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Study Title: Big Cypress Deer/Panther Relationships;
Deer Herd Health and Reproduction

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Abstract: White-tailed deer (Odocoileus virginianus) track counts, observations, and a fall collection of doe deer were utilized to compare deer herds inhabiting Florida panther (Felis concolor coryi) habitat in the Bear Island (BI) and Corn Dance Units (CDU) of Big Cypress National Preserve (BCNP), Fakahatchee Strand State Preserve (FS), Florida Panther National Wildlife Refuge (PR) and Collier Enterprise (CE) lands. Necropsies were used to obtain standard body measurements, kidney fat indices (KFI's), amounts of fat on the tail, kidney, pericardial lining and heart, abomasal parasite loads, inter-uterine fecundity and physical condition. Although the FS herd increased during this study, deer in FS, CDU and PR were less numerous than deer in BI. Deer in FS and CDU had lower KFI's, tail fat and physical condition values than deer in BI, PR and CE. Deer from FS and CDU had fecundity rates less than 1.0 fawns per adult female while females from other areas produced more than 1.0 fawns per adult female. There was an inverse relationship between physical condition and APC's.

White-tailed deer (Odocoileus virginianus) are important prey items for the Florida panther (Felis concolor coryi) throughout south Florida (Maehr et al. 1990). Because deer herds are an easily manipulated component of panther habitat, it is important to understand the interrelationships between deer and their environment. Deer inhabiting lands representing a range of private and public ownerships, management philosophies, and recreational use levels were

studied to examine variation in herd health and reproduction. The objectives of this study were to:

- 1) assess deer herd health and physical condition;
- 2) determine deer herd fecundity rates;
- 3) calculate age and sex structures; and
- 4) estimate deer herd densities.

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STUDY AREAS

Study areas were located in Collier County, Florida (Fig 1). Climate of the area is tropical savannah (Duever et al. 1986) with average monthly temperatures ranging from 18.6 C in January to 28.3 C in August.

Approximately 80% of the 140 mm of rainfall occurs between May and October (Carter et al. 1973).

The 15,335 ha Bear Island (BI) is a mosaic of cypress (Taxodium distichum), slash pine (Pinus elliotti), oak (Quercus spp.) hammocks, prairies of low scrubby saw palmetto (Serona repens), wiregrass (Aristida spp.) and other grasses in drier sites at 4.5 m above mean sea level (MSL). Drainage from Okaloachoochee slough forms extensive fresh water marshes of sawgrass (Cladium jamaicensis), pickerelweed (Pontederia lanceolata), fire flag (Thalia geniculata), and arrowhead (Sagittaria lancifolia) that occupy approximately 20% of the area (Fig. 2) (McPherson 1973). Soils are primarily deep sands and marls (Leighty et al. 1954).

Approximately 50% of Collier Enterprises (CE) lands (3800 ha) consists of agricultural fields and improved pastures of planted cattle forage such as Aeschynomene americana and grasses at 7 m MSL. Forested cover includes slash pine, cypress strands and domes, and oak hammocks. The Okaloachoochee slough consists of fresh water marshes of sawgrass, pickerelweed, and fire flag and covers 20% of the area (Fig. 3). Deep, comparatively fertile sands are the principal soils of CE (Leighty et al. 1954).

The 45,000 ha Corn Dance Unit (CDU) of the BCNP is dominated by broad expanses of small, stunted cypress trees growing in bare mineral soil at 2.5 m MSL. The understory, when present, is scattered clumps of sawgrass or beakrush (Rhynchospora spp.) growing on a thin soil of marl or sand (Duever et al. 1986). Cypress domes and strands with larger trees occur through the area and typically contain mid-story species such as wax myrtle (Myrica cerifera),

pond apple (Annona glabra), and cocoplum (Chrysobalanus icaco). The central portion of CDU contains slash pine forests with associated saw palmetto and cabbage palms (Sabal palmetto) (Fig. 4). Soils are thin, leached, infertile marls and sand (Leighty et al. 1954).

Fakahatchee Strand State Preserve (FS) (38,000 ha) is the major drainage of the western Big Cypress Swamp and has an average elevation of approximately 3 m MSL. Prior to 1944 FS was dominated by old growth cypress. From 1944-1950 FS was logged and most of the large cypress was removed (Alvarez 1978). The regrowth of the strand was principally by the previously sub-dominant species. Currently, mixed swamp hardwoods including red maple (Acer rubrum), cypress, royal palm (Roystonea elata) willow (Salix caroliniana) pond apple, sweet bay (Magnolia virginiana), myrtle and popash (Fraxinus caroliniana) occur most frequently in the heavily forested central portion of FS. Prairies of maidencane (Panicum hemitomon), muhly grass (Muhlenbergia capillaris), sawgrass and scattered cypress form expansive openings along the eastern and western fringes of the strand (Fig. 5). (McPherson 1973). Soils are poorly drained peaty muck or brown peat 0.3-1.2 m deep under the heavily forested central portion of FS and shallow, poorly drained fine marls along the periphery (Leighty et al. 1954).

The 9,838-ha Florida Panther National Wildlife Refuge (PR) is intermediate between the cypress dominated FS and CDU and the more upland BI and CE. It has an average elevation of approximately 4 m MSL and contains the northern portion of the Fakahatchee Strand where mixed swamp hardwoods and cypress dominate. It also contains upland areas of oak hammocks and pine

forests similar to portions of BI (Fig. 6). Soils of PR are a mix of fine sands, loamy fine sand, marl, sandy marl, and muck (Leighty et al. 1954).

METHODS

Transects 1.6 km (1 mile) long representative of FS (N = 6), PR (N = 6) and CDU (N = 10) vegetation were established to conduct deer track counts (Tyson 1952). Tracks were counted during May-June from 1987-1991. Transects were counted 4-6 times depending on water levels. Data from BI track counts performed by the Commission's Bureau of Wildlife Management personnel was utilized for comparison (Manor et al. 1990). Records were kept on the numbers and sex of deer observed during collections. Deer were spotlighted and collected by rifle from BI, CDU, FS and CE. During 1986-1988, harvested deer from leased land that subsequently became PR were returned by hunters during legal doe harvest days. Carcasses were kept on ice until being refrigerated prior to necropsy. Most necropsies were performed within 10 hours post-mortem. Standard measurements and age (Severinghaus 1949) were determined for each animal prior to necropsy. Post-mortem examinations followed procedures of Nettles (1981). Levels of fat deposits on the tail, pericardium, heart and kidney (Stockle et al. 1978) were assigned a value of 1-9. The ratio of kidney fat weight to kidney weight (kidney fat index, KFI) was determined (Riney 1955). A physical condition value of 1-12 was assigned to each animal based on endogenous fat deposits, coat and muscling qualities and conditions, or abnormalities observed during necropsy. Abomasal parasite counts were determined and analyzed according to Eve and Kellogg (1977). Reproductive tracts of females were removed and examined for fetuses.

A fecal assay of diaminopimelic acid (DAPA) was done to document any nutritional differences among study areas. Levels of DAPA, an amino acid, found in the cell walls of ruminant bacteria, fluctuates directly with levels of digestible energy (Nelson et al. 1982). Approximately 10 fecal pellets were removed from the intestinal tracts of adult deer during necropsy for DAPA analysis. Pellets from adult deer in each area were combined into a single sample for each year and analyzed by the Washington State University Wildlife Habitat Lab.

Data Analysis

The null hypotheses that track counts did not vary among years and areas was tested using ANOVA. When the null hypothesis was rejected, differences were identified by the Newman-Keuls multiple range test (Zar 1974). The rates of deer observed per hour for each collection night were ranked for all areas and years. Differences among areas and years were tested for by the Kruskal-Wallis analysis of variance by ranks. When differences existed they were identified by Dunn's multiple comparison procedure (Hollander and Wolfe 1973).

Morphometric values (weight, length, girth), fat level estimates (tail, heart, peri-cardial, kidney, KFI), physical condition estimates, and APC data from adult (> 1 year old) female deer were analyzed by ANOVA to determine if significant differences existed among areas or years. The Newman-Keuls multiple comparison test was used to identify which means were different.

A 5 x 2 (area x possibilities) contingency table was constructed listing the frequencies of occurrence of either 0 or more than 0 fetuses by area. Likewise, a similar table was made listing the frequencies of occurrence of

either 1 or 2 fetuses by area. Chi-square analysis was used to test the following null hypotheses:

1. The incidence of pregnancy was the same in all areas; and
2. The intra-uterine fecundity rate was the same for all areas.

Chi-square values were derived using the Bonferroni adjustment and therefore are conservative (Johnson and Wichern 1982).

RESULTS

The 1989 and 1991 mean tracks per transect (3.2, 4.8, respectively) in FS were significantly higher than 1987 (1.5) and 1988 (1.3) ($p < 0.05$) (Fig 7). There were no other yearly differences found within areas. The mean number of tracks per transect in BI during 1985-1987 (11.5, Schortemeyer et al. 1991) was significantly greater than CDU and FS. No other area differences were observed. Estimates of density derived from track counts (Tyson 1952) were 1 deer/67-102 ha in CDU, 1 deer/74-91 ha in PR, 1 deer/ 17-27 ha in BI and 1 deer/54-81 ha (1989 and 1991 data) in FS.

The mean number of deer observed per hour in FS during collections was 0.351, lowest of all areas, but was significantly different only from CE (5.45) ($p < 0.05$) (Fig. 8). The numbers of deer observed per hour in FS increased from 0.270 in 1986 to 0.683 in 1990, although this increase was not significant ($p > 0.05$). No other area had notable trends. The adult sex ratio was lowest in FS (1 male:1.2 females) and highest in CDU (1 male:3.6 females) (Table 1).

One hundred fifty-one deer were collected and 21 were returned by hunters from PR (hunt club leased lands). One hundred twenty were adult

females, 19 were adult males, 16 were yearling females and 18 were yearling males. The morphometric values of all deer are in Appendix 1.

There were significant area differences for mean morphometric values of adult females (Table 2). The mean weights and lengths of female deer from FS and CDU were significantly less than the means of BI, CE and PR ($p < 0.05$). Although mean weights of adult females from all areas tended to increase with age, deer from CDU and FS weighed less than deer from BI, CE and PR in most age classes (Fig. 9).

There were significant area differences in mean fat and physical condition indices (Table 3). Deer from FS and CDU had lower levels of fat than did deer from CE and BI. PR deer had a few fat level estimates similar to both groups. The mean KFI's of adult females from FS and CDU were less than those of BI and CE ($p < 0.05$). The mean KFI of PR deer was not significantly different from either group ($p > 0.05$). There were no differences among yearly KFI means for CDU, FS and PR deer. However, the mean 1988 KFI's for BI and CE were significantly greater than other years ($p < 0.05$) (Fig. 10). The mean tail fat indices and physical condition values of PR, FS and CDU were less than those of CE and BI ($p < 0.05$). Fat indices and physical condition values of all deer are in Appendix 2.

The pregnancy rate of FS deer (68.2%) was significantly lower than other areas ($p < 0.05$). However, the mean number of fetuses per pregnant doe (1.33) was high enough that net productivity of FS deer (0.91) was not significantly different than other areas ($p > 0.05$) (Table 4). There were no yearly

differences observed within areas for any reproductive parameter.

Reproductive data for all adult female deer are in Appendix 3.

Mean APC for BI (726) was lower than CDU (1270) ($p < 0.05$). There were no other area differences (Table 5). There was an inverse relationship between APC's and physical condition (Fig. 11).

There was no significant difference among areas for DAPA values ($p > 0.05$). Although PR and CE were ranked higher than other areas there was no significant difference among areas for DAPA values ($p > 0.05$) (Table 6).

DISCUSSION

Density estimates from deer track counts should be viewed with caution because they are most appropriately used as long-term trend indicators. However, when examined over the relatively short period covered in this study, herds appear to be stable in CDU and PR and increasing in FS. Track count results in these cypress-dominated habitats were very similar with a range of mean tracks per transect of only 1.25 to 4.8. In contrast, the mean tracks per transect in the more upland BI ranged between 9.55 and 14.88 (Manor et al. 1990). Problems with transect methodology and naturally occurring events may have contributed to the suggestion of an increasing herd in FS. After the virtual elimination of off-road vehicle traffic in FS in 1987, deer track count transects, which had been placed along muddy trails, began to revegetate rapidly. Transects were shifted yearly to compensate for loss of the trackable medium. In 1989, track counts were conducted along bulldozed fire lines created during an April 1989 fire. Tracks increased from a mean of 1.25 in 1988 to 3.2 in 1989. It is possible that deer may have been attracted to

fire lines by the more palatable new growth of forage and ease of travel through previously dense vegetation. By 1990, revegetation prevented tracks from being counted anywhere in FS. In 1991 however, tram clearing and repair allowed tracks to be counted. The mean number of tracks per transect on these trams was highest of any year (4.8). Observations made during track counts and panther field activities indicate that much of the tram usage was by does with young fawns temporarily stranded by high water levels. Given the above caveats, it is possible that the significantly higher 1989 and 1991 track counts reflect a true herd increase. This is further supported by the increase in the mean rate of deer observed per hour during collections from 0.270 in 1986 to 0.683 in 1990 and by personal observations made in FS since 1984.

Increases in FS, CDU or PR deer densities approaching BI can not be expected. Cypress forests and prairie habitats support fewer deer than pine flatwoods, hardwood hammocks or marshes (Harlow 1959). Harlow (1959) estimated the potential deer density in cypress swamps to be 1 deer/ 45 ha (approximately the density indicated by the FS 1991 track counts) and 1 deer/ 283 ha in prairies. The potential deer density in the cypress-dominated areas of FS and CDU is probably within these estimates. The potential deer density in PR, with a mix of cypress swamps, prairies and more upland plant communities is likely somewhat higher.

The adult sex ratio of all areas was comparatively low. The sex ratio was lowest (1 male:1.2 females) in the unhunted FS herd but was not notably different from hunted herds. Similar mean ages of collected adult females

(2.4 - 3.3) suggest equivalent mortality rates for all areas. The more heavily hunted Everglades Wildlife Management Area had a somewhat higher ratio (1 male:4.6 females) during the time of this study (Crossett and Johnson 1990).

Deer weights have long been used as habitat condition indicators (Severinghaus 1955). Heavier deer result from better available nutrition (Verme 1963). Differences observed in morphometrics of adult females are probably habitat/diet related. Deer from CDU weighed less, and had smaller lengths and girths than deer from other areas. Deer from FS weighed more and were bigger than CDU deer but weighed less and were smaller than other areas. Weights were negatively influenced by poor quality of available forage caused by infertile, shallow soils and long hydroperiods in CDU and by long hydroperiods in FS. Heavier deer are characteristic of healthier, more reproductive animals. The productivity of white-tailed deer is directly affected by diet quality. Productivity doubled when females were switched from a low quality to a high quality ration in a captive study (Verme 1965). Although not significantly different from other areas, the net productivity of the herds from cypress-dominated areas (FS and CDU) was < 1.0 fawn per adult female, while the other areas had a net productivity > 1.0 fawn per adult female (Table 4).

