

# VEGETATION of the ATLANTIC COASTAL RIDGE of BROWARD COUNTY, FLORIDA, Based on 1940 Imagery\*

by Bryan Steinberg

**ABSTRACT:** *With the 1940 imagery and past vegetational studies in southern Florida as a base, the vegetation of the Atlantic Coastal Ridge of Broward County is mapped to show Strand, Tropical Hammock, Low Hammock, Mangrove, Swamp, Scrub, Pine Flatwoods, Dry Prairie, Wet Prairie and Marsh. Differences in vegetational types have characteristic species composition, ecology and soils.*

Southern Florida's vegetation was surveyed as early as the 1760's. Spanish records of southern Florida's vegetation before the English period (1763-1783) are few and lack detail. The first English surveys were by DeBrahm (1773) and Romans (1775). They described some vegetation types (pinelands, hammocks, swamps, marshes), and physical coastal features (inlets and rivers). During the 1800's the need for military information in the Seminole Wars brought about the production of the first reasonably accurate vegetation maps of southern Florida (Bruff, 1846; Ives, 1856). Federal surveys delineating townships and ranges for southern Florida (MacKay, 1845; Williams, 1870; Fries, 1898) also described some vegetation characteristics as

did the United States Coast and Geodetic Survey (1883, 1884) of the area from the coastline west to the first coastal ridge.

Contemporary methods of vegetation analysis were pioneered in the early 1900's. Harshberger (1914) and Harper (1927) produced the first ecological studies of the vegetation of southern Florida. Later, Davis (1943) stressed ecology, soils and topography and introduced remote sensing to vegetation analysis. Alexander (1958) published the only detailed vegetation analysis of a part of Broward County, a coastal section in Pompano Beach (T.49S, R. 43E, Sec. 6).

Urbanization has caused the spread of exotic species into natural habitats. Currently *Schinus terebinthifolius* Raddi, *Casuarina equisetifolia* Forst and *Melaleuca quinquenervia* (Cav.) Blake are three exotic tree species which have invaded much of the native vegetation of Broward County. These species spread into any habitat that is disturbed.

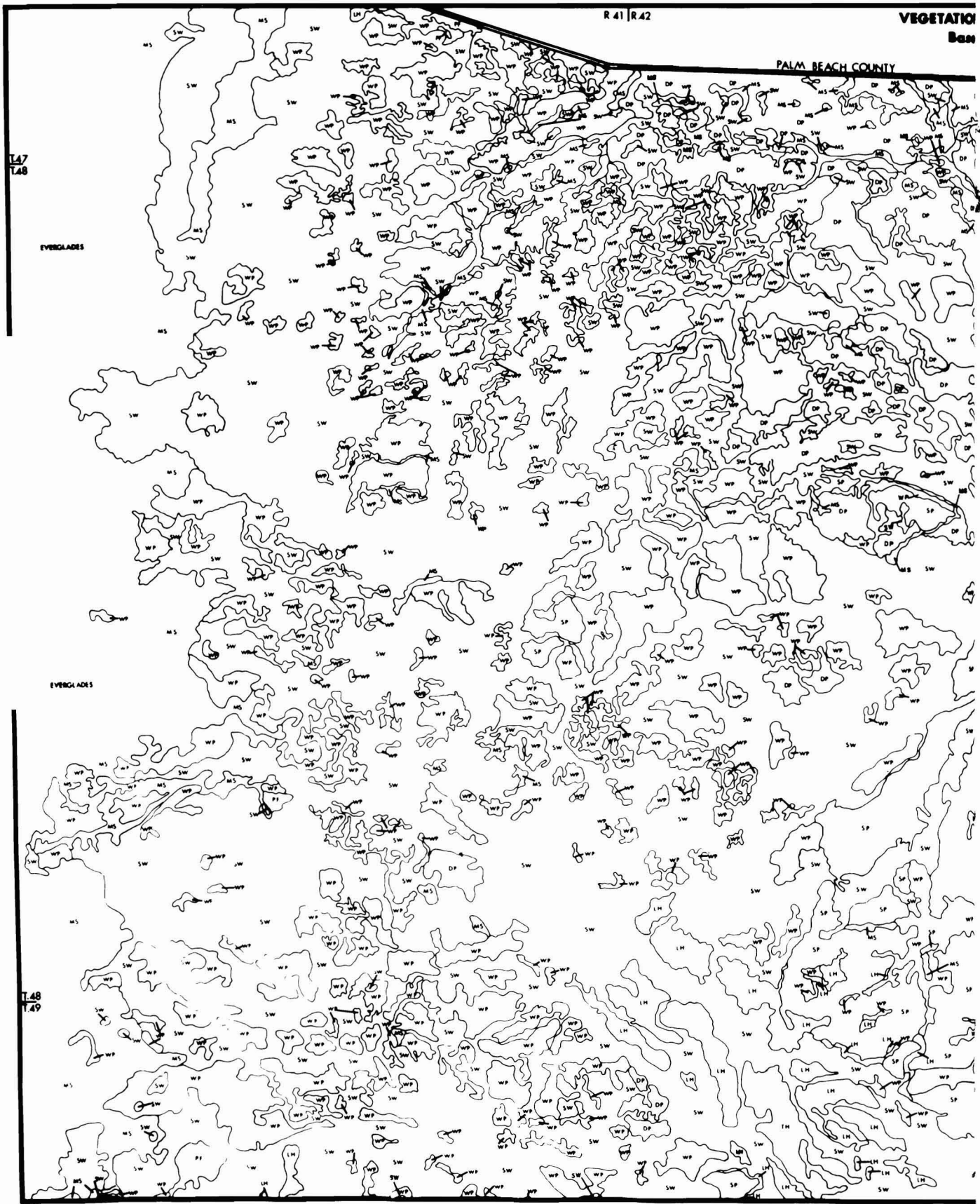
I have mapped the vegetation of the Atlantic Coastal Ridge of Broward County from the earliest imagery available (1940). The vegetation maps will aid in the assess-

ment of human interference and exotic species spread into the natural habitat of the County.

