United States Department of Agriculture

Soil Conservation Service

Northeast NTC
160 East 7th Street
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Subject: Trip Report - NASA GTE; BREW Workshop, 25 to 27 January 1990

Date: 29 January 1990

To: Dr. Carolyn Olson
National Leader
National Soil Survey Investigation Staff
National Soil Survey Center
Midwest National Technical Center
USDA-Soil Conservation Service
100 Centennial Mall North
Lincoln, NE 68508-3866

Enclosed is a copy of the participants (enclosure 1), schedule of workshop activities (enclosure 2), plans for Canadian study (enclosure 3) and a copy of my report (enclosure 4). The workshop was most productive as results from the Everglades study were presented and plans for the study in Canada were made (enclosure 4).

The study in Schefferville, Quebec, is planned for the period of 23 July 1990 to 14 August 1990. All incurred travel expenses will be paid for by NASA through the University of Delaware to me. I will contact Jerry Hammond and Roy Twidt at NHQ concerning the authorization needed to take a government vehicle and equipment into Canada.

I have enclosed a copy of my correspondence with Dr. Nigel Roulet of York University concerning radar studies at Schefferville. My other contact person in Canada is Dr. Tim Moore of McGill University. With kind regards.

James A. Doolittle
James A. Doolittle
Soil Scientist (GPR)

cc:
E. G. Knox, National Leader, NSSL, NSSC, SCS, Lincoln, NE

Posted: Mon, Jan 8, 1990 3:28 PM EST Msg: GGJA-2918-8105
From: JMFLETCHER
To: SCS.NENTC
CC: RTWIDT
Subj: FNM-MTG APPROVAL-ATTN: FIN MGR
This message constitutes meeting attendance approval.
Individual travel authorization must be obtained (ATR 1-1.7).
Your staff should notify attendee of this attendance approval.

01. NAME OF MEETING: NASA RESEARCH MTG

02. LOCATION: LANGLEY, VA

03. MEETING DATES: 1/25-27/89

04. MEETING SPONSOR: NASA

05. MEETING TYPE: 2

07. PER DIEM RATE FOR MEETING SITE: Y

07.A RATE: $74.00

08B. REDUCED LODGING RATE: NA

09. ATTENDEES:
JAMES DOOLITTLE, RES SS, NENTC, CHESTER,PA $700.00

15. RECOMMENDED BY: C STEVEN HOLZHEY, ACTING DIRECTOR, MNTC

Encl 1

BREW Mailing List
January, 1990

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BREW WORKSHOP AGENDA

Langley Research Center, January 26-27, 1990
Conference Bldg. 1218, Rm 107

Friday, Jan. 26

1000	Introduction	G. Whiting

Presentation of BREW Results - 1989

1015	Sub-surface features of Everglade soils	J. Doolittle
1030	Root and methane profiles of E-glades soils	M. Hardisky
1045	E-glades radon and methane flux and the sedimentary methane reservoir	J. Chanton
1100	SF_6 as an inert tracer of gas exchange	C. Kelley
1115	Methane oxidation in E-glades	G. King(GJW)
1130	Methane emission under increased ambient CO_2	J. Dacey
1145	Sulfur emissions from a variety of habitats in E-glades	M. Hines
1200	LUNCH	
1300	CO_2 exchange and remote sensing in E-glades	G. Whiting
1315	Modeling activities and software improvements for gas flux studies in the E-glades	T. James
1330	Remote sensing and geographic information data base advancements for the E-glades	R. Travis
1345	Discussion of Results	
1430	**** BREAK ****	

Planning for BREW Canadian Activities

1445	Overview of GTE/ABLE-3B plans for Canada, 1990	J. Hoell
1500	Tour of Canadian sites in Moosonee/Kinosheo and Intro. to Schefferville	J. Drewry
1515	Logistical Plans for Schefferville	

Encl 2

1630 ADJOURN

1900 Dinner & Discussion of BREW's Future at Local Eatery

Saturday, Jan. 27

Continue BREW-Canadian Plans, 1990

0900	Overview of Schefferville region and CH_4 work	T. Moore

Individual Research Plans for BREW

1000	Soil type, root biomass, & radar studies	M. Hardisky
1010	Tower measurements of radon fluxes & biogenic gas transport	C. Martens
1017	Isotopic characterization of methane flux	C. Martens
1025	**** Break ****	
1040	Methane oxidation studies in tundra and bog soils	G. King(GJW)
1050	Sulfur/Methane plans for Kinosheo/Schefferville	J. Dacey
1100	Sulfur emissions from bogs and fens in Scheff.	M. Hines
1110	CO_2 and remote sensing plans for Canada	G. Whiting
1120	Airborne & satellite-based remote sensing for Canadian boreal wetlands research	R. Travis
1130	LUNCH	
1300	Roundtable discussion - collaborative plans - logistics	
1600	ADJOURN	

Encl 3

BREW PLANNING: WETLANDS STUDIES IN CANADA, SUMMER 1990

A) Overall BREW objective: To investigate the magnitude and factors controlling biogenic trace gas exchange in major global wetland ecosystems.

B) Strategy: Use naturally occuring gradients in the environment to conduct experiments.

1- Latitude/Climate Gradient:
- -Temperate Salt Marsh, Delaware, 1986
- -Tropical Flood Plain, Brazil, 1985 and 1987 (Methane only)
- -Arctic Tundra, Alaska, 1988
- -Tropical Grassland, Florida, 1989
- -Boreal Wetland/Forest, Canada, 1990

2- Environmental/Geochemical Gradients:
- -Salinity
- -Soil Moisture
- -Nutrient Status
- -Anthropogenic Impact
- -Vegetation

C) Objectives In Canada - 1990

1- Add Boreal systems to latitude/biome gradient.

2- Gradients:
- -Soil Moisture (spatial and temporal changes)
- -Nutrient Status (e.g. bog <----> fen)
- -Anthropogenic Impact (e.g. sulfur input changes along longitudinal gradient: Alaska <--> HBL <--> Schefferville)
- -Vegetation (bog, fen, alpine tundra, woodlands)

D) Planned Studies

1- Sulfur flux from marine environment of Hudson and James Bays (Dacey)*

2- Sulfur flux from vegetated wetlands. Effects of vegetation/ecosystem type and gradient in anthropogenic S input. (Hines)*

3- Carbon dioxide exchange in vegetation canopies. Seasonal, nutient, and vegetation gradients. (Bartlett/Whiting)*#

4- Methane flux. Seasonal, nutrient, and vegetational gradients. (Harriss/Crill/Bartlett)*#

5- Methane isotopes. Diffusive vs. ebullative flux, fractionation during transport and oxidation. (Chanton)*

6- Tracing of gas exchange processes using radon. Soil, vegetation, and canopy dynamics effects. (Martens)*#

7- Methane oxidation. Magnitude and effects of soil oxygen dynamics, light, soil moisture, etc. (King)*

8- Below ground primary production/methane pool interactions. (Hardisky/Gross/Klemas/Doolittle)*#

* Collaborations with Canadian investigators.
\# Collaborations with GTE/ABLE investigators.

E) Site Selection

1- Criteria:
- -Access to multiple vegetation types.
- -Access to nutrient, soil moisture gradients.
- -On-site laboratory/living facilities.
- -Location of Canadian and ABLE collaborators.

2- Options:

-Schefferville, Quebec. Diversity of vegetation types within close proximity to lab and living facilities. Past and current studies by Canadian scientists. Road access to sites. Presence of ABLE tower studies? Schefferville is most likely site for part or all of studies 2-8, above. Meets all scientific criteria plus ease of access and presence of Subarctic Research Laboratory facilities. Presence of ABLE tower operations is important, but not overriding, factor in selection.

-Hudson Bay Lowlands/Moosonee, Ontario. Meets most scientific criteria except not as great a diversity of vegetation types. A problem is that many comparable studies, especially related to methane, are planned by Canadian NWP. Difficulty of access to sites is major drawback, particularly for seasonal and process-oriented work. Moosonee will be the base for study 1 and will probably be visited by investigators from studies 2 and 4 and, possibly, studies 3, 5, and 6. Presence of ABLE tower would be enticing but time and expense of access still an overriding factor, given that most objectives can be accomplished at Schefferville.

SOIL INVESTIGATIONS

The soils observed in the study area were remarkably similar in morphology. All were classified as **Biscayne** (loamy, carbonatic, hyperthermic, shallow Typic Fluvaquent) soils. However, the soils observed within the Everglades National Park differed from the recognized Biscayne series in being frequently flooded for very long periods and having, in many areas, a mucky silt loam surface texture.

