

Gen aspect s. Fla topographical expression one
of extreme flatness, yet diversification. Along Florida
east coast, at Coastal ridge strip
higher land betw. ocean & Lake Oke-Ch. depression.
(40 miles wide, 100 mi long) series of higher land,
& Pleistocene marine terraces, ~~scalloped~~ scalloped
by streams Kissimmee & Fisheating. V. of Ev. dep. is higher
land of Big Cypress & Devil garden. Many 10,000 islands
drowned dunes. Filling in Ev. dep - organic peat &
muck soils now being changed. Wood of trees
dec. during Pleistocene - beech but some Pliocene
exp at surface.

Pliocene - s. Fla sea bottom covered warm shallow
water teeming marine life. Shoreline, s. through
Lake Co. to Sebring, w. Arcadia Sarasota, n. across Gulf
toward Tallahassee. Shell beds in shales

Pliocene sea withdrew left moderately flat surface
central & upper # Eos. sloping to east from Dev. Cypress
& Atl. coastal ridge.

Close of Pliocene Fla. plateau uplifted old sea
bottom because land surface strange animals, fresh
wq. lakes - rivers minor streams - no deep gorges but
larger streams emerged. To mt valleys as far as
continental shelf.

Pleistocene - Great Ice Age. Glaciers formed used up water -
sea level fell. warm intervals melted sea level rose.

5 low - shore line off shore from present - sub-series
erosion - subterranean solution. Fresh water lakes &
marshes - Lake Ev. Nebraskan, Kansan, Illinoian. glacial
stage - 2 subst. Wisconsin: Loman (early Wis) & Ford (lower)

Fla. indicated erosion surfaces, solution holes,
soil zones, fresh water limestone & marl.

Nebraskan Glacial -

Cont. erosion & solution in Late Pliocene Fla. plain slightly tilted westward, major stream dev. toward Gulf of Mexico. No deposits recognized

Aftonian Interglacial

Nearly all Fla. beneath the sea - so Fla covered water 250 feet. Islands in Salt County near and land. Patches of marine shells Caloosa near Ft. T. Aftonian

Kansan Glacial.

land covered - fresh water mollusks - removed next interglacial

Yarmouth Interglacial

In Fla. flooded salt water. Sea rose to 215 ft shore line, fell to 170 when it remained. In Eos only thin marine shell marl - calcareous sandstone Ft. Thompson area. Basal portions Key Largo limestone occurring as coral reef.

Illinoian Glacial. Climate cooled, ice sheets spread - sea level dropped. Eos. area became vast marshy lowland with shallow bays deep - fresh water marl 4 ft thick. Solution + erosion active esp. on higher land areas along Gulf + Atlantic coasts.

Saugamon Interglacial

Sea rose to 100 ft above, then 20, then 42. Present - 20 + 20 - present sea level - present topography. Marine bar at sea level adv. coast. Wind blown wave tossed sand in solution water if heaped up above high tide level, behind bar, in broad Eos. lake like depression should exist. Miami oolite 55 + n. no mollusk shells Coffee Hill Hammock of Ft. Thompson form. Growth of Miami bar + upper Key Largo coral reefs enclosing Eos. Tidal currents scoured in and out through lower parts of bar leaving spillways. - self

3.
sum waep betw. Miami + Ft. L. Betw. South Miami +
Homeslead - very near - low prairies.

Wisconsin Glacial

Lowest glacial substage - southern Fla. land
Eo + lake Oke dep - immense fresh water lake. sliding
through old tidal channels - network solution holes in
solids. calcareous rocks of Tertiary made more permeable.
Dune building at coastal ridge - SW coast Ten. flow

Mid-Wisconsin invasion: 25 feet. Dep. of marine
Sea rose again
terrace at 5 ft. shoreline, mantling of old rocks with
quartz sand. Deps Gaud + n. Big Cypress sand - old tidal
inlets ~~is~~ choked with sand, sand in solution holes
+ caverns - strip in smooth floor betw. deeper
parts lake Oke - Eo dep + Atl. coastal ridge, above
shoreline beach ridges + dunes

