

United States Department of Agriculture
Soil Conservation Service

Chester, PA 19013
610-490-6042

Subject: Sodium-affected Soils Study
East Texas; 22 to 27 May 1994.

Date: 16 June 1994

To: Gaylon L. Lane
State Soil Scientist
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Temple, Texas

Purpose:

To evaluate the use EM techniques to predict exchangeable sodium percentage (ESP) in areas of Diboll soils. If effective, this technique can be used to characterize the distribution of sodium and the composition of map units in areas of sodium-affected soils in east Texas.

Participants:

Ron Bauer, Soil Scientist, SCS, NSSC, Lincoln, NE
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Bill Deauman, District Conservationist, SCS, Groveton, TX
Craig Ditzler, Soil Scientist, SCS, NSSC, Lincoln, NE
Jim Doolittle, Soil Specialist, SCS, Chester, PA
Raymond Dolezel, Area Soil Scientist, SCS, Nacogdoches, TX
Larry Gibbs, Civil Engineering Technician, SCS, Nacogdoches, TX
Lynn Gray, Soil Scientist, SCS, Groveton, TX
Kirby Griffith, Soil Survey Party Leader, SCS, Center, TX
Tom Hallmark, Professor, Texas A & M University, College Station, TX
Tom Holt, Soil Scientist, SCS, Lufkin, TX
Jerry Ince, Civil Engineer, SCS, Nacogdoches, TX
Gaylon Lane, State Soil Scientist, SCS, Temple, TX
Conrad Neitsch, Asst. State Soil Scientist, SCS, Temple, TX
Levi Steptoe, Soil Survey Party Leader, SCS, Groveton, TX

Activities:

Five areas of Diboll (fine-silty, siliceous, thermic Albic Glossic Natraqualfs) were surveyed with an EM38 meter in Trinity and Angelina counties, Texas.

Equipment:

The electromagnetic induction meter used was the EM38 manufactured by GEONICS Limited. General theory on the operation and use of this meter are contained in the addendum to this report. Measurements of conductivity are expressed as milliSiemens per meter (mS/m).

Two-dimensional contour plots of the survey areas were prepared using SURFER software developed by Golden Software, Inc. Data used to

construct these simulations were kriged and the resulting matrices smoothed using cubic spline techniques.

With EM methods, depth of penetration is dependent upon intercoil spacing, transmission frequency, and coil orientation relative to the ground surface. The EM38 meter integrates values of apparent conductivity over the upper 0.75 m in the horizontal dipole orientation, and over the upper 1.5 m in the vertical dipole orientation.

Survey Procedures:

At each survey area, a woodland and a pasture site were selected within the same soil delineation. At most survey areas, a 90 by 90 m grid was established on both the woodland and pasture site. The grid interval was 10 m. Survey flags were inserted in the ground at each grid intersection. This provided 100 observation points at each site. At each grid intersection, measurements were taken with the EM38 meter placed on the ground surface in both the horizontal and vertical dipole orientations.

At each grid intersection, the relative elevation of the surface was determined. Elevations were not tied to an elevation benchmark; the datum was assumed to be 30 m.

At each grid site, following the completion of the EM survey a representative grid line was selected by Dr. Hallmark for sampling. Samples were collected at ten observation points along the grid line. These samples will be analyzed by Texas A & M University for soluble and extractable Na, Ca, Mg; CEC-7; electrical conductivity; and pH.

Discussion:

Site 1 - Trinity County

Two-dimensional contour plots for the pasture and wooded sites are simulated in Figure 1. The contour interval is 0.20 m. Relief is about 1.1 m and 2.6 m for the pasture and wooded sites, respectively.

Figures 2 and 3 represent two dimensional plots of apparent conductivity values across the pasture and wooded sites, respectively. In each figure, the upper and lower plots simulate data collected in the horizontal and vertical dipole orientation, respectively. For each plot, the interval is 10 mS/m. The spot symbols represent the location of the observation sites used for sampling. The location of the sample line for the wooded site was unknown to me when these plots were being prepared.

For all but one observation point, EM response increased with increasing soil depth (response in the vertical greater than in the horizontal dipole orientation). This indicates the presence of more conductive materials (i.e. greater clay, soluble salt, and/or water contents) with increasing soil depth. The reverse relationship at one observation point was attributed to high concentrations of animal wastes on the soil surface.

Figure 2 contains two-dimensional plots of apparent conductivity values simulated from data collected with the EM38 meter in the pasture site. In both orientations, EM responses increased toward the left-hand margin of the plots. In this lower-lying portion of the survey site (see Figure 1), salts and animal wastes were visible and concentrated on the soil surface. These features would account for the elevated EM response. In other portions of the survey site, EM responses were lower and generally less variable.

Electromagnetic responses were relatively high across this site. Based on 100 observations, the average apparent conductivity was 88 mS/m, with a range of 56 to 181 mS/m in the horizontal mode. One-half of the observations collected in the horizontal dipole orientation had apparent conductivity values between 71 and 94 mS/m. Based on 100 observations, the average apparent conductivity was 137 mS/m, with a range of 98 to 180 mS/m in the vertical mode. One-half of the observations collected in the vertical dipole orientation had apparent conductivity values between 125 and 149 mS/m.

Figure 3 is a two-dimensional plot of apparent conductivity values simulated from data collected with the EM38 meter in the wooded site. In both orientations, EM responses increased toward the lower left-hand margin of the plots. The lower-left hand corner of the plot was more higher-lying than most other portions of the survey site.

Compared with the pasture site, electromagnetic responses were lower and less variable across the wooded site. Based on 100 observations, the average apparent conductivity was 35.49 mS/m, with a range of 26 to 50 mS/m in the horizontal mode. One-half of the observations collected in the horizontal dipole orientation had apparent conductivity values between 32 and 38 mS/m. Based on 100 observations, the average apparent conductivity was 66.47 mS/m, with a range of 52 to 94 mS/m in the vertical mode. One-half of the observations collected in the vertical dipole orientation had apparent conductivity values between 60 and 70 mS/m.

Site 2 - Trinity County

Two-dimensional contour plots for the pasture and woodland sites are simulated in Figure 4. The contour interval is 0.20 m. For each site, relief is about 1 m.

Figures 5 and 6 represent two dimensional plots of apparent conductivity values across the pasture and wooded sites, respectively. In each figure, the upper and lower plots simulate data collected in the horizontal and vertical dipole orientation, respectively. For each plot, the interval is 10 mS/m. The spot symbols represent the location of the observation sites used for sampling.

For all observation points, EM response increased with increasing soil depth (response in the vertical greater than in the horizontal dipole orientation). This indicates the presence of more conductive

materials (i.e. greater clay, soluble salt, and/or water contents) with increasing soil depth.

Figure 5 contains two-dimensional plots of apparent conductivity values simulated from data collected with the EM38 meter in the pasture site. In both orientations, EM responses increased toward the upper margin of the plots. This trend of increasing EM response was orthogonal to the topography of the soil surface (see Figure 4) and, therefore, does not appear to be associated with "terrain effects."

Electromagnetic responses were moderate across this site. Based on 100 observations, the average apparent conductivity was 35.39 mS/m, with a range of 20 to 47 mS/m, in the horizontal mode. One-half of the observations collected in the horizontal dipole orientation had apparent conductivity values between 32 and 39 mS/m. Based on 100 observations, the average apparent conductivity was 63.81 mS/m, with a range of 37 to 85 mS/m in the vertical mode. One-half of the observations collected in the vertical dipole orientation had apparent conductivity values between 59 and 63 mS/m.

Figure 6 is a two-dimensional plot of apparent conductivity values simulated from data collected with the EM38 meter in the wooded site. In both orientations, EM responses were moderate across the site. No trends could be identified in the simulations.

Electromagnetic responses were similar for the wooded site and the pasture sites. This would be the only soil delineation in which responses were similar between wooded and pasture sites. Based on 100 observations, the average apparent conductivity was 36.14 mS/m, with a range of 24 to 60 mS/m in the horizontal mode. One-half of the observations collected in the horizontal dipole orientation had apparent conductivity values between 32 and 39 mS/m. Based on 100 observations, the average apparent conductivity was 64.47 mS/m, with a range of 46 to 93 mS/m in the vertical mode. One-half of the observations collected in the vertical dipole orientation had apparent conductivity values between 57 and 71 mS/m.

Site 3 - Angelina County

Two-dimensional contour plots for the pasture and wooded sites are simulated in Figure 7. The contour interval is 0.20 m. Relief is about 0.6 m and 1.4 m for the pasture and wooded sites, respectively.

Figures 8 and 9 represent two dimensional plots of apparent conductivity values across the pasture and wooded sites, respectively. In each figure, the upper and lower plots simulate data collected in the horizontal and vertical dipole orientation, respectively. For each plot, the interval is 10 mS/m. The spot symbols represent the location of the observation sites used for sampling.

For all observation points, EM response increased with increasing soil depth (response in the vertical greater than in the horizontal dipole orientation). This indicates the presence of more conductive

materials (i.e. greater clay, soluble salt, and/or water contents) with increasing soil depth.

Figure 8 contains two-dimensional plots of apparent conductivity values simulated from data collected with the EM38 meter in the pasture site. Electromagnetic responses were complex with no apparent trends or patterns.

Electromagnetic responses were relatively high across the pasture site. Based on 100 observations, the average apparent conductivity was 79.35 mS/m, with a range of 56 to 110 mS/m in the horizontal mode. One-half of the observations collected in the horizontal dipole orientation had apparent conductivity values between 70 and 87 mS/m. Based on 100 observations, the average apparent conductivity was 126.53 mS/m, with a range of 91 to 166 mS/m in the vertical mode. One-half of the observations collected in the vertical dipole orientation had apparent conductivity values between 111 and 140 mS/m.

Figure 9 is a two-dimensional plot of apparent conductivity values simulated from data collected with the EM38 meter in the wooded site. In both orientations, EM responses increased toward the upper right-hand and lower left-hand margins of the plots. These areas were more open, less wooded, and transitional to adjacent grassed areas.

Compared with the pasture site, and with the exception of the aforementioned transitional areas, electromagnetic responses were lower and less variable across the wooded site. Based on 100 observations, the average apparent conductivity was 34.93 mS/m, with a range of 24 to 59 mS/m in the horizontal mode. One-half of the observations collected in the horizontal dipole orientation had apparent conductivity values between 29 and 37 mS/m. Based on 100 observations, the average apparent conductivity was 65.22 mS/m, with a range of 43 to 110 mS/m in the vertical mode. One-half of the observations collected in the vertical dipole orientation had apparent conductivity values between 56 and 69 mS/m.

Site 4 - Angelina County

At this site, only a pasture area was surveyed. A two-dimensional contour plot of the pasture sites is simulated in Figure 10. The contour interval is 0.20 m. This site contained several terraces and was the most sloping area investigated. Relief was about 3.5 m.

Figure 11 represent two dimensional plots of apparent conductivity values across the pasture site. The upper and lower plots simulate data collected in the horizontal and vertical dipole orientation, respectively. For each plot, the interval is 10 mS/m. The spot symbols represent the location of the observation sites used for sampling.

For all observation points, EM response increased with increasing soil depth (response in the vertical greater than in the horizontal dipole orientation). This indicates the presence of more conductive

materials (i.e. greater clay, soluble salt, and/or water contents) with increasing soil depth.

Figure 11 contains two-dimensional plots of apparent conductivity values simulated from data collected with the EM38 meter. In the higher lying (see Figure 10) right-hand portion of both plots, patterns are linear and believed to manifest the presence and affects of several terraces. The terraces appear to have modified the hydrology and salt concentrations of the soils. In the lower-lying (see Figure 10), left-hand portion of the plots, patterns appear to be more complex and variable.

Electromagnetic responses were relatively high across this site. Based on 100 observations, the average apparent conductivity was 89.84 mS/m, with a range of 58 to 131 mS/m in the horizontal mode. One-half of the observations collected in the horizontal dipole orientation had apparent conductivity values between 79 and 100 mS/m. Based on 100 observations, the average apparent conductivity was 139.12 mS/m, with a range of 95 to 170 mS/m in the vertical mode. One-half of the observations collected in the vertical dipole orientation had apparent conductivity values between 125 and 154 mS/m.

Site 5 - Angelina County

A two-dimensional contour plot of the pasture site is simulated in Figure 12. The contour interval is 0.20 m. Relief is about 1.4 m. No topographic data was collected for the wooded site.

Figures 13 and 14 represent two dimensional plots of apparent conductivity values across the pasture and wooded sites, respectively. In each figure, the upper and lower plots simulate data collected in the horizontal and vertical dipole orientation, respectively. For each plot, the interval is 10 mS/m. The spot symbols represent the location of the observation sites used for sampling.