The Biscayne series consists of shallow (25 to 50 cm) or very shallow (< 25 cm) poorly and very poorly drained, moderately or moderately rapid permeable soils over limestone. The Biscayne soils formed in recent calcareous deposits of dominantly silt-sized sediments that precipitated from marine or fresh water. Slopes are less than 2 percent.

Enclosure 1 is a portion of the interpretation record for the Biscayne series. Enclosures 2 and 3 are soil characterization data collected from cultivated areas of Biscayne soils in Dade County, Florida.

A typifying pedon of Biscayne mucky silt loam from a fresh-water marsh near the Mahogany Hammock interpretive trail, Everglades National Park, Florida:

> Ap--0 to 13 centimeters; very dark gray (10YR3/1) mucky silt loam; moderate medium granular structure; slightly sticky, nonplastic; common fine and medium roots; strongly effervescent; mildly alkaline; clear smooth boundary.
>
> Cg1--13 to 23 centimeters; gray (10YR6/1) marl with a texture of silt loam; massive; slightly sticky and nonplastic; few fine roots; about 5% snail shell fragments: strongly effervescent; mildly alkaline; abrupt smooth boundary.
>
> Cg2--23 to 38 centimeters; light gray (10YR7/1) marl with a texture of silt loam; massive; slightly sticky and nonplastic; few fine roots; about 20% snail shell fragments; strongly effervescent; mildly alkaline; abrupt irregular boundary.
>
> 2R--38 centimeters; hard, porous, oolitic limestone.

Soil thickness and depth to limestone ranges from 3 to 50 cm. Snail shells and shell fragments ranging from sand sized to 3 cm occur in some or all horizons in most pedons. These soil range from nonsaline to moderately saline.

The A horizon has a hue of 10YR or 2.5Y, values of 2 to 6, and chroma of 3 or less, with or without light brownish gray or light gray mottles. Where matrix values are 3.5 or less, thickness of the A horizon is less than 18 cm or less than 10 cm if the A horizon lies directly on bedrock. A thin layer of organic material overlies the A horizon in some places. Reaction is mildly alkaline to moderately alkaline. Calcium carbonate equivalencies range from 70 to nearly 100 percent. Texture is mucky silt loam, silt loam, or silt. Gravel ranges from 0 to 35 percent in cultivated areas. The fragments range from 2 mm to 7.5 cm on diameter.

The Cg horizon has hue of 10YR or 2.5Y, values of 4 to 7, and chroma of 3 or less, with or without streaks and pockets having hue of 10YR, value of 2 or 3, and chroma of 3 or less. Discontinuous lenses or pockets of muck occur in some pedons. Texture of the marl is silt loam or silt with thin discontinuous layers of mucky silt loam or silty clay loam.

The 2R horizon is limestone with a smooth to irregular surface. The study areas were underlain at shallow (0 to 50 cm) depths by the Miami Limestone. The Miami Limestone is an oolitic, highly permeable, creamy-white limestone which is perforated with numerous solution cavities (Harris and Tuttle, 1977). In outcrops observed near Rock Reef Pass, the surface was deeply pitted and broken into lapies. Froehlich (1973) reported solution cavities extending to depths as great as 1.5 meters.

Within the study areas, the depth to limestone was more variable over short than over long distances at all sites. During field investigations, 285 observations to bedrock were made. The distribution of these measured depths is displayed in Figure 1A. The average and median depths to bedrock were 33.6 and 33.4cm, respectively. One-half of the measured depths occurred within the interquartile range of 26.9 to 39.8 cm. The distribution of the observed depths were: 90%, 0 to 50 cm; 9%, 50 to 100 cm; and 1%, 100 to 150 cm.

The distribution of the depths to bedrock among the four study areas were similar. The average depth to bedrock was 42 cm at Paurotis Pond, 34 cm at Mahogany Hammock, 29 cm at Pa Hay Okee Overlook, and 28 cm at Taylor Slough. It has been reported by Froehlich (1973) and Harris and Tuttle (1977) that the limestone dips slightly towards and is therefore deeper nearer the coast. The results of this study agree with their findings. Variations in the depths to bedrock along the EM survey lines at each study site are graphed in Figure 1B. Depths graphed in this figure are based on the average of three auger measurements at each observation site. Greater variations in the depths to bedrock occur within than among the four study sites.

To demonstrate the short range variability in the depth to bedrock, a one meter square grid was established at the Pa Hay Okee Overlook study area. This observation site was observed to have a wide distribution in depths to bedrock. Therefore, this site may represents the extreme rather than the typical variations observed in depths to bedrock. The grid interval was 5 cm. A total of 441 depths to bedrock were systematically collected with a push probe. Figure 2 and 3 are three- and two-dimensional diagram of the depth to bedrock within the gridded area. All measurements are in cm.

Within the one meter square grid, depths to limestone ranged from 20.3 to 213.4 cm. The average and median depths to bedrock were 55.6 and 48.3 cm, respectively. One-half of the measured depths occurred within the interquartile range of 40.6 to 61.0 cm. The distribution of the measured depths to bedrock was: 54%, 0 to 50 cm; 39%, 50 to 100 cm; 4%, 100 to 150 cm; and 3%, greater than 150 cm.

Electromagnetic Induction (EM) Survey

The EM-38 electromagnetic ground conductivity meter was developed specifically for measuring soil conductivity within the root zone (McNeill, 1986a). The meter has been used extensively to measure the apparent electrical conductivity of saline soils (Corwin and Rhoades, 1982 and 1984; De Jong, 1979; Kingston, 1985; Rhoades and Corwin, 1981; Rhoades and Halvorson, 1977; Slavich and Read, 1985; Williams, 1983; Williams and Baker, 1982; Williams and Hoey, 1987; and Wollenhaupt et al., 1986). This technology has also been used to map bedrock surfaces (Zalasiewicz, 1985), thickness of clays (Palacky, 1987) or sand and gravel deposits (Rumbens, 1984), and for groundwater investigations (McNeill, 1988).

The operation of the EM-38 meter is described in detail by McNeill (1986b). Electromagnetic (EM) methods measure the electrical conductivity between the receiver and transmitter coils. For surveying, the EM-38 meter is placed on the ground surface or suspended at a specified distance. An oscillating dipolar magnetic field is produced by the transmitter coil. This primary magnetic field induces an electrical current in the ground which generates a secondary magnetic field in a manner that the amplitude of the induced current is proportional to the electrical conductivity of the scanned earthen materials. The magnitude of this current is measured at the receiver coil and is a function of the apparent electrical conductivity of the soil.

Electromagnetic methods measure the apparent electrical conductivity of earthen materials. Factors influencing the conductivity of earthen materials include (i) the volumetric water content, (ii) amount and type of salts in solution, (iii) the amount and type of clays in the soil matrix, and (iv) the soil temperature. The apparent conductivity (ECa) of the soil has been related to the paste extract conductivity (ECe) by the relationship ECe = 5ECa (McNeill, 1986a). Table 1 (from McNeill, 1986a) illustrates this relationship. Measurements are expressed in millisiemens/meter (mS/m).

Table 1

Soil Conductivity vs. Salinity (from McNeill, 1986a)

Salinity	ECe (mS/cm)	ECa (mS/m)
Slight	0-4	0-80
Moderate	4-8	80-160
High	8-12	160-240
Extreme	>12	>240

As discussed by Benson and others (1984), the absolute values are not necessarily diagnostic in themselves, but lateral and vertical variations in the conductivity are significant. Interpretations of the EM data are often based on the identification of spatial patterns in the data set.

Four transect lines were established during this field investigation. Observation sites were located at 7.5 m (Paurotis Pond, Mahogany Hammock, and Pa Hay Okee Observation Site) and 3.25 m (Taylor Slough) intervals. A Geonic Limited EM-38 electromagnetic induction soil conductivity meter was used in this study. With the EM-38 meter placed on the surface and orientated in both vertical and horizontal dipole positions, profile measurements of the electromagnetic conductivity were made at each observation point to depths of 1.5 and 0.75 meters, respectively.

Though soils and depth to bedrock were similar, electromagnetic conductivities varied widely among the sites (Table 2). Generally, Paurotis Pond and Mahogany Hammock sites displayed the highest EM-vertical and -horizontal measurements. As Mahogany Hammock and Paurotis Pond are closest to marine influences, the elevated EM values at these sites may have been produced by higher concentrations of soluble salts. Though the relative electrical conductivity of soils is determined mainly by volumetric water content, Williams and Baker (1982) reported that 65 to 70% of the variations in ECa values can be explained by soil salinity.