Rumen analysis has suggested that BI deer have a diet higher in crude protein, phosphorus, and calcium than do CDU deer (McCown 1988). Fawns consuming adequate amounts of protein grow faster, become bigger (Ullrey et al. 1967), have increased chances of survival (Verme 1962) and are more

productive as adults (Verme 1965) than are comparable fawns on a protein deficient ration. It is possible that differences in dietary protein are responsible for area differences in sizes and productivity of deer.

Although storage of body fat is not necessary for over-winter survival of sub-tropical deer, the ability to store fat reflects habitat conditions. The lower mean fat level values of CDU and FS females is additional evidence that forage quality is sub-optimal in cypress-dominated habitats. Low KFI and tail fat values of FS and CDU deer are particularly useful because these fat depots are among the first catabolized by deer during under nutritional stress. The significant 1988 increase in the KFI's in BI and CE where oaks are common is believed related to the heavy acorn production that year.

The inverse relationship between physical condition and APC's has been previously noted for BI and CDU deer (McCown 1988) and for other southeastern deer (Davidson et al. 1982). Abomasal parasites do not usually directly affect physical condition because, with the exception of extreme intensities of Haemonchus contortus, they are not pathogenic (Davidson et al. 1980). Rather, the relationship is associative and reflective of range conditions. Deer in good physical condition tend to have low APC counts while those in poorer condition have higher APC counts.

Although a small sample size ($N = 45$) of captured panthers in several different areas prevents significant differences from being indicated, area differences in panther health indices, reproduction and densities were similar to those of deer (Roelke 1990).

Blood values useful for assessment of physical condition in panthers were lower in FS panthers than in panthers in PR, BI, CE and other ranchlands north of I-75. Lower packed-cell volume, hemoglobin count, red blood cell counts and serum iron levels suggest that FS panthers are more anemic than panthers in BI, PR and CE, probably due to lowered nutritional status and heavier parasite loads. The mean physical condition of female panthers was estimated to be lower in FS than in BI, PR and CE (Roelke 1990). Possibly as a result of fewer large prey items in their diet (Maehr et al 1990), mean body weights of adult panthers were 14% less for males in FS and 22% less for females in FS than in areas north of I-75 (Maehr 1990). Average documented litter size of panthers residing in FS (1.33, N = 3) was well below the average for all panthers (2.0, N = 14) (Maehr et al. 1991). No birth (or reproduction) by a collared panther was documented during the study period in CDU (N = 2) (D. Jansen, pers. commun.). Panther densities in FS and CDU are much lower than in PR, BI and CE. Currently, only 3 collared panthers inhabit the 83,000 ha of FS and CDU while 9 collared panthers inhabit or frequently use the 29,000 ha of BI, PR and CE.

CONCLUSIONS AND MANAGEMENT IMPLICATIONS

Deer and panthers in the cypress-dominated habitats of CDU and FS are smaller, leaner, less thrifty, less productive and less numerous than in BI and CE. These characteristics are largely attributable to the nature of the habitat. Given the endangered status of the Florida panther and its dependence on deer, a program to significantly increase the quantity and quality of deer forage in FS and CDU is recommended. This can be accomplished

through a combination of prescribed burning, planting of native food crops and the creation of openings.* Prescribed fire can be used inexpensively to treat prairies and pinelands in FS and CDU. Growing tissue is more palatable, digestible and nutritional than mature tissue (Short et al. 1972). Crude protein, important to deer for body growth and maintenance as well as maintenance of healthy ruminant micro-flora, may increase 2 to 3 fold in new growth of for up to 3 months after a burn. In addition, levels of calcium and phosphorus, necessary for skeletal growth and energy availability, more than doubled in new growth of forage after a fire (Stransky and Harlow 1981). Establishment of food plots of native species such as joint vetch (Aeschynomene americana) could increase herd condition if done on a large scale. Joint vetch is a legume high in crude protein and minerals, reseeds itself for 2 years after the initial planting and mature plants tolerate inundation. In 1987, the Florida Department of Natural Resources planted small plots of joint vetch in FS totalling less than 1 ha that were browsed heavily by deer. Plants inside deer proof wire exclosures were approximately 3 times taller and much more dense than surrounding plants. During collections and track counts deer were frequently observed browsing in the plots. Food plots should be expanded in FS and created in CDU to include up to 0.5 % of the areas. Food plots should be planted in December-February to benefit females during the latter stages of gestation and fawns during early stages of growth. Because the dense canopy prevents growth of forage species in much of FS, wildlife openings should be created to allow early successional species to grow. The effect of openings on deer in FS was demonstrated by the

clearcutting of the area in the 1940's. Benefitting from the tremendous increase in available forage, deer were 7 times more abundant than today (C. Chappell, pers. comm.). Clearcutting FS today would eliminate many unique areas of tropical flora, possibly extirpate many unique species and clearly would be irresponsible. However, a much smaller, more practical way to create openings would be to clear existing trams and the many older willow and myrtle thickets within the strand. A vegetation survey should precede clearing to avoid trams containing rare or endangered plants.

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Table 1. Adult male:adult female ratios in Corn Dance Unit (CDU), Bear Island (BI), Fakahatchee Strand State Preserve (FS), Collier Enterprises (CE), and Florida Panther National Wildlife Refuge (PR), from spotlight observations, 1984-1990.

AREA	YEARS	N	MALES	FEMALES	FAWNS & UNID	MALE:FEMALE RATIO
CDU	84-90	357	44	157	156	1:3.6
BI	84-90	370	63	145	162	1:2.3
FS	86-90	107	27	32	48	1:1.2
CE	86-90	195	22	60	113	1:2.7
PR	89-90	63	11	24	28	1:2.2

Table 2. Mean morphometric values of adult does collected in October 1986-1990 in Bear Island (BI) and Corn Dance Units (CDU) of Big Cypress National Preserve, Collier Enterprises (CE), Florida Panther National Wildlife Refuge (PR), Fakahatchee Strand State Preserve (FS). Values followed by the same subscript were not significantly different ($p < 0.05$).

AREA	NO.	AGE	WEIGHT (kg)	LENGTH (cm)	GIRTH (cm)
BI	29	2.8	42.0 a	126.7 a	76.3 ab
CE	23	2.9	41.6 a	122.5 b	76.8 a
PR	24	3.3	40.7 a	124.7 ab	78.4 a
FS	22	2.5	37.6 b	119.1 c	73.2 b
CDU	22	2.4	31.5 c	108.9 d	66.9 c

Table 3. Mean physical condition values of adult does collected in Collier Enterprises (CE), Bear Island (BI), Florida Panther National Wildlife Refuge (PR), Fakahatchee Strand State Preserve (FS), and Corn Dance Unit (CDU), 1986-1990. Column values followed by the same subscript were not different ($p < 0.05$)

Area	No.	Age	Kidney fat index ¹	Tail fat ²	Heart fat ²	Peri- cardial fat ²	Kidney fat ²	Physical condition value ³
CE	23	2.9	42.8 a	6.1 a	6.1 a	6.9 a	7.0 a	9.1 a
BI	29	2.8	40.4 a	5.6 a	5.3 ab	6.1 ab	5.5 b	8.7 a
PR	24	3.3	27.6 ab	4.0 b	4.3 b	4.9 abc	4.3 bc	7.1 b
FS	22	2.5	21.7 b	3.7 b	4.0 b	4.6 bc	4.3 bc	7.4 b
CDU	22	2.4	19.5 b	2.9 b	4.0 b	3.8 c	3.4 c	6.5 b

1. Kidney fat index is calculated by the following: weight of the kidney fat/weight of the kidney X 100. It is expressed as a percentage.
2. Fat levels were ranked from 1 - 9 with 1 representing very low or absent fat.
3. Physical condition was ranked from 1 - 12 with 1 representing very poor condition.

Table 4. Mean reproductive condition of adult does collected in October 1984-1990. Asterisk indicates significant area difference ($p < 0.025$).

AREA ¹	NUMBER	AGE	PERCENT PREGNANT	FETUS/ PREG DOE	NET PRODUCTIVITY
FS	22	2.5	68.2*	1.33	0.91
CDU	29	2.5	90.0	1.04	0.90
PR	24	3.3	91.7	1.14	1.04
BI	37	2.8	89.0	1.24	1.11
CE	23	2.9	95.6	1.31	1.26

1. FS = Fakahatchee Strand State Preserve

CDU = Corn Dance Unit of Big Cypress National Preserve

PR = Florida Panther National Wildlife Refuge

BI = Bear Island Unit of Big Cypress National Preserve

CE = Collier Enterprises

Table 5. Mean APC's of adult deer collected in Bear Island (BI), Fakahatchee Strand State Preserve (FS)*, Corn Dance Unit (CDU), Florida Panther National Wildlife Refuge (PR) and Collier Enterprises (CE) 1986 - 1990.

	BI	FS	CDU	PR	CE
1986	847	1561			
1987	629	495	1060	1058	2422
1988	448	987	2158	1289	816
1989	1123	596	913	210	424
1990	582	713	948	893	538
MEAN	726	870	1270	863	1050

Table 6. Mean DAPA levels of adult deer collected in Fakahatchee Strand State Preserve (FS), Bear Island (BI), Corn Dance Unit (CDU), Florida Panther National Wildlife Refuge (PR), and Collier Enterprises (CE) 1986 - 1989.

	FS	BI	CDU	PR	CE
1986	0.726	0.730		0.782	
1987	0.664	0.552	0.616	0.761	0.605
1988	0.626	0.697	0.783		0.791
1989	0.760	0.693	0.753	0.751	0.783
MEAN	0.694	0.668	0.717	0.765	0.726

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FLORIDA PANTHER
NATIONAL
WILDLIFE
REFUGE

FAKAHATCHEE
STRAND
STATE
PRESERVE

COLLIER
ENTERPRISES

BEAR ISLAND

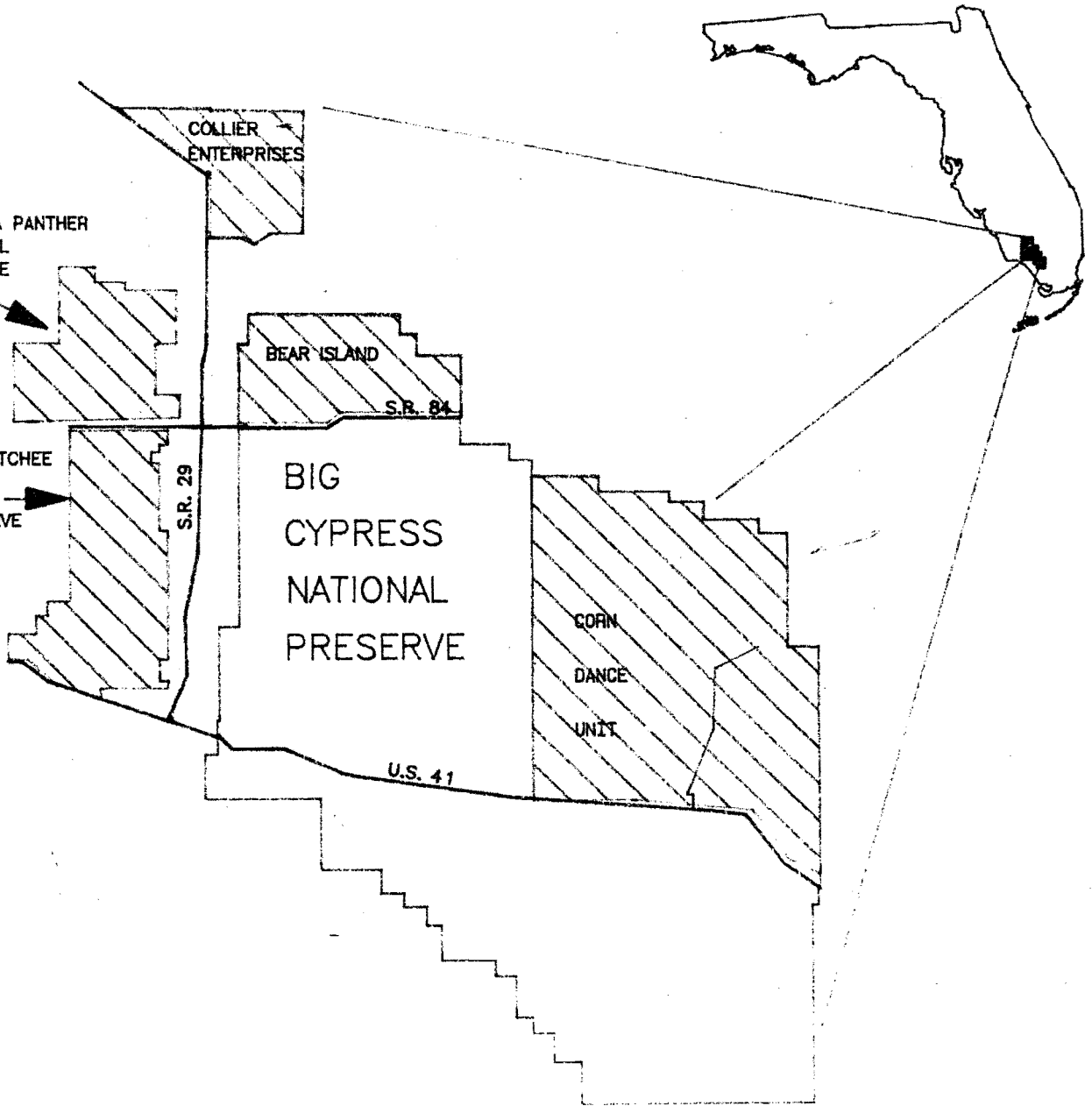
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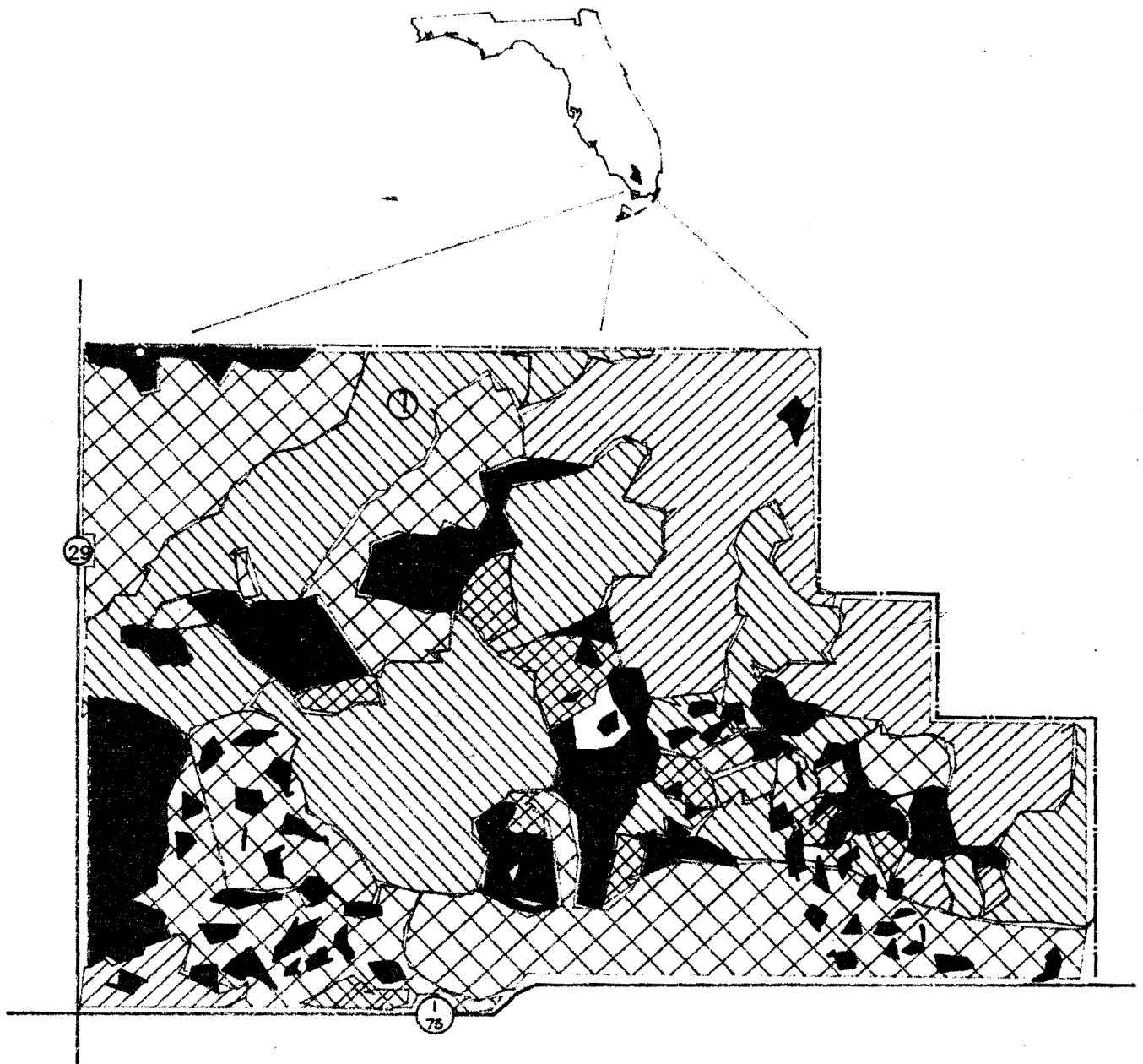
BIG
CYPRESS
NATIONAL
PRESERVE