**METHODS** — The vegetation maps were produced using standard stereoscopic techniques with aerial photographs from the United States Department of Agriculture (1940, 1947, 1948, 1949). Ground truth surveys were made of the existent vegetation to aid in the interpretation of the vegetation from the photographs. Changes which occurred before 1940 in the vegetation are not shown on the vegetation maps, but earlier studies which described vegetation features were compared with vegetation maps. Particularly useful early studies were by DeBrahm (1773), Romans (1775), MacKay (1945), Bruff (1846), Ives (1856), Williams (1870), United States Coast and Geodetic Survey (1883, 1884), Fries (1898), Harshberger (1914), Harper (1927), Davis (1943), and Alexander (1958).



\*See "Behind the Scenes," inside front cover.

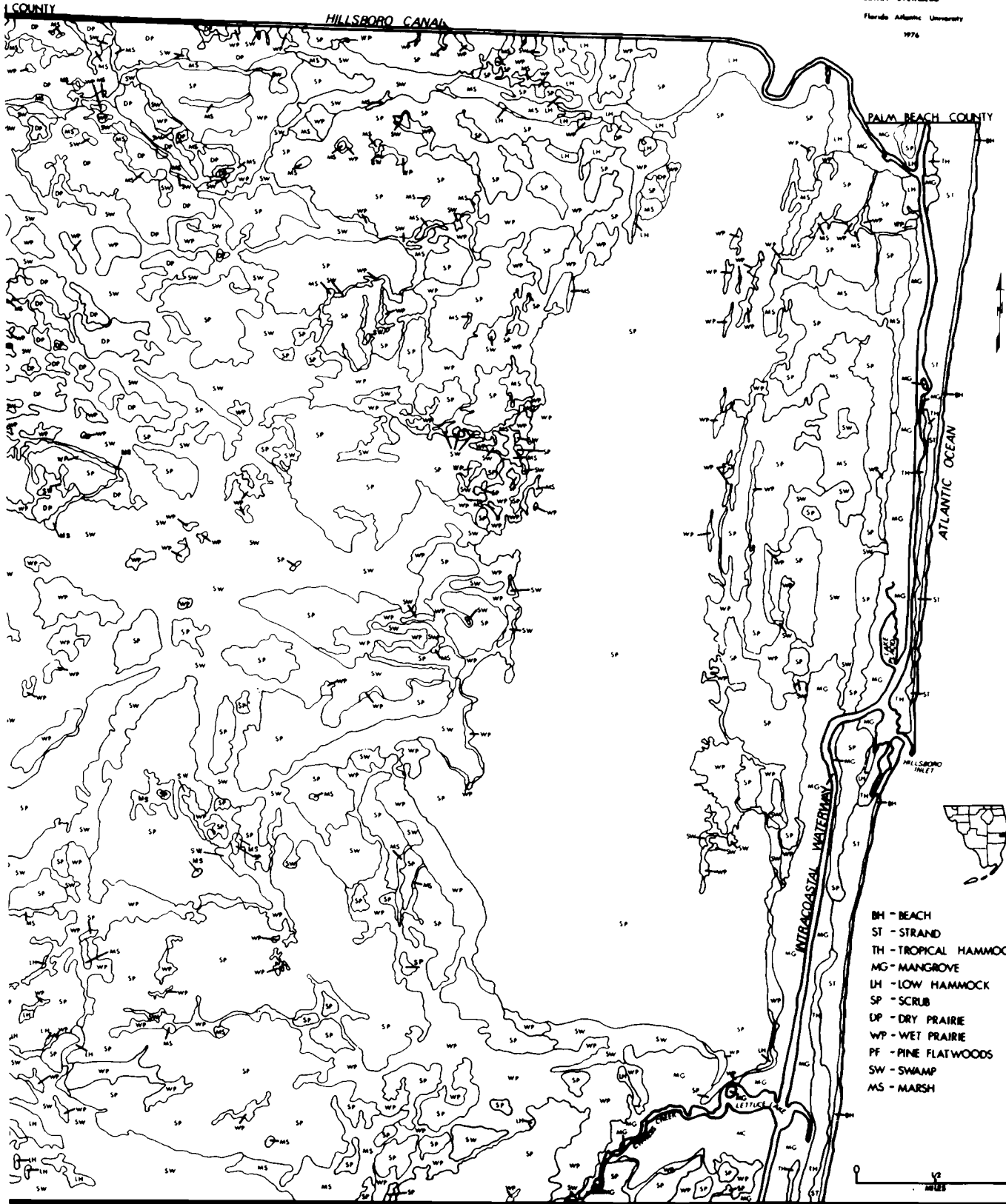


Map 1: Vegetation Map of Broward County, based on 1940 imagery, northern section. [Bryan Steinberg]

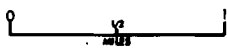
**VEGETATION MAP OF COASTAL BROWARD COUNTY**  
 Based on 1940 Imagery, Map 1

R42/R43

Interpreted and drawn by  
 MEYAN STEINBERG  
 Florida Atlantic University  
 1976



- BH - BEACH
- ST - STRAND
- TH - TROPICAL HAMMOCK
- MG - MANGROVE
- LH - LOW HAMMOCK
- SP - SCRUB
- DP - DRY PRAIRIE
- WP - WET PRAIRIE
- PF - PINE FLATWOODS
- SW - SWAMP
- MS - MARSH



Vegetation — Ten vegetation types are recognized.