Variations among the sites existed not only in relative magnitudes of the EM readings, but also in the relationships between EM-vertical and EM-horizontal measurements. Soils at the Paurotis Pond and Taylor Slough sites displayed normal electrical conductivity profiles (electrical conductivity increases with depth; EMV > EMH). Paurotis Pond and Taylor Slough were the wettest sites, each with about 15 cm of surface water. Soils at the Pa Hay Okee site displayed an inverted electrical conductivity profile (electrical conductivity decreases with depth; EMV < EMH). When measured, the Pa Hay Okee site did not have surface water and was the driest of all sites. Mahogany Hammock which had the most variable depth to bedrock and was the most disturbed site, had soils which displayed both inverted and normal electrical conductivity profiles.

Weak positive correlations were found to exist between depth to bedrock and EM measurements. However, the EM measurements explained very little of the variation in the depth to bedrock (Table 3). As the depths to bedrock were shallow and variations in the depth to bedrock across sites were slight, the EM is not an appropriate tool for determining the depth to bedrock in the Everglades where variations in the chemistry and source of ground water may be more significant factors affecting the measurements.

Table 2

BASIC STATISTICS FOR EM AND SOIL DEPTH SURVEYS, EVERGLADES NATIONAL PARK, FLORIDA*

PAUROTIS POND

	MEAN	MIN	MAX	FIRST	MEDIAN	THIRD
EMV	47	38	60	40	44	53
EMH	47	34	49	36	38	44
DEPTH	42	34	54			

MAHOGANY HAMMOCK

	MEAN	MIN	MAX	FIRST	MEDIAN	THIRD
EMV	78	60	87	75	80	83
EMH	78	56	90	72	79	83
DEPTH	34	18	77			

PA HAY OKEE

	MEAN	MIN	MAX	FIRST	MEDIAN	THIRD
EMV	7	5	12	6	6	8
EMH	15	20	6	14	15	15
DEPTH	29	11	51			

TAYLOR SLOUGH

	MEAN	MIN	MAX	FIRST	MEDIAN	THIRD
EMV	17	11	36	15	15	17
EMH	12	10	15	11	12	14
DEPTH	28	21	39			

* Used Genoic EM38 ground conductivity meter which provided depths of exploration of 1.5 meters in the vertical dipole mode (EMV) and 0.5 meter in the horizontal dipole mode (EMH). Measures the apparent conductivity of earthen materials in millisiemens per meter (mS/m). All reported soil depths are to bedrock and are expressed in cm.

Table 3

CORRELATION (R^2) BETWEEN SOIL DEPTH AND EM VALUES*

SITE	EMV-DEPTH	EMH-DEPTH
PAUROTIS POND	0.172	0.125
MAHOGANY HAMMOCK	0.008	0.239
PA HAY OKEE	0.052	0.313
TAYLOR SLOUGH	0.234	0.046

* Used Genoic EM38 ground conductivity meter which provided depths of exploration of 1.5 meters in the vertical dipole mode (EMV) and 0.5 meter in the horizontal dipole mode (EMH). Measures the apparent conductivity of earthen materials in millisiemens per meter (mS/m). All reported soil depths are to bedrock and are expressed in cm.

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Enclosure 4-1

MLRA(S): 156A
CN, 8-89
TYPIC FLUVAQUENTS, LOAMY, CARBONATIC, HYPERTHERMIC, SHALLOW

THE BISCAYNE SERIES CONSISTS OF VERY SHALLOW AND SHALLOW POORLY DRAINED AND VERY POORLY DRAINED MODERATELY OR MODERATEL RAPIDLY PERMEABLE SOILS OVER LIMESTONE. THEY FORMED IN RECENT CALCAREOUS, SILTY SEDIMENTS OF MARINE OR FRESHWATER ORIGIN. THEY OCCUR IN BROAD LOW COASTAL FLATS, FRESHWATER, MARSHES AND SLOUGHS THAT HAVE BEEN ARTIFICIALLY DRAINED. TYPICALLY, THE SURFACE LAYER IS GRAY SILT LOAM (MARL) ABOUT 5 INCHES THICK. THE UNDERLYING LAYER IS LIGHT GRAY SILT LOA (MARL) ABOUT 10 INCHES THICK. HARD, POROUS, LIMESTONE BEDROCK OCCURS BELOW 15 INCHES. SLOPES ARE LESS THAN 2 PERCENT.

LANDSCAPE AND CLIMATE PROPERTIES

ANNUAL AIR TEMPERATURE	FROST FREE DAYS	ANNUAL PRECIPITATION	ELEVATION (FT)	DRAINAGE CLASS	SLOPE (PCT)

ESTIMATED SOIL PROPERTIES

DEPTH (IN.)	USDA TEXTURE	UNIFIED	AASHTO	FRACT. >10 IN (PCT)	FRACT. > 3 IN (PCT)	PERCENT OF MATERIAL LESS THAN 3" PASSING SIEVE NO. 4	10	40	200	CLAY (PCT)
0-15	GR-MARL	ML, CL-ML	A-4		0-5	60-85	50-75	35-70	35-70	10-2[illegible]
0-15	MARL	ML	A-4		0	100	100	80-100	80-100	5-1[illegible]
15	WB									

DEPTH (IN.)	LIQUID LIMIT	PLAS-TICITY INDEX	MOIST BULK DENSITY (G/CM3)	PERMEA-BILITY (IN/HR)	AVAILABLE WATER CAPACITY (IN/IN)	SOIL REACTION (PH)	SALINITY (MMHOS/CM)	SAR	CEC (ME/100G)	CACO3 (PCT)	GYPSUM (PCT)
0-15	23-28	<7	1.00-1.20	0.6-6.0	0.10-0.20	7.4-8.4	<4				
0-15	-	NP-4	1.00-1.20	0.6-6.0	0.15-0.20	7.4-8.4	<4				
15											

DEPTH (IN.)	ORGANIC MATTER (PCT)	SHRINK-SWELL POTENTIAL	EROSION FACTORS K	T	WIND EROD. GROUP	WIND EROD. INDEX
0-15	3-6	LOW	.32	1	8	
0-15	1-2	LOW	.32	1		
15						

CORROSIVITY STEEL	CORROSIVITY CONCRETE
HIGH	LOW

FLOODING FREQUENCY	FLOODING DURATION	FLOODING MONTHS	HIGH WATER TABLE DEPTH (FT)	HIGH WATER TABLE KIND	HIGH WATER TABLE MONTHS	CEMENTED PAN DEPTH (IN)	CEMENTED PAN HARDNESS	BEDROCK DEPTH (IN)	BEDROCK HARDNESS	SUBSIDENCE INIT. (IN)	SUBSIDENCE TOTAL (IN)	HYD GRP	POTENT FROST ACTION
NONE			0-1.0	APPARENT	JUN-SEP	-		1-20	HARD	-	-	B/D	-

Enclosure 4-2

N A R R A T I V E   P E D O N   D E S C R I P T I O N

Pedon: Biscayne
Soil Survey Number S85-FN-025-001
Location:
Richard Alger Study Field.
Precipitation: cm - Aquic Moisture Regime.
Water Table Depth: 510
Drainage: Poorly drained
Stoniness: Erosion or Deposition:
Parent Material: unconsolidated sediments from marl material
Classification: Coarse-silty, carbonatic, hyperthermic Typic Fluvaquent
Diagnostic Horizons:
Described By:

NSSL Pedon Number: 85P0676
Print Date: 11/17/89

Permeability: Moderate
Land Use: Cropland
Runoff:

Sample Date: 05/85

Ap -- 0 to 20 cm; grayish brown (10YR 5/2) moist silt loam; granular structure parting to subangular blocky; slightly sticky, nonplastic; strongly effervescent; abrupt smooth boundary.
This horizon has some small gravel fragments in lower parts.
85P3488

None -- 20 to 38 cm; light gray (10YR 7/2) moist silt loam; moderate medium subangular blocky structure; slightly sticky, nonplastic; strongly effervescent; abrupt wavy boundary.
85P3489

R -- 38 to 43 cm; weathered bedrock.
Limestone texture. Grab sample for fine above rock.
85P3490