S.R. 29

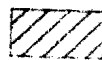
CORN
DANCE
UNIT

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Pine/palmetto/palm



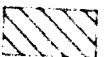
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Cypress forest



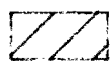
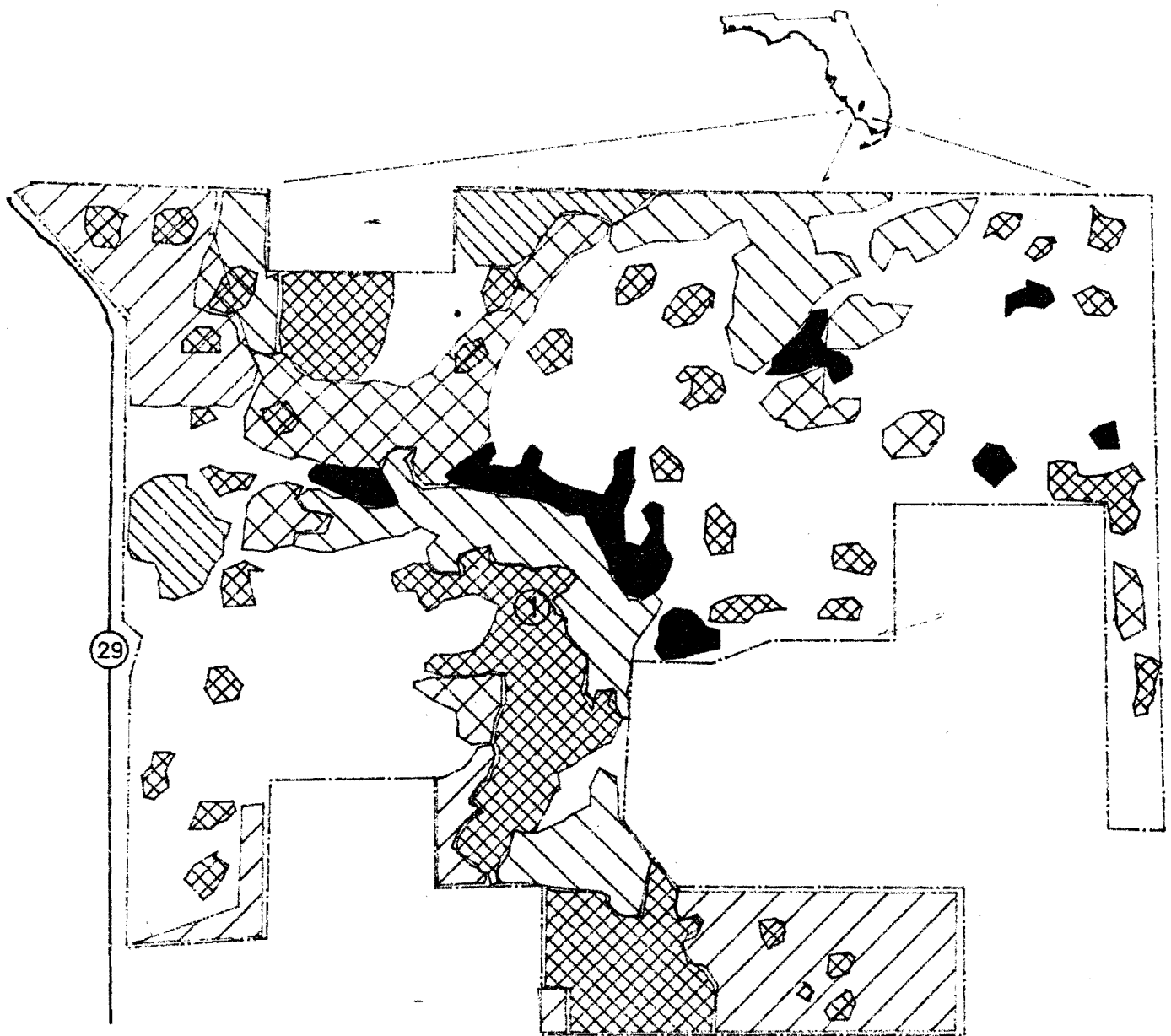
Hardwood hammocks



Fresh water marshes and sloughs



Okaloacoochee slough



Cropland



Cypress



Wet Prairie



Fresh Water Marsh



Hardwood Hammock



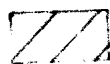
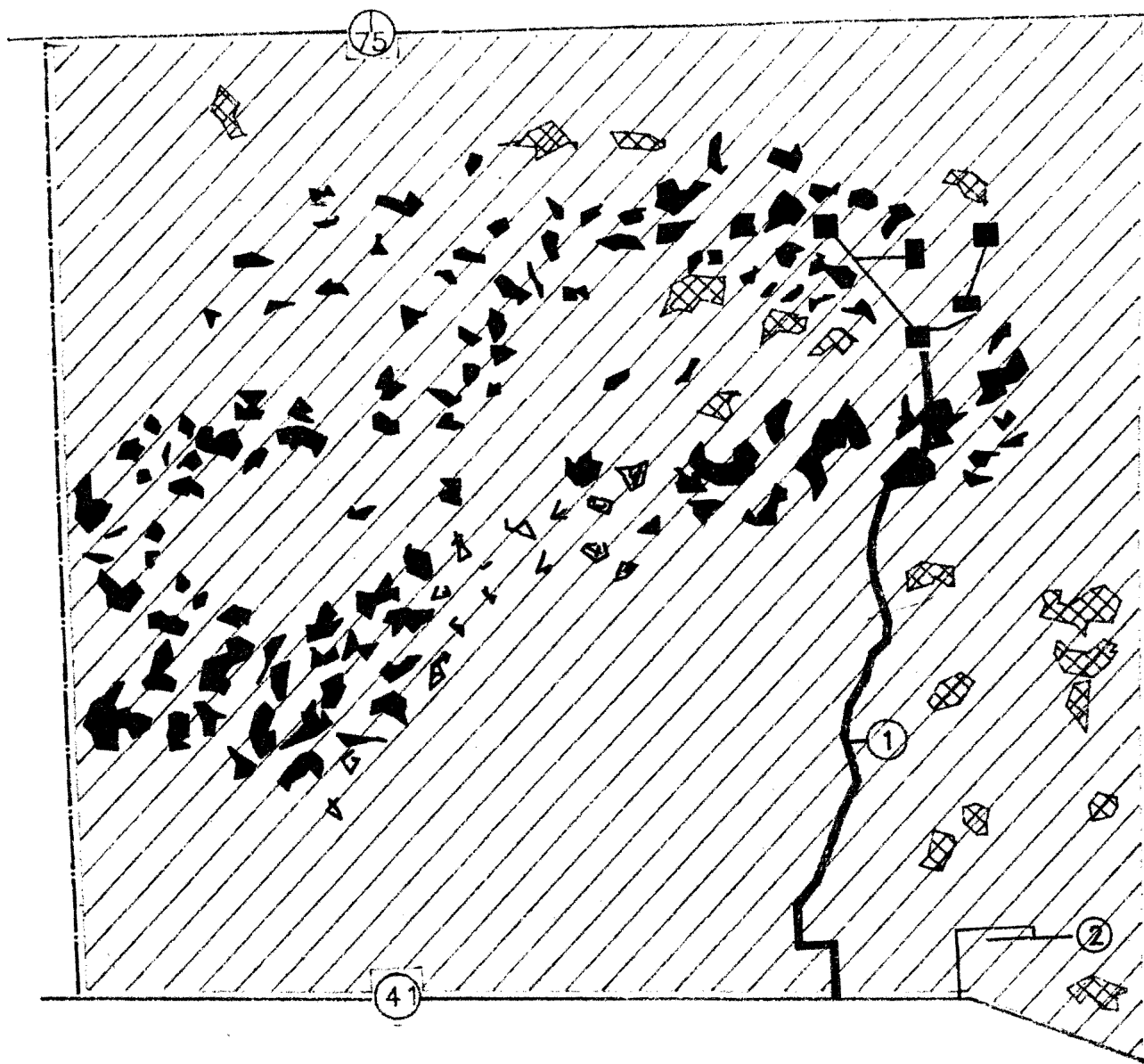
Pine Flatwoods