Strand: = Sea Beach Formation and Dune Formation (Harshberger, 1914); = "Strand" (Davis, 1943) but not Coastal Hammock (see below). Strand is the first vegetation to occur inland from the ocean on beaches along the coasts. Soils are undifferentiated beach sands. The species are herbaceous to shrubby, salt tolerant, display varying degrees of succulence, and are often dispersed by the ocean.

Species in the Strand are characteristically zoned:

ZONE 1: Closest to the ocean this zone typically contains *Ipomoea pes-caprae* (L.) R. Brown, *Canavalia maritima* (Aubl.) Thouars., *Iva imbricata* Walt. and *Paspalum distichum* L.

ZONE 2: *Uniola paniculata* L., *Tournefortia gnaphaloides* (L.) R. Br., *Suriana maritima* L., *Scaevola plumieri* Vahl. and *Helianthus debilis* Nutt. often occur in this dune stabilizer zone.

ZONE 3: This zone consists mostly of thorny or prickly plants, commonly including *Opuntia compressa* (Salisb.) Macbride var. *austrina* (Small) L. Benson, *Yucca aloifolia* L., *Cnidioscolus stimulosus* (Michx.) Engelm. & Gray and *Agave decipiens* Baker.

ZONE 4: The zone farthest from the ocean contains thickets of shrubby plants such as *Serenoa repens* (Bartr.) Small, *Coccoloba uvifera* (L.), *Chrysobalanus icaco* L., *Randia aculeata* L., *Sabal palmetto* (Walt.) Lodd ex Schultes and *Scaevola plumieri* Vahl.

Strand vegetation occurred along the entire coast of Broward County (Maps 1, 2 and 3).

**Tropical Hammock:** = High Hammock Formation (Harshberger, 1914): includes Coastal Hammock of Davis (1943). These hammocks seem to be confined to areas where the temperature inside rarely, if ever, drops below freezing. Most commonly these habitats are coastal probably because of the warming effect of the ocean. The soils are Palm Beach fine sand (U.S.D.A., 1946) and a variety of sands, loams and rocklands (Davis, 1943).

Occasionally tropical hammocks are found inland at higher elevations on limestone outcrops or inland sand dunes.

The characteristic species are:

TREES: *Bursera simaruba* (L.) Sarg., *Mastichodendron foetidissimum* (Jacq.) Cronquist, *Sabal palmetto*, *Coccoloba diversifolia* Jacq., *Krugiodendron ferreum* (Vahl) Urban, *Metopium toxiferum* (L.) Krug & Urban, *Zanthoxylum fagara* (L.) Sarg. *Simarouba glauca* DC.

SHRUBS: *Ardisia escallonioides* Schlecht. & Cham., *Eugenia axillaris* (Sw.) Willd., *Psychotria nervosa* Sw., *Amyris elemifera* L., *Coccothrinax argenteata* (Jacq.) Bailey.

HERBS: *Rivina humilis* L., *Nephrolepis exaltata* (L.) Schott.

VINES: *Smilax bona-nox* L., *Vitis shuttleworthii* House.

EPIPHYTES: *Tillandsia fasciculata* Sw. *T. recurvata* L., *T. usneoides* L., *Encyclia tampensis* (Lindl.) Small.

Tropical Hammock was common along the coast of Broward County between the ocean and the Intra-coastal Waterway (Maps 1, 2, and 3). Inland tropical hammocks occurred in Broward County but less frequently (Maps 2 and 3).

**Low Hammock:** Includes Oak Hammocks, Oak Cabbage Palm Hammocks and Cabbage Palm Hammocks of Davis (1943). These hammocks are dominated by southern temperate tree species and are rarely flooded. Most Low Hammocks are elevated, but sometimes they occur in depressions or in ecotones between Scrub and some other vegetation of lower elevation (e.g., Marsh, Wet Prairie, Swamp, Mangrove). Some of the more common soils are Dade fine sand, St. Lucie fine sand (U.S.D.A., 1946) and Limestone outcrops.

The typical dominant species are:

TREES: *Quercus virginiana* Mill., *Sabal palmetto*, *Ficus aurea* Nutt., *Celtis laevigata* Willd., *Morus rubra* L.

SHRUBS: *Psychotria nervosa*, *P. sulzneri* Small, *Serenoa repens*, *Callicarpa americana* L. *Rhus copallina* L.

HERBS: *Thelypteris normalis* (C. Chr.) Small, *Nephrolepis exaltata*, *Pteridium aquilinum* (L.) Kuhn, *Blechnum serrulatum* Richard.

VINES: *Smilax auriculata* Walt., *S. laurifolia* L., *Vitis rotundifolia* Michx., *V. shuttleworthii*.