For all observation points, EM response increased with increasing soil depth (response in the vertical greater than in the horizontal dipole orientation). This indicates the presence of more conductive materials (i.e. greater clay, soluble salt, and/or water contents) with increasing soil depth.

Figure 13 contains two-dimensional plots of apparent conductivity values simulated from data collected with the EM38 meter in the pasture site. In both orientations, EM responses were relatively invariable across the left-hand portion, but increased toward the upper right-hand portion of the plots.

Electromagnetic responses were relatively high across this site. Based on 100 observations, the average apparent conductivity was 81 mS/m, with a range of 61 to 135 mS/m in the horizontal mode. One-half of the observations collected in the horizontal dipole orientation had apparent conductivity values between 69 and 89 mS/m.

Based on 100 observations, the average apparent conductivity was 126.18 mS/m, with a range of 98 to 176 mS/m in the vertical mode. One-half of the observations collected in the vertical dipole orientation had apparent conductivity values between 110 and 140 mS/m.

Figure 14 is a two-dimensional plot of apparent conductivity values simulated from data collected with the EM38 meter in the wooded site. In both orientations, EM responses were relatively uniform across the site with no apparent trends.

Compared with the pasture site, electromagnetic responses were lower and less variable across the wooded site. Based on 100 observations, the average apparent conductivity was 37.06 mS/m, with a range of 31 to 50 mS/m in the horizontal mode. One-half of the observations collected in the horizontal dipole orientation had apparent conductivity values between 35 and 38 mS/m. Based on 100 observations, the average apparent conductivity was 62.04 mS/m, with a range of 51 to 85 mS/m in the vertical mode. One-half of the observations collected in the vertical dipole orientation had apparent conductivity values between 59 and 65 mS/m.

Results:

1. The electromagnetic properties at each site have been characterized. Generally, EM responses were found to vary between most paired pasture and wooded sites. Pasture sites had higher and more variable EM response than wooded sites. These relationships are believed to be a manifestation of differences in soil hydrology, sodium concentrations, and perhaps crayfish activity. Differences in lithology may explain the lack of significant variations between the pasture and wooded areas at Site 2.

2. The enclosed plots show spatial relationships. These plots are believed to reflect changes in soil type (taxonomic) and/or soil properties. The rate and magnitude of change are indicated by the simulated gradients. Generally no relationship was found to exist between EM response and surface elevation. However, EM responses appear to reflect the influence of management (wooded versus pasture sites, terraces, concentration of animal wastes).

New plots can and will be generated based on the results of laboratory analyses.

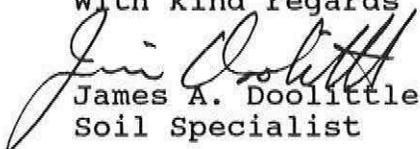
3. Preliminary field results suggest that the EM38 meter has discerned differences in soil properties existing between wooded and pasture areas of Diboll soils. Samples collected for laboratory analyses will be used to characterize several soil properties. Predictive models will be developed from the results of these analyses. It is hoped that a predictive equation can be developed which will enable soil scientist to rapidly and more comprehensively assess map unit composition (determine soils that have natric horizons and soils that are sodium-affected but do not have a natric horizon).

4. Enclosed is a copy of the data collected at each site. If desired, a disk containing the data file (Lotus worksheet) will be forwarded to any participant.

5. We were a pretty good field team! Much was accomplished in a relatively short period of time. All participants were exposed to EM techniques. Levi Steptoe is qualified on the calibration and field operation of the EM38 conductivity meter. Levi single-handedly completed the survey at Site 5.

It is my pleasure to work in Texas and with the members of your fine staff.

With kind regards


James A. Doolittle
Soil Specialist

cc:

James Culver, National Leader, SSQAS, NSSC, SCS, Lincoln, NE
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Review of Electromagnetic Induction Methods

Electromagnetic inductive (EM) is a surface-geophysical method in which electromagnetic energy is used to measure the terrain or apparent conductivity of earthen materials. This technique has been used extensively to monitor groundwater quality and potential seepage from waste sites (Brune and Doolittle, 1990; Byrnes and Stoner, 1988; De Rose, 1986; Greenhouse and Slaine, 1983; Greenhouse et al., 1987; and Siegrist and Hargett, 1989)

For surveying, the meter is placed on the ground surface or held above the surface at a specified distance. A power source within the meter generates an alternating current in the transmitter coil. The current flow produces a primary magnetic field and induces electrical currents in the soil. The induced current flow is proportional to the electrical conductivity of the intervening medium. The electrical currents create a secondary magnetic field in the soil. The secondary magnetic field is of the same frequency as the primary field but of different phase and direction. The primary and secondary fields are measured as a change in the potential induced in the receiver coil. At low transmission frequency, the ratio of the secondary to the primary magnetic field is directly proportional to the ground conductivity. Values of apparent conductivity are expressed in milliSiemens per meter (mS/m).

Electromagnetic methods measure the apparent conductivity of earthen materials. Apparent conductivity is the weighted average conductivity measurement for a column of earthen materials to a specified penetration depth (Greenhouse and Slaine; 1983). The averages are weighted according to the depth response function of the meter (Slavich and Petterson, 1990).

Variations in the meters response are produced by changes in the ionic concentration of earthen materials which reflects changes in sediment type, degree of saturation, nature of the ions in solution, and metallic objects. Factors influencing the conductivity of earthen materials include: (i) the volumetric water content, (ii) the amount and type of ions in soil water, (iii) the amount and type of clays in the soil matrix, and (iv) the soil temperature. Williams and Baker (1982), and Williams (1983) observed that, in areas of salt affected soils, 65 to 70 percent of the variation in measurements could be explained by the concentration of soluble salts. However, as water provides the electrolytic solution through which the current must pass, a threshold level of moisture is required in order to obtain meaningful results (Van der Lelij, 1983).

The depth of penetration is dependent upon the intercoil spacing, transmission frequency, and coil orientation relative to the ground surface. Table 1 list the anticipated depths of measurements for the EM38 meter. The actual depth of measurement will depend on the conductivity of the earthen material(s) scanned.

TABLE 1

Depth of Measurement

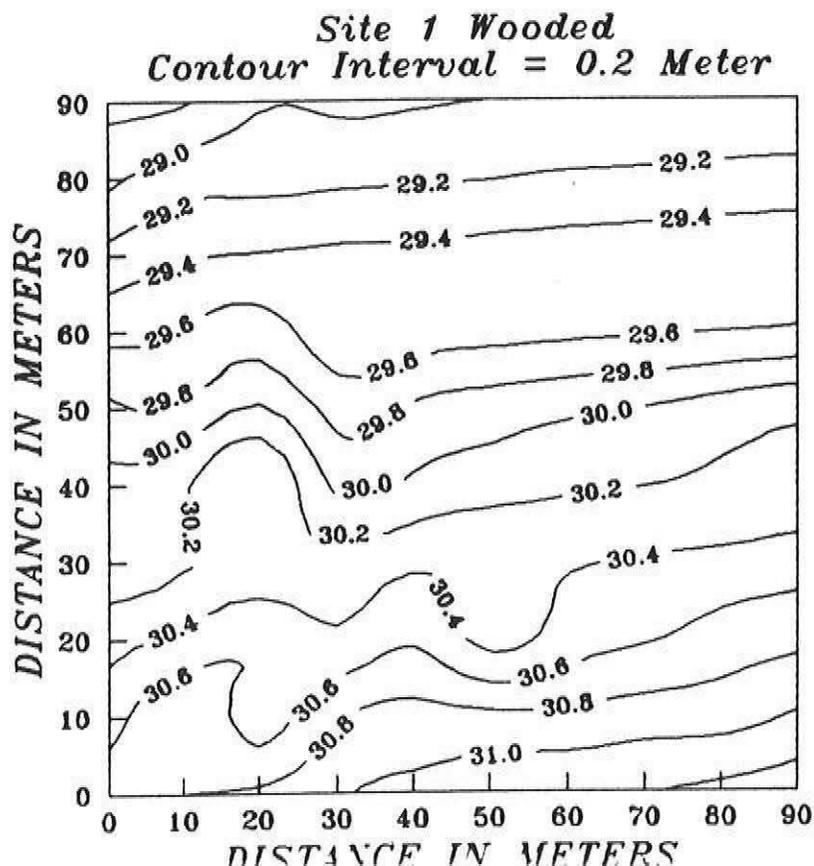
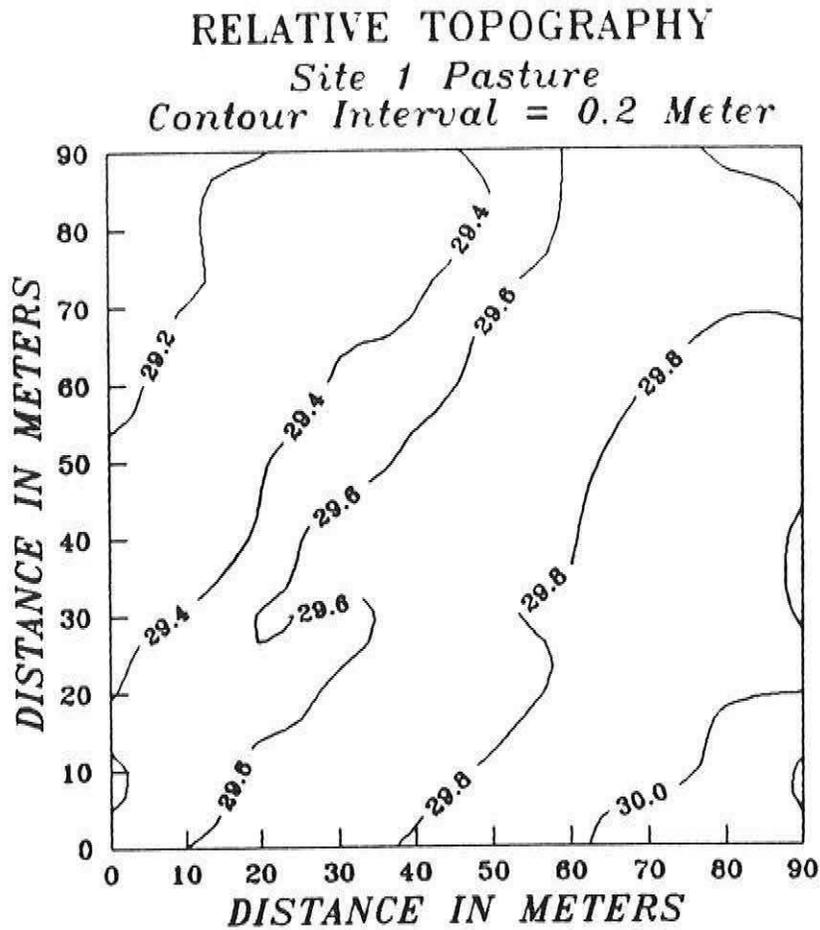
Meter	Intercoil Spacing	Depth of Measurement	
		Horizontal	Vertical
EM38	1.0 m	0.75 m	1.5 m

The conductivity meters provide limited vertical resolution and depth information. However, as discussed by Benson and others (1984), the absolute EM values are not necessarily diagnostic in themselves, but lateral and vertical variations in these measurements are significant. The seasonal variation in soil conductivity (produced by variations in soil moisture and temperature) can be added to the statement by Benson. Interpretations of the EM data are based on the identification of spatial patterns in the data set appearing on two-dimensional contour plots.