Pasture/Rangeland



Okaloacoochee slough



Cypress Forest



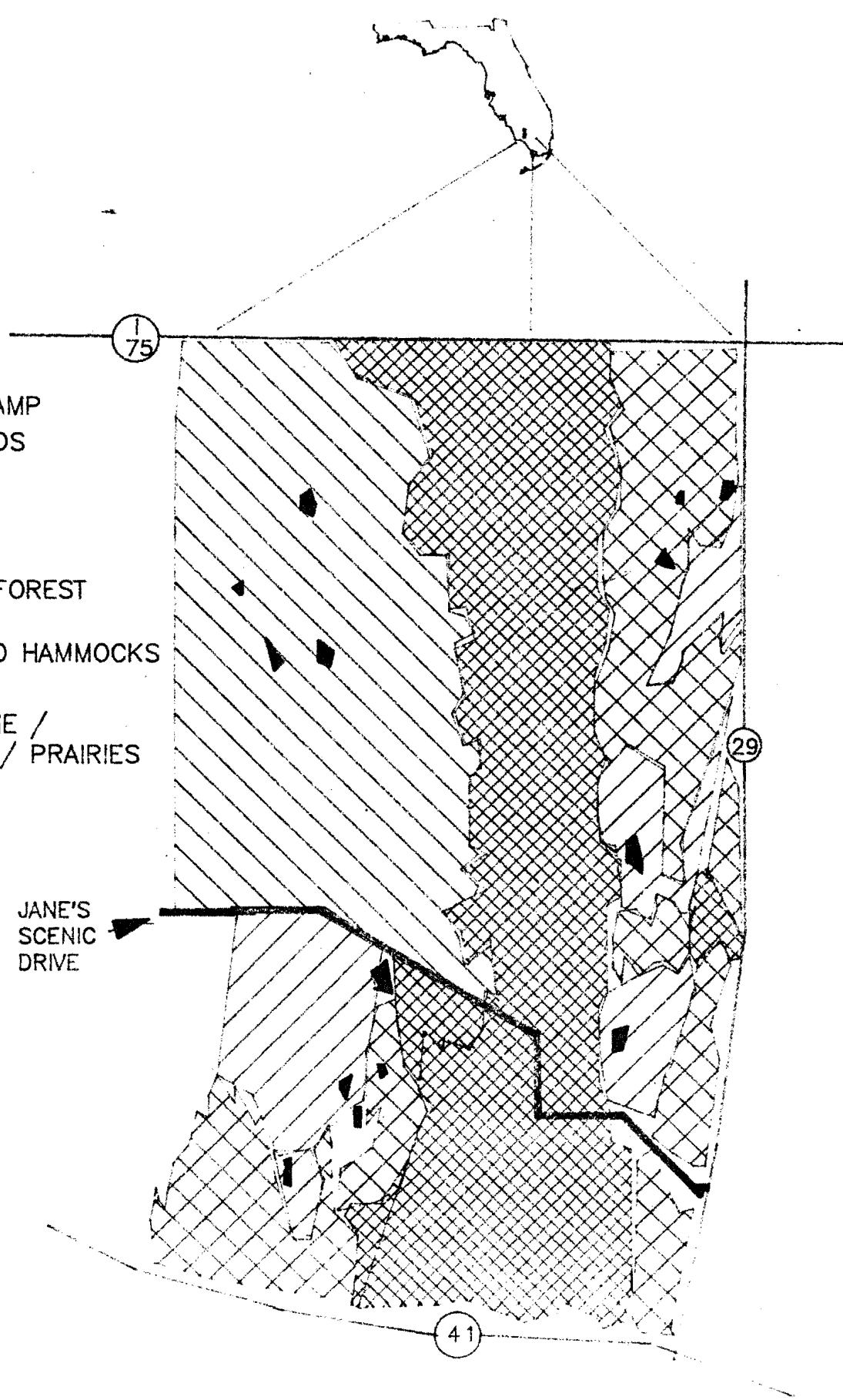
Pine/Palmetto/Palm



Hardwood Hammock

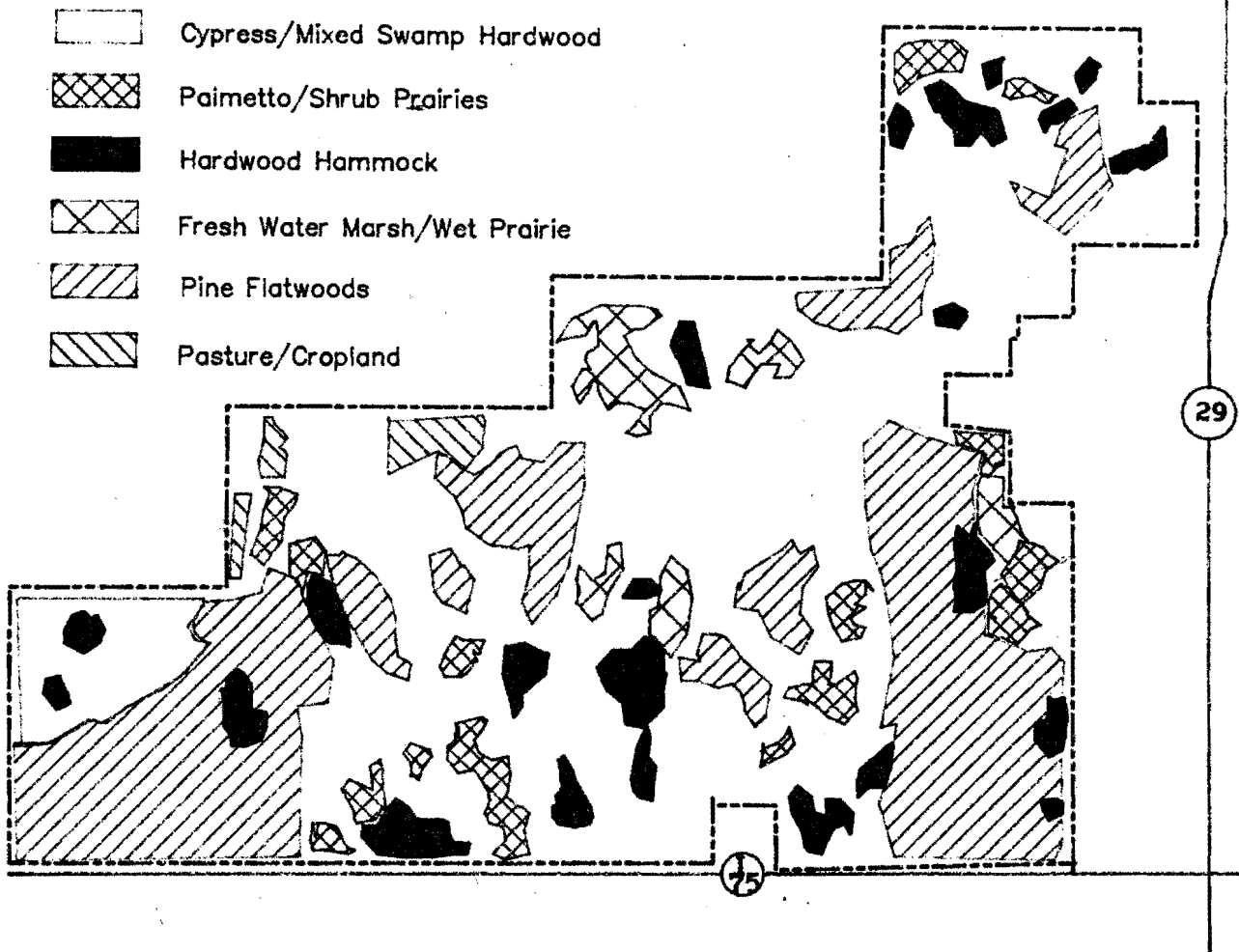
① 11-mile oil road

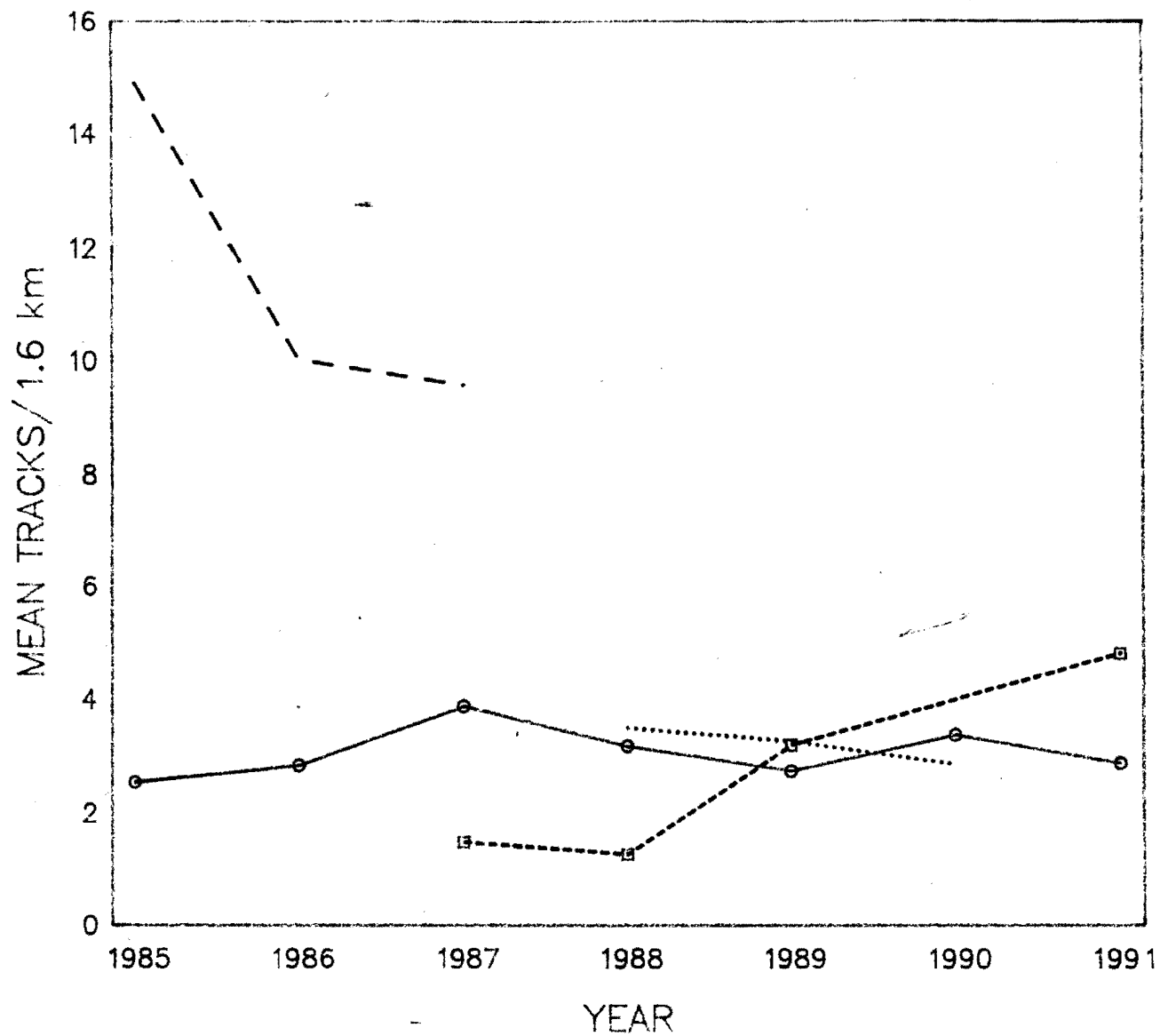
② Training Airport

- 
- A map showing land use types in a coastal area. The map is bounded by a horizontal line at the top and a curved line at the bottom. A vertical line on the right side is labeled '29'. A horizontal line at the top is labeled '1' and '75'. A road labeled 'JANE'S SCENIC DRIVE' runs from the left towards the center. The map is divided into several regions with different hatching patterns. A legend on the left identifies these patterns: 'MIXED SWAMP HARDWOODS' (cross-hatch), 'PRAIRIES' (diagonal lines), 'CYPRESS FOREST' (diagonal lines), 'HARDWOOD HAMMOCKS' (solid black), and 'MIXED PINE / CYPRESS / PRAIRIES' (diagonal lines). The map shows a large area of 'MIXED SWAMP HARDWOODS' in the upper right, a large area of 'PRAIRIES' in the lower left, and a large area of 'CYPRESS FOREST' in the center. 'HARDWOOD HAMMOCKS' are shown as small black patches. 'MIXED PINE / CYPRESS / PRAIRIES' is shown in the lower right. The road 'JANE'S SCENIC DRIVE' runs through the 'PRAIRIES' and 'CYPRESS FOREST' areas.
- MIXED SWAMP
HARDWOODS
 - PRAIRIES
 - CYPRESS FOREST
 - HARDWOOD HAMMOCKS
 - MIXED PINE /
CYPRESS / PRAIRIES