EPIPHYTES: *Tillandsia usneoides*, *T. recurvata*, *T. fasciculata*, *Encyclia tampensis*, *Polypodium polypodioides* (L.) Watt.

Low Hammock was frequently associated with the Hillsboro River, Cypress Creek, Middle River and New River systems in Broward County (Maps 1, 2, and 3) as well as ecotones between Scrub and some vegetation of lower elevation. Pine Island Ridge is a distinctive stand of Low Hammock approximately 10 - 15 mi inland elevated above the Everglades on St. Lucie sands (Map 3).

**Mangrove:** These are brackish to salt water swamps characteristic of protected coastal areas where there is shallow salt or brackish water little disturbed by wave action. The soils are Perrine Marl (U.S. D.A., 1946) and undifferentiated mangrove peats (Davis, 1943).

The dominant species are tree or shrubs and may occur in zones. The outer zone is of *Rhizophora mangle* L. In back of this zone may occur a band of *Avicennia germinans* (L.) L. and *Leguncularia racemosa* Gaertn. f. The inner zone may contain *Conocarpus erecta* L. and *Dalbergia ecasto-phyllum* (L.) Benth.

Mangroves were common in 1940 on both sides of the Intra-coastal Waterway (Maps 1, 2, and 3). Most of these mangroves have replaced coastal fresh water system (Marsh) present before the dredging of the Intra-coastal Waterway and the opening of new inlet to the ocean (United States Coast and Geodetic Survey, 1883, 1884 Austin, 1976).

**Swamp:** Includes all Swamp classifications of Harshberger (1914) Harper (1927) and Davis (1943). This is any stand of natural fresh water vegetation dominated by tree species, which is seasonally flooded or flooded most of the year. The most common soils are Lauderhill and Dania mucks (U.S.D.A., 1971), Davie mucky fine sand, and Pompano fine sand (U.S.D.A., 1946).

The most common species are:

TREES: *Taxodium distichum* (L.) Richard, *Acer rubrum* L., *Persea borbonia* (L.) Spreng. *Salix caroliniana* Michx., *Ficus citrifolia* Mill., *Quercus laurifolia* Michx., *Magnolia virginiana* L.

SHRUBS: *Psychotria nervosa*, *P. sulzneri*, *Myrsine guianensis* (Aubl.) Kuntze, *Myrica cerifera* L., *Baccharis halimifolia* L.

HERBS: *Sagittaria lancifolia* L., *Thalia geniculata* L., *Pontederia lanceolata* Nutt., *Nuphar luteum* (L.) Sibth. & Sm. spp. *macrophyllum* (Small) Beal., *Crinum americanum* L., *Cladium jamaicensis* Crantz., *Lemna perpusilla* Torr., *Blechnum serrulatum*, *Osmunda regalis* L., *Nephrolepis biserrata* Schott.

VINES: *Smilax auriculata*, *S. laurifolia*, *Vitis shuttleworthii*, *V. rotundifolia*, *Parthenocissus quinquefolia* (L.) Planchon., *Toxicodendron radicans* (L.) Kuntze.

EPIPHYTES: *Tillandsia fasciculata*, *T. utriculata* L., *T. usneoides*, *T. setacea* Sw., *T. balbisiana* Schultes, *Epidendrum rigidum* Jacq., *E. anceps* Jacq., *Encyclia tampensis*, *Polypodium poly-podioides*, *Campyloneurum phyllitidis* (L.) Presl., *Phlebodium aureum* (L.) Sm.

Swamp was common in Broward County along river systems (e.g., Cypress Creek, Middle River, and New River) and on the western section of the Atlantic Coastal Ridge south to New River (Maps 1 and 2).

*Scrub*: = Sand Pine Scrub (Davis, 1943); = Pine Barrens (Romans, 1775). This is the characteristic vegetation of sand ridges of St. Lucie, Paola, and Pomello sands (U.S.D.A., 1973). Scrub is not known to occur at elevations less than 10 - 15 ft. above sea level. Fire is important in maintaining Scrub and burning commonly occurs every 20 - 40 yr. (Florida Department of Natural Resources, 1975). The species display xeric adaptations such as small thick or succulent leaves, and specialized underground parts. Suckers are very common as a means of reproduction. The most common species are:

TREES: *Pinus clausa* (Engelm.) Sarg. (Sometimes not present).

SHRUBS: *Quercus virginiana* var. *geminata* Sarg., *Q. myrtifolia* Willd., *Q. chapmanii* Sarg., *Q. minima* (Sarg.) Small., *Serenoa repens*, *Ceratiola ericoides* Michx., *Ximenia americana* L., *Licania michauxii* France., *Lyonia ferruginea* (Walt.) Nutt., *L. lucida* (Lam.) K. Koch, *Vaccinium myrsinites* Lam.

HERBS: *Polygonella gracilis* (Nutt.) Meissner, *P. fimbriata* (Ell.) Horton, *P. polygama* (Vent.) Engelm & Gray, *Palafoxia feayi* Gray, *Sisyrinchium solstitiale* Bicknell.

VINES: *Cassytha filiformis* L., *Smilax laurifolia*.

EPIPHYTES: *Tillandsia recurvata*, *T. balbisiana*.

Scrub occurred in Broward County mostly west of the Intracoastal Waterway from the Palm Beach County line to Dade County and was transversed by Swamp and Marsh systems (Maps 1, 2 and 3). The largest Scrub ridge was transversed to the north by the Hillsboro River system and to the south by the Cypress Creek system (Map 1).