Enclosure 4-2

*** PRIMARY CHARACTERIZATION DATA ***
(DADE COUNTY, FLORIDA)

S85FL-025-001

PRINT DATE 11/17/89

SAMPLED AS : BISCAYNE ; COARSE-SILTY, CARBONATIC, HYPERTHERMIC TYPIC FLUVAQUENT
REVISED TO : ;

NSSL - PROJECT 85P 132, DADE CO
- PEDON 85P 676, SAMPLES 85P3488-3490
- GENERAL METHODS 1B1A, 2A1, 2B

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
NATIONAL SOIL SURVEY LABORATORY
LINCOLN, NEBRASKA 68508-3866

SAMPLE NO.	DEPTH (CM)	HORIZON	-1-- (- - -TOTAL - - -) CLAY LT .002	-2-- SILT .002 -.05	-3-- SAND .05 -2	-4-- (- -CLAY- -) FINE LT .0002	-5-- CO3 LT .002	-6-- (- -SILT- -) FINE .002 -.02	-7-- COARSE .02 -.05	-8-- (- - - -SAND- - - -) VF .05 -.10	-9-- F .10 -.25	-10- M .25 -.50	-11- C .5 -1	-12- VC 1 -2	-13- (-COARSE FRACTIONS(MM)-) - - - - WEIGHT - - - - 2 -5	-14- 5 -20	-15- 20 -75	-16- .1- 75	-17- (>2MM) WT PCT OF WHOLE SOIL
			<- - - - - - - - - - - - - - PCT OF <2MM (3A1) - - - - - - - - - - - - - - - ->												<- PCT OF <75MM(3B1)->				SOIL
85P3488S	0- 20	AP	9.5	85.9	4.6		7.2	84.1	1.8	0.6	1.4	1.2	0.8	0.6	1	2	--	7	3
85P3489S	20- 38	CKG	3.8	95.5	0.7		--	93.8	1.7	0.2	0.2	0.2	0.1	--	TR	1	--	1	1
85P3490G	38- 43	R													--	--	--		--P

DEPTH (CM)	ORGN C 6A1C PCT	TOTAL N 6B3A <2MM	EXTR P 6S3 PPM	TOTAL S 6R3A	(- - DITH-CIT - -) EXTRACTABLE FE 6C2B	AL 6G7A	MN 6D2A	(RATIO/CLAY) CEC 8D1	15 BAR 8D1	(ATTERBERG) - LIMITS - LL 4F1	PI 4F	(- BULK DENSITY -) FIELD MOIST 4A3A	1/3 BAR 4A1D	OVEN DRY 4A1H	COLE WHOLE SOIL 4D1	(- - -WATER CONTENT - -) FIELD MOIST 4B4	1/10 BAR 4B1C	1/3 BAR 4B1C	15 BAR 4B2a	WRD WHOLE SOIL 4C1
				<- PERCENT	OF	<2MM -->				PCT <0.4MM		<- - G/CC	- - ->		CM/CM	<- - -PCT OF <2MM - ->				CM/CM
0- 20	2.28	0.214						0.41	0.73				1.21	1.21	--			29.0	6.9	0.27
20- 38	1.56							0.11	1.13	48	3		1.13	1.14	0.003			38.2	4.3	0.38
38- 43													1.70	1.70				11.9		

AVERAGES, DEPTH 25- 38: PCT CLAY 4 PCT .1-75MM 2

Enclosure 4-2

*** PRIMARY CHARACTERIZATION DATA ***

S85FL-025-001 PRINT DATE 11/17/89
SAMPLED AS : BISCAYNE ; COARSE-SILTY, CARBONATIC, HYPERTHERMIC TYPIC FLUVAQUENT
NATIONAL SOIL SURVEY LABORATORY ; PEDON 85P 676, SAMPLE 85P3488-3490

DEPTH (CM)	-1--	-2--	-3--	-4--	-5--	-6--	-7--	-8--	-9--	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-	-20-
	(- NH4OAC EXTRACTABLE BASES -)					ACID-		(- -CEC- -)		EXCH	SAR	BASE		CARBONATE		CASO4 AS		(- - - -PH - - -)		
	CA	MG	NA	K	SUM	ITY		SUM	NH4-	NA		SATURATION		AS CACO3		GYPSUM		SAT	CACL2	H2O
	5B5A	5B5A	5B5A	5B5A	BASES			CATS	OAC			SUM	NH4OAC	<2MM	<20MM	<2MM	<20MM	PASTE	.01M	
	6N2E	6O2D	6P2B	6Q2B		6H5A		5A3A	5A8B	5B5B	5E	5C3	5C1	6E1G	6E4	6F1A	6F4	8C1B	8C1F	8C1F
	<- - - - - - - - - - - -MEQ / 100 G - - - - - - - - - - - - ->									PCT		<- -PCT- >		<- -PCT ->		<- -PCT ->			1:2	1:1
0- 20		1.1	0.3	0.6					3.9	3	1	100	100	93				7.6	7.7	7.9
20- 38		0.9	0.1	TR					0.4	10	1	100	100	96				7.4	7.7	8.0
38- 43														94					8.2	8.1

DEPTH (CM)	(- - - - - - - -WATER EXTRACTED FROM SATURATED PASTE- - - - - - - - - -)											
	CA	MG	NA	K	CO3	HCO3	CL	SO4	NO3	H2O	TOTAL SALTS EST.	ELEC. COND.
	6N1B	6O1B	6P1B	6Q1B	6I1B	6J1B	6K1C	6L1C	6M1C	8A	8D5	8A3A
	< - - - - - - - - - - - - -MEQ / LITER - - - - - - - - - - - >									<- -PCT ->		MMHOS /CM
0- 20	16.4	2.6	2.2	3.9	--	5.0	4.1	8.8	5.9	73.2	0.1	2.46
20- 38	9.0	1.3	1.3	0.9	--	5.1	1.7	2.7	2.2	75.9	0.1	1.31
38- 43												

ANALYSES: S= ALL ON SIEVED <2MM BASIS G= <2MM ON GROUND <75MM BASIS P= FABRIC ON <75MM FRACTION

Enclosure 4-2

*** PRIMARY CHARACTERIZATION DATA ***

S85FL-025-001 PRINT DATE 11/17/89
SAMPLED AS : BISCAYNE ; COARSE-SILTY, CARBONATIC, HYPERTHERMIC TYPIC FLUVAQUENT
NATIONAL SOIL SURVEY LABORATORY ; PEDON 85P 676, SAMPLE 85P3488-3490

CLAY MINERALOGY (<.002mm)

SAMPLE NUMBER	-1--	-2--	-3--	-4--	-5--	-6--	-7--	-8--	-9--	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-	-20-
	FRACT ION	X-RAY 7A2i peak size					THERMAL DTA 7A3b Percent		THERMAL TGA 7A4b Percent		ELEMENTAL 7C3 Percent SiO2	AL2O3	Fe2O3	MgO	CaO	K2O	Na2O		EGME RETN 7D2 mg/g	INTERPRETATION
85P3489	TCLY	CA 2					----						0.6							

FRACTION INTERPRETATION:

TCLY Total Clay, <0.002mm

MINERAL INTERPRETATION:

CA calcite

RELATIVE PEAK SIZE: 5 Very Large 4 Large 3 Medium 2 Small 1 Very Small 6 No Peaks

Enclosure 4-3

N A R R A T I V E   P E D O N   D E S C R I P T I O N

Pedon: Biscayne
Soil Survey Number S85-FL-025-002
Location: Dade County, Florida
Richard Alger Test Field.
Precipitation: cm - Aquic Moisture Regime.
Water Table Depth: 510
Drainage:
Stoniness: Erosion or Deposition:
Parent Material: un
onsolidated sediments from marl material over unconsolidated sediments from limestone
mater
Classification: Coarse-silty, carbonatic, hyperthermic Typic Fluvaquent
Diagnostic Horizons:
Described By:

NSSL Pedon Number: 85P0677
Print Date: 11/17/89
Permeability: Moderate
Land Use: Cropland
Runoff:
Sample Date: 05/85

Solution holes contain residual fine loamy material overlain by sapric muck or mucky silt loam.