References

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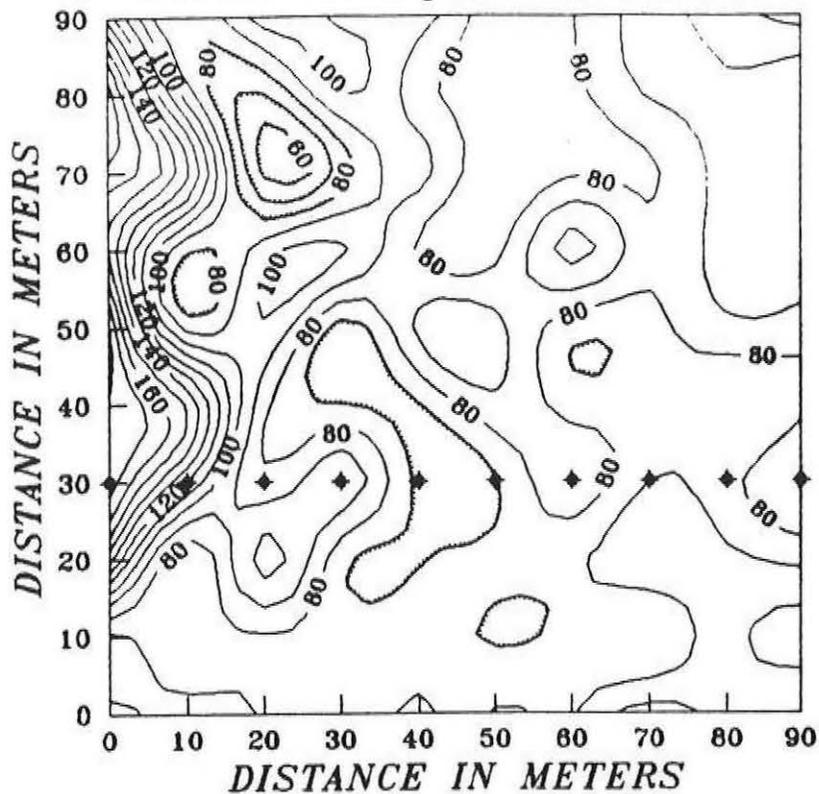
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EM38 SURVEY OF SODIUM-AFFECTED SOILS

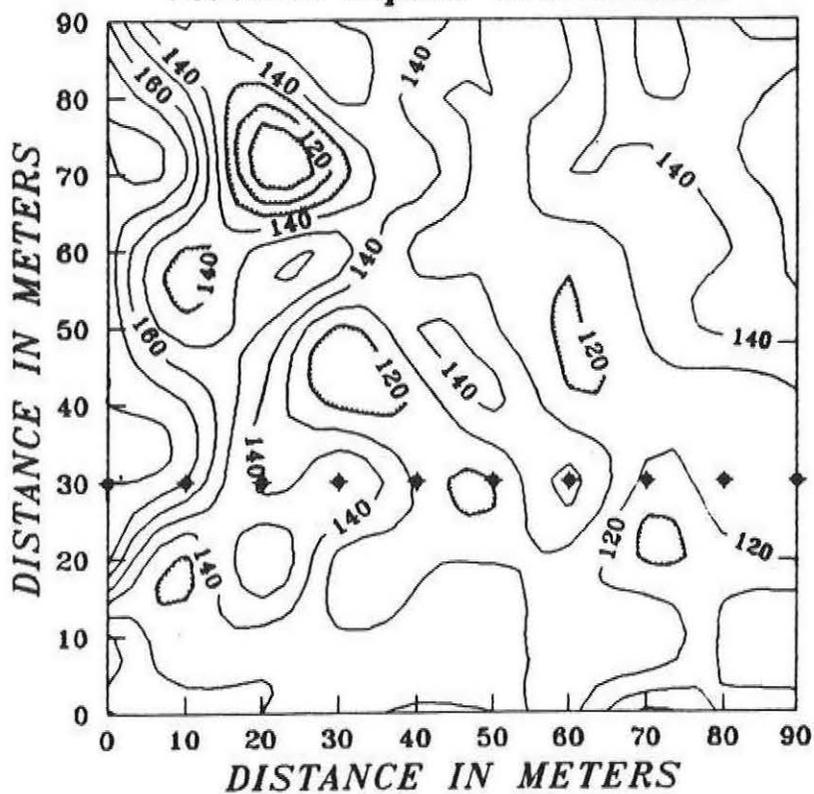
Site 1 Pasture

Horizontal Dipole Orientation



Site 1 Pasture

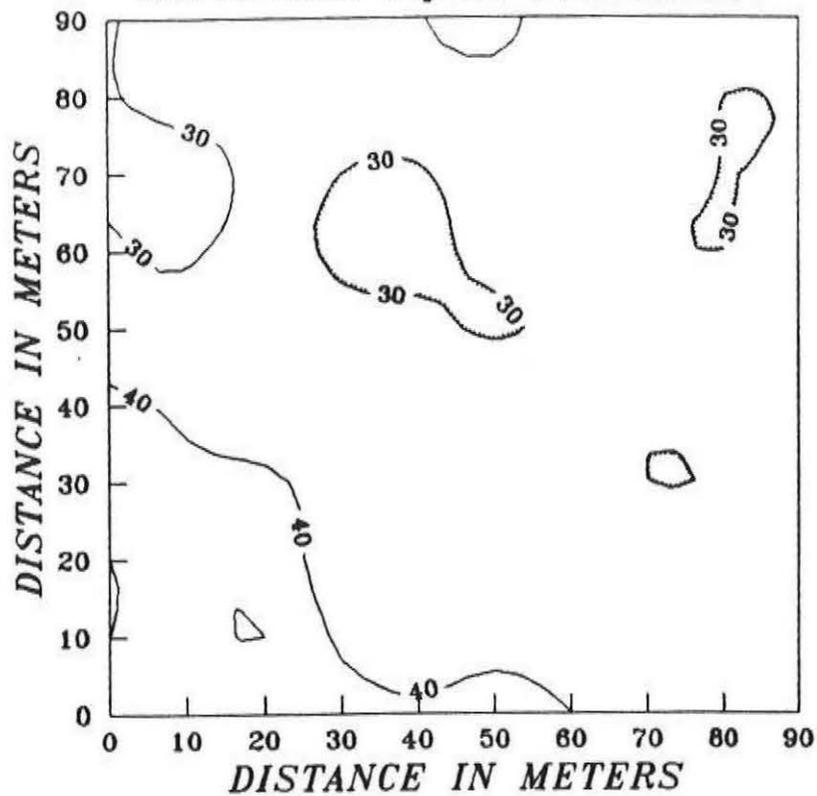
Vertical Dipole Orientation



EM38 SURVEY OF SODIUM-AFFECTED SOILS

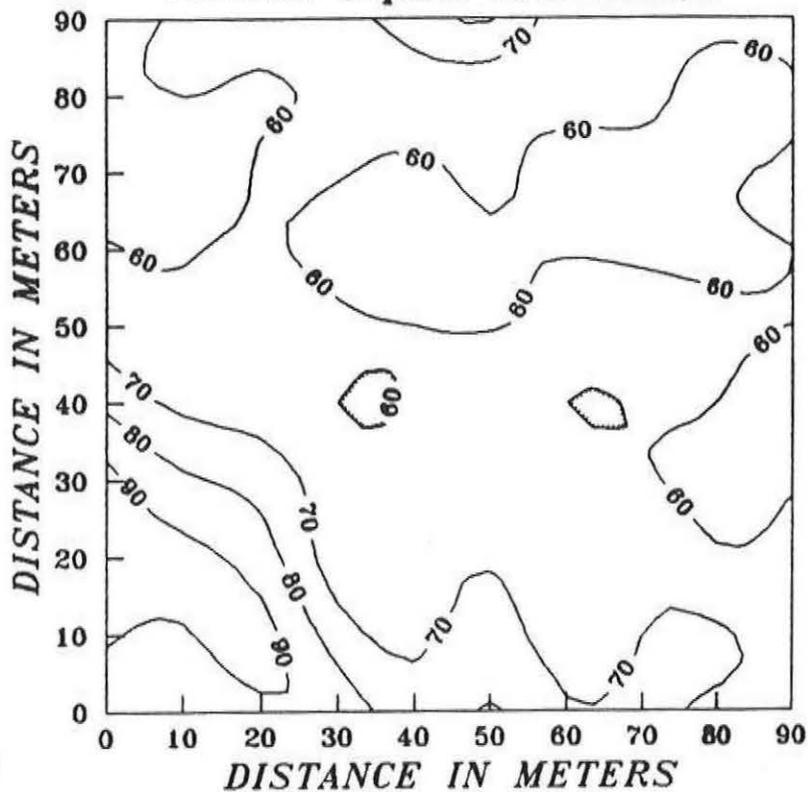
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Horizontal Dipole Orientation

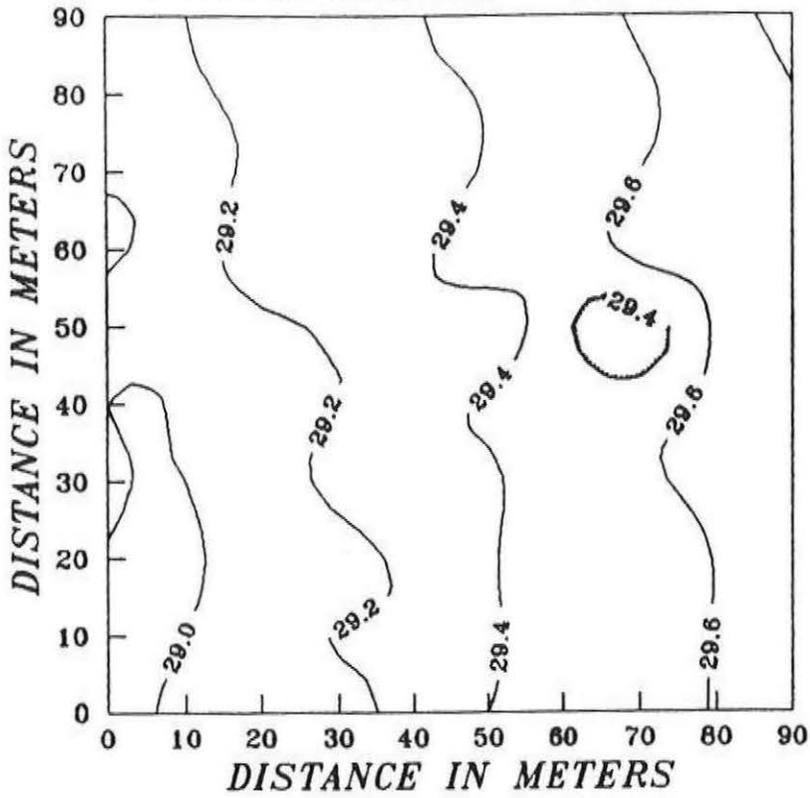


Site 1 Wooded

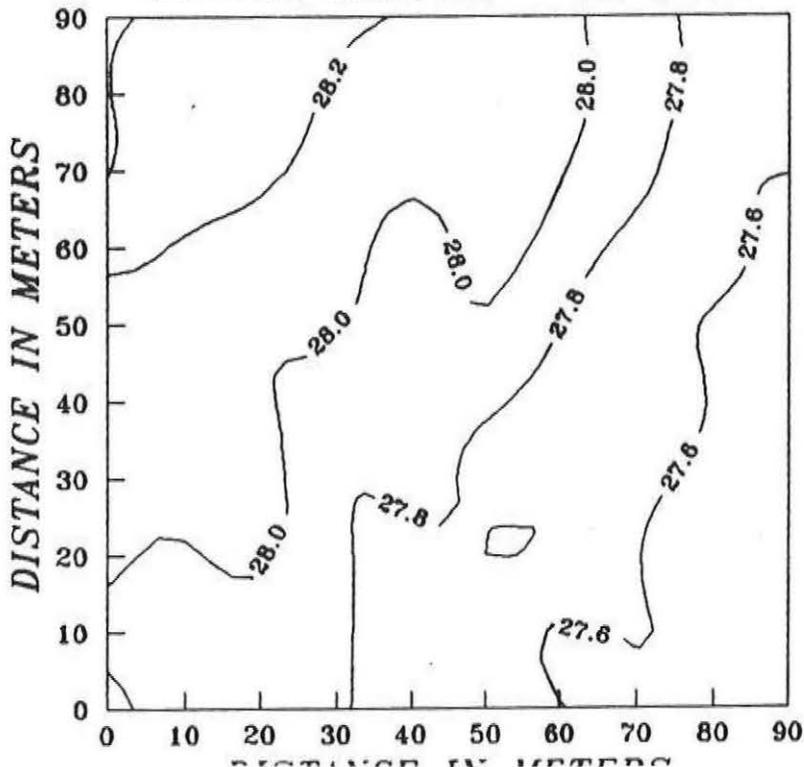
Vertical Dipole Orientation



RELATIVE TOPOGRAPHY
Site 2 Pasture
Contour Interval = 0.2 Meter



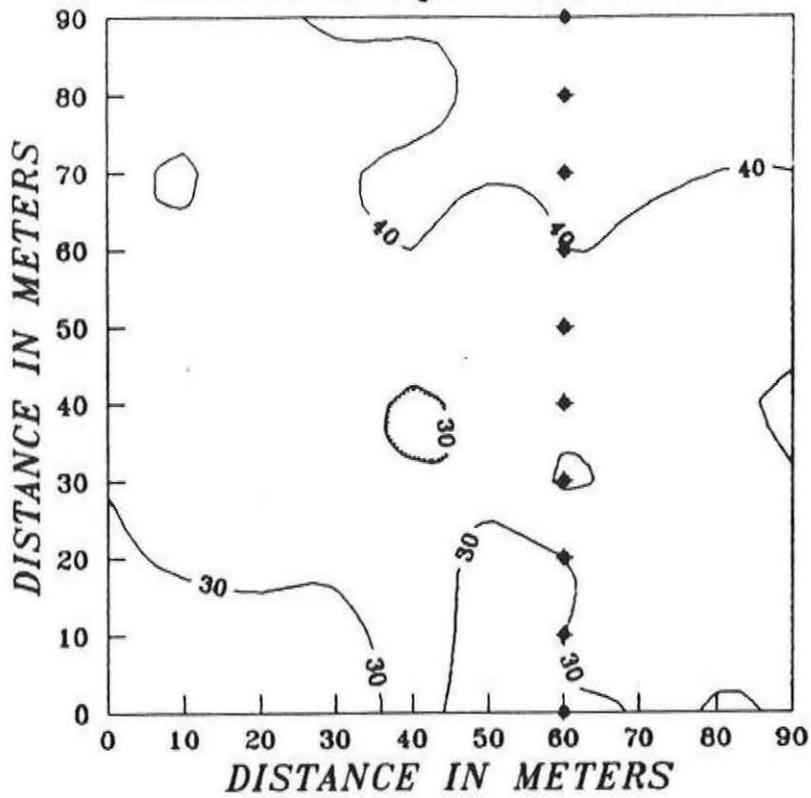
Site 2 Wooded
Contour Interval = 0.2 Meter