*Pine Flatwoods*: = Slash Pine (Harshberger, 1914); = Flatwoods (Harper, 1927); = Dry Pineland and Wet Pineland (Long & Lakela, 1971). Pine Flatwoods occur where soils are moderately to well drained and are fairly uniform in elevation. This habitat was not common on the Atlantic Coastal Ridge of southern Florida (MacKay, 1845; Ives, 1856; Williams, 1870), even though previous authors believed Pine Flatwoods was the dominant vegetation in that area (Harper, 1927; Davis 1943). Pine Flatwoods may occur on Immokalee soil (Davis, 1943), but also occur on a variety of other soil types such as Arzell and Broward fine sands (Wet Prairie soils) and St. Lucie sands (Scrub soil). The presence of Pine Flatwoods in Wet Prairie is mostly due to drainage of soils since the turn of the century. Scrub may be replaced by Scrubby Flatwoods dominated by *Pinus elliottii* Engelm. and *Quercus* spp. if the burning cycle is increased. The normal burning cycle for

Pine Flatwoods is from 3 - 7 yr (Hofstetter, 1974).

In southern Florida Pine Flatwoods vegetation has the following common species:

TREES: *Pinus elliottii* (at least 3 trees per acre).

SHRUBS: *Serenoa repens* and *Ilex glabra* (L.) Gray (two most common shrubs), *Lyonia ferruginea*, *Lyonia lucida*, *Befaria racemosa* Vent.

HERBS: *Coreopsis leavenworthii* T & G, *Heliotropium polyphyllum* Lehmann, *Hypericum tetrapetalum* Lam., *Satureja rigida* Bartr. ex Benth.

A few scattered stands of Pine Flatwoods occurred in Broward County in 1940 bordering the Everglades (Map 2) and in the southern sections of the county 3 - 5 mi inland (Map 3).

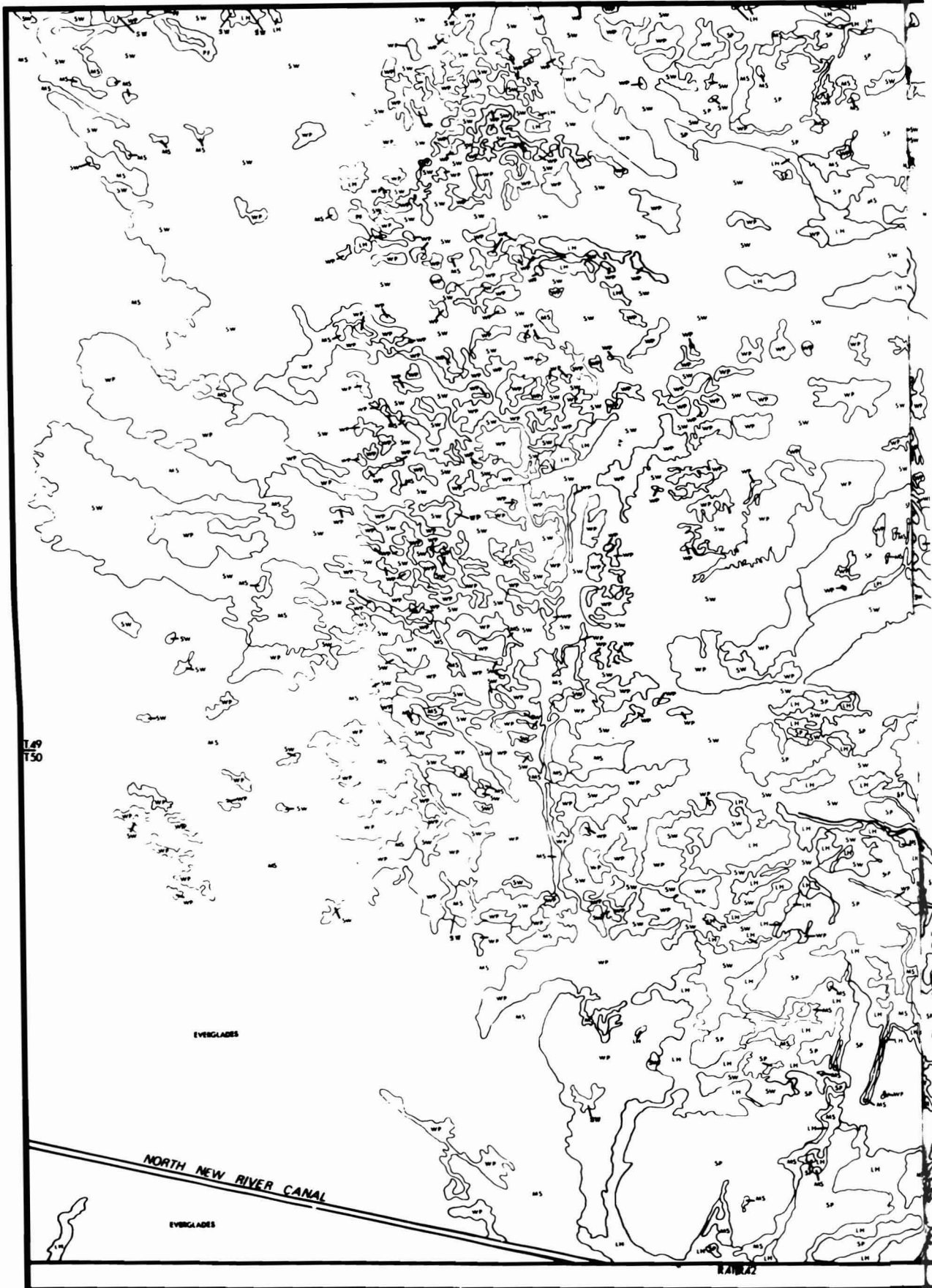
*Dry Prairie*: = Palm Savana (Harper, 1927); = Palmetto Prairie (Kuchler, 1964). Dry prairie is similar to Pine Flatwoods in soil and species composition except *Pinus elliottii* does not exceed 2 trees per acre (Harper, 1927).

