies and are primarily coastal in South Florida. Neotropical birds require available forage as close to the coast as possible to augment migration across the Gulf of Mexico and Caribbean. Coastal pinelands are targeted for urban and agricultural development. Pine Island in Lee County is an example of an area of pinelands that should be protected.

5.9. Identify important habitat linkages. Important connecting areas include: CREW to the Southwest International Airport mitigation lands (Lee County), Rookery Bay National Estuarine Research Reserve to Belle Meade CARL (Collier County), Corkscrew Sanctuary to Lake Trafford (Lee and Collier counties), Babcock-Webb WMA to Charlotte Harbor Flatwoods and Charlotte Harbor State Buffer Preserves (Charlotte County).

6. Complete purchase of and manage mesic flatwoods in contiguous, connected, unfragmented patches for the conservation of South Florida biodiversity, including nongame species, rare and unique species, and keystone species such as the swallow-tailed kite, Florida weasel, and various owl and raptor species.

6.1. Purchase additional mesic flatwoods for the preservation of the beautiful pawpaw. Very few populations of this plant are protected on public lands. The Charlotte Harbor Flatwoods (Charlotte County) area should be prioritized for ongoing and additional public land purchase.

6.2. Determine if old-growth mesic pine flatwoods support rare plant and animal species, or specific species guilds. Examine the habitat value of mesic pine flatwoods for rare and endemic plants. Old-growth pinelands may support rare and unique species of plants and animals or community guilds.

6.3. Inventory and characterize the importance of mesic flatwoods to avian populations, particularly neotropical migrants, owls and raptors.

6.4. Examine wading bird use of the wetland enclosures of mesic pine flatwoods, including prairies and freshwater "isolated" wetlands.

7. Perform additional research on mesic pine flatwoods.

7.1. Survey mesic flatwoods in southwest Florida for the beautiful pawpaw, and conduct research on appropriate fire regimes for this species. Updated surveys for the beautiful pawpaw have not been conducted. The range of this species should be determined in order to better understand how to manage the population.

7.2. Determine what fire regimes are recommended in mesic flatwoods to stabilize or increase beautiful pawpaw populations on public lands in southwest Florida.

7.3. Perform a hydrologic study of the water recharge potential of mesic pine flatwoods under natural hydrologic conditions.

7.4. Examine the correlation between soil type and mesic pine flatwoods habitats.

7.5. Examine the influence of fire regimes in maintaining optimal plant and animal species diversity.

7.6. Examine invertebrate diversity and life-cycles in the mesic pine flatwoods.

7.7. Monitor mesic pine flatwoods to evaluate biodiversity. Monitor community-level processes, community structure, and community composition, including rare and keystone species, and species guilds.

7.8. Improve reference ecosystem information for community composition, biodiversity, and site-to-site variability.

8. **Increase public awareness concerning mesic pine flatwoods**. Identify mesic flatwoods in text, maps, and on resource presentations to raise public awareness of the different types of pine flatwoods. Stress the important ecosystem function of isolated and ephemeral wetlands included in the mesic flatwoods community. Establish the landscape-scale importance of this community to wide-ranging species and the significance of regional losses of this habitat in South Florida.