EM38 SURVEY OF SODIUM-AFFECTED SOILS

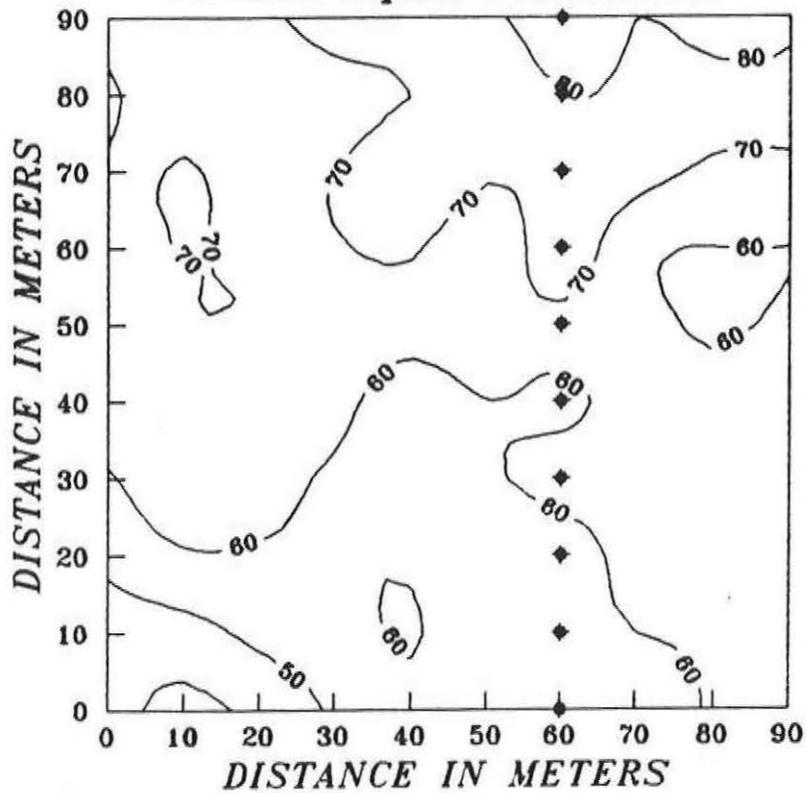
Site 2 Pasture

Horizontal Dipole Orientation



Site 2 Pasture

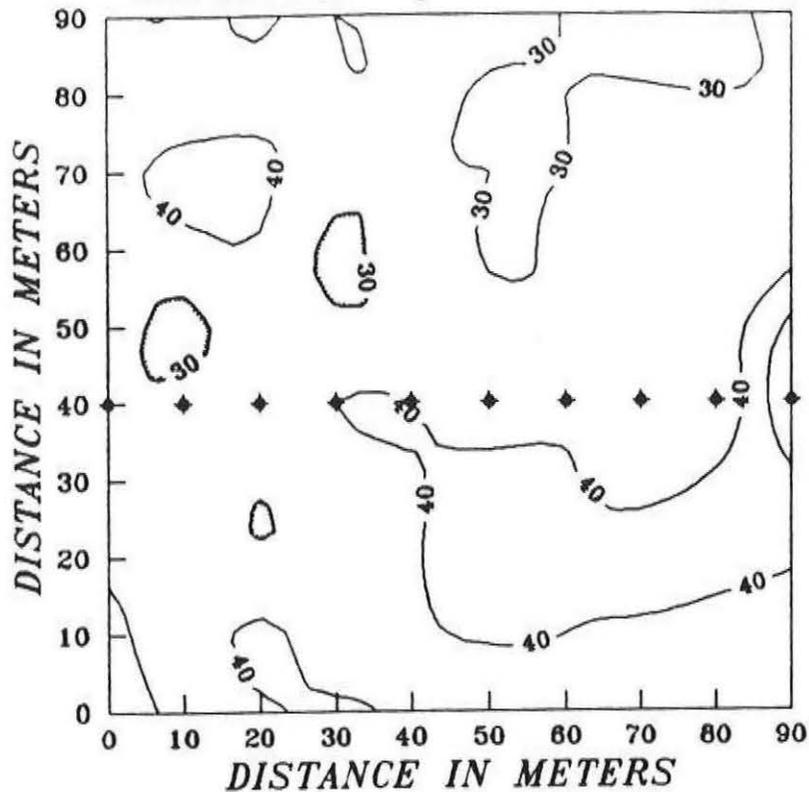
Vertical Dipole Orientation



EM38 SURVEY OF SODIUM-AFFECTED SOILS

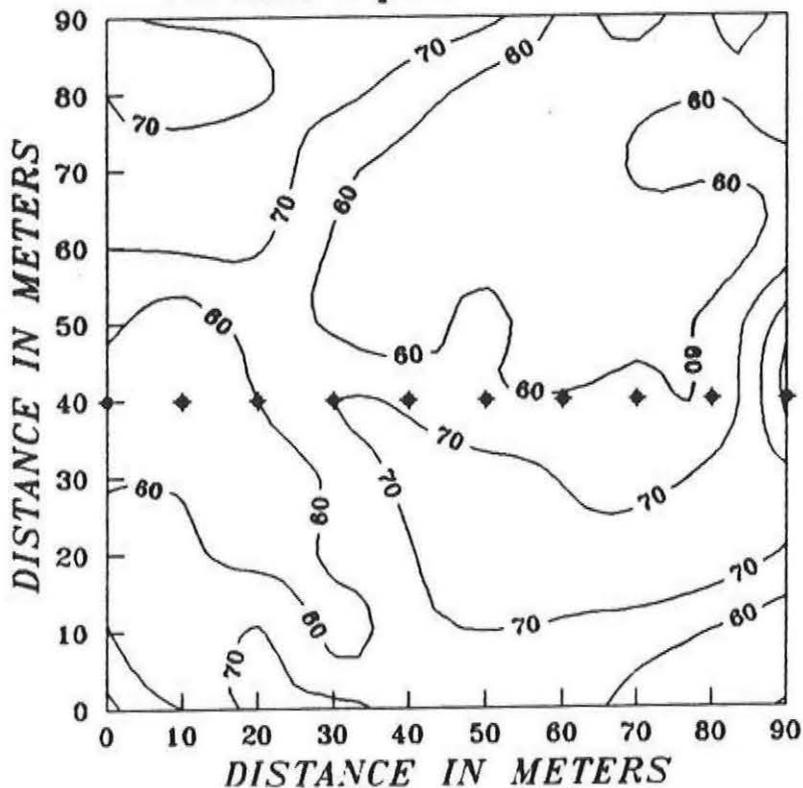
Site 2 Wooded

Horizontal Dipole Orientation

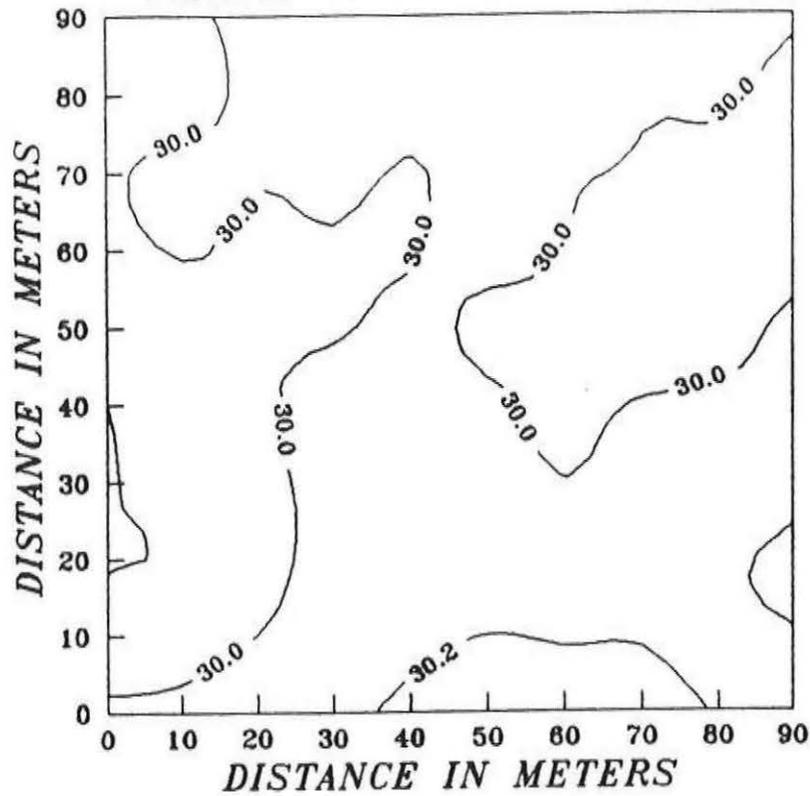


Site 2 Wooded

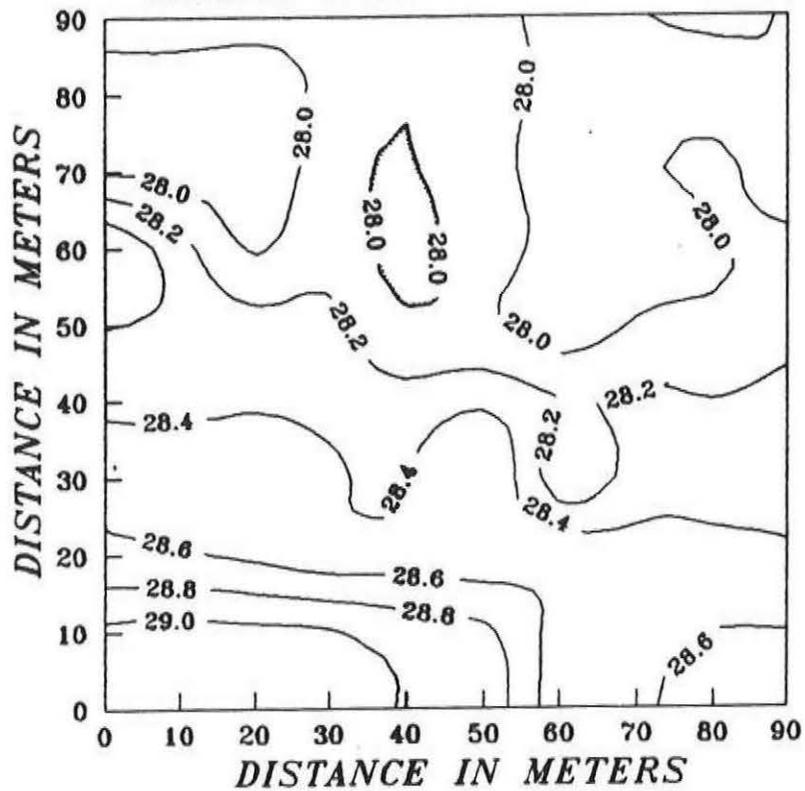
Vertical Dipole Orientation



RELATIVE TOPOGRAPHY
 Site 3 Pasture
 Contour Interval = 0.2 Meter



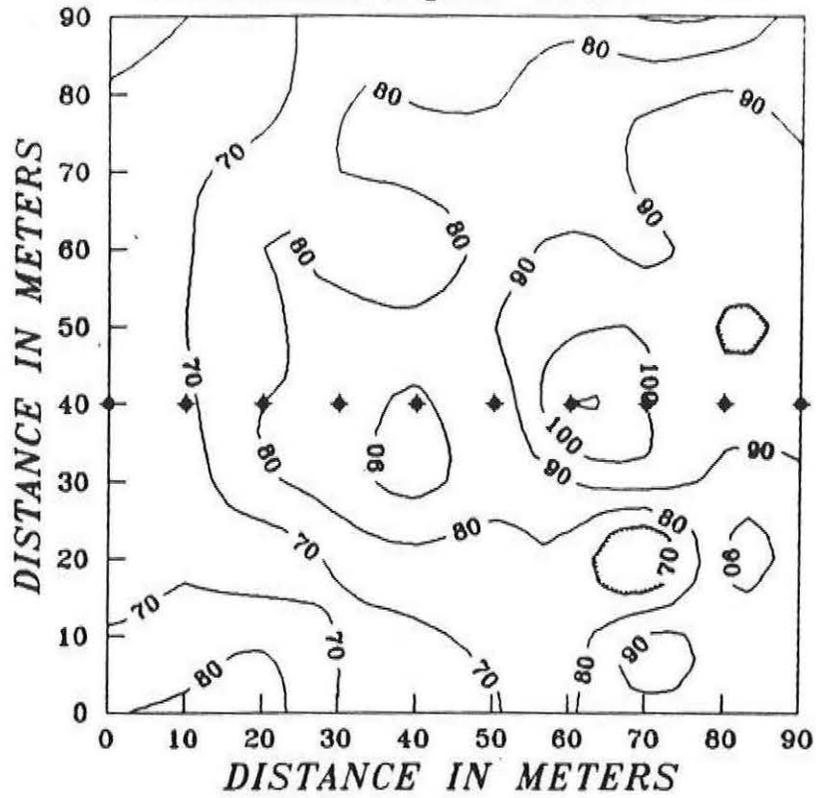
Site 3 Wooded
 Contour Interval = 0.2 Meter