Saturated underlying rocks salt water,
adding to that which remained previous inundation.
Some still in rocks Caloosa - Ft. Thompson - diluted
fresh water + chem. reactions (base-exchange)

late Wisconsin - ocean below present level -
needed heaped up sand into series of beach
ridges notably Ft. Pierce, Martin + Palm Beach counties.
Beach ridges + lagoons exert primary control on
surficial drainage - impose Ullis-like drainage
pattern. Sea fell - notch at Miami in a low sea-
cliff Silver Bluff. wave-cut beach plain betw. Miami
+ Ft. L. No. 1. follows old shore line.

Ocean fallacy - much sand scoured out of
old channels. Intertidal + dune bldg. marbles being
coastal ridge lake Flint near + pear + used of
Eos - laid down.

Recent.

Pleistocene time ended as late Wisconsin glaciers melted back & sea rose to present. Lower ends of Caloosq, Miami, here, Hillsboro, Jupiter St. Lucie & Jupiter became flooded streams. Lake Worth, Lake Land, Indian River, salt water lagoons — Fla. Bay, Biscayne Bay, Barnes Sound, Card Sound. Ten thousand islands, made of dunes.

Climate

Highest temp Miami 96° - lowest 27°. Mean annual Miami 75°. Everglades Exp. Sta Belle Glade, 4 mi east of S. tip of lake, mean ann. 1924-44 72° F. highest 100° - lowest 24°.

No part mainland here from north. Frost hazard greatly on peat soils than sand. Killing frosts fall, 10 of 20 years in Belle Glade, 4 of 44 at Miami. early months 18 yrs. last. Nov. 16, 1940 Belle Glade Nov. 21, 1914 Miami latest 29 April 1928 Belle Glade 18 March, 1915, Miami. Coldest on virgin saw grass peat 9° F Mar. 14, 32 at Shawano. 13° Dec 1954 + 5 mi near 20 mi. Bend W. P. B. canal. Miami temp. 5° higher on cultivated peat soils than on virgin peat - also heat more readily.

Humidity in peat very high - 100%. sunest 1994. east winds

Rainfall variable. On east several inches more than around lake. Ave. coast Miami + T.L. + Hyp. ave. 59.34 Canal P.T. etc 51.11. S E lake 55.44

Rainfall heaviest Canal Pt. Nov 6-732-21-92 in.
in 8 hours betw 11pm & 7a.m. Rainfall Belle Glade same
storm 10.90 inch.

4 months June to Oct make up rainy season
& furnish 2/3rds yearly rf. months heaviest
June & Sept inland, Oct. east coast. Damaging
floods may occur during wet periods when crops
are in the ground because it is not economical
to provide ditches & canals large enough to
handle extreme run-off from occasional heavy
rains. The rel. dry months Nov. to May include
most of the season in which truck crops are
produced. During winter & spring, periods of
drought lasting 2 or 3 mos. are not uncommon.
Belle Glade only 1 inch rain fell in four months Nov Dec.
1924 & heard 39. Irrigation use.

1. Natural Veg. Sub. dids.
Saw grass *karisicum jamaicensis* - 8 ft or more on deep peat.
Less than 3 ft. on shallow peat or porous limestone.
plants come in - marsh ferns, royal ferns, smartweed,
pigweed, golden rod, castor beans.
2. Strip 15 x mi wide - custard apple (among
glabra & associates.
Willow & eldes - most cleared.
transitional zone betw. sawgrass & ridge and
slough - variety of shrubs - wax myrtle -
marsh herbs, sawgrass, arrowhead cattails in wet.
old water holes in sawgrass willows around edges -
arrowheads & cattails in middle around water holes.
Wax myrtle in med. sawgrass since canals.
sawgrass - Istok poga N.W - Allapattah flats N.E.