JANE'S
SCENIC
DRIVE

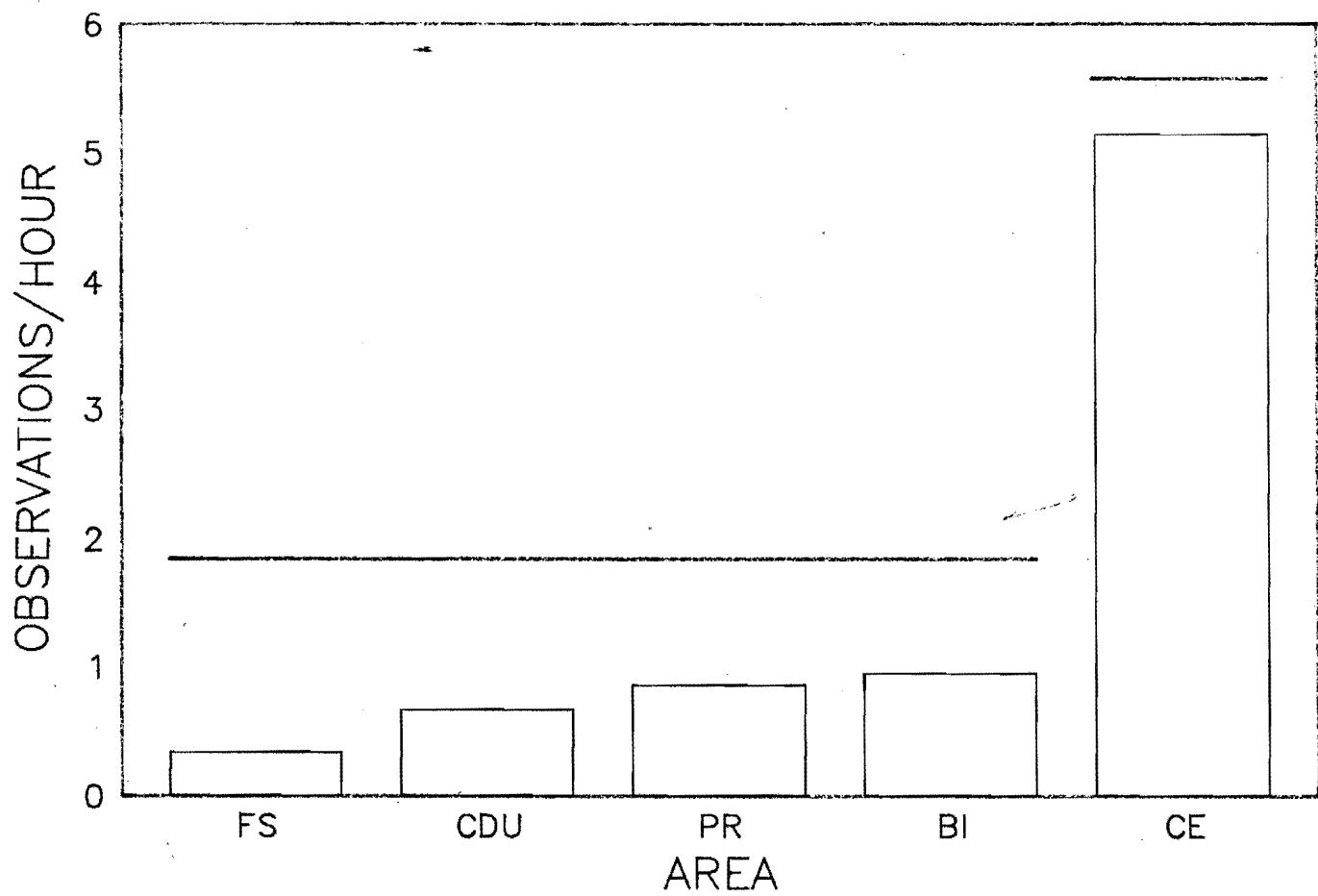
41

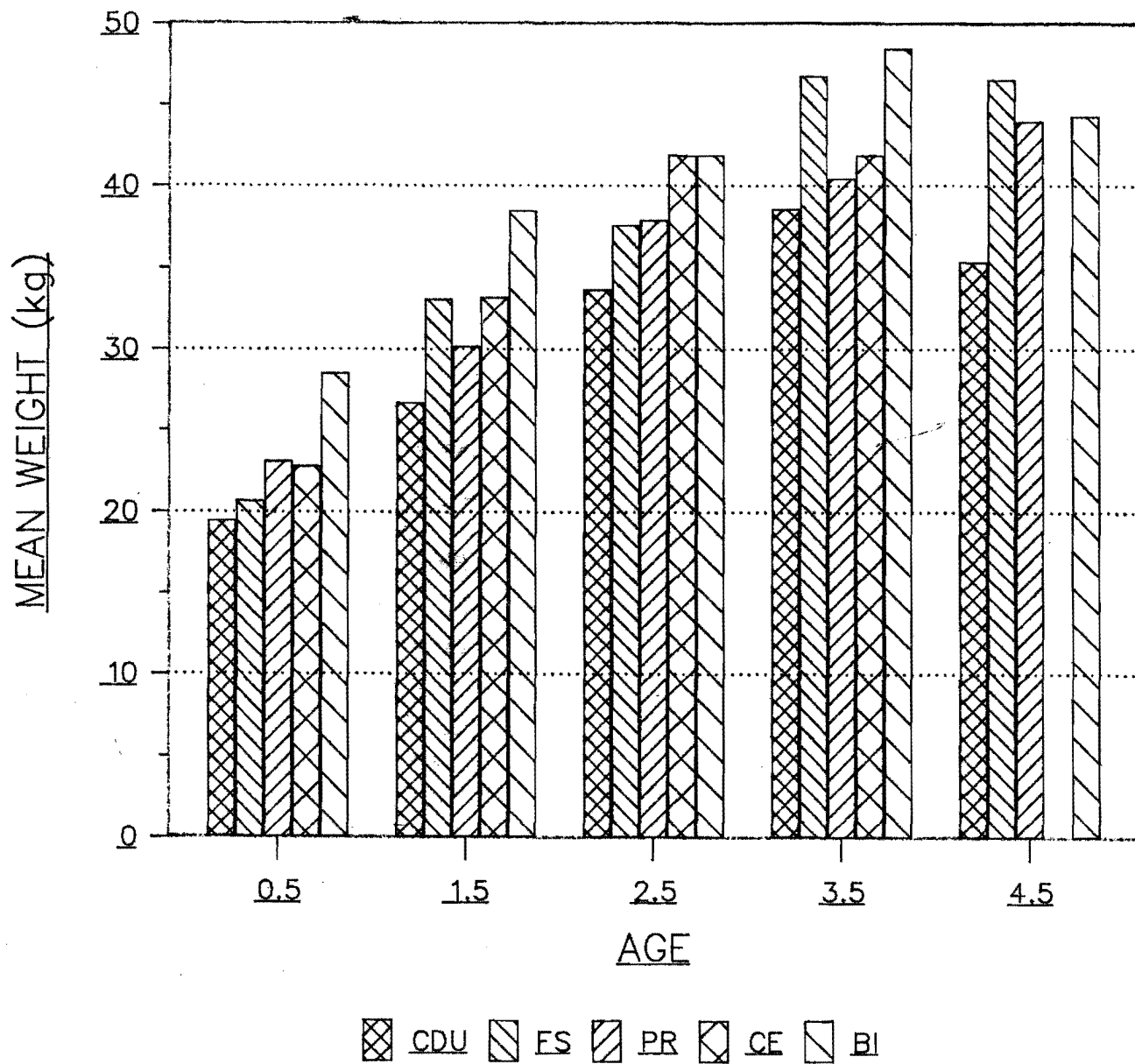


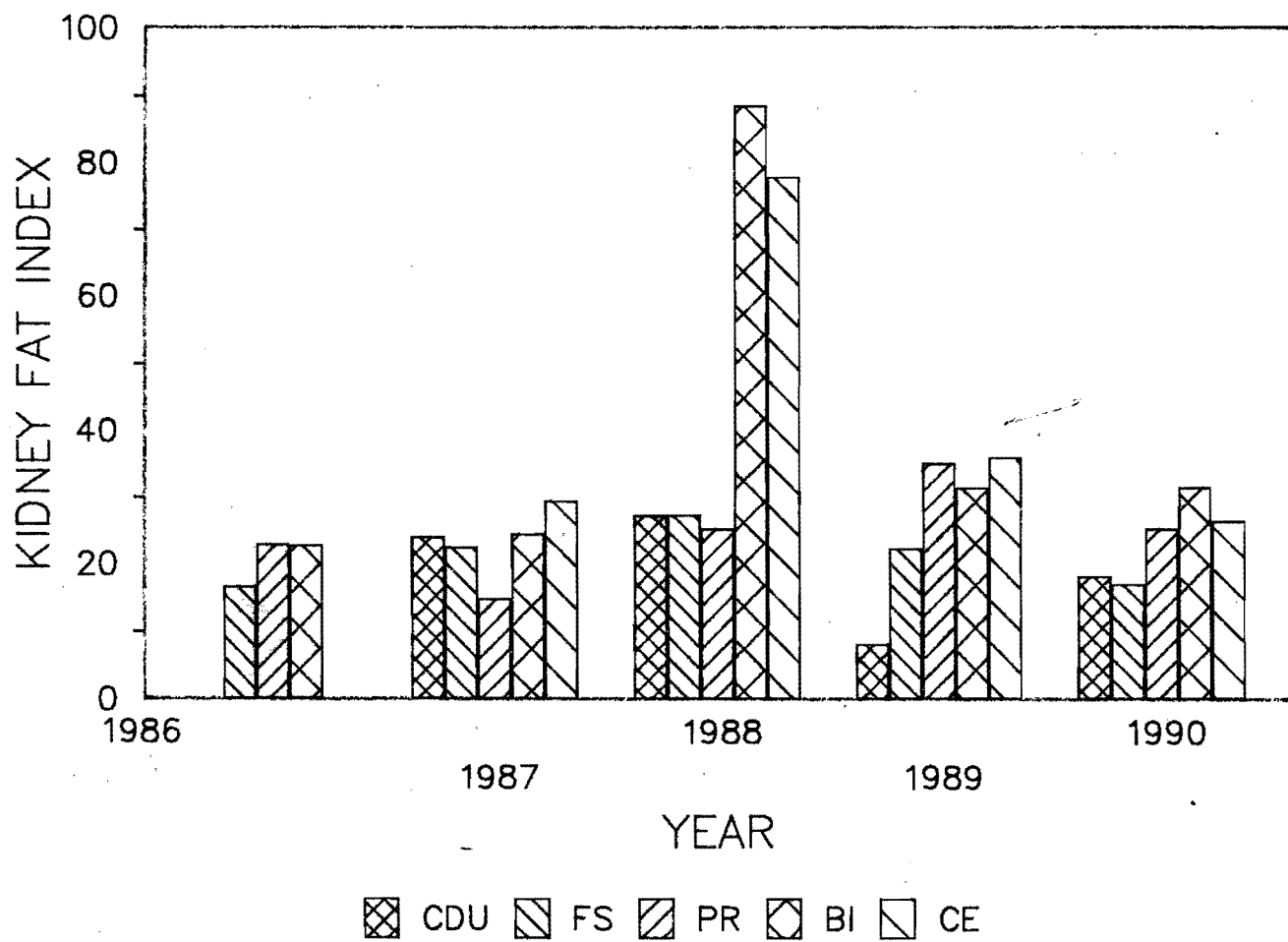


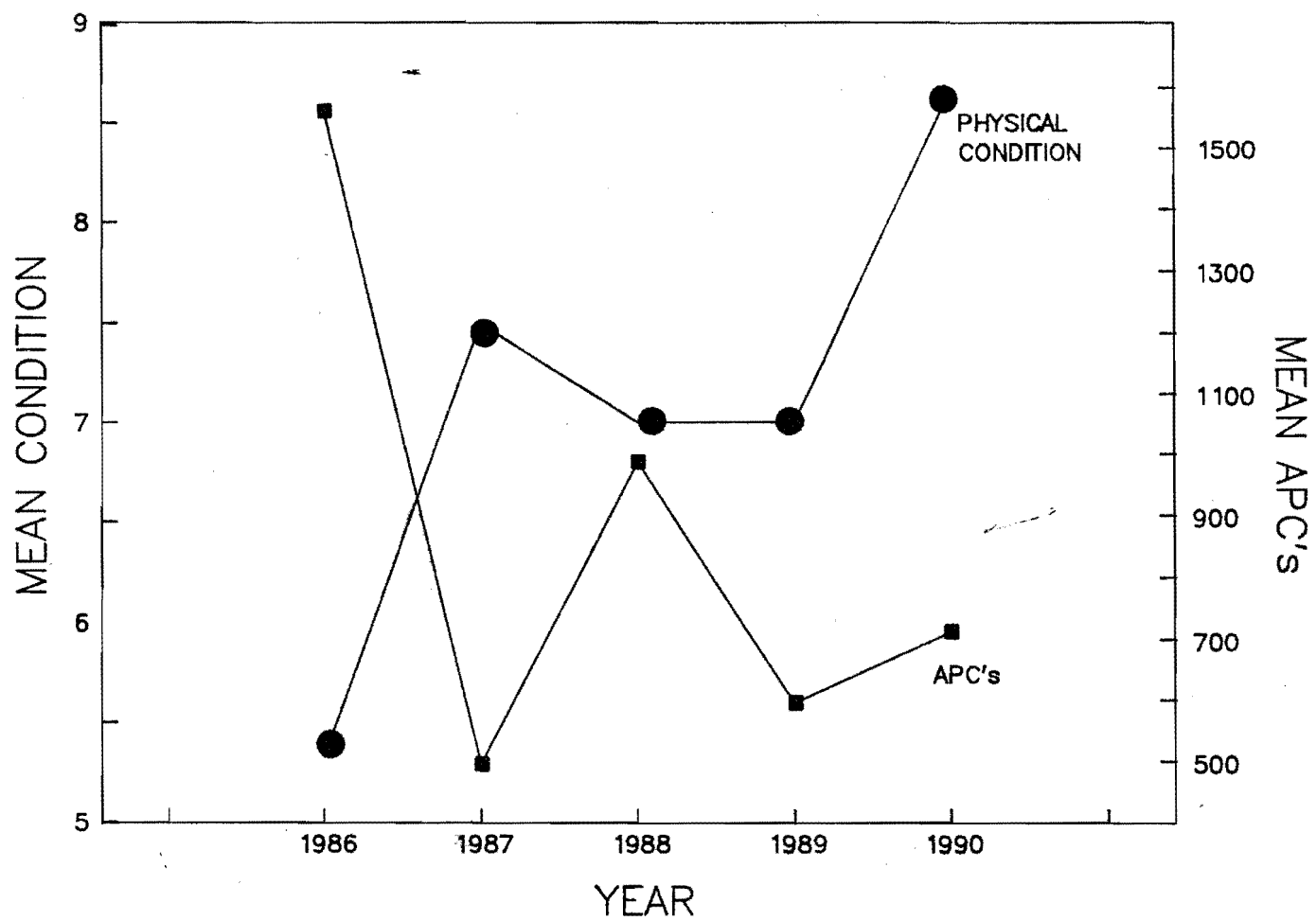
Corn Dance Unit Fakahatchee Strand Florida Panther
 State Preserve National Refuge Bear Island

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Appendix 1. Morphometric values of white-tailed deer collected in southwest Florida, October 1986-1990.

NO.	YEAR	AREA ¹	SEX	AGE	WEIGHT (kg)	LENGTH (cm)	GIRTH (cm)
154	86	FS	M	0.5	29.7	119.5	67.5
155	86	FS	F	2.5	32.4	123.0	73.5
156	86	FS	F	5.5	37.3	133.0	79.5
157	86	FS	F	0.5	18.2	101.5	55.0
158	86	FS	M	2.5	52.7	127.5	86.5
166	86	FS	M	3.5	52.7	134.0	87.5
167	86	FS	F	2.5	38.2	123.5	75.5
202	87	FS	F	1.5	34.1	116.0	70.0
203	87	FS	F	2.5	34.1	99.5	66.5
204	87	FS	F	1.5	30.5	107.0	68.0
205	87	FS	M	1.5	37.3	120.0	74.0
267	88	FS	F	2.5	34.1	109.0	69.0
257	88	FS	M	1.5	43.2	127.0	79.0
258	88	FS	F	5.5	37.3	101.0	76.0
259	88	FS	M	2.5	45.5	129.0	78.0
260	88	FS	F	4.5	47.7	121.0	84.0
261	88	FS	M	0.5	23.2	102.0	62.0
262	88	FS	F	1.5	31.8	113.0	70.0
264	88	FS	F	1.5	38.6	123.0	74.0
265	88	FS	M	2.5	57.3	139.0	87.0
266	88	FS	F	0.5	23.2	102.0	64.0
346	89	FS	F	2.5	35.0	114.0	72.0
347	89	FS	M	0.5	30.5	105.0	73.0
348	89	FS	F	2.5	37.3	118.0	70.0
349	89	FS	F	4.5	45.5	124.0	83.0
350	89	FS	F	1.5	34.1	117.0	71.0
351	89	FS	F	2.5	50.9	132.0	81.0
352	89	FS	M	0.5	33.5	116.0	68.0
382	90	FS	F	2.5	40.9	121.5	76.0
383	90	FS	F	2.5	31.8	123.0	64.0
384	90	FS	M	0.5	22.7	102.0	56.5
385	90	FS	F	0.5	20.5	95.5	57.5
386	90	FS	F	2.5	37.7	122.5	73.0
387	90	FS	F	2.5	41.8	120.5	72.0
395	90	FS	M	2.5	45.5	134.5	70.0
406	90	FS	M	2.5	54.5	133.0	82.0
407	90	FS	F	1.5	28.2	122.0	63.0
408	90	FS	F	3.5	46.8	136.5	80.0

Appendix 1. Continued

NO.	YEAR	AREA ¹	SEX	AGE	WEIGHT (kg)	LENGTH (cm)	GIRTH (cm)
159	86	BI	F	2.5	45.5	149.0	79.0
160	86	BI	F	3.0	42.7	124.5	81.5
161	86	BI	F	2.0	40.9	130.0	78.5
162	86	BI	M	0.5	21.8	106.0	55.0
163	86	BI	F	0.5	23.6	99.5	68.0
164	86	BI	F	2.5	40.9	132.0	80.0
165	86	BI	F	2.5	45.5	131.0	85.0
206	87	BI	F	4.5	42.7	123.5	-
207	87	BI	M	2.5	36.4	123.0	73.5
208	87	BI	F	4.5	41.4	130.0	80.0
209	87	BI	F	5.5	40.9	125.0	72.0
210	87	BI	F	0.5	25.4	116.0	66.5
211	87	BI	F	1.5	47.7	126.0	68.0
212	87	BI	F	2.5	39.1	118.5	79.5
213	87	BI	F	1.5	32.7	116.0	65.0
244	88	BI	F	2.5	34.1	125.0	74.0
245	88	BI	F	2.5	43.2	125.0	70.0
246	88	BI	F	1.5	38.6	117.0	70.0
247	88	BI	F	2.5	47.7	126.0	83.0
248	88	BI	F	3.5	47.7	129.0	82.0
249	88	BI	F	3.5	45.5	124.0	81.0
310	89	BI	F	1.5	34.1	125.0	74.0
311	89	BI	F	2.5	45.5	135.0	75.0
312	89	BI	F	2.5	36.4	118.0	70.0
314	89	BI	F	4.5	50.0	128.0	82.0
315	89	BI	M	0.5	26.4	111.0	67.0
318	89	BI	F	0.7	27.3	104.0	64.0
329	89	BI	F	2.5	39.6	109.0	-
331	89	BI	F	4.5	43.2	126.0	77.0
414	90	BI	F	1.5	34.1	128.5	69.5
415	90	BI	F	2.5	49.1	138.0	82.5
416	90	BI	M	0.5	31.8	116.0	69.5
417	90	BI	F	2.5	36.4	123.0	71.5
418	90	BI	F	3.5	52.3	145.5	80.0
396	90	BI	F	2.5	39.1	122.0	74.0
397	90	BI	F	1.5	41.4	124.5	76.0

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Appendix 1. Continued

NO.	YEAR	AREA ¹	SEX	AGE	WEIGHT (kg)	LENGTH (cm)	GIRTH (cm)
177	86	PR	M	1.5	27.3	113.0	66.0
178	86	PR	M	-	34.1	124.0	70.0
179	86	PR	F	2.5	39.5	127.0	73.0
180	86	PR	F	2.5	37.7	121.0	73.0
238	87	PR	M	2.5	40.4	126.0	70.0
239	87	PR	F	5.5	40.9	133.0	74.0
240	87	PR	F	1.5	29.5	103.0	65.0
241	87	PR	M	1.5	36.4	126.0	71.0
242	87	PR	F	4.5	40.9	117.0	77.0
296	88	PR	F	0.5	24.5	106.0	67.0
297	88	PR	M	2.5	34.1	120.0	69.0
298	88	PR	F	2.5	41.4	123.0	77.0
300	88	PR	F	0.5	21.8	86.0	-
301	88	PR	F	2.5	37.3	111.0	75.0
302	88	PR	M	0.5	24.5	83.0	58.0
303	88	PR	M	2.5	45.5	97.0	84.0
305	88	PR	F	1.5	30.9	114.0	77.0
306	88	PR	F	2.5	35.5	111.0	74.0
307	88	PR	F	3.0	38.2	107.0	70.0
308	88	PR	F	5.5	45.5	125.0	77.0
309	88	PR	F	4.0	47.7	103.0	86.0
322	89	PR	F	3.5	39.1	126.0	77.0
323	89	PR	F	3.5	47.7	125.0	81.0
324	89	PR	M	0.5	25.9	104.0	64.0
325	89	PR	F	2.5	35.0	114.0	75.0
326	89	PR	F	2.5	35.0	126.0	80.0
327	89	PR	F	4.5	43.2	121.0	82.0
328	89	PR	M	0.5	29.5	104.0	65.0
330	89	PR	F	3.5	42.3	126.0	77.0
398	90	PR	F	2.5	33.2	121.5	71.0
399	90	PR	F	3.5	38.6	128.0	79.0
400	90	PR	M	0.5	23.6	115.5	62.5
401	90	PR	F	2.5	42.3	125.5	73.0
402	90	PR	F	4.5	44.1	125.0	73.0
403	90	PR	M	0.5	20.5	99.0	56.0
404	90	PR	F	2.5	38.6	121.0	73.5
405	90	PR	F	5.5	47.7	132.0	76.0

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Appendix 1. Continued.