EM38 SURVEY OF SODIUM-AFFECTED SOILS

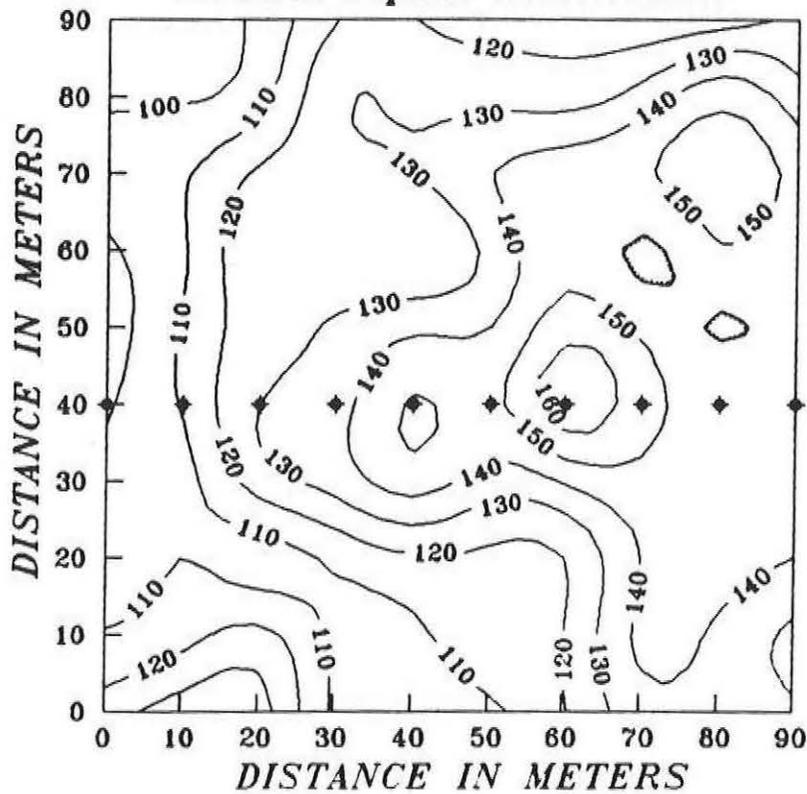
Site 3 Pasture

Horizontal Dipole Orientation



Site 3 Pasture

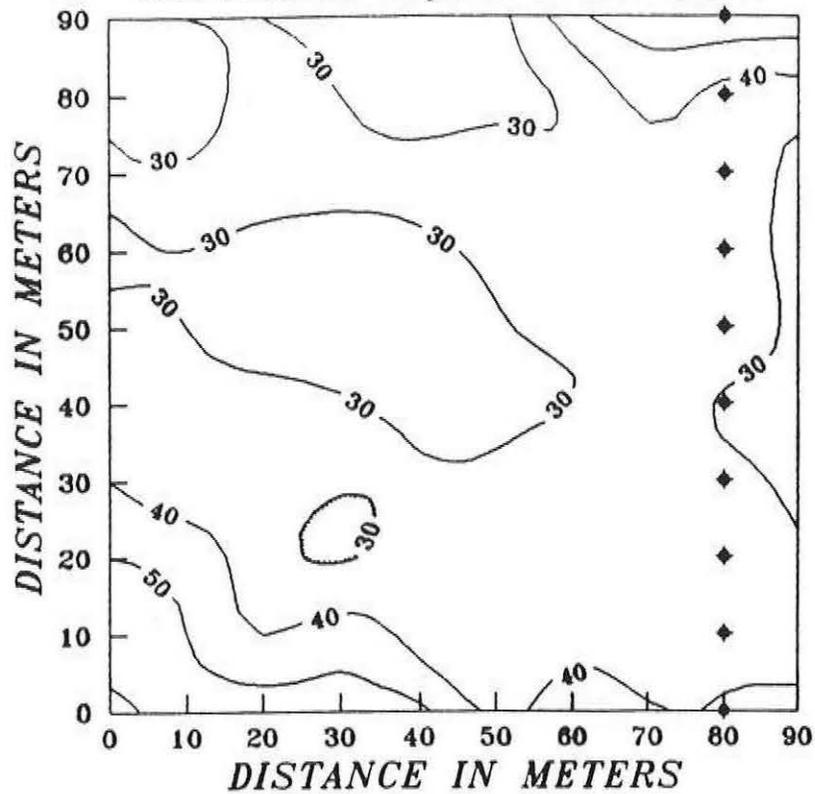
Vertical Dipole Orientation



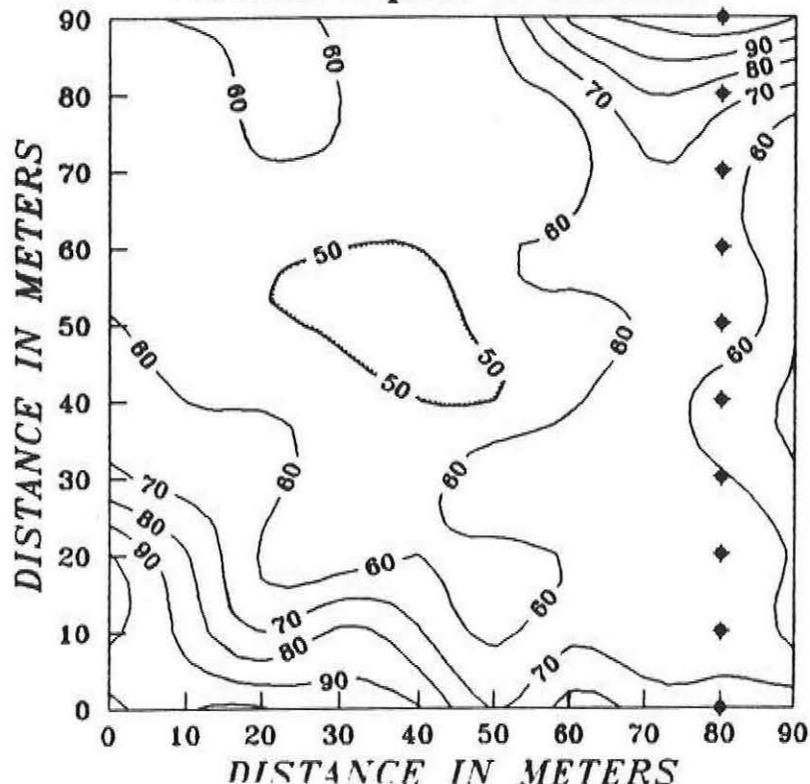
EM38 SURVEY OF SODIUM-AFFECTED SOILS

Site 3 Wooded

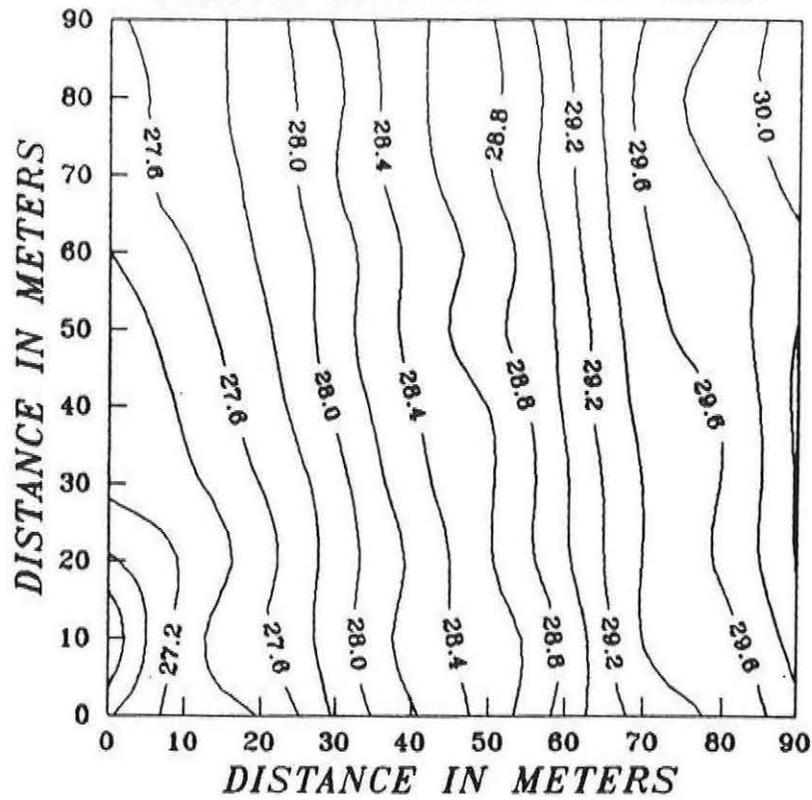
Horizontal Dipole Orientation



Site 3 Wooded
Vertical Dipole Orientation



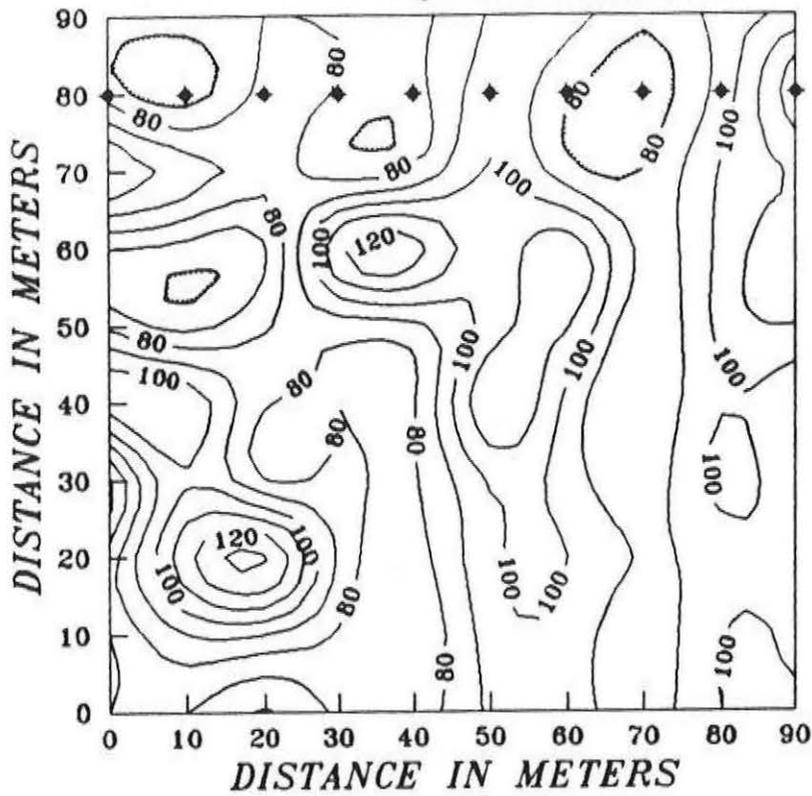
RELATIVE TOPOGRAPHY
Site 4 Pasture
Contour Interval = 0.2 Meter