Ridge-and-slough

1. Hillsboro lake section, N. Hillsboro canal + west of coastal ridge, + larger section W. of Miami canal + the rock rim in a body more than 100 mi. long + from 5 to 20 mi. wide, shaped like a flattened V pointing toward Miami.

Sloughs - many small oval islands - ponds - lakes. sloughs with aquatic plants, bladderworts, coastal moss, spider lily, horsehoes-water + slough grasses that bend in the current. Islands - red bay, sweet bay (bay head) wax myrtle, ~~abundant~~ halcyon halcyon, royal, mimosa + common swamp ferns. Sawgrass on edge. These islands floating masses of saw grass + tree grasses. Organic remains - wax myrtle - hays - ferns. Trees roots anchor to bottom. widest on up - tapering lower. Direction water flowed in part. Hillsboro area - islands S-E - west, N. of T. trail, S.E. + south of trail SW toward Shark River.

40 mile Bend on trail. Sloughs - marsh glades

2-14 inches marsh over rock - hammocks built up on weathered, partly leached honey combed basaltic limestone. Hammocks 6 to 14 inches higher than surrounding glades. Veg varies - pure stand cabbage palm - cypress, oak, cabbage palm, gumbo limbo, wild citrus, ^{wild} tamarind - vines + ferns. Glades N. of trail pond cypress, wax myrtle. S - sparse grass + poverty grass. arrowhead cattails, myrtle willow around open water.

Sandy coastal ridge.

~~side~~ W. side N. Callicott. + N + E of the lake sandy Canal low flat irregular pattern poorly drained areas - switch grass cattails - hammocks cypress flat meadows wide grass, ~~low~~ broad grass, ~~willow~~, water oaks

Rock rim w + sw hians porous solits thin cover sand or pocket of clay.

Carib. pine
Coastal marshes

sparse sawgrass + needle grass.

red mangrove east + black. sou. Beaches

marsh in so. low shrubs + grasses - cabbage palm, native manzanilla + buttonwood

Soils

The peats, a smaller acreage marsh, extensive marsh. 100 dif. organic + mineral soils.

5 of 8 land capability classes.

I. Suitable for cult. without special practices

very dark very sandy.

II. Simple practices

peat + muck.

clay soil

wet acid

Soil Groups.

Subgroup

A1. Peat + muck occupy all but rockland areas of true Everglades.

None in class I land capability because subject to subsidence when drained ~~can~~ cannot be farmed without special practices for drainage, water control + correction or maintenance of soil fertility.

Peat + muck, that are suitable ~~highly productive~~ ~~highly suitable~~ for cultivation can be made highly productive but the management of such land requires special attention to water control, fertilizers, plant diseases + pests.

All peat + muck dark brown or dark grey - formed in swamps by partial decay of plant materials. Peat almost entirely plant remains with very little mineral. Muck 35-40 mineral + peaty

between. underlying material may be marl, limestone, shallow sand or deep sand. Differences - plants material, depth & underlying nature - det. capability farming use, subject to estate/landowner water control.

Simple practices - IAI - peat & muck - Okeechobee muck (mustard apple) & Gordon's cake - Okeechobee peaty muck (willow-and-elder) etc. layers organic soil 5 feet deep. Oke-muck dark grey - 4 ft underlain by brown fibrous peat. Oke-muck dark grey, marly Okeelanta peaty muck consists of from 6-14 inches finely fibrous organic overlayers of muck. no water make excellent upland if water table controlled.

Intensive practices - Everglades peat & peaty muck, Brighton peat & peaty muck & Paulico muck. Sawgrass 6-14 inches black, finely fibrous peat, underlain by brown fibrous peat that rests on the rock or sand. Brighton peat is brown fibrous, felty peat that becomes very dark brown or almost black on cell. Paulico muck black, well oxidized cont. 60-70% mineral matter.

Class IV A1 - less than 5 ft deep. not suitable for regular cult. water control diff. crops grown for few years on areas that are or can be made dry enough, during dry periods. Recommended water storage or grazing when practicable.