Ap -- 0 to 18 cm; grayish brown (10YR 5/2) moist silt loam and marl; moderate granular structure; slightly sticky, nonplastic; common fine and medium roots; strongly effervescent; abrupt smooth boundary.
Common sand small snail shell fragments.
85P3491

C -- 18 to 38 cm; grayish brown (10YR 5/2) moist silt loam and marl; moderate angular blocky structure; slightly sticky, nonplastic; common fine and medium roots; strongly effervescent; abrupt wavy boundary.
Common fine (10YR 7/2) pockets of soft CaCO3; few fine and medium (10YR 5/4 and 5/8) streaks and pockets.
85P3492

O -- 38 to 51 cm; black (10YR 2/1) moist sapric material and muck; massive; nonsticky, nonplastic; moderately alkaline (pH=8.0); abrupt irregular boundary.
Confined to solution holes greater than 2 inches in depth.
85P3493

2C -- 51 to 76 cm; brown to dark brown (10YR 4/3) moist silty clay loam; sticky, plastic.
Horizon confined to solution holes greater than 2 inches in depth; unable to sample this horizon due to high water table

R -- 76 to 89 cm; weathered bedrock.
Texture is oolithic limestone.

Enclosure 4-3

*** PRIMARY CHARACTERIZATION DATA ***
(DADE COUNTY, FLORIDA)

S85FL-025-002

PRINT DATE 11/17/89

SAMPLED AS : BISCAYNE ; COARSE-SILTY, CARBONATIC, HYPERTHERMIC TYPIC FLUVAQUENT
REVISED TO : ;

NSSL - PROJECT 85P 132, DADE CO
- PEDON 85P 677, SAMPLES 85P3491-3493
- GENERAL METHODS 1B1A, 2A1, 2B

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
NATIONAL SOIL SURVEY LABORATORY
LINCOLN, NEBRASKA 68508-3866

SAMPLE NO.	DEPTH (CM)	HORIZON	-1-- CLAY LT .002 (TOTAL)	-2-- SILT .002 -.05 (TOTAL)	-3-- SAND .05 -2 (TOTAL)	-4-- FINE LT .0002 (CLAY)	-5-- CO3 LT .002 (CLAY)	-6-- FINE .002 -.02 (SILT)	-7-- COARSE .02 -.05 (SILT)	-8-- VF .05 -.10 (SAND)	-9-- F .10 -.25 (SAND)	-10- M .25 -.50 (SAND)	-11- C .5 -1 (SAND)	-12- VC 1 -2 (SAND)	-13- 2 -5 (COARSE FRACTIONS (MM) WEIGHT)	-14- 5 -20	-15- 20 -75	-16- .1- 75	-17- (>2MM) WT PCT OF WHOLE SOIL
			<- PCT OF <2MM (3A1)											->	<- PCT OF <75MM(3B1)			->	
85P3491S	0- 18	AP	7.1	89.4	3.5		0.3	87.3	2.1	0.5	1.1	0.9	0.6	0.4	TR	TR	--	3	TR
85P3492S	18- 38	C	3.7	94.8	1.5		2.9	92.1	2.7	0.3	0.3	0.3	0.3	0.3	TR	--	--	1	TR
85P3493S	38- 76	O													--	--	--		--

DEPTH (CM)	ORGN C 6A1C PCT	TOTAL N 6B3A <2MM	EXTR P 6S3 PPM	TOTAL S 6R3A	DITH-CIT EXTRACTABLE FE 6C2B	AL 6G7A	MN 6D2A	(RATIO/CLAY) CEC 8D1	15 BAR 8D1	(ATTERBERG - LIMITS -) LL 4F1	PI 4F	(BULK DENSITY) FIELD MOIST 4A3A	1/3 BAR 4A1D	OVEN DRY 4A1H	COLE WHOLE SOIL 4D1 CM/CM	(WATER CONTENT) FIELD MOIST 4B4	1/10 BAR 4B1C	1/3 BAR 4B1C	15 BAR 4B2a	WRD WHOLE SOIL 4C1 CM/CM
				<- PERCENT OF <2MM -->						PCT <0.4MM		<- - G/CC - - ->				<- - -PCT OF <2MM - ->				
0- 18	2.36	0.214						0.44	0.94				1.18	1.20	0.006			43.6	6.7	0.43
18- 38	2.35							0.65	1.54	52	2		1.10	1.11	0.003			48.3	5.7	0.47
38- 76	20.4																			

AVERAGES, DEPTH 25- 76: PCT CLAY 0 PCT .1-75MM 0

Enclosure #-3

*** PRIMARY CHARACTERIZATION DATA ***

S85FL-025-002 PRINT DATE 11/17/89
SAMPLED AS : BISCAYNE ; COARSE-SILTY, CARBONATIC, HYPERTHERMIC TYPIC FLUVAQUENT
NATIONAL SOIL SURVEY LABORATORY ; PEDON 85P 677, SAMPLE 85P3491-3493

DEPTH (CM)	-1--	-2--	-3--	-4--	-5--	-6--	-7--	-8--	-9--	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-	-20-
	(- NH4OAC EXTRACTABLE BASES -)					ACIDITY		(- -CEC- -)		EXCH NA	SAR	BASE SATURATION		CARBONATE AS CACO3		CASO4 AS GYPSUM		(- - - -PH - - -)		
	CA 5B5A 6N2E	MG 5B5A 6O2D	NA 5B5A 6P2B	K 5B5A 6Q2B	SUM BASES	6H5A		SUM CATS 5A3A	NH4-OAC 5A8B	5B5B	5E	SUM 5C3	NH4OAC 5C1	<2MM 6E1G	<20MM 6E4	<2MM 6F1A	<20MM 6F4	SAT PASTE 8C1B	CACL2 .01M 8C1F 1:2	H2O 8C1F 1:1
	<- - - - - - - - - - -MEQ / 100 G - - - - - - - - - - - - ->									PCT		<- -PCT- ->		<- -PCT ->		<- -PCT ->				
0- 18		1.2	0.3	0.5					3.1	3	1	100	100	95				7.9	7.9	8.3
18- 38		0.6	0.1	--					2.4	3	TR	100	100	93				7.6	7.6	8.1
38- 76														24					7.3	7.3

DEPTH (CM)	(- - - - - - - -WATER EXTRACTED FROM SATURATED PASTE- - - - - - - - - -)											
	CA 6N1B	MG 6O1B	NA 6P1B	K 6Q1B	CO3 6I1B	HCO3 6J1B	CL 6K1C	SO4 6L1C	NO3 6M1C	H2O 8A	TOTAL SALTS EST. 8D5	ELEC. COND. 8A3A MMHOS /CM
	< - - - - - - - - - - - - -MEQ / LITER - - - - - - - - - - - >									<- -PCT ->		
0- 18	9.0	1.8	2.6	4.0	--	2.9	6.4	5.5	0.1	73.8	0.1	1.85
18- 38	5.2	0.4	0.7	0.1	--	5.0	0.4	1.4	--	83.0	TR	0.63
38- 76												

ANALYSES: S= ALL ON SIEVED <2MM BASIS

*** PRIMARY CHARACTERIZATION DATA ***

S85FL-025-002 PRINT DATE 11/17/89
SAMPLED AS : BISCAYNE ; COARSE-SILTY, CARBONATIC, HYPERTHERMIC TYPIC FLUVAQUENT
NATIONAL SOIL SURVEY LABORATORY ; PEDON 85P 677, SAMPLE 85P3491-3493

	-1--	-2--	-3--	-4--	-5--	-6--	-7--	-8--	-9--	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-	-20-
	CLAY MINERALOGY (<.002mm)																			
	FRACT	X-RAY					THERMAL				ELEMENTAL								EGME	INTER
SAMPLE	ION						DTA		TGA		SiO2	AL2O3	Fe2O3	MgO	CaO	K2O	Na2O		RETN	PRETA
		7A2i					7A3b		7A4b		7C3								7D2	TION
NUMBER		peak size					Percent				Percent								mg/g	
85P3492	TCLY	CA 1					----						0.7							

FRACTION INTERPRETATION:

TCLY Total Clay, <0.002mm

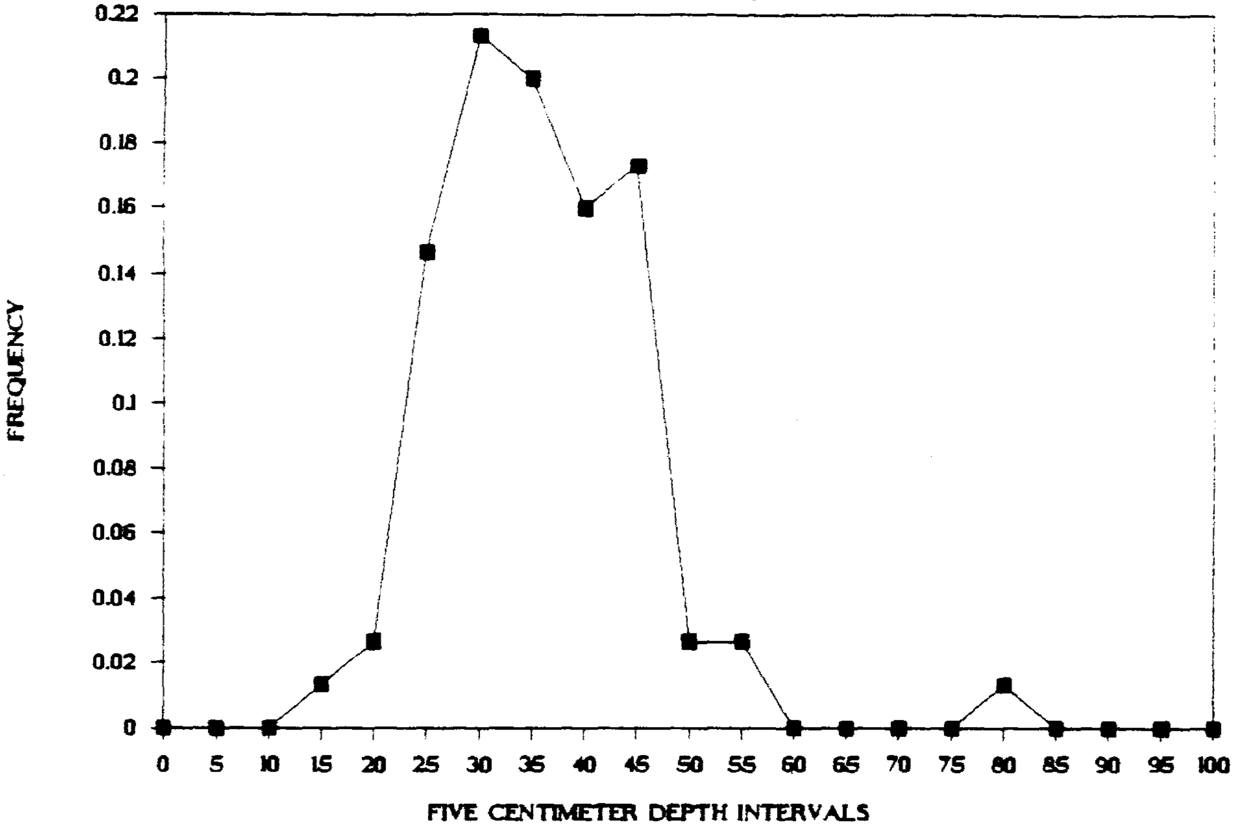
MINERAL INTERPRETATION:

CA calcite

RELATIVE PEAK SIZE: 5 Very Large 4 Large 3 Medium 2 Small 1 Very Small 6 No Peaks