EM38 SURVEY OF SODIUM-AFFECTED SOILS

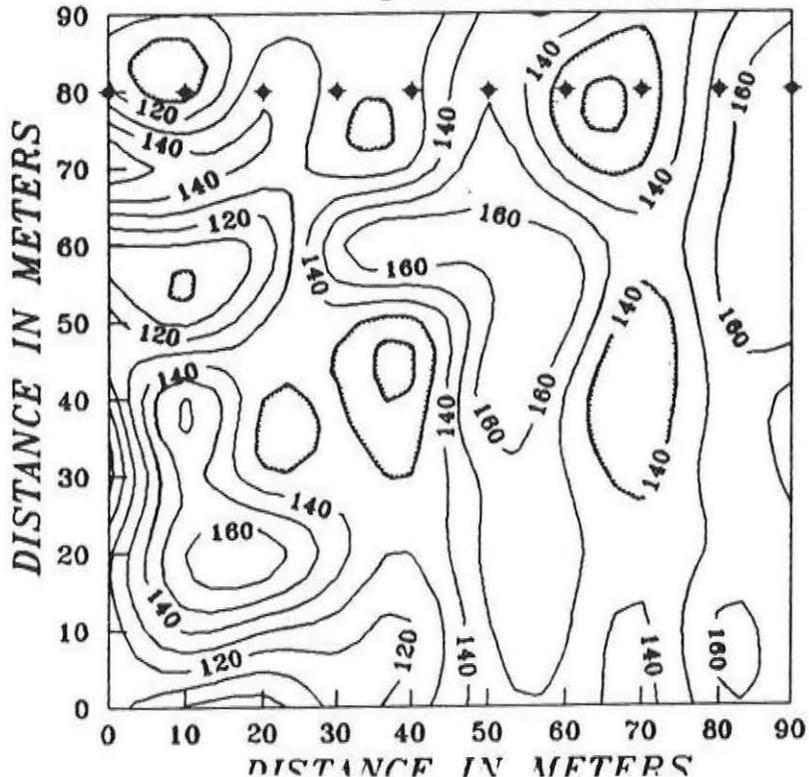
Site 4 Pasture

Horizontal Dipole Orientation

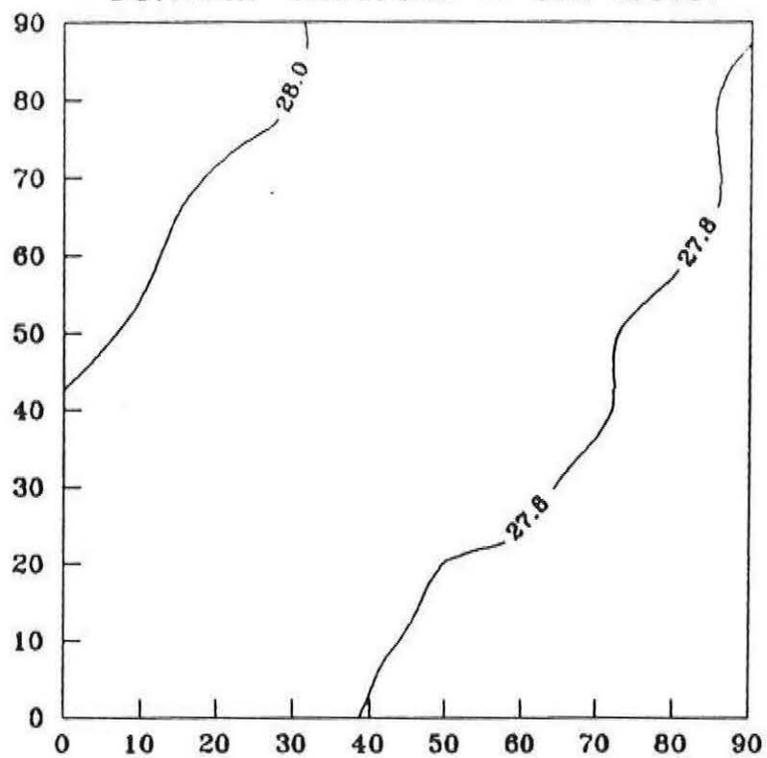


Site 4 Pasture

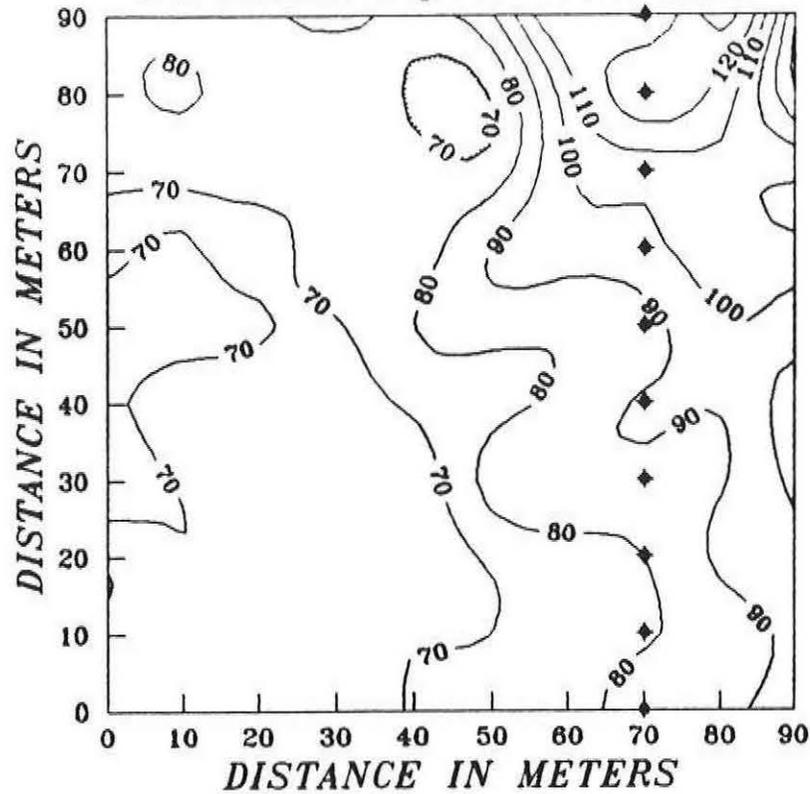
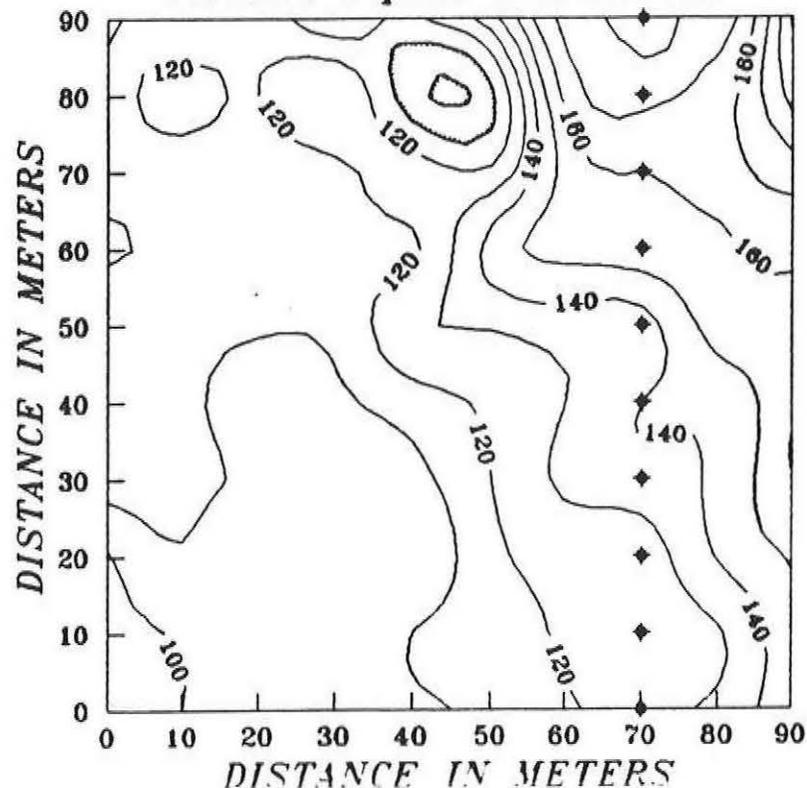
Vertical Dipole Orientation



RELATIVE TOPOGRAPHY
Site 5 Pasture
Contour Interval = 0.2 Meter



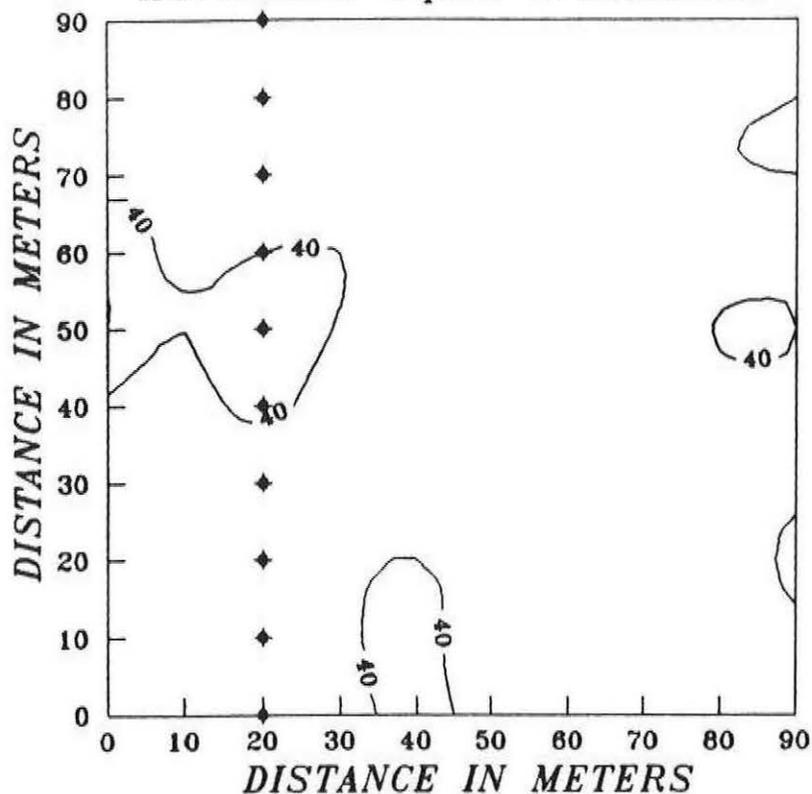
EM38 SURVEY OF SODIUM-AFFECTED SOILS

*Site 5 Pasture**Horizontal Dipole Orientation**Site 5 Pasture**Vertical Dipole Orientation*

EM38 SURVEY OF SODIUM-AFFECTED SOILS

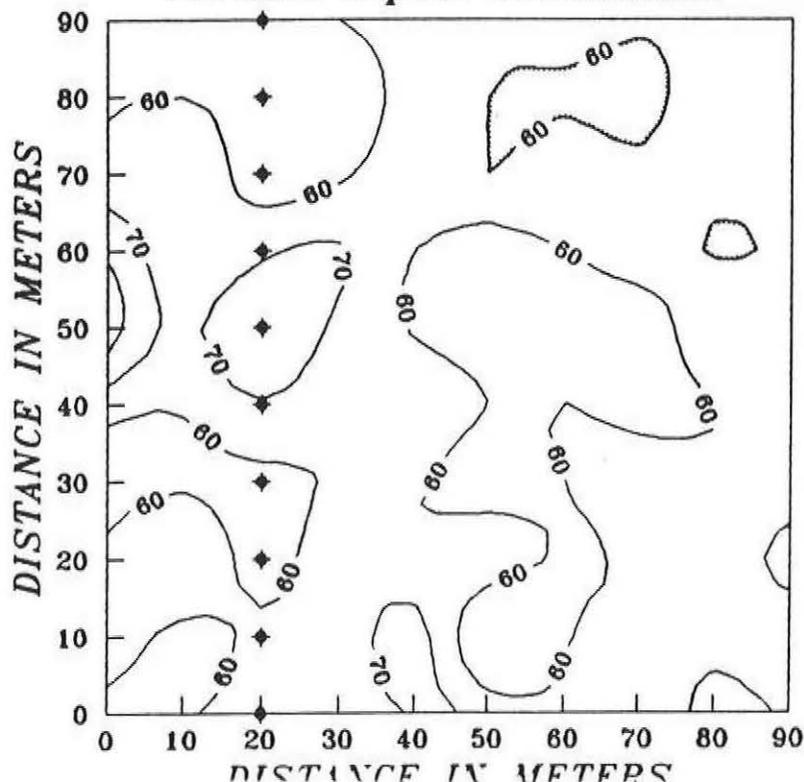
Site 5 Wooded

Horizontal Dipole Orientation



Site 5 Wooded

Vertical Dipole Orientation



Texas: EM38 Study of sodium affected soils
 May 23 to 26, 1994
 May 23 1994

Site #1 (Garcia property; Trinity County)