IAI - sandy peat - over limestone or sand & marl not suitable except for wood land islands in ridge-and-slough sections.

VIII - A1 - not suitable for any cultivation or grazing. box-hatched peat tidal marshes & mangrove swamps. remains of lilies, water grass, spargy, fibrous brown. drainage not recommended because of extreme shrinkage & oxidatory. Coals more than 3/4 in or drying. Water holes & sloughs - wildlife.

Mineral soils.

sands, nearl. rockland.

Apx naturally wet - poorly drained, nearl. calcareous
A3. Wet acid. B1 - sandy soils contain large clay
& ~~retain~~ retain water - grey sandy with brown hard pan.
C1, incoherent rapidly permeable sands & c2
rockland & stony.

II - A2 nearl. drained & farmed readily. Perrine,
Kialeah, Hollywood Hallandale.

II A3 - dark Portsmouth fine sand - 12 to 30 inches ^{dark} _{with}
organic matter

II B1 - Palmdale fine sandy loam - scattered
hammocks used for Keyhole crop land citrus
pattern.

III - cultivation with intense practices. Charlottes,
Pompano, Clewiston Dairie mucky fine sands.

III - B1 grey sandy - with cropping with
intensive moisture saving & fertilizing - Decatur
Fields Broward

III-C1 Palm Beach fine sand - suitable truck crops
citrus with intensive fert. green manure &
irrigation.

IV. A2. Perrine nearl. - Okeechobee fine sandy nearl
Flamingo nearl - Okeechobee. Flaw. has a very
compact plastic light grey subsoil.
& shall be drained readily - used only
if water controlled.

IV-A3 Clewiston fine sand Dairie light in color
nearly inert - intractable light with depth almost
pure quartz. dark layer - trucks if water table
controlled - intensive fert. that includes minor
elements.

IV-C2 Rockland - avocados & fruits - Rockdale.
Miami colite - pockets of clay

V - grazing - excessively drained Cow in fert. Dade &
V-III - not to any thing, hucis fine sands.

Water Conditions by Everglades Drainage District.

Sources and Quality of Water.

Water in Ev. Dr. Distr. comes mostly from precipitation within Distr., ave. 54 inches year + that upon Lake Okeechobee Dr. basin which averages 61 inches. Quantity of flow into distr. through sub-surface aquifer is negligible so far as it will affect gen. plain water control. Some ditches or wells penetrating underlying rock may release sufficient flow materially to increase amount of pumping required for drainage.

Lake Oke - 725 sq. mi in area receives surface flow of some 4,000 sq. mi of land, 3/4 through Kiss R. Before drainage of Glades was begun, only outlet for flood waters from lake was by overflow along southern shore ~~Ditch~~ - Lake elevation 20 ft above mean sea level. Low portions of Lake rim now is levees + control works constr. + operated by War Dept. hold lake level betw. 12.6 and 15.6 elevation above mean sea level, + permit flow out only, except for leakage + gates, as released into the drainage canals for irrigation supply.

The water ⁱⁿ the soil and that in the rock are one body. Artesian flow from deep strata recharged in distant areas is prevented by Hawthorn form.

Surface + soil waters of Eos. incl Lake Oke. are readily usable for dom. needs + crop irrigation. Water in permeable Miami + Tamiami formations underlying lower + middle Glades are sweet + potable. supplies lost to recharged locally from precip. within Dr. district. Water yielded by the occasional solution holes + lenses of permeable material ~~are~~ in the Ft. Thompson formation under the upper Glades, is usually so highly charged minerals - cannot be used household or irr.

Subsidence of Organic Soils.

Sawgrass peat in natural, saturated condition weighs 60-65 lbs. per cubic feet. Dried in sun it loses 2/3rd vol. 3/4th weight. Cultivation further compacts surface layer. Natural oxidation further destroys. More disastrous are fires. Long weeks or months will put out by heavy rains.