NO.	YEAR	AREA ¹	SEX	AGE	WEIGHT (kg)	LENGTH (cm)	GIRTH (cm)
197	87	CDU	F	2.5	31.4	114.0	74.5
198	87	CDU	F	1.5	27.7	110.5	81.0
199	87	CDU	F	2.5	38.6	-	-
200	87	CDU	F	1.5	29.1	108.5	69.0
201	87	CDU	F	1.5	29.1	113.5	69.0
250	88	CDU	F	1.5	25.0	110.0	66.0
251	88	CDU	F	1.5	25.9	104.0	67.0
252	88	CDU	F	2.5	34.1	115.0	73.0
253	88	CDU	F	1.5	25.0	108.0	61.0
254	88	CDU	F	1.5	28.2	115.0	66.0
255	88	CDU	F	2.5	34.1	116.0	70.0
256	88	CDU	F	2.5	36.8	115.0	70.0
332	89	CDU	F	4.5	36.8	114.0	74.0
333	89	CDU	F	2.5	36.4	120.0	75.0
334	89	CDU	F	0.5	19.5	102.0	57.0
335	89	CDU	F	2.5	32.7	119.0	68.0
336	89	CDU	F	1.5	25.4	105.0	64.0
337	89	CDU	F	4.5	34.1	113.0	72.0
338	89	CDU	M	3.5	54.5	128.0	81.0
409	90	CDU	M	2.5	38.6	137.5	75.5
410	90	CDU	F	2.5	30.9	125.5	71.0
411	90	CDU	F	2.5	28.6	113.5	65.0
412	90	CDU	F	1.0	25.0	105.0	59.5
413	90	CDU	F	3.0	38.6	123.5	70.5
419	90	CDU	M	0.5	16.8	93.5	57.0
420	90	CDU	F	3.0	38.6	125.0	78.5
421	90	CDU	F	0.5	19.5	104.5	60.0

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Appendix 1. Continued.

NO.	YEAR	AREA ¹	SEX	AGE	WEIGHT (kg)	LENGTH (cm)	GIRTH (cm)
214	87	CE	F	0.5	15.9	98.0	58.0
215	87	CE	F	0.5	23.2	103.0	61.0
216	87	CE	F	3.5	35.9	119.5	82.5
217	87	CE	F	1.5	33.2	113.0	69.0
218	87	CE	M	1.5	42.7	130.0	80.5
219	87	CE	F	3.5	40.9	118.0	80.0
220	87	CE	M	0.5	22.7	115.0	63.0
221	87	CE	F	2.5	31.8	127.0	71.0
222	87	CE	F	3.5	38.2	126.0	76.5
223	87	CE	F	3.5	40.0	125.5	75.5
224	87	CE	F	0.5	20.4	102.0	61.5
271	88	CE	F	2.5	47.7	121.0	85.0
272	88	CE	F	3.0	42.7	117.0	78.0
273	88	CE	F	2.0	42.7	118.0	79.0
274	88	CE	M	0.5	25.0	111.0	69.0
275	88	CE	M	1.5	29.5	110.0	67.0
276	88	CE	F	3.0	38.2	114.0	76.0
277	88	CE	F	3.5	47.3	130.0	68.0
278	88	CE	F	2.0	34.1	113.0	75.0
279	88	CE	F	0.5	26.4	101.0	67.0
339	89	CE	F	2.5	45.5	124.0	83.0
340	89	CE	F	2.5	37.7	121.0	79.0
341	89	CE	F	2.5	46.4	125.0	82.0
342	89	CE	F	0.5	25.5	108.0	66.0
343	89	CE	F	2.5	47.7	122.0	80.0
344	89	CE	F	2.5	43.2	139.0	74.0
345	89	CE	M	0.5	31.8	108.0	75.0
388	90	CE	F	3.5	50.0	132.0	84.0
389	90	CE	F	3.5	45.5	123.5	75.5
390	90	CE	F	0.5	25.5	102.5	61.5
391	90	CE	F	5.5	44.5	121.5	77.0
392	90	CE	F	2.5	42.3	117.0	70.0
393	90	CE	F	2.5	44.5	128.5	73.5
394	90	CE	F	3.5	37.3	121.5	72.5

- 1 FS = Fakahatchee Strand State Preserve
 BI = Bear Island Unit of Big Cypress National Preserve
 PR = Florida Panther National Wildlife Refuge
 CDU = Corn Dance Unit of Big Cypress National Preserve
 CE = Collier Enterprises

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Appendix 2. Physical condition values of adult does collected 1986 -1990.

NO.	AREAL	YEAR	AGE	KIDNEY FAT INDEX	TAIL FAT ²	HEART FAT ²	PERI- CARDIAL FAT ²	KIDNEY FAT ²	CONDITION VALUE ³
155	FS	86	2.5	9.8	2	5	4	2	6
156	FS	86	5.5	9.0	2	5	5	2	5
167	FS	86	2.5	31.3	3	3	5	1	5
202	FS	87	1.5	37.2	5	5	6	8	9
203	FS	87	2.5	35.0	5	5	5	6	9
204	FS	87	1.5	10.1	3	2	2	2	6
258	FS	88	1.5	0.0	2	2	2	2	6
260	FS	88	4.5	64.8	8	5	5	8	9
262	FS	88	1.5	22.5	2	2	2	3	6
264	FS	88	1.5	32.5	5	5	3	5	8
267	FS	88	2.5	17.4	3	5	5	8	8
346	FS	89	2.5	11.3	2	2	5	2	6
348	FS	89	2.5	18.2	2	3	5	3	8
349	FS	89	4.5	35.2	5	5	8	6	8
350	FS	89	1.5	23.1	3	5	5	3	7
351	FS	89	2.5	17.2	2	5	5	3	8
382	FS	90	2.5	14.0	5	5	5	3	8
383	FS	90	2.5	7.2	2	1	1	1	6
386	FS	90	2.5	22.5	5	5	8	8	11
387	FS	90	2.5	27.5	8	6	8	8	11
407	FS	90	1.5	7.1	2	2	2	2	5
408	FS	90	3.5	24.7	5	5	5	8	8
MEAN			2.5	21.7	3.7	4.0	4.6	4.3	7.4
159	BI	86	2.5	20.5	6	5	5	5	8
160	BI	86	3.0	32.4	5	8	8	6	9
161	BI	86	2.0	12.1	6	5	5	2	8
164	BI	86	2.5	27.7	8	5	5	5	11
165	BI	86	2.5	21.6	6	5	8	5	11
206	BI	87	4.5	29.5	5	5	5	6	8
208	BI	87	4.5	46.6	5	5	6	4	8
209	BI	87	5.5	23.9	5	5	4	3	8
211	BI	87	1.5	30.5		8		9	
212	BI	87	2.5	36.9	6			8	10
213	BI	87	1.5	10.0	3	2			5

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Appendix 2. Continued

NO.	AREA ¹	YEAR	AGE	KIDNEY FAT INDEX	TAIL FAT ²	HEART CARDIAL	PERI- FAT ²	KIDNEY FAT ²	CONDITION VALUE ³

244	BI	88	2.5	20.5				2	8
245	BI	88	2.5	144.0	8				11
246	BI	88	1.5	22.5		2	8	2	8
247	BI	88	2.5	86.4	8	5	8		11
248	BI	88	3.5	184.0	8				11
249	BI	88	3.5	70.2	5	8			11

310	BI	89	1.5	10.0	2		1	2	5
311	BI	89	2.5	1.9	5	4	5		8
312	BI	89	2.5	63.4	6	5	8	7	9
314	BI	89	4.5	30.9	3	5	8	5	8
329	BI	89	2.5	11.6	2	1			2
331	BI	89	4.5	74.0	6		8		11

396	BI	90	2.5	29.6	5		6	7	8
397	BI	90	1.5	23.7	8	5	6	7	8
414	BI	90	1.5	16.6	5				8
415	BI	90	2.0	49.0	9	8			11
417	BI	90	3.0	15.4	5	6	5	4	8
418	BI	90	3.5	55.5	8			9	11

MEAN			2.8	40.4	5.6	5.3	6.1	5.5	8.7

179	PR	86	2.5	.5	2		2	0	5
180	PR	86	2.5	40.4	4	2	5	6	6

239	PR	87	5.5	15.5	-	2	2	2	5
240	PR	87	1.5	45.0	-	2	3	2	6
242	PR	87	4.5	14.3	1	-	-	2	8

298	PR	88	2.5	43.4	2	8	5	5	5
301	PR	88	2.5	8.3	5	2	-	2	5
305	PR	88	1.5	7.9	2	2	-	1	5
306	PR	88	2.5	60.4	2	2	2	2	6
307	PR	88	3.0	9.6	2	6	1	1	6
308	PR	88	5.5	31.9	5	6	2	5	6
309	PR	88	4.0	15.6	5	3	4	5	8

322	PR	89	3.5	32.3	2	8	8	5	9
323	PR	89	3.5	28.6	5	8	8	5	11
325	PR	89	2.5	48.8	8	5	8	8	11
326	PR	89	3.5	53.1	8	5	8	8	11
327	PR	89	4.5	15.2	3	6	8	5	8

Appendix 2. Continued.

NO.	AREA ¹	YEAR	AGE	KIDNEY FAT ²	TAIL FAT ²	HEART FAT ²	PERI- CARDIAL	KIDNEY FAT ²	CONDITION VALUE ³
330	PR	89	3.5	33.3	8	7	8	8	11
398	PR	90	2.5	18.4	2	2	2	5	5
399	PR	90	3.5	9.8	2	2	2	1	5
401	PR	90	2.5	41.3	5	5	8	8	8
402	PR	90	4.5	23.9	5	5	8	8	8
404	PR	90	2.5	14.0	2	2	2	2	2
405	PR	90	5.5	45.3	8	7	8	8	11
MEAN			3.3	27.6	4.0	4.3	4.9	4.3	7.1
197	CDU	87	2.5	10.8	2	2	2	3	2
198	CDU	87	1.5	24.3	5	3	5	5	8
199	CDU	87	2.5	23.5	2	6	6	8	8
200	CDU	87	1.5	13.7	2	5	5	3	5
201	CDU	87	1.5	22.9	3	-	-	4	7
250	CDU	88	1.5	12.9	2	2	-	1	6
251	CDU	88	1.5	7.6	2	3	2	2	6
252	CDU	88	2.5	87.1	8	6	6	8	9
253	CDU	88	1.5	6.2	2	2	1	2	5
254	CDU	88	1.5	44.8	2	5	8	6	6
255	CDU	88	2.5	15.5	2	4	2	2	6
256	CDU	88	2.5	16.7	2	5	2	2	5
332	CDU	89	4.5	6.4	1	3	2	1	4
333	CDU	89	2.5	11.3	4	4	8	5	8
335	CDU	89	2.5	2.1	1	1	1	1	5
336	CDU	89	1.5	5.9	2	3	3	1	5
337	CDU	89	4.5	14.7	2	4	5	3	7
410	CDU	90	2.5	7.8	1	2	1	1	5
411	CDU	90	2.5	24.8	5	5	2	4	8
412	CDU	90	1.0	10.1	2	2	1	1	5
413	CDU	90	3.0	31.8	8	8	8	7	11
420	CDU	90	3.0	9.0	4	5	2	2	6
MEAN			2.4	19.5	2.9	4.0	3.8	3.4	6.5
216	CE	87	3.5	31.0	8	6	6	8	9
217	CE	87	1.5	14.0	2	4	4	4	8
219	CE	87	3.5	38.9	8	4	-	8	9

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NO.	AREA ¹	YEAR	AGE	KIDNEY FAT INDEX	TAIL FAT ²	HEART FAT ²	PERI- CARDIAL FAT	KIDNEY FAT ²	CONDITION VALUE ³
221	CE	87	2.5	25.4	5	8	8	8	10
222	CE	87	3.5	46.5	5	8	6	8	11
223	CE	87	3.5	21.2	5	7	7	6	9
271	CE	88	2.5	117.0	8	5	8	8	8
272	CE	88	3.0	45.2	5	5	5	5	11
273	CE	88	2.0	37.3	8	8	8	8	11
276	CE	88	3.0	134.0	5	5	8	8	9
277	CE	88	3.5	65.7	2	8	8	8	11
278	CE	88	2.0	68.4	8	5	8	8	8
339	CE	89	2.5	77.3	8	7	8	8	11
340	CE	89	2.5	28.1	3	3	5	5	8
341	CE	89	2.5	41.5	8	7	8	8	5
343	CE	89	2.5	16.7	6	6	5	5	8
344	CE	89	2.5	16.9	3	5	4	2	6
388	CE	90	3.5	34.6	7	6	8	9	11
389	CE	90	3.5	26.8	8	8	8	8	11
391	CE	90	5.5	39.9	8	8	8	9	11
392	CE	90	2.5	31.2	8	6	8	9	11
393	CE	90	2.5	13.4	8	7	8	7	6
394	CE	90	3.5	13.6	5	5	5	5	8
MEAN			2.9	42.8	6.1	6.1	6.9	7.0	9.1

- FS = Fakahatchee Strand State Preserve
BI = Bear Island Unit of Big Cypress National Preserve
PR = Florida Panther National Wildlife Refuge
CDU = Corn Dance Unit of Big Cypress National Preserve
CE = Collier Enterprises
- Depots of fat were assigned values of 1-9 with 1 representing nonexistent or very low levels and 9 representing heavy deposits
- Physical condition values of 1-12 were estimated with 1 representing very poor condition and 12 extremely good.

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Appendix 3. Reproductive status of adult does collected 1986 - 1990.

NO.	YEAR	AREA ¹	AGE	PREG?	FETUS NO.

155	86	FS	2.5	Y	1
156	86	FS	5.5	N	0
167	86	FS	2.5	Y	1

202	87	FS	1.5	Y	2
203	87	FS	2.5	N	0
204	87	FS	1.5	N	0

258	88	FS	1.5	N	0
260	88	FS	1.5	Y	2
262	88	FS	1.5	Y	1
264	88	FS	1.5	Y	1
267	88	FS	2.5	Y	1

346	89	FS	2.5	Y	1
348	89	FS	2.5	Y	1
349	89	FS	4.5	Y	1
350	89	FS	1.5	Y	1
351	89	FS	2.5	Y	2

382	90	FS	2.5	N	0
383	90	FS	2.5	N	0
386	90	FS	2.5	Y	2
387	90	FS	2.5	Y	1
407	90	FS	1.5	N	0
408	90	FS	3.5	Y	2

MEAN			2.5	68.2%	0.91

159	86	BI	2.5	Y	1
160	86	BI	3.0	Y	1
161	86	BI	2.0	Y	1
164	86	BI	2.5	Y	1
165	86	BI	2.5	Y	1

206	87	BI	4.5	Y	1
208	87	BI	4.5	Y	1
209	87	BI	5.5	Y	2
211	87	BI	1.5	Y	1
212	87	BI	2.5	Y	1
213	87	BI	1.5	Y	1

244	88	BI	2.5	Y	1
245	88	BI	2.5	Y	2
246	88	BI	1.5	Y	1

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Appendix 3. Continued.

NO.	YEAR	AREA ¹	AGE	PREG?	FETUS NO.