ALL MEASUREMENTS IN METERS OR MS/M

PASTURE SITE					
X	Y	ELEV.(m)	EM38H	EM38V	ELEV.(FT)
0	0	29.46	74	132	96.66
0	10	29.65	68	118	97.28
0	20	29.38	133	172	96.4
0	30	29.35	175	180	96.28
0	40	29.28	179	180	96.06
0	50	29.24	181	179	95.94
0	60	29.13	150	175	95.56
0	70	29.15	167	178	95.62
0	80	29.14	176	179	95.6
0	90	29.17	127	161	95.7
10	0	29.60	66	121	97.1
10	10	29.50	75	137	96.8
10	20	29.58	71	128	97.04
10	30	29.41	120	170	96.5
10	40	29.25	149	171	95.98
10	50	29.25	86	144	95.98
10	60	29.27	81	138	96.04
10	70	29.20	134	171	95.8
10	80	29.18	97	153	95.72
10	90	29.19	80	128	95.78
20	0	29.70	71	130	97.44
20	10	29.65	79	136	97.28
20	20	29.55	104	159	96.94
20	30	29.61	83	136	97.14
20	40	29.44	83	139	96.58
20	50	29.39	99	150	96.42
20	60	29.33	95	154	96.24
20	70	29.25	58	103	95.98
20	80	29.28	69	122	96.06
20	90	29.19	105	160	95.76
30	0	29.76	79	132	97.64
30	10	29.66	76	131	97.3
30	20	29.63	73	127	97.2
30	30	29.56	97	149	96.98
30	40	29.69	70	118	97.4
30	50	29.48	66	118	96.72
30	60	29.41	102	156	96.48
30	70	29.37	73	124	96.36
30	80	29.34	100	153	96.26
30	90	29.29	98	149	96.08
40	0	29.82	68	129	97.84
40	10	29.75	74	134	97.6
40	20	29.72	70	128	97.5
40	30	29.68	67	128	97.38
40	40	29.63	70	122	97.2
40	50	29.64	92	140	97.24
40	60	29.50	79	127	96.8
40	70	29.39	94	146	96.44
40	80	29.34	85	134	96.26
40	90	29.36	96	149	96.34

Site #1 (Garcia property; Trinity County)

ALL MEASUREMENTS IN METERS OR MS/M

ELEV.(FT)

PASTURE SITE

X	Y	ELEV.(m)	EM38H	EM38V	ELEV.(FT)
50	0	29.92	81	130	98.16
50	10	29.82	69	135	97.84
50	20	29.76	72	129	97.64
50	30	29.79	69	120	97.72
50	40	29.68	88	142	97.36
50	50	29.69	93	131	97.42
50	60	29.66	76	130	97.3
50	70	29.61	71	125	97.14
50	80	29.41	75	130	96.5
50	90	29.45	74	126	96.62
60	0	29.94	71	124	98.22
60	10	29.93	73	124	98.18
60	20	29.83	72	127	97.88
60	30	29.81	87	143	97.8
60	40	29.79	75	122	97.72
60	50	29.75	74	119	97.62
60	60	29.68	104	123	97.36
60	70	29.68	78	140	97.36
60	80	29.64	77	131	97.26
60	90	29.61	79	132	97.14
70	0	30.18	56	98	99
70	10	29.94	79	130	98.22
70	20	29.94	62	108	98.22
70	30	29.86	70	117	97.98
70	40	29.88	78	125	98.04
70	50	29.88	76	131	98.02
70	60	29.80	84	134	97.78
70	70	29.72	78	135	97.52
70	80	29.79	91	150	97.74
70	90	29.64	93	152	97.24
80	0	30.03	64	112	98.52
80	10	30.05	63	108	98.58
80	20	29.98	68	116	98.36
80	30	29.90	77	127	98.1
80	40	29.90	70	121	98.1
80	50	29.92	88	143	98.16
80	60	29.87	95	139	98
80	70	29.78	94	147	97.7
80	80	29.69	92	147	97.42
80	90	29.87	84	141	98
90	0	30.13	69	118	98.84
90	10	30.22	57	100	99.16
90	20	29.99	73	121	98.4
90	30	30.02	91	128	98.48
90	40	30.03	77	128	98.52
90	50	29.94	86	144	98.24
90	60	29.88	95	153	98.04
90	70	29.78	93	153	97.7
90	80	29.79	98	156	97.72
90	90	29.86	76	132	97.96

Site #1 (Garcia property; Trinity County)
 ALL MEASUREMENTS IN METERS OR MS/M

WOODED SITE

X	Y	ELEV.(m)	EM38H	EM38V	ELEV.(FT)
0	0	30.80	44	83	101.04
0	10	30.50	50	91	100.05
0	20	30.34	50	94	99.55
0	30	30.07	50	93	98.65
0	40	30.04	43	78	98.55
0	50	29.84	34	66	97.9
0	60	29.55	32	61	96.95
0	70	29.26	27	54	96
0	80	28.96	29	57	95
0	90	28.75	29	57	94.33
10	0	30.80	42	81	101.06
10	10	30.76	47	89	100.92
10	20	30.46	49	92	99.92
10	30	30.18	43	82	99.01
10	40	30.17	38	68	98.97
10	50	29.81	33	62	97.8
10	60	29.61	29	59	97.14
10	70	29.38	26	53	96.4
10	80	29.12	33	60	95.55
10	90	28.78	34	61	94.42
20	0	30.84	47	88	101.17
20	10	30.53	50	93	100.17
20	20	30.58	46	85	100.32
20	30	30.26	42	76	99.28
20	40	30.41	34	67	99.78
20	50	30.02	36	70	98.5
20	60	29.70	33	62	97.43
20	70	29.41	32	61	96.5
20	80	29.14	32	59	95.6
20	90	28.98	35	64	95.08
30	0	30.98	46	87	101.65
30	10	30.77	38	75	100.95
30	20	30.43	35	65	99.85
30	30	30.25	35	65	99.25
30	40	29.95	32	60	98.27
30	50	29.72	33	63	97.51
30	60	29.47	28	54	96.7
30	70	29.43	30	61	96.55
30	80	29.15	33	62	95.65
30	90	28.97	38	68	95.05
40	0	31.04	42	74	101.85
40	10	30.86	35	68	101.25
40	20	30.57	36	65	100.3
40	30	30.36	35	64	99.6
40	40	30.03	33	61	98.51
40	50	29.82	32	60	97.85
40	60	29.50	27	52	96.8
40	70	29.43	29	58	96.57
40	80	29.17	36	65	95.71
40	90	28.98	39	74	95.07

Site #1 (Garcia property; Trinity County)
 ALL MEASUREMENTS IN METERS OR MS/M

WOODED SITE

X	Y	ELEV. (m)	EM38H	EM38V	ELEV. (FT)
50	0	31.10	45	81	102.03
50	10	30.83	37	73	101.15
50	20	30.32	36	69	99.49
50	30	30.36	34	62	99.62
50	40	30.10	36	69	98.75
50	50	29.89	29	59	98.07
50	60	29.53	33	58	96.87
50	70	29.45	34	62	96.61
50	80	29.19	36	64	95.76
50	90	29.00	45	81	95.13
60	0	31.17	40	71	102.25
60	10	30.83	36	66	101.15
60	20	30.49	36	65	100.03
60	30	30.38	36	65	99.66
60	40	30.16	33	60	98.96
60	50	29.95	33	64	98.26
60	60	29.55	33	59	96.95
60	70	29.46	30	55	96.65
60	80	29.22	37	64	95.85
60	90	29.01	30	63	95.18
70	0	31.19	38	72	102.32
70	10	30.89	38	70	101.35
70	20	30.57	37	67	100.3
70	30	30.41	30	61	99.78
70	40	30.19	33	61	99.05
70	50	29.99	35	64	98.4
70	60	29.57	31	58	97.03
70	70	29.48	32	56	96.71
70	80	29.23	35	63	95.89
70	90	29.03	33	63	95.23
80	0	31.25	35	68	102.54
80	10	30.91	40	71	101.4
80	20	30.68	33	61	100.64
80	30	30.44	31	58	99.87
80	40	30.23	32	60	99.19
80	50	30.07	32	61	98.64
80	60	29.59	30	59	97.09
80	70	29.50	30	59	96.8
80	80	29.25	30	55	95.96
80	90	29.05	35	64	95.31
90	0	31.32	38	70	102.77
90	10	31.01	34	65	101.73
90	20	30.74	33	63	100.85
90	30	30.49	32	59	100.03
90	40	30.27	30	57	99.32
90	50	30.13	31	60	98.85
90	60	29.61	33	60	97.16
90	70	29.52	32	61	96.85
90	80	29.26	31	59	96.01
90	90	29.08	35	65	95.4

May 24 1994

Site #2 (USDA-FS lands; Trinity County)

ALL MEASUREMENTS IN METERS OR MS/M

PASTURE SITE

X	Y	ELEV.(m)	EM38H	EM38V	ELEV.(FT)
50	0	29.40	28	54	96.46
50	10	29.38	28	53	96.4
50	20	29.38	28	54	96.38
50	30	29.38	32	59	96.4
50	40	29.41	33	60	96.48
50	50	29.35	38	67	96.3
50	60	29.46	35	65	96.66
50	70	29.42	41	71	96.52
50	80	29.41	42	72	96.48
50	90	29.43	43	78	96.54
60	0	29.47	29	56	96.7
60	10	29.45	30	56	96.62
60	20	29.50	30	55	96.78
60	30	29.49	41	63	96.74
60	40	29.46	35	58	96.64
60	50	29.42	37	67	96.52
60	60	29.44	40	74	96.6
60	70	29.52	42	74	96.84
60	80	29.47	44	80	96.68
60	90	29.49	46	85	96.76
70	0	29.54	31	55	96.92
70	10	29.51	35	60	96.82
70	20	29.49	37	63	96.74
70	30	29.57	35	62	97
70	40	29.49	37	64	96.76
70	50	29.30	36	64	96.12
70	60	29.68	37	63	97.36
70	70	29.60	43	74	97.12
70	80	29.57	46	78	97.02
70	90	29.63	46	80	97.22
80	0	29.61	42	61	97.16
80	10	29.61	36	61	97.16
80	20	29.61	37	62	97.16
80	30	29.65	33	60	97.28
80	40	29.65	38	63	97.28
80	50	29.63	33	58	97.2
80	60	29.68	33	60	97.36
80	70	29.75	40	68	97.62
80	80	29.69	44	77	97.42
80	90	29.73	47	83	97.54
90	0	29.75	36	63	97.62
90	10	29.72	35	62	97.5
90	20	29.71	35	62	97.48
90	30	29.66	39	67	97.32
90	40	29.70	42	71	97.44
90	50	29.67	36	63	97.34
90	60	29.75	35	60	97.6
90	70	29.74	40	67	97.56
90	80	29.79	44	78	97.72
90	90	29.88	45	80	98.02

May 24 1994

Site #2 (USDA-FS lands; Trinity County)

ALL MEASUREMENTS IN METERS OR MS/M

PASTURE SITE

X	Y	ELEV. (m)	EM38H	EM38V	ELEV. (FT)
0	0	28.93	24	45	94.92
0	10	28.96	25	46	95.02
0	20	28.99	27	52	95.12
0	30	29.02	31	59	95.22
0	40	29.00	35	64	95.14
0	50	29.02	33	61	95.22
0	60	28.99	35	64	95.12
0	70	29.02	34	62	95.22
0	80	29.12	31	58	95.54
0	90	29.08	35	67	95.42
10	0	29.03	20	37	95.24
10	10	29.00	24	46	95.16
10	20	28.97	32	59	95.06
10	30	29.00	35	65	95.16
10	40	29.02	35	65	95.2
10	50	29.05	38	69	95.32
10	60	29.08	38	70	95.42
10	70	29.07	41	71	95.38
10	80	29.15	36	66	95.64
10	90	29.19	38	69	95.76
20	0	29.05	23	43	95.3
20	10	29.11	27	52	95.52
20	20	29.11	32	59	95.52
20	30	29.14	33	63	95.6
20	40	29.17	35	65	95.7
20	50	29.16	39	69	95.68
20	60	29.32	35	68	96.2
20	70	29.25	34	65	95.96
20	80	29.27	32	61	96.02
20	90	29.34	36	66	96.26
30	0	29.12	27	51	95.54
30	10	29.21	28	55	95.84
30	20	29.16	31	59	95.66
30	30	29.23	31	59	95.9
30	40	29.19	34	63	95.78
30	50	29.24	36	66	95.94
30	60	29.27	36	69	96.04
30	70	29.27	38	70	96.02
30	80	29.29	35	64	96.08
30	90	29.18	43	80	95.74
40	0	29.28	31	56	96.06
40	10	29.23	32	61	95.9
40	20	29.24	33	59	95.92
40	30	29.33	31	58	96.24
40	40	29.35	29	55	96.3
40	50	29.37	35	65	96.36
40	60	29.36	40	71	96.32
40	70	29.29	42	77	96.08
40	80	29.35	37	70	96.3
40	90	29.38	42	77	96.38

May 24 1994

Site #2 (USDA-FS lands; Trinity County)