This vegetation commonly occurs as a result of overburning of Scrub or Pine Flatwoods vegetation. Except for lack of *Pinus elliottii*, the typical species of Dry Prairies are the same as Pine Flatwoods (See Pine Flatwoods) but *Serenoa repens* is the dominant species.

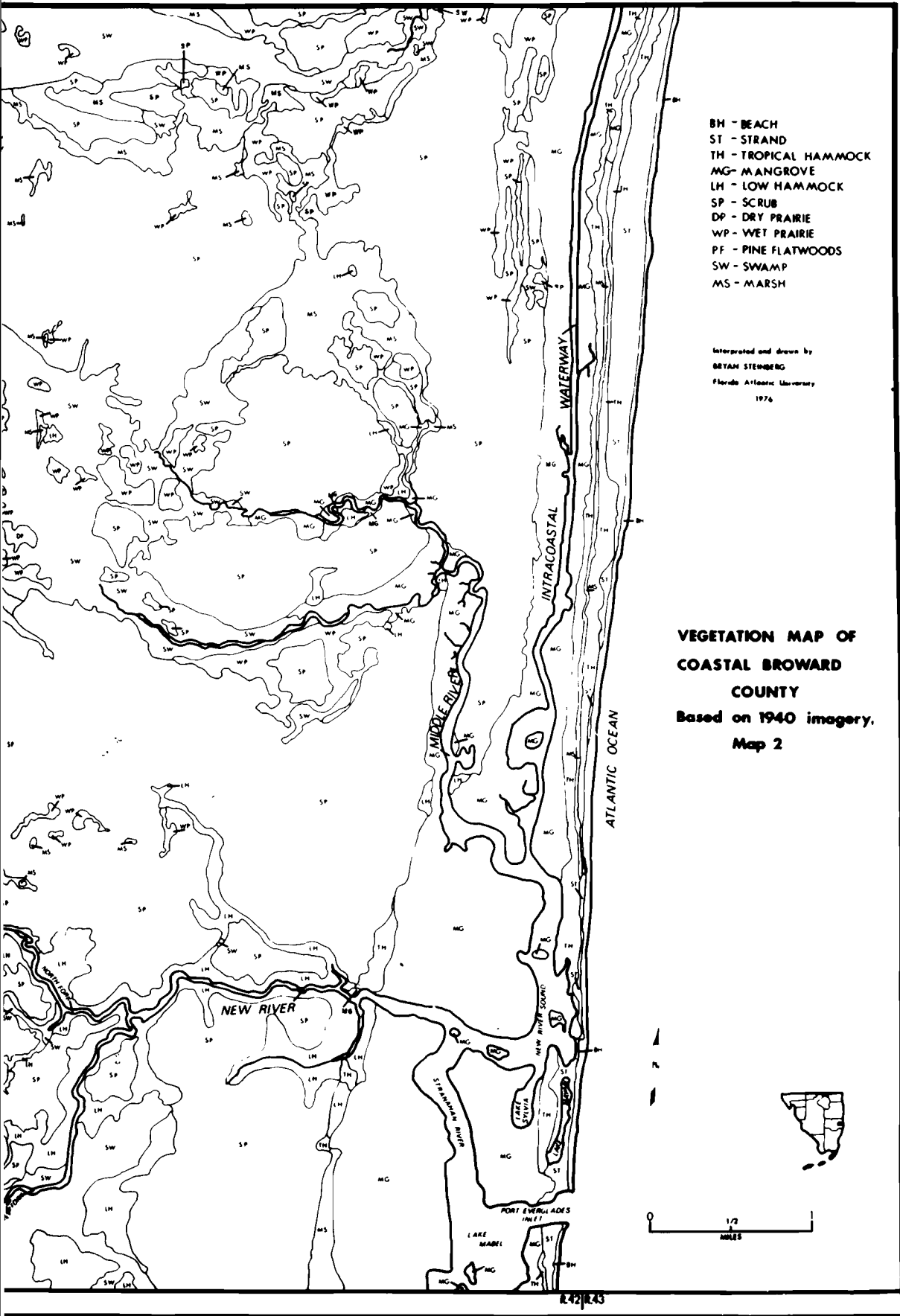
In Broward County, Dry Prairie occurred in the northern section four to six mi inland (Map 1) and in the southern section 3 - 5 mi inland (Map 3).