247	88	BI	2.5	Y	2
248	88	BI	3.5	N	0
249	88	BI	3.5	Y	2

310	89	BI	1.5	Y	1
311	89	BI	2.5	Y	2
312	89	BI	2.5	Y	1
314	89	BI	4.5	Y	2
329	89	BI	2.5	N	0
331	89	BI	4.5	Y	1

396	90	BI	2.5	Y	1
397	90	BI	1.5	Y	1
414	90	BI	1.5	Y	1
415	90	BI	2.5	Y	1
417	90	BI	2.5	Y	1
418	90	BI	3.5	Y	2

MEAN			2.8	93.1%	1.17

179	86	PR	2.5	Y	1
180	86	PR	2.5	Y	1

239	87	PR	5.5	N	0
240	87	PR	1.5	Y	1
242	87	PR	4.5	Y	2

298	88	PR	2.5	Y	1
301	88	PR	2.5	Y	1
305	88	PR	1.5	Y	1
306	88	PR	2.5	Y	1
307	88	PR	3.0	Y	2
308	88	PR	5.5	Y	2
309	88	PR	4.0	Y	1

322	89	PR	3.5	Y	1
323	89	PR	3.5	Y	1
325	89	PR	2.5	Y	1
326	89	PR	3.5	Y	1
327	89	PR	4.5	Y	1
330	89	PR	3.5	N	0

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Appendix 3. Continued.

NO.	YEAR	AREA ¹	AGE	PREG?	FETUS NO.

398	90	PR	2.5	Y	1
399	90	PR	3.5	Y	1
401	90	PR	2.5	Y	1
402	90	PR	4.5	Y	1
404	90	PR	2.5	Y	1
405	90	PR	5.5	Y	1

MEAN			3.3	91.7%	1.04

197	87	CDU	2.5	Y	1
198	87	CDU	1.5	Y	1
199	87	CDU	2.5	Y	2
200	87	CDU	1.5	Y	1
201	87	CDU	1.5	Y	1

250	88	CDU	1.5	Y	1
251	88	CDU	1.5	Y	1
252	88	CDU	2.5	Y	1
253	88	CDU	1.5	N	0
254	88	CDU	1.5	Y	1
255	88	CDU	2.5	Y	1
256	88	CDU	2.5	Y	1

332	89	CDU	4.5	N	0
333	89	CDU	2.5	Y	1
335	89	CDU	2.5	Y	1
336	89	CDU	1.5	N	0
337	89	CDU	4.5	Y	1

410	90	CDU	2.5	Y	1
411	90	CDU	2.5	Y	1
413	90	CDU	3.0	Y	1
420	90	CDU	3.0	Y	1

MEAN			2.4	85.7%	0.90

216	87	CE	3.5	Y	1
217	87	CE	1.5	Y	1
219	87	CE	3.5	Y	1
221	87	CE	2.5	Y	1
222	87	CE	3.5	Y	2
223	87	CE	3.5	Y	1

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Appendix 3. Continued.

NO.	YEAR	AREA ¹	AGE	PREG?	FETUS NO.

271	88	CE	2.5	Y	2
272	88	CE	3.0	Y	1
273	88	CE	2.0	Y	1
276	88	CE	3.0	Y	1
277	88	CE	3.5	Y	1
278	88	CE	2.0	Y	1

339	89	CE	2.5	Y	1
340	89	CE	2.5	Y	2
341	89	CE	2.5	Y	1
343	89	CE	2.5	Y	1
344	89	CE	2.5	Y	2

388	90	CE	3.5	Y	2
389	90	CE	3.5	Y	2
391	90	CE	5.5	Y	2
392	90	CE	2.5	Y	1
393	90	CE	2.5	N	0
394	90	CE	3.5	Y	1

MEAN			2.9	95.6%	1.26

1. AREA FS = Fakahatchee Strand State Preserve
 BI = Bear Island Unit of Big Cypress National Preserve
 PR = Florida Panther National Wildlife Refuge
 CDU = Corn Dance Unit of Big Cypress National Preserve
 CE = Collier Enterprises

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Appendix 4. The Fakahatchee Strand State Preserve Deer Herd
With a Profile of Resident Panthers

The Fakahatchee Strand State Preserve Deer Herd

With a Profile of Resident Panthers

by

J. W. McCown

INTRODUCTION

The Fakahatchee Strand State Preserve (FS) has long been identified as suitable habitat for the Florida panther (Felis concolor coryi) (Beard 1948, Maehr 1990). The panther is endangered, numbering no more than 50 individuals residing south of Lake Okeechobee (Maehr 1990). Throughout its south Florida range the panther is dependent on large prey, primarily white-tailed deer (Odocoileus virginianus) and wild hogs (Sus scrofa) (Maehr et al. 1990). Panther management, therefore, is, to a degree, prey management. Appropriate prey management depends in large part on understanding factors influencing the population. In 1986, the Florida Game and Fresh Water Fish Commission began a study to better understand panther/deer relationships in FS and to provide information for appropriate management and enhancement of both deer and panther populations. In addition to FS, deer herds from the Bear Island (BI) and Corn Dance Units (CDU) of Big Cypress National Preserve, Florida Panther National Wildlife Refuge (PR), and Collier Enterprises (CE) were studied. The objectives of this study were:

1. Assess deer herd health and compare physiological values among study areas;
2. Determine deer herd natality rates;
3. Calculate age and sex structures;
4. Estimate deer numbers and density; and

5. Assess deer herd densities in relation to carrying capacity. I acknowledge many individuals without whom this study would not have been possible. Particularly helpful were S.D. Wright, S.R. Telford and D.J. Forrester, University of Florida School of Veterinary Medicine, who conducted necropsies. Also, my colleagues J.C. Roof, E.D. Land and D.S. Maehr performed admirably often with little sleep and frequently under adverse conditions. The success of this study is due also in no small part to the efforts of the staffs of FS and PR and employees of CE.

STUDY AREA

Physiography

FS is the major drainage of the western Big Cypress swamp and is located in south central Collier County, Florida. It is bounded on the north and east by Interstate 75 and State Road 29, respectively, on the west by southern Golden Gate Estates and on the south by the Gulf of Mexico. This report focuses on that portion of FS north of U.S. 41 (Fig. 1).

The topography of FS is flat and falls imperceptibly from a peak elevation of 4 m above mean sea level near I-75 to approximately 1 m along U.S. 41. FS is underlain by highly permeable limestone of the Tamiami formation. Soils are poorly drained peaty muck or brown peat 0.3 - 1.2 m deep under the heavily forested central portion of FS and the shallower, poorly drained Ochopee fine sandy marls along the periphery (Leighty et al. 1954). Climate of the area is tropical savannah (Duever et al. 1986) with average monthly temperatures ranging between 18.6 C in January to 28.3 C in August (Carter et al. 1973). Approximately 80% of the 140 mm of rainfall occurs between May and October (Carter et al. 1973). Given rainfall, poorly drained

soils and slow drainage along an average elevation decline of approximately 13.3 cm per km, portions of FS remain inundated through much of the year.

History

Until the mid-twentieth century the forest canopy in FS was dominated by old growth cypress (Taxodium distichum) and associated royal palms (Roystonea elata). Sub-canopy hardwoods included red maple (Acer rubrum), willow (Salix caroliniana), and popash (Fraxinus caroliniana) (Beard 1948). From 1944 through 1950 the main cypress slough of FS was logged by the Lee-Tidewater Company and most of the large cypress trees were removed (Alvarez 1978). The harvest operation laced the area with an elevated network of tramways and borrow canals still evident today (Fig 1). Extensive fires, fed by large amounts of slash and exacerbated by drought, were common after logging (K. Alvarez, pers comm.). The regrowth of the forest was not followed by a simple regeneration of the cypress but instead the previously sub-dominant species became dominant. Early stages of regrowth in willow, maple, and early successional forbs and herbs proved a temporary boon to deer. After cessation of logging, the area was sold to the Gulf American Land Corporation who marketed it as a sportsman's paradise. Approximately 6000 lots, some as small as 0.1 ha (0.25 ac) were sold (Alvarez, pers. comm.). Owners were allowed recreational access over the entire area. Hunting was the primary use of the strand (Tebeau 1966). By the early 1960's the deer herd had increased to an estimated 1 deer/10 ha (C. Chappell, pers. comm.). By the late 1960's, fire protection allowed plant succession to proceed to the point that habitat conditions for deer began to deteriorate. In 1967 and 1968 forest canopy closure and high water levels caused severe overbrowsing and led to a deer "die off" of noteworthy proportions (T. Hines, pers. comm.). In November 1968

a special hunt was held in an effort to improve the habitat conditions resulting from overbrowsing. In the 2 day hunt 109 deer were removed from FS (C. Chappell, pers. comm.). In 1974 the state began to acquire the FS from the Gulf American Land Corporation. The Department of Natural Resources currently owns approximately 19,000 of the 38,000 ha preserve (C. DuToit, pers. comm.).

Vegetation

FS consists of mixed swamp hardwoods dominated by red maple, pond apple (Annona glabra), sweet bay (Magnolia virginiana), willow, pop ash and myrtle (Myrica cerifera). Remnant cypress forests and domes are common throughout the area. Prairies of maidencane (Panicum hemitomon), muhly grass (Muhlenbergia capillaris), sawgrass (Cladium jamaicensis) and scattered cypress form expansive openings along the eastern and western fringes of the strand. Small oak (Quercus spp.) hammocks occur on higher sites throughout (Fig. 2) (McPherson 1973).

MATERIALS AND METHODS

Deer

Transects 1.6 km long representative of FS (N=6), PR (N=6) and CDU (N=10) vegetation were established to conduct deer track counts. Track counts were performed in May or June from 1987 - 1991. Unseasonably high water levels prevented tracks from being counted in PR in 1991. Transects were counted 4 - 6 times depending on water levels. Records were kept on the numbers and sex of deer observed during all field activities.

Deer were spotlighted and collected by rifle from Bear Island (BI), Corn Dance Unit (CDU), the Florida Panther National Wildlife Refuge (PR), and Collier Enterprises (CE) in addition to FS (Fig. 3). From 1986-1988 deer from

PR were returned by Fakahatchee Conservation Club (FCC) hunters from their leased property that subsequently became part of PR. Carcasses were kept on ice until being refrigerated prior to necropsy. Most necropsies were performed within 10 hours post-mortem. Weight, length, and girth were determined for each animal prior to necropsy. Ages were determined through wear and replacement of lower teeth (Severinghaus 1949). Post-mortem examinations followed procedures of Nettles (1981). Levels of fat deposits on the tail, pericardium, heart, and kidney (Stockle et al. 1978) were assigned a value of 1-9. The ratio of kidney fat weight to kidney weight (kidney fat index, KFI) was determined (Riney 1955). A physical condition value of 1-12 was assigned to each animal based on endogenous fat deposits, coat and muscling qualities, and conditions or abnormalities observed during necropsy. Abomasal parasite counts (APC's) were determined and analyzed according to Eve and Kellogg (1977).

A fecal assay of diaminopimelic acid (DAPA) was performed to document any nutritional differences among study areas. Levels of DAPA, an amino acid, found in the cell walls of ruminant bacteria, fluctuates directly with levels of digestible energy (Nelson et al. 1982). Approximately 10 fecal pellets were removed from the intestinal tracts of adult deer during necropsy for DAPA analysis. Pellets from adult deer in each area were combined into a single sample for each year and analyzed by the Washington State University Wildlife Habitat Lab.

Reproductive tracts of females were removed and examined for fetuses. Fetuses were removed and aged using fetal length-age correlations (Harlow and Jones 1965).

Panthers

A profile of panther health, reproduction and usage of the area was constructed using published literature (Maehr et al. 1991) and Florida Game and Fresh Water Fish Commission annual performance reports (Maehr 1990, Roelke 1990). During the period 1 January 1981 through 15 May 1991 8 panthers residing principally in FS were immobilized and examined approximately 20 times. During the same period 21 panthers residing north of I-75 were examined approximately 38 times. Standard measurements, reproductive condition and general health were recorded and reported. Panthers were assigned physical condition values of 1 (excellent) - 4 (grave) (Roelke 1990). During the period 1 January 1986 through 31 December 1990, 7 panthers were located 1,126 times in or near FS (Appendix 1). When panther activity indicated denning, the numbers of young were estimated by field sign observed while approaching the female on foot and by observation during capture attempts (Maehr 1990).

Data Analysis

The deer track count transect data was tested by ANOVA for significant differences among all areas and among years for FS. When significant differences existed they were identified by the Newman-Keuls multiple range test (Zar 1974). The rates of deer observed per hour for each collection night were ranked for all areas and by year for FS. Differences among areas and years were tested for by the Kruskal-Wallis analysis of variance by ranks. When differences existed they were identified by Dunn's multiple comparison procedure (Hollander and Wolfe 1973).

Morphometric values (weight, length, girth), fat level estimates (tail, heart, peri-cardial, kidney, KFI), physical condition estimates, and APC data from adult females (> 1 year old) were analyzed by ANOVA to determine

if a significant difference existed among area or year means. When ANOVA rejected the null hypothesis of equal area or year means the Newman-Keuls multiple comparison test was used to identify which means were different.

A 5 x 2 contingency table was constructed listing the frequencies of occurrence of either 0 or more than 0 fetuses by area. Likewise, a similar table was constructed listing the frequencies of occurrence of either 1 or 2 fetuses by area. A chi-square analysis was used to test the following null hypotheses: 1. The incidence of pregnancy was the same in all areas and; 2. the intra-uterine fecundity rate was the same for all areas.

Chi-square values were derived using the Bonferroni adjustment and therefore are conservative (Johnson and Wichern 1982).

To estimate trends in panther use of FS, the use patterns of those cats located in the preserve during the study period were examined. An index was calculated by dividing the known radio-collar days (known days alive) of panthers # 8, # 9, # 10, #11, # 12, # 25, # 30 and # 37 into the total number of radio locations in an area bounded by the Transverse Mercator points (EW, NS) : 455.0, 2892.5; 465.0, 2892.5; 455.0, 2868.0; 465.0, 2868.0 (a rectangle encompassing the preserve) (Appendix 1). This ratio is an approximation of the percentage of each year that these 7 panthers spent in FS. Differences between weights of adult panthers in FS and all other areas north of I-75 were tested for using a t-test for each sex.

RESULTS

Deer

Track count data indicate that the herd in FS may be increasing while other herds appear to be more stable (Fig 4). The mean number of tracks

per transect in BI for the years 1985-1987 (11.47) (Schortemeyer et al. 1991) was significantly greater than PR and FS ($p < 0.05$). No other area differences were observed. The FS 1989 and 1991 mean numbers of tracks per transect (3.2 and 4.8 respectively) were significantly greater than 1987 (1.47) and 1988 (1.25) means ($p < 0.05$). No other yearly differences were found within other areas. Estimates for FS generated by 1989 and 1991 track counts suggest a density of approximately 1 deer per 54-81 ha.

The mean number of deer observed per hour in FS during collections was 0.351, lowest of all study areas, but was significantly different only from CE (5.45) ($p < 0.05$) (Fig 5). Although the deer observed per hour in FS during collections increased from 0.270 in 1986 to 0.683 it was not a significant increase.

Observations made during collections indicate an adult sex ratio of 1 male:1.2 females in FS, lowest sex ratio of the areas studied (Table 1).

One hundred fifty-one deer were collected and 21 were returned by hunters from PR (FCC leased lands). One hundred twenty were adult females, 19 were adult males, 16 were yearling females and 18 were yearling males.