Most cult. land of northern Eas. have subsided as much as 5 feet since drainage began 30 yrs ago. some places 6 ft. Virgin peat or muck - rate of subsidence rapid at first, decreases with time. Rate proportional to water table. Okeelanta - 1916 little under cult. recent years - loss of depth 1.5 ft in first 3 years - decreasing rate 1 inch per year 10 yrs (?) Custard-apple & willow and elder peaty muck on shore lake - higher mineral - subsides half rate.

Effect of no drainage along canal elevation along canals Hillsboro, New River & Miami 2.5 ft below els. between them. High ground betw. lower now than originally because water table 2 ft or more below ground surface.

Subsidence	
Water Table (feet)	.03
1.0	.14
3.0	

very little loss in surface half foot - loss prop. to depth above water table. Kind of crop makes no difference. Virgin land with pump drainage subsided nearly as much as cult. lands nearby. Oxid. proceeds faster before soil disturbed than after surface compacted. Desirable to avoid draining peat soil until it is wanted.

loss in elevation will decrease the depth of ditches and the height of levees built of the material - decrease capacity of drains + not. against overflow. increase pumping lift + cause water seepage from underlying ditches + marshes. Cont. subsid. will decrease number of years land may be used.

Existing Water Control Works.

1. Levees built by War Dept. so, east + north shores Okla.
2. Calappa hatches + St. Louis canals for reg. Lake level - War Dept.
3. Canals excavated drainage districts to remove excess water

Tributary ditches, dikes + pumping plants sub-drainage districts org. to drain areas within main district as well as ~~old~~ ditches, dikes + pumping plants installed since land owners.

Principal canals; West Palm, Hillsboro, N. New River + Miami

Cross + Palms canals; S. New River, Miami with Atlanta below Ft. Lauderdale.

Tamiami Canal.

lesser drains Cypress Creek, Snake Creek, Snapper Creek
Pompano N. Miami S. Miami
Indian Prairie Canal into Lake Okla.

not adequately performing, obstructions to flow not being ~~used~~ removed. Ground subsidizing, Miami, Hillsboro + West Palm (never excavated to desired depth.

Nearly all land requires artificial drainage + irrigation.

Lake Okechobee.

- 1. hence 68 mi - S. side + lake, so. + east sides from near west district boundary. Except Kuduam, Torrey + Little islands.
- 2. hence 15 mi (6 mi east Kissimmee R. + north of Lake Okechobee City.)
 Auth. Cong. 1929, completed 1936. Top. elevations ranges 32.6 to 34.6 ft - 4.4 to 6.4 ft. above highest waves in 1928 hurricane

6 hurricane gates - drainage + boat passage closed when storm tides forecast. Ext. full height of hence - designed to be partly open to regulate flow but normally wide open + lake levels reg. other with. Gates at Moore Haven, Clewiston, Lake Harbor, South Bay, Canal Point + Okechobee city. Lake levels by War Dept betw. 12.6 + 15.6 - dist. Caloosa + St. Lucie maintenance of depth for nav. one slight.

Caloosa + St. Lucie R.

1929. old drainage canal outlet to lake west enlarged + new control works. War Dept. lock for boats - 20 mi from lake Okechobee + Moore Haven lock lake levels - Okechobee spelling nav. + ground water. Rainy seasons pasture lands inundated along Caloosa. Cultivated lands now used only for cattle. Dry seasons too dry. (7 ft lower)

St. Lucie Canal

n.e. 24 mi. Port Mayaca into St. Lucie River 6 mi s. of Stuart. Op. War Dept. 29. Grazing - citrus + truck Port Mayaca. Indian Town?

near lake old lock & spillway connect. Ev. Draining district
 now not used. New lock at St. Louis R. Canal cap.
 5000 cu. ft second at El 15.6. Does not overflow.
 Trib. drains enter the connect spillway overfalls find
 spillways to prevent erosion. Farm lands Port
 Neayee-Indian Town have gravity drainage-
 irrigated by pumping from canal.

West Palm B. Canal.