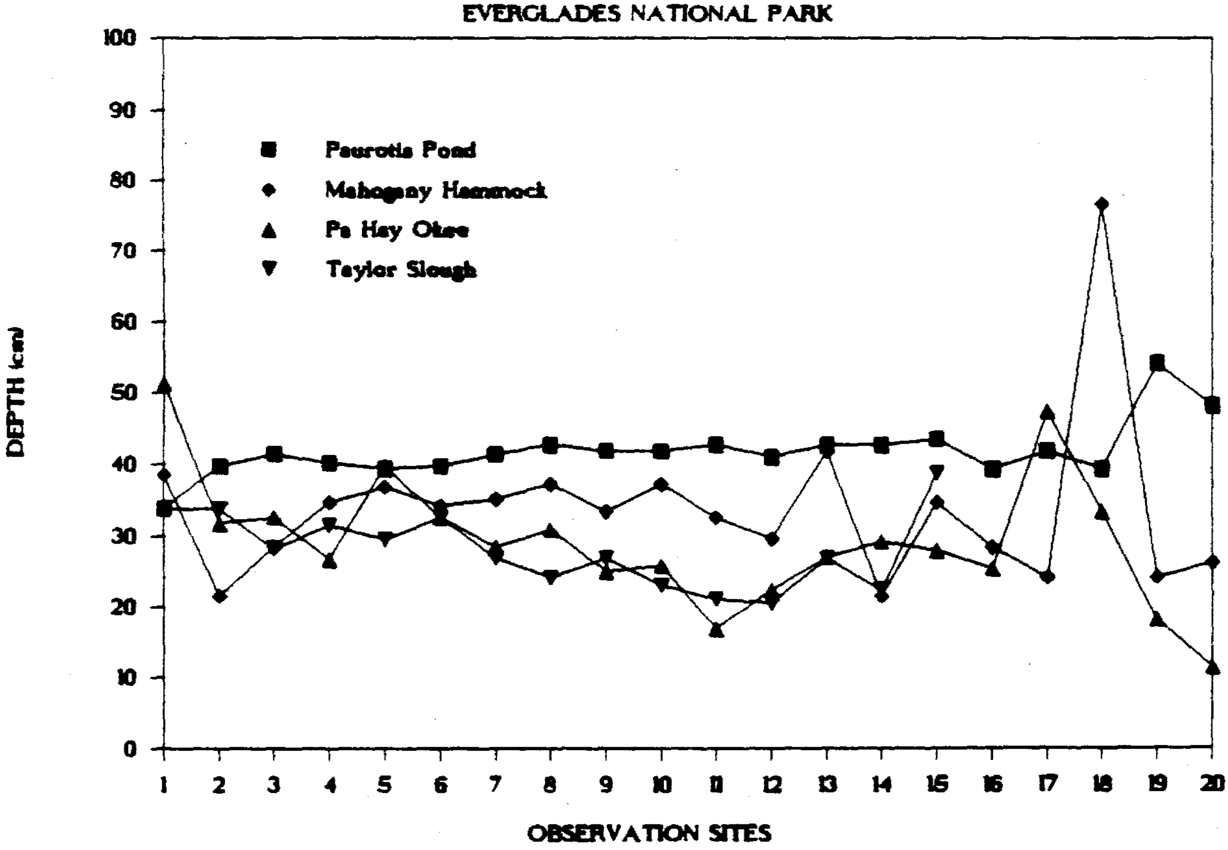
DEPTH TO BEDROCK

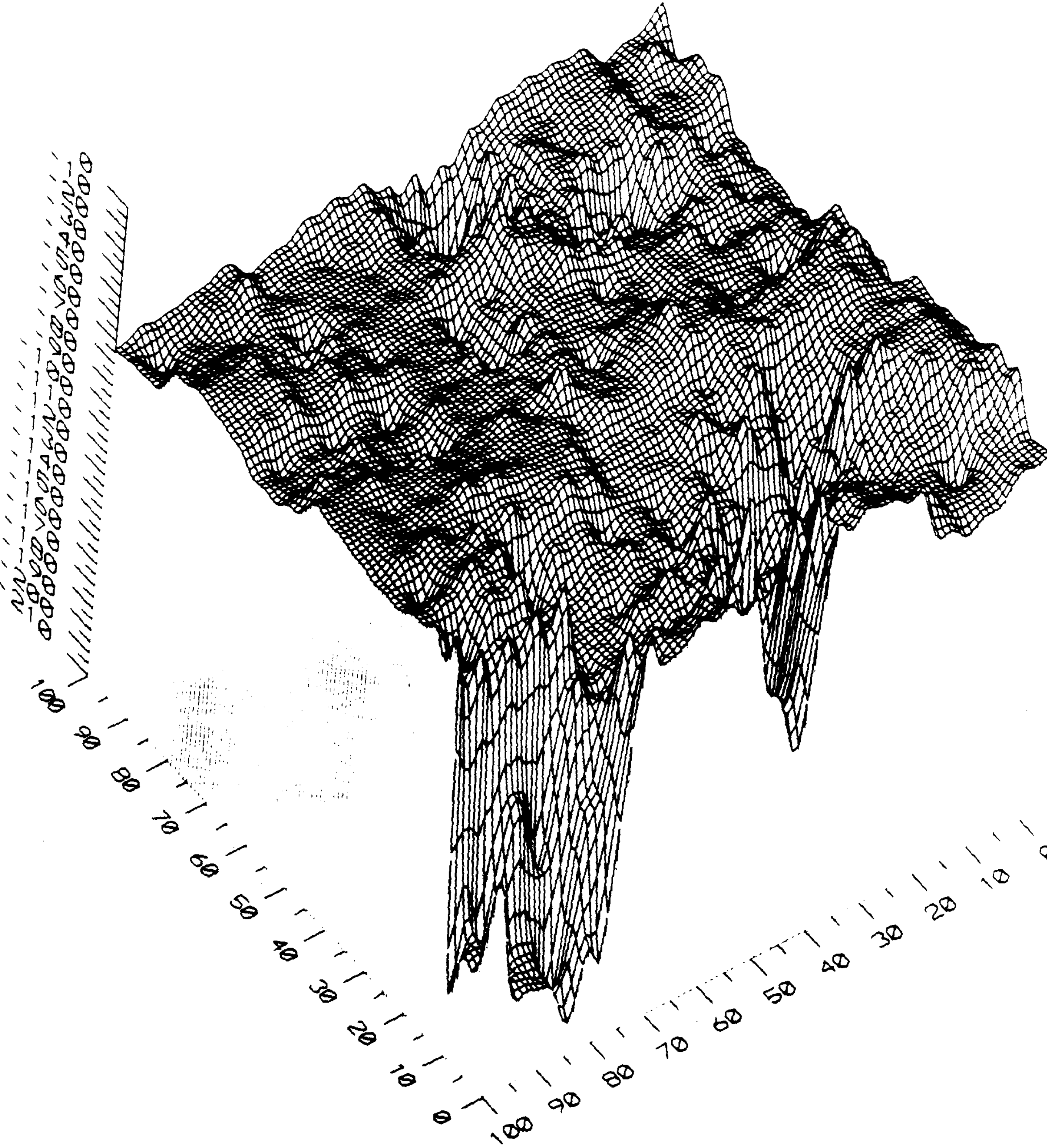
EVERGLADES NATIONAL PARK



DEPTHS TO BEDROCK

EVERGLADES NATIONAL PARK

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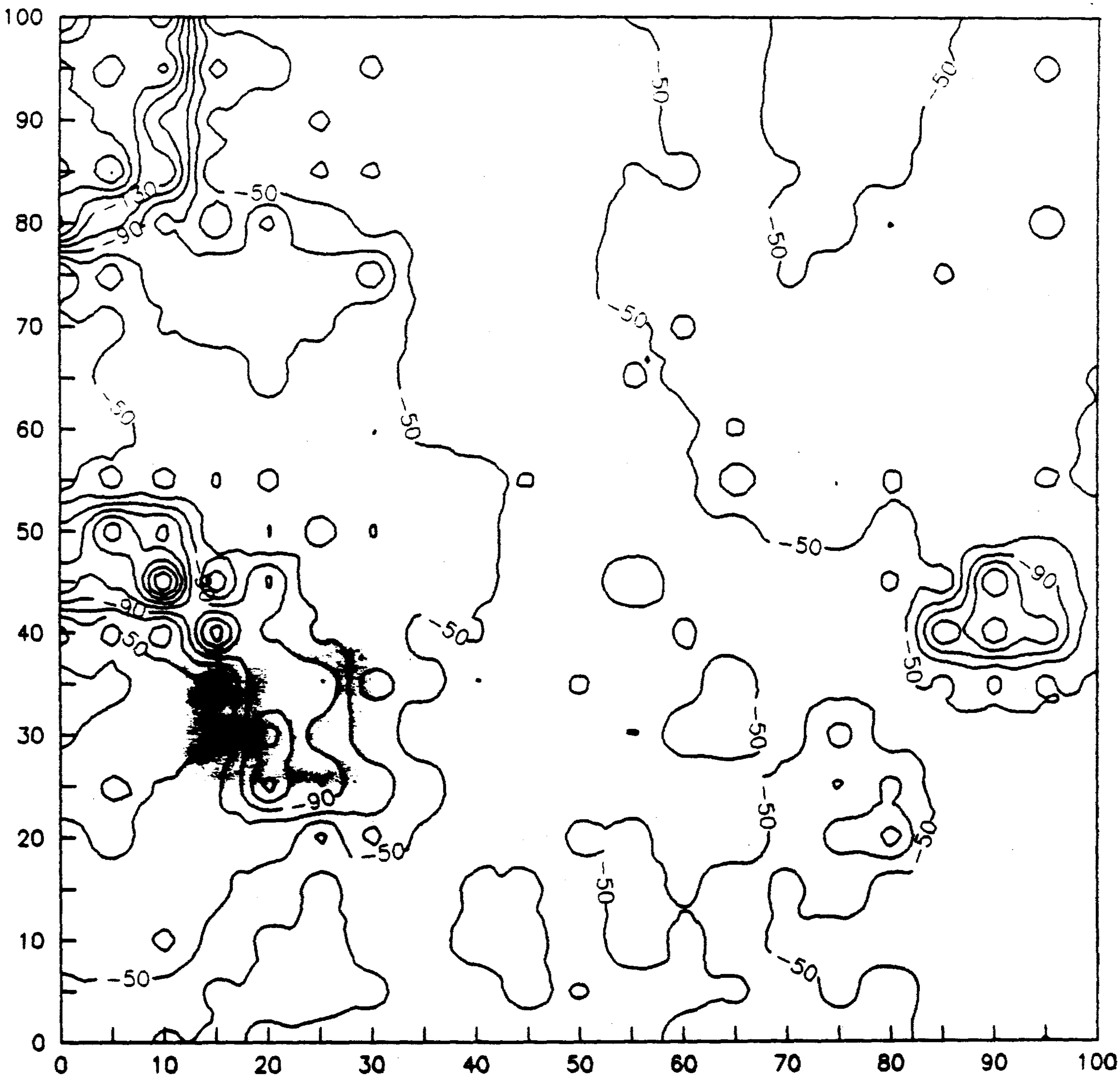
100 90 80 70 60 50 40 30 20 10 0