Mean morphometric values of adult females are provided in Table 2. The mean weights of female deer from FS and CDU were less than the means from BI, CE and PR ($p < 0.05$). Although mean weights of adult females from all areas tended to increase with age, deer from CDU and FS weighed less than deer from BI, PR, and CE in most age classes (Fig 6). The mean KFI's of adult females from FS and CDU were less than those of PR, BI and CE deer ($p < 0.05$) (Table 3). The mean KFI's of adult females from FS, CDU and PR were comparatively stable and did not fluctuate as dramatically as did BI and CE (Fig 7). The mean tail fat indices and physical condition values of PR, FS

and CDU were less than those of CE and BI ($p < 0.05$). There were fewer differences among areas for estimates of organ fat levels (heart, peri-cardial and kidney) (Table 3). The mean APC's of adult FS deer for all years (879) was within the range from other areas (726-1318) and was not different from other area values (Table 4). However, the mean APC of BI deer (754) was significantly different from that of CDU (1318) ($p < 0.05$). There was an inverse relationship between APC's and physical condition of FS deer (Fig 8). Although the mean DAPA level of adult deer from FS was low (0.694), it was not significantly different from other areas (Table 5).

The percentage of pregnant adult deer in FS (68.2%) was significantly less than all other areas ($p < 0.05$) (Table 6). However, because the number of fetuses produced by pregnant FS deer (1.33) was higher than other areas, although not significant, the net productivity was similar to other areas.

Panthers

Generally lower blood values (packed cell volume, hemoglobin count, red blood cell counts, serum iron), weights, extent of subcutaneous fat and coat quality indicated panthers in FS were not as healthy as panthers north of I-75. Differences in physical condition values were particularly noteworthy among females. The mean physical condition score of FS females (2.0) was worse than females north of I-75 (1.4).

Average documented litter size of panthers residing in FS (1.33, $N = 3$) was well below the average for all panthers (2.0, $N = 14$) (Maehr et al. 1991). Mean body weights of adult panthers were 14% less for males and 22% less for females. The difference for males was significant ($P < 0.05$) (Maehr, unpub. data).

Between 1986 and 1990 the total number of collared panthers in or near FS varied from 3 to 4. The highest number of radio locations were recorded in 1986, the fewest in 1987. A declining index of panther use was noted from 1986 through 1990 (Table 7). When all known panthers (including uncollared kittens) are considered, the number of panthers in FS varied from 3 to 6, with the highest total (6) occurring only in 1990.

DISCUSSION

Deer

Density estimates from deer track counts should be viewed with caution. They are most appropriately used as a long term trend indicator. The deer herd trend in FS appears to be increasing as evidenced by track counts. However, results of track counts were confounded by problems in transect methodology and naturally occurring events. After the virtual elimination of ORV traffic in 1987, deer transects began regrowing rapidly in vegetation. It was predicted (McCown 1988, 1989; DuToit 1989) that this would result in transects that were unusable. In 1989 track counts were conducted along bulldozer lines created during fire suppression. It is possible deer may have been attracted to these paths by regrowth of forage and ease of travel through previously dense vegetation. By 1990 thick regrowth of vegetation prevented tracks from being counted on fire lines. In 1991, however, the recent clearing and mowing of trams allowed tracks to be counted. However, much of the tram usage was by does with fawns during a period of very high water. Given the above caveats, it is possible that deer numbers have increased in FS. This is supported by the increase in the number of deer observed per hour during collections from 0.270 in 1986 to 0.683 in 1990. Collections were conducted in similar areas from year to year. It is likely

that the upper limit to herd increases is determined by the quality of strand habitat. Increases in FS deer densities approaching BI (1 deer/25-40 ha; Schortemeyer et al. 1990) can not be expected. Prairie and cypress habitats support fewer deer than pine flatwoods, hardwood hammocks or marshes (Harlow 1959). Harlow (1959) estimated the potential deer density in swamps to be 1 deer/45 hectares (approximately the density indicated by the 1991 track count along trams in the swamp portion of FS) and in prairies to be 1 deer/283 hectares. It would be reasonable to assume the potential deer density in FS falls within these figures and may currently exist at these expected levels.

The FS white-tailed deer adult sex ratio of 1 male:1.2 females was the lowest sampled (Table 1); but indicative of a stable herd. The average age of adult females (2.5) compared to other herds (2.4 - 3.3) suggests a comparable mortality rate (Table 2).

The similarity of mean weights of 2.5 year old FS females to those from CDU and PR and the difference of FS from BI and CE deer seem habitat related. FS, CDU and PR are primarily swamp ecosystems dominated by cypress or mixed swamp hardwoods. Although strand soil is deep and organic, annual hydropatterns substantially reduce available nutrients and forage. Further, there were similarities in condition indicators among the "cypress" deer herds. Deer body weights have long been used as indicators of habitat conditions (Severinghaus 1955). Heavier deer result from better nutrition (Verme 1963) and are characteristic of healthier, more reproductive animals (Verme 1965). The 3 herds inhabiting cypress habitats had lower numbers of fetuses per doe than did the other herds, although not significantly less (Table 6). Although storage of body fat is not necessary for over-winter survival of sub-tropical deer, the ability to store fat reflects habitat

conditions. FS deer had similar mean KFI's as other deer inhabiting cypress habitats (CDU and PR) and significantly less than other herds (Table 3). The dramatic increase in the KFI's of BI and CE in 1988 (Fig. 7) is believed related to the heavy acorn crop of that year. Oak trees are more common in BI and CE than in other areas. Similar mean condition values among FS, CDU and PR further support the conclusion that deer inhabiting cypress dominated habitats are smaller, leaner, less productive and exist at lower densities than deer in other areas.

The inverse relationship between physical condition and APC's has been previously noted for BI and CDU herds (McCown 1988) and for other southeastern deer (Davidson et al. 1982). APC's do not usually directly affect physical condition because with the exception of extreme intensities of Haemonchus contortus abomasal parasites are not pathogenic (Davidson et al. 1980). Rather the relationship is associative and reflective of range conditions. Deer in good physical condition tend to have low APC's while those in poorer physical condition have high APC's. Deer in FS appear to be in good physical condition relative to current habitat conditions.

Panthers

Similar to conclusions concerning FS deer, lower body weights, fat levels and overall physical condition of female panthers in FS may be affecting reproduction. Panthers in poorer physical condition will have fewer offspring (Maehr et al. 1991) and have a more difficult time rearing them. The annual decline in the panther use index is likely due to several factors including the removal of resident female #8 in 1987, the dispersal of subadult #10 out of FS in late 1986, the northward shift of resident male #12 after 1988 and the deaths of subadult male #30 and adult male #37 in 1990 (Maehr et

al. 1991). Further, no kittens were collared in the preserve after 1986 although at least 3 were known to have been produced (Maehr 1990). Considering these qualifications the panther use index may not be representative of actual panther use through 1990. Projecting current use patterns through 1991, however, suggests that an actual decline in panther use will be measurable. The combined influences of #37's death, #12's very infrequent visits to FS and no additional collared kittens, has left #09 as the only known resident of the preserve. There does not appear to be a reasonable explanation for any observed or predicted variation in panther use based solely on deer herd analyses. The current documented decline in panther use of FS has occurred during an apparent deer herd increase. More likely, the variation is influenced more by a combination of natural fluctuations in panther demographics and unnatural mortality (highway mortality and kitten removals).

MANAGEMENT IMPLICATIONS

Deer in FS are generally smaller, leaner, in poorer physical condition, less productive and less numerous than deer in BI and CE. These physiologic and demographic qualities of FS deer are largely attributable to the nature of the habitat. However, habitats can be manipulated. Given the endangered status of the Florida panther and its dependence on deer a program to significantly increase deer numbers and the quantity and quality of deer forage is reasonable. This can most easily be accomplished in FS through creation and maintenance of early successional openings in the strand and prescribed burning of the prairies and pinelands. Additionally, planting of native species of forage in food plots should be considered. The effect of early successional vegetation upon the FS deer was demonstrated by the

clearcutting of the 1940's. Clearcutting the strand would eliminate many unique areas of tropical flora, possibly extirpate many wildlife and plant species and clearly would be irresponsible. However, a much smaller, more practical way to create openings would be to clear existing trams and the many older willow and myrtle thickets distributed along the tramways. A vegetation survey should precede tram clearing. Trams or areas along trams containing endangered plants should not be cleared. Trams and thickets could be cleared by a method similar to the one recently employed along the East Main and South Main trams. To significantly affect the FS deer herd, openings should be distributed throughout the area and approach 10% of strand habitat. Prescribed fire can be used inexpensively to treat prairies and pinelands to increase the amount, availability, and mineral content of forage for deer (Stransky and Harlow 1981). Current efforts by DNR in FS to clear trams and burn prairies and pinelands should continue and increase with special attention given to annual tram maintenance (mowing, discing). Additionally, the expansion of recently created food plots should be considered. In 1987 the Florida Department of Natural Resources tried an experimental planting of joint vetch (Aeschynomene americana). Observations of these plots indicate that the vetch inside deer proof wire exclosures was taller and more dense than the surrounding plants indicating heavy browsing by deer. During collections and track counts, deer were frequently observed browsing in food plots. The current small acreage of food plots (< 2 acres) should be significantly expanded to a minimum of 1% of FS. Because Aeschynomene has been proven to grow in FS, is native and reseeds itself, consideration should be given to increasing planted acreage.

RESEARCH NEEDS

If significant money and manpower is to be spent in an effort to increase the FS herd then adequate provisions should be made to measure the effect. To document long term herd trends, approximately 8 - 10 permanent track count transects 1.6 km long should be established in representative plant communities of FS. They should be distributed in proportion to plant community occurrence. Track count transects should be treated with a disc or other implement to ensure a good tracking medium. Tracks should be counted during a period of low water after the February - March fawning season . Further details for conducting track counts can be found in Mitchell (1986).

Although much can be inferred from changes in deer density estimates, continuation of annual or biannual collections of deer should be considered to evaluate trends in herd health. Further, changes in plant species composition and nutritional quality resulting from habitat manipulations and plantings should be documented.

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Table 2. Mean morphometric values of adult does collected in October 1986-1990 in Bear Island (BI) and Corn Dance Units (CDU) of Big Cypress National Preserve, Collier Enterprises (CE), Florida Panther National Wildlife Refuge (PR), Fakahatchee Strand State Preserve (FS). Values followed by the same subscript were not significantly different ($p < 0.05$).

AREA	NO.	AGE	WEIGHT (kg)	LENGTH (cm)	GIRTH (cm)
BI	29	2.8	42.0 a	126.7 a	76.3 ab
CE	23	2.9	41.6 a	122.5 b	76.8 a
PR	24	3.3	40.7 a	124.7 ab	78.4 a
FS	22	2.5	37.6 b	119.1 c	73.2 b
CDU	22	2.4	31.5 c	108.9 d	66.9 c

Table 1. Adult male:adult female ratios in Corn Dance Unit (CDU), Bear Island (BI), Fakahatchee Strand State Preserve (FS), Collier Enterprises (CE), and Florida Panther National Wildlife Refuge (PR), from spotlight observations, 1984-1990.

AREA	YEARS	N	MALES	FEMALES	FAWNS & UNID	MALE:FEMALE RATIO
CDU	84-90	357	44	157	156	1:3.6
BI	84-90	370	63	145	162	1:2.3
FS	86-90	107	27	32	48	1:1.2
CE	86-90	195	22	60	113	1:2.7
PR	89-90	63	11	24	28	1:2.2

Table 3. Mean physical condition values of adult does collected in Collier Enterprises (CE), Bear Island (BI), Florida Panther National Wildlife Refuge (PR), Fakahatchee Strand State Preserve (FS), and Corn Dance Unit (CDU), 1986-1990. Column values followed by the same subscript were not different ($p < 0.05$)

Area	No.	Age	Kidney fat index ¹	Tail fat ²	Heart fat ²	Peri- cardial fat ²	Kidney fat ²	Physical condition value ³
CE	23	2.9	42.8 a	6.1 a	6.1 a	6.9 a	7.0 a	9.1 a
BI	29	2.8	40.4 a	5.6 a	5.3 ab	6.1 ab	5.5 b	8.7 a
PR	24	3.3	27.6 ab	4.0 b	4.3 b	4.9 abc	4.3 bc	7.1 b
FS	22	2.5	21.7 b	3.7 b	4.0 b	4.6 bc	4.3 bc	7.4 b
CDU	22	2.4	19.5 b	2.9 b	4.0 b	3.8 c	3.4 c	6.5 b

1. Kidney fat index is calculated by the following: weight of the kidney fat/weight of the kidney X 100. It is expressed as a percentage.
2. Fat levels were ranked from 1 - 9 with 1 representing very low or absent fat.
3. Physical condition was ranked from 1 - 12 with 1 representing very poor condition.

Table 4. Mean APC's of adult deer collected in Bear Island (BI), Fakahatchee Strand State Preserve (FS), Corn Dance Unit (CDU), Florida Panther National Wildlife Refuge (PR) and Collier Enterprises (CE) 1986 - 1990.

	BI	FS	CDU	PR	CE
1986	847	1561			
1987	629	495	1060	1058	2422
1988	448	987	2158	1289	816
1989	1123	596	913	210	424
1990	582	713	948	893	538
MEAN	726	870	1270	863	1050

Table 5. Mean DAPA levels of adult deer collected in Fakahatchee Strand State Preserve (FS), Bear Island (BI), Corn Dance Unit (CDU), Florida Panther National Wildlife Refuge (PR), and Collier Enterprises (CE) 1986 - 1989.

	FS	BI	CDU	PR	CE
1986	0.726	0.730		0.782	
1987	0.664	0.552	0.616	0.761	0.605
1988	0.626	0.697	0.783		0.791
1989	0.760	0.693	0.753	0.751	0.783
MEAN	0.694	0.668	0.717	0.765	0.726

Table 6. Mean reproductive condition of adult does collected in October 1984-1990. Asterick indicates significant area difference ($p < 0.025$).

AREA ¹	NUMBER	AGE	PERCENT PREGNANT	FETUS/ PREG DOE	NET PRODUCTIVITY
FS	22	2.5	68.2*	1.33	0.91
CDU	29	2.5	90.0	1.04	0.90
PR	24	3.3	91.7	1.14	1.04
BI	37	2.8	89.0	1.24	1.11
CE	23	2.9	95.6	1.31	1.26

1. FS = Fakahatchee Strand State Preserve
 CDU = Corn Dance Unit of Big Cypress National Preserve
 PR = Florida Panther National Wildlife Refuge
 BI = Bear Island Unit of Big Cypress National Preserve
 CE = Collier Enterprises

Table 7. Radio-collared panthers, days alive per year, and total radio locations per year in the Fakahatchee Strand State Preserve.

Panther No.	<u>Days Alive</u>				
	1986	1987	1988	1989	1990
8	365	104	---	---	---
9	365 (1)*	365 (1)	366	365	365 (2)
10	351	27	---	---	---
12	337	365	366	365	365
25			192	---	---
30				360	29
37					300
Days Alive	1418	861	924	1090	1059
Locations in FS	397	176	205	187	161
Total radio locations: total days (ratio)	.28	.20	.22	.17	.15

* known kittens