Se then e - dis. lake Worth s. limit W. P. B.
 42 mi long - 20 mi head w of mid point.

Western half peat & musk. ~~Terr.~~ miles
 hom lake - sugar cane, truck - Pelican lake & Palatka.
 hoxahatchee - citrus - east again, truck,
 West Palm lock & control. sand bars & section
 unexcavated impede flow. lake to 20 mi. head
 old ditches they levee s. side W P B canal. Dikes
 by farmers. E. 20 mi. head, state road 25
 embankments.

cross canal - Hillsboro to w, joins W. P. B. canal at
 20 mi. head. Between these, Big mound canal & 2
 large drains, drain sandy flat woods N. Range Cule
 canal - lake Worth to W P B canal

Water pumped W P B canal by Pelican lake & Palatka
 sub. drainage district - hoxahatchee. Irrigated also

Pumping in heavy rains frequently raise water
 in W P B canal above lake level. Flow may be
 toward lake (1944) 1940.2 - 29% time flow into
 lake from canal pt.

Hillsboro.

Extrem s cor. lake - canal s.e. straight reaches
Deerfield Beach. 51 mi. Rarely muck + peat - then
sandy coastal ridge. Truck farming 16 mi.
Long middle muds, near Belle Glade old deserted
Cork + cutler. Only hurricane gate here. 12 mi. above
Ellow Bend not excavated into rock. Hypocenters - ~~cities~~
flow + farms protected by dikes.

Imm. tributaries - Cross Canal - water from them in.
Balls Canal w - connects N. New River + Miami.

Rainy season, pumping how cult. Canals
raises water surface in upper Hillsboro
above lake.

N. New River Canal.

Only waterway through ^{the} ~~the~~ ^{the} ~~the~~ Everglades that
permits passage quantities of water from lake to
Atlantic. 58 miles into New River

muck + peat except 6 or 7 mi. lower end.
truck farms + urban. back + control at South Bay.

Imm. Road 26 protects land s + w. Canal. Everse
E + w. to county line.

Balls canal crosses N. New River at Okechobee
6 mi south. Flow how it toward lake in rains.

3 year period 40-42 N. flow 13%

Miami S. from Lake Harbor, s.e. 85 mi. from
hurricane gate to disch. canalized river 5 mi.
Biscayne Bay. Some cane - mostly undeveloped
Greater part too shallow for cult. Miami Canal
intersects Balls Canal at 6 1/2 mi from hurricane gate
+ connects with South New River canal north of Broward-
Palm Co. line.

Near Lake Oke. is lock and spillway structure of Everglades Drainage District, which is always open and needs repair but could be made usable. In digging this canal, rock etc. only ~~to~~ be two. Miami + a mill above the connection with South New River Canal. 25 mi. only 2-4 ft deep. rock dam built + broadened + now offers little obstruction. Near county line an earth dam which was built to prevent flooding at Pensacola but helps to hold water in wild lands. 3 large sluices opened in dry weather so that fresh water flow may keep rock from working up canal to contaminate well field. Salt dam at 36 mi ft.

Practically all drainage from lands in P B County is ditch. into Lake Oke + there is rel. little flow into the canal. Cap. not suff. to prevent overflow of adjoining lands. Broward Co., surface water flows S or SW across canal, following old natural drainage lines: shallow, clogged with hepacints + no service to drainage. Better Rd 26 A + Hialeah land is inundated in wet seasons + excessively drained in dry. Cult. lands bordering upper sections of Miami Canal are drained by pumping into Lake Oke or into the canal north of the lock at Lake Harbor + are irrigated by the same pumps + drainage ditches.

Cross Canal. Millshov to W P P. canal 13 mi long
 track. ~~to~~ Dam. grade very slight to east.
 borders drained + irrigated

Balles.

Gain Kelliker west to Sunday line. East to
3 mi west N. ~~W.~~ New River Canal through track farms.

Small abstracted culverts that pass only
small water. Flow both ways. Dikes pumped

to irrigate.

S. New River Canal.