100
90
80
70
60
50
40
30
20
10
0
0
10
20
30
40
50
60
70
80
90
100
-50
-90

BASIC STATISTICS FOR EM AND SOIL DEPTH SURVEYS, EVERGLADES NATIONAL PARK, FLORIDA*

PAUROTIS POND

	MEAN	MIN	MAX	FIRST	MEDIAN	THIRD
EMV	47	38	60	40	44	53
EMH	47	34	49	36	38	44
DEPTH	42	34	54			

MAHOGANY HAMMOCK

	MEAN	MIN	MAX	FIRST	MEDIAN	THIRD
EMV	78	60	87	75	80	83
EMH	78	56	90	72	79	83
DEPTH	34	18	77			

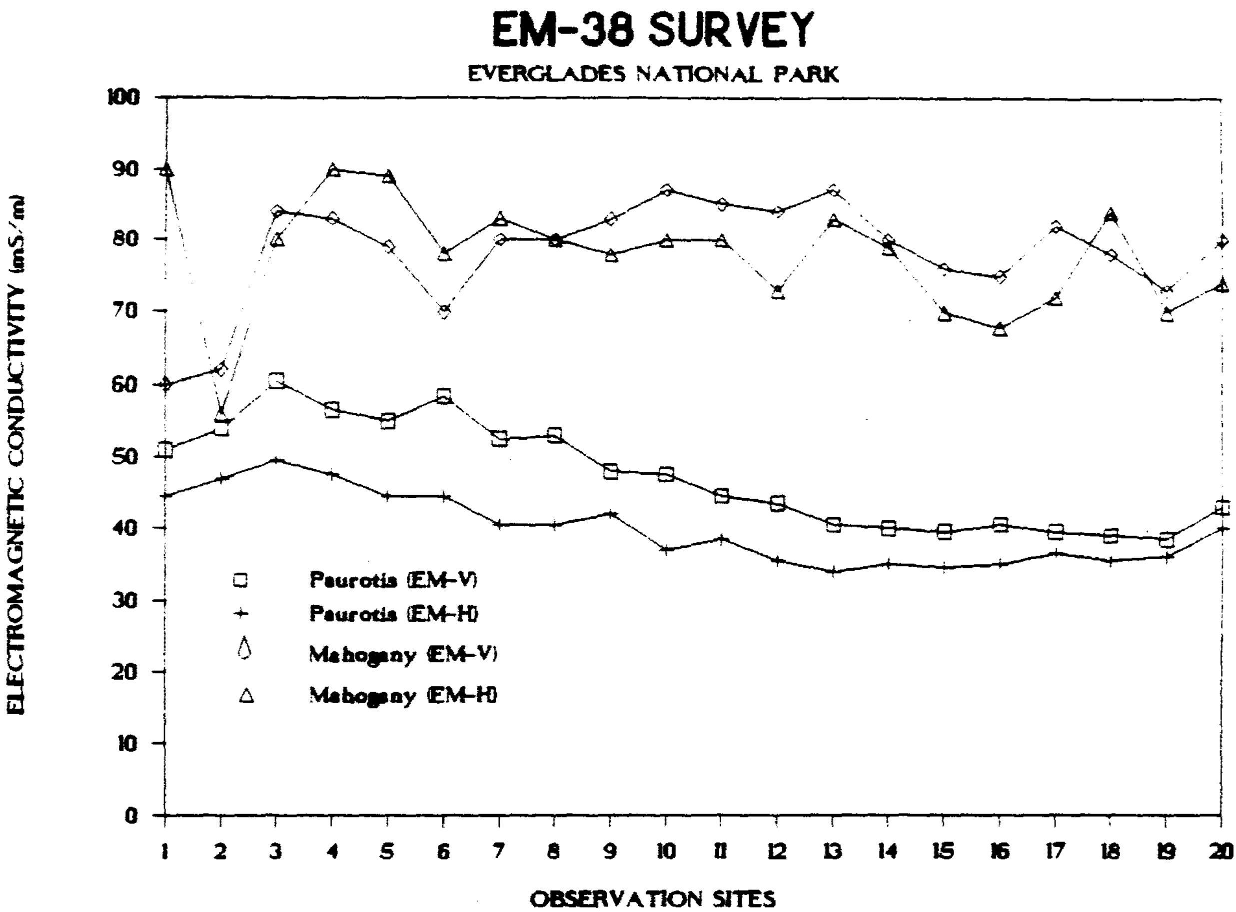
PA HAY OKEE

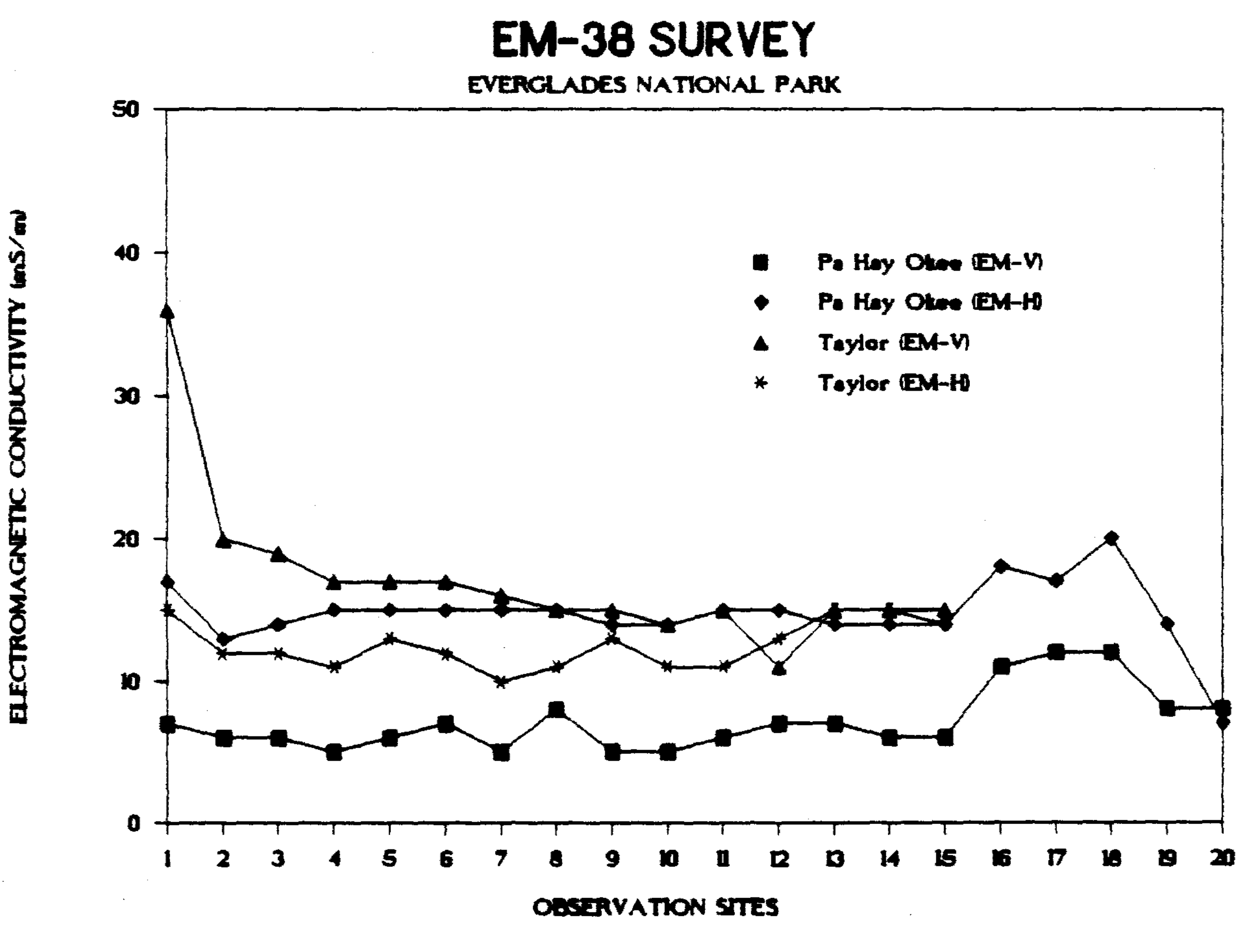
	MEAN	MIN	MAX	FIRST	MEDIAN	THIRD
EMV	7	5	12	6	6	8
EMH	15	20	6	14	15	15
DEPTH	29	11	51			

TAYLOR SLOUGH

	MEAN	MIN	MAX	FIRST	MEDIAN	THIRD
EMV	17	11	36	15	15	17
EMH	12	10	15	11	12	14
DEPTH	28	21	39			

* Used Genoic EM38 ground conductivity meter which provided depths of exploration of 1.5 meters in the vertical dipole mode (EMV) and 0.5 meter in the horizontal dipole mode (EMH). Measures the apparent conductivity of earthen materials in millisiemens per meter (mS/m). All reported soil depths are to bedrock and are expressed in cm.


EM-38 SURVEY
EVERGLADES NATIONAL PARK
ELECTROMAGNETIC CONDUCTIVITY (mS/m)
100
90
80
70
60
50
40
30
20
10
0
Paurotis (EM-V)
Paurotis (EM-H)
Mahogany (EM-V)
Mahogany (EM-H)
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
OBSERVATION SITES


EM-38 SURVEY
EVERGLADES NATIONAL PARK
ELECTROMAGNETIC CONDUCTIVITY (mS/m)
50
40
30
20
10
0
Pa Hay Okee (EM-V)
Pa Hay Okee (EM-H)
Taylor (EM-V)
Taylor (EM-H)
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
OBSERVATION SITES

BASIC STATISTICS FOR EM AND SOIL DEPTH SURVEYS, EVERGLADES NATIONAL PARK, FLORIDA*

PAUROTIS POND

	MEAN	MIN	MAX	FIRST	MEDIAN	THIRD
EMV	47	38	60	40	44	53
EMH	47	34	49	36	38	44
DEPTH	42	34	54			

MAHOGANY HAMMOCK

	MEAN	MIN	MAX	FIRST	MEDIAN	THIRD
EMV	78	60	87	75	80	83
EMH	78	56	90	72	79	83
DEPTH	34	18	77			

PA HAY OKEE

	MEAN	MIN	MAX	FIRST	MEDIAN	THIRD
EMV	7	5	12	6	6	8
EMH	15	20	6	14	15	15
DEPTH	29	11	51			

TAYLOR SLOUGH

	MEAN	MIN	MAX	FIRST	MEDIAN	THIRD
EMV	17	11	36	15	15	17
EMH	12	10	15	11	12	14
DEPTH	28	21	39			

* Used Genoic EM38 ground conductivity meter which provided depths of exploration of 1.5 meters in the vertical dipole mode (EMV) and 0.5 meter in the horizontal dipole mode (EMH). Measures the apparent conductivity of earthen materials in millisiemens per meter (mS/m). All reported soil depths are to bedrock and are expressed in cm.

CORRELATION (R^2) BETWEEN SOIL DEPTH AND EM VALUES

SITE	EMV-DEPTH	EMH-DEPTH
PAUROTIS POND	0.172	0.125
MAHOGANY HAMMOCK	0.008	0.239
PA HAY OKEE	0.052	0.313
TAYLOR SLOUGH	0.234	0.046