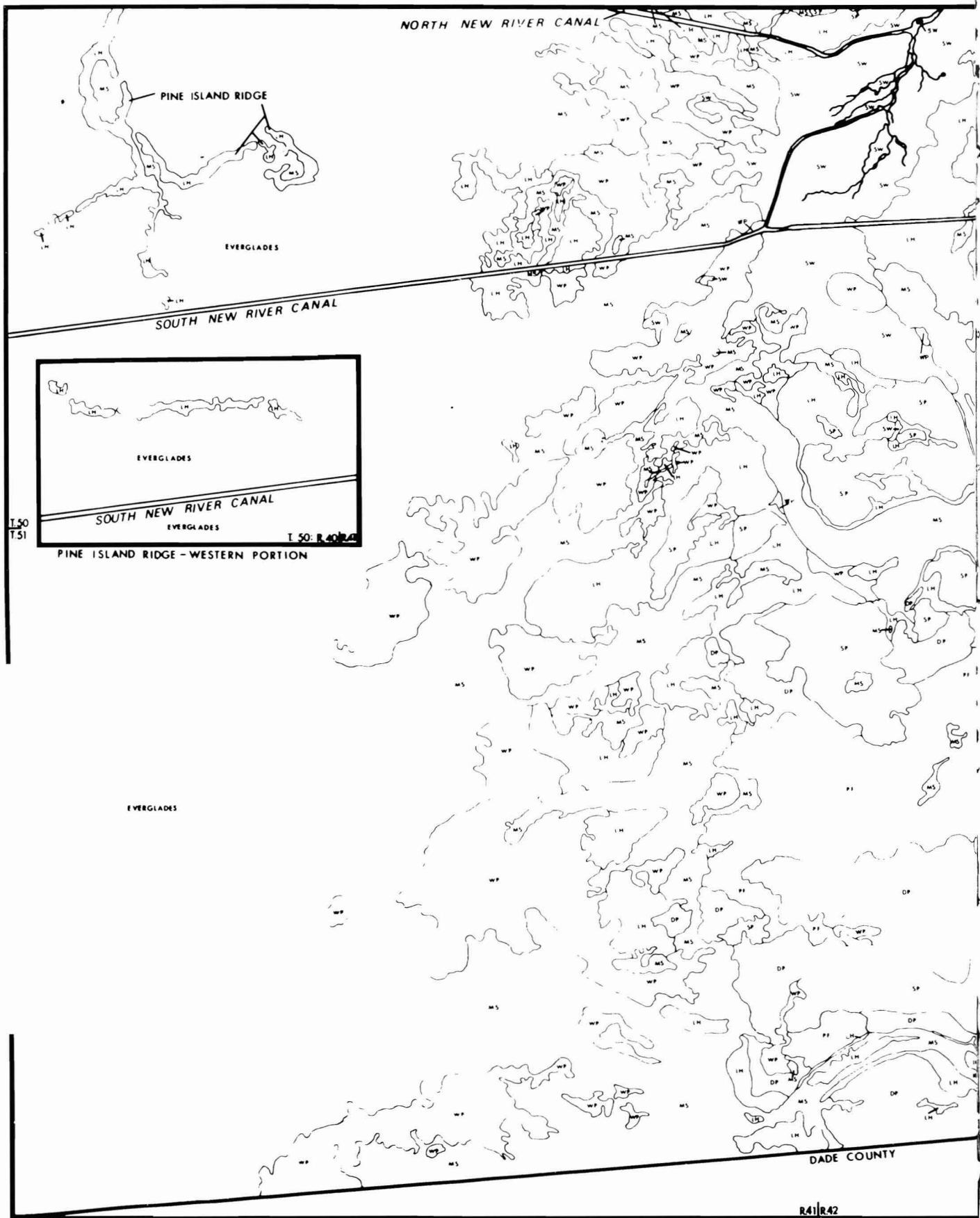
*Wet Prairie*: Includes all Wet Prairie classifications of Davis (1943). This is low dominantly "grassy" vegetation of seasonally wet soils. Most commonly the soils are Arzell and Broward fine sands (U.S.D.A., 1946). A surface layer of muck up to a few inches deep may occur in wetter sites such as temporary ponds.

Characteristically Wet Prairie lacks trees, but *Pinus elliottii* may be present in dryer sites and *Taxodium distichum* may be widely scattered in wetter sites. The typical species are:



Map 2: Vegetation Map of Broward County, based on 1940 imagery, central section. [Bryan Steinberg]





Map 3: Vegetation Map of Broward County, based on 1940 imagery, southern section. [Bryan Steinberg]

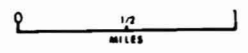




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Integrated and drawn by  
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**VEGETATION MAP OF  
 COASTAL BROWARD  
 COUNTY**  
 Based on 1940 imagery,  
 Map 3



COUNTY

SHRUBS: *Myrica cerifera*, *Baccharis halimifolia*.

HERBS: *Aristida patula* Chapm. ex Nash, *Spartina bakerii* Merrill, *Andropogon glomeratus* (Walt.) BSP, *Hypericum fasciculatum* Lam., *Oxypolis filiformis* (Walt.) Britt., *Pluchea rosea* R.K. Godfrey, *Rhynchospora corniculata* (Lam.) Gray, *Flaveria linearis* Lag., *Eupatorium coelestinum* L., *Xyris jupicai* Richard, *Sabatia grandiflora* (Gray) Small.

Wet Prairie was common in Broward County interspersed with Marsh or Swamp bordering the Everglades and also was present in depressions within Scrub ridges (Maps 1, 2, and 3).

**Marsh:** Includes Saw-grass Marshes, Flag Marshes, Aquatic-plant Marshes, Cat-tail Marshes, Spike-rush or Needle-grass Marshes, Mixed Herb and Shrub Marshes, Fern Marshes and Bulrush Marshes of Davis (1943). Marsh is treeless fresh water vegetation on soils that are seasonally wet or covered with water most of the year. This is the characteristic vegetation of the Everglades. Soils usually have a thick muck layer of a few to several feet. Some of these soils are Everglades peat, Okeelanta muck and Parkwood sandy loam (U.S.D.A., 1946).

The most common species are:

SHRUBS: *Myrica cerifera*, *Salix caroliniana*, *Baccharis halimifolia*, *Ludwigia octovalvis* (Jacq.) Raven, *L. peruviana* (L.) Hara.

HERBS: *Cladium jamaicensis*, *Sagittaria lancifolia*, *Pluchea odorata* Cassini, *Pontederia lanceolata*, *Nuphar luteum*, *Nymphaea odorata* Ait., *Utricularia purpurea* Walt., *Blechnum serrulatum*, *Thelypteris totta*, *Sabatia grandiflora*, *Panicum hemitomom* Schultes, *Spartina bakerii*.

In Broward County, Marsh was common in transverse depressions which cut through the Scrub ridges and also in the section of the Atlantic Coastal Ridge bordering the Everglades (Maps 1, 2, and 3).

**CONCLUSIONS** — The origins of stands of the current vegetation become evident when compared with the vegetation maps (Maps 1,

2, and 3). Today much of coastal Broward County is urbanized with remnants of the vegetation remaining in scattered sites. These stands can be linked to pre-urban vegetation systems in the county. Scattered stands of Scrub vegetation (T.47S., R.42E., Secs. 1, 6; T.488S., R.42E., Secs. 6, 12, 13, 24, 25) are all part of one large scrub ridge (Map 3). Similarly scattered stands of Swamp (T. 49S., R.42E., Secs. 5, 9, 10, 11) are part of a swamp system associated with Cypress Creek.

Successional changes in the vegetation since 1940 also became evident when the current vegetation is compared with the vegetation maps (Maps, 1, 2, and 3). Some of the changes in the vegetation which have occurred are Wet Prairie to Pine Flatwoods (T.48S., R.41E., Sec. 33), Scrub to Dry Prairie (T.48S., R.42E., Sec. 33), Scrub to Low Hammock or urbanized sections with *Quercus virginiana* and *Pinus elliottii* the dominant tree species (T. 50S., R.42E., Sec. 4).

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#### LITERATURE CITED

Alexander, T.R. 1958. Ecology of the Pompano Beach Hammock. Quart. J. Florida Acad. Sci. 21: 199-304.

- Austin, D.F. 1976. Mangroves as monitors of change in the Spanish River. Florida Environ. Urban Issues. 3(3): 4-7, 15-16.
- Bruff, J.G. 1846. The State of Florida Map published by D. McClelland, Washington.
- Davis, J.H. 1943. The Natural features of Southern Florida. Florida Geol. Bull. 25:6-301.
- DeBrahm, J.W.G. 1973. Report of the General Survey in the Southern District of North America. L. Devolsey, Editor. Univ. S. Carolina Press, Columbia, 1971.
- Florida Department of Natural Resources. 1975. Florida Environmentally Endangered Lands Plan. Florida Dept. of Nat. Res. Tallahassee.
- Fries, J.D. 1898. United States Survey Plot of T.50S, R.41E. with the outlines of the sections established.
- Harper, R.M. 1927. Natural Resources of Southern Florida. Ann. Rept. Florida Geol. Sur. 18:22-206.
- Harshberger, J.W. 1914. The Vegetation of South Florida. Trans. Wagner Free Institute of Science. Phil. 7:51-189.
- Hofstetter, R.H. 1974. The Effect of Fire on Pineland and Sawgrass Communities of Southern Florida. In: Gleason, P.G., Environments of South Florida, Present and Past. Mem. Miami Geol. Soc. 2:201-209.
- Ives, J.G. 1856. Memoirs to Accompany a Military Map of Florida. Wynkoop Co., N.Y.
- Kuchler, A.W. 1964. Potential Natural Vegetation of the Conterminous United States. Amer. Geog. Soc. Sp. Publ. No. 36, N.Y.
- Long, R.W. and O. Lakela, 1971. Flora of Tropical Florida. University of Miami Press, Coral Gables.
- MacKay, G. 1845. Survey Plots of T.48S., R.41E., T.48S., R.42E., T.48S., R.43E., T.49S., R.42E., T.49S., R.43E., T.50S., R.42E., T.51S., R.42E. with the outline of the sections established.
- U.S.G.S. 1883. East Coast of Florida from Biscayne Bay Northward. Reprint No. 1510.
- U.S.G.S. 1884. East Coast of Florida between Hillsboro and New River Inlets. Reg. No. 1657.
- U.S.G.S. 1884. East Coast of Florida between South End of Lake Worth and Hillsboro Inlet. Reg. No. 1661.
- U.S.D.A. 1914, 1946, 1962, 1973. Soil Surveys, Broward County, Florida.
- U.S.D.A. 1940, 1947, 1948, 1949. Aerial photographs, Broward County, Florida.
- Williams, M.A. 1870. Survey Plots of T.48S., R.41E., T.48S., R.42E., T.48S., R.43E., T.49S., R.42E., T.49S., R.43E., T.50S., R.42E., T.51S., R.42E., with the outline of the sections established.