ALL MEASUREMENTS IN METERS OR MS/M

WOODED SITE

X	Y	ELEV.(m)	EM38H	EM38V	ELEV.(FT)
0	0	28.10	49	83	92.2
0	10	27.95	44	71	91.7
0	20	28.04	38	64	92
0	30	28.04	35	59	92
0	40	28.10	30	53	92.2
0	50	28.16	35	63	92.38
0	60	28.24	37	70	92.65
0	70	28.41	36	72	93.2
0	80	28.41	37	70	93.2
0	90	28.42	37	69	93.25
10	0	27.86	37	70	91.4
10	10	27.92	35	61	91.6
10	20	27.98	36	62	91.8
10	30	28.07	34	59	92.1
10	40	28.07	32	56	92.1
10	50	28.16	28	55	92.4
10	60	28.19	36	71	92.5
10	70	28.26	43	76	92.7
10	80	28.29	34	66	92.8
10	90	28.38	39	71	93.1
20	0	27.86	38	71	91.4
20	10	27.89	42	71	91.5
20	20	28.04	31	57	92
20	30	28.07	31	54	92.1
20	40	28.01	35	60	91.9
20	50	28.04	35	63	92
20	60	28.16	39	71	92.4
20	70	28.22	42	76	92.6
20	80	28.32	36	69	92.9
20	90	28.38	27	72	93.1
30	0	27.83	42	73	91.3
30	10	27.83	34	57	91.3
30	20	27.83	35	62	91.3
30	30	27.83	35	62	91.3
30	40	27.95	40	70	91.7
30	50	28.01	32	58	91.9
30	60	28.07	28	59	92.1
30	70	28.13	34	63	92.3
30	80	28.16	39	72	92.4
30	90	28.26	40	74	92.7
40	0	27.71	37	66	90.9
40	10	27.71	38	66	90.9
40	20	27.77	39	69	91.1
40	30	27.83	39	72	91.3
40	40	27.86	40	68	91.4
40	50	27.95	32	54	91.7
40	60	27.95	35	56	91.7
40	70	28.04	30	57	92
40	80	28.13	37	65	92.3
40	90	28.19	35	77	92.5

May 24 1994

Site #2 (USDA-FS lands; Trinity County)

ALL MEASUREMENTS IN METERS OR MS/M

WOODED SITE

X	Y	ELEV.(m)	EM38H	EM38V	ELEV.(FT)
50	0	27.77	34	61	91.1
50	10	27.71	41	70	90.9
50	20	27.80	45	79	91.2
50	30	27.77	43	75	91.1
50	40	27.83	35	61	91.3
50	50	27.98	33	63	91.8
50	60	28.04	29	55	92
50	70	28.10	30	53	92.2
50	80	28.16	28	56	92.4
50	90	28.19	40	73	92.5
60	0	27.61	39	65	90.6
60	10	27.58	40	69	90.5
60	20	27.77	42	74	91.1
60	30	27.74	41	69	91
60	40	27.74	37	61	91
60	50	27.80	30	51	91.2
60	60	27.92	32	54	91.6
60	70	28.01	30	53	91.9
60	80	28.04	30	54	92
60	90	28.07	29	58	92.1
70	0	27.55	33	56	90.4
70	10	27.61	38	66	90.6
70	20	27.61	45	76	90.6
70	30	27.68	36	64	90.8
70	40	27.77	36	62	91.1
70	50	27.68	33	57	90.8
70	60	27.74	33	56	91
70	70	27.86	38	61	91.4
70	80	27.92	31	57	91.6
70	90	27.86	24	46	91.4
80	0	27.52	32	55	90.3
80	10	27.52	35	60	90.3
80	20	27.46	45	77	90.1
80	30	27.52	41	73	90.3
80	40	27.58	34	62	90.5
80	50	27.58	35	62	90.5
80	60	27.68	30	55	90.8
80	70	27.65	37	61	90.7
80	80	27.71	30	60	90.9
80	90	27.77	27	60	91.1
90	0	27.43	35	61	90
90	10	27.43	33	55	90
90	20	27.43	42	69	90
90	30	27.43	48	78	90
90	40	27.55	60	93	90.4
90	50	27.49	52	85	90.2
90	60	27.49	36	65	90.2
90	70	27.61	33	61	90.6
90	80	27.74	31	57	91
90	90	27.71	34	58	90.9

May 25 1994

Site #3 (Angelina County)

ALL MEASUREMENTS IN METERS OR MS/M

PASTURE SITE

X	Y	ELEV.(m)	EM38H	EM38V	ELEV.(FT)
0	0	30.04	79	124	98.54
0	10	29.88	71	111	98.04
0	20	29.80	65	101	97.78
0	30	29.77	64	101	97.68
0	40	29.80	63	99	97.76
0	50	29.85	61	95	97.92
0	60	29.92	63	99	98.16
0	70	29.96	65	102	98.3
0	80	29.93	61	99	98.2
0	90	29.91	56	91	98.12
10	0	30.03	83	136	98.52
10	10	29.93	73	116	98.2
10	20	29.82	69	110	97.84
10	30	29.92	66	106	98.16
10	40	29.90	68	111	98.1
10	50	29.94	70	111	98.22
10	60	30.01	69	109	98.46
10	70	30.05	68	109	98.6
10	80	29.93	63	99	98.2
10	90	29.96	60	95	98.28
20	0	30.07	84	135	98.66
20	10	30.00	78	123	98.44
20	20	29.95	65	106	98.26
20	30	29.95	78	125	98.26
20	40	29.95	80	130	98.26
20	50	29.99	78	126	98.4
20	60	29.97	80	129	98.34
20	70	30.01	75	122	98.46
20	80	30.04	66	107	98.54
20	90	30.04	65	103	98.56
30	0	30.13	70	109	98.86
30	10	30.06	70	109	98.62
30	20	30.04	72	112	98.56
30	30	30.06	85	134	98.62
30	40	30.11	82	136	98.78
30	50	29.97	83	131	98.34
30	60	29.98	77	126	98.36
30	70	30.04	80	127	98.56
30	80	30.07	79	129	98.66
30	90	30.05	76	120	98.58
40	0	30.26	66	104	99.28
40	10	30.14	69	108	98.9
40	20	30.08	77	119	98.68
40	30	30.05	93	145	98.6
40	40	30.07	92	151	98.66
40	50	30.06	83	138	98.62
40	60	29.98	75	121	98.36
40	70	29.99	82	130	98.38
40	80	30.04	79	127	98.54
40	90	30.10	72	120	98.76

May 25 1994

Site #3 (Angelina County)

ALL MEASUREMENTS IN METERS OR MS/M

PASTURE SITE

X	Y	ELEV. (m)	EM38H	EM38V	ELEV. (FT)
50	0	30.35	69	108	99.56
50	10	30.20	71	115	99.08
50	20	30.10	75	118	98.74
50	30	30.08	84	135	98.68
50	40	30.04	84	147	98.56
50	50	29.95	90	140	98.26
50	60	30.07	84	133	98.66
50	70	30.05	84	140	98.58
50	80	30.02	79	127	98.48
50	90	30.10	73	117	98.74
60	0	30.35	79	119	99.56
60	10	30.18	75	120	99
60	20	30.14	77	120	98.9
60	30	30.00	90	141	98.44
60	40	29.96	110	166	98.3
60	50	29.93	98	156	98.18
60	60	30.00	93	147	98.42
60	70	30.02	81	146	98.48
60	80	30.10	87	126	98.74
60	90	30.08	74	117	98.68
70	0	30.30	85	135	99.4
70	10	30.18	91	142	99
70	20	30.11	59	140	98.8
70	30	30.11	94	147	98.8
70	40	30.01	100	154	98.46
70	50	29.87	99	148	98
70	60	29.93	88	138	98.18
70	70	29.99	94	149	98.38
70	80	30.02	87	135	98.48
70	90	30.13	69	113	98.86
80	0	30.18	84	137	99.02
80	10	30.08	86	138	98.68
80	20	30.05	90	144	98.6
80	30	30.16	88	140	98.94
80	40	30.05	93	146	98.6
80	50	29.89	89	139	98.08
80	60	29.97	96	149	98.32
80	70	29.96	99	156	98.28
80	80	30.04	91	147	98.56
80	90	30.11	71	116	98.78
90	0	30.08	80	132	98.68
90	10	30.01	81	128	98.46
90	20	29.94	84	140	98.24
90	30	30.12	88	144	98.82
90	40	30.14	95	143	98.88
90	50	30.07	93	145	98.66
90	60	29.88	93	141	98.04
90	70	29.94	93	147	98.24
90	80	29.91	84	134	98.12
90	90	30.06	86	122	98.62

May 25 1994

Site #3 (ANGELINA County)

ALL MEASUREMENTS IN METERS OR MS/M

WOODED SITE

X	Y	ELEV.(m)	EM38H	EM38V	ELEV.(FT)
0	0	29.11	47	86	95.5
0	10	29.05	54	102	95.31
0	20	28.65	50	101	94.01
0	30	28.57	40	73	93.72
0	40	28.35	35	67	93.01
0	50	28.41	32	61	93.2
0	60	28.56	29	56	93.71
0	70	27.99	31	58	91.82
0	80	27.80	28	55	91.22
0	90	28.20	26	57	92.51
10	0	29.15	54	99	95.62
10	10	29.08	50	87	95.41
10	20	28.62	46	81	93.91
10	30	28.53	34	66	93.61
10	40	28.35	32	60	93
10	50	28.35	30	55	93
10	60	28.29	30	58	92.8
10	70	27.95	31	57	91.7
10	80	27.84	25	53	91.33
10	90	28.17	30	61	92.41
20	0	29.11	56	101	95.51
20	10	29.05	40	70	95.31
20	20	28.56	34	59	93.71
20	30	28.50	35	64	93.52
20	40	28.38	33	59	93.1
20	50	28.27	26	51	92.74
20	60	27.98	28	52	91.81
20	70	27.92	33	59	91.61
20	80	27.86	34	63	91.42
20	90	28.11	30	62	92.21
30	0	29.09	53	92	95.43
30	10	29.02	45	82	95.21
30	20	28.48	29	54	93.44
30	30	28.44	31	53	93.31
30	40	28.32	31	55	92.91
30	50	28.24	24	48	92.64
30	60	28.13	27	50	92.3
30	70	28.04	32	58	92
30	80	28.04	30	60	92
30	90	28.04	26	59	92
40	0	28.99	52	91	95.12
40	10	28.90	36	71	94.8
40	20	28.50	34	60	93.5
40	30	28.39	31	56	93.14
40	40	28.26	28	50	92.72
40	50	28.04	24	43	92
40	60	27.92	28	50	91.6
40	70	27.98	32	58	91.8
40	80	28.01	26	52	91.91
40	90	28.08	25	56	92.11

May 25 1994

Site #3 (ANGELINA County)

ALL MEASUREMENTS IN METERS OR MS/M

WOODED SITE

X	Y	ELEV.(m)	EM38H	EM38V	ELEV.(FT)
50	0	28.93	38	69	94.92
50	10	28.84	31	58	94.61
50	20	28.50	32	57	93.52
50	30	28.59	32	67	93.81
50	40	28.35	27	50	93.02
50	50	28.04	29	55	92
50	60	28.11	32	59	92.22
50	70	28.08	33	59	92.11
50	80	28.08	28	57	92.11
50	90	28.08	27	60	92.11
60	0	28.50	46	84	93.5
60	10	28.53	36	67	93.6
60	20	28.52	32	61	93.56
60	30	28.08	38	69	92.11
60	40	28.20	30	58	92.51
60	50	27.84	33	58	91.34
60	60	27.87	33	61	91.44
60	70	27.87	32	57	91.44
60	80	27.93	32	63	91.64
60	90	27.93	47	93	91.64
70	0	28.56	41	76	93.71
70	10	28.54	34	63	93.64
70	20	28.47	34	63	93.41
70	30	28.29	35	65	92.81
70	40	28.23	35	65	92.61
70	50	28.02	34	61	91.92
70	60	27.86	35	67	91.41
70	70	27.96	37	69	91.72
70	80	27.92	43	80	91.61
70	90	27.99	56	103	91.82
80	0	28.67	41	74	94.06
80	10	28.60	37	66	93.82
80	20	28.45	36	66	93.34
80	30	28.32	33	61	92.91
80	40	28.20	29	55	92.51
80	50	28.04	36	67	92
80	60	27.98	34	63	91.8
80	70	28.02	36	64	91.92
80	80	27.96	37	74	91.74
80	90	28.03	59	110	91.95
90	0	28.74	47	77	94.3
90	10	28.60	30	57	93.82
90	20	28.41	31	59	93.21
90	30	28.39	27	51	93.14
90	40	28.29	28	49	92.83
90	50	28.09	27	51	92.16
90	60	28.03	27	55	91.97
90	70	27.93	27	52	91.65
90	80	27.99	36	66	91.82
90	90	27.99	56	100	91.82

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Site #4 (Angelina County)

ALL MEASUREMENTS IN METERS OR MS/M

PASTURE SITE

X	Y	ELEV.(m)	EM38H	EM38V	ELEV.(FT)
0	0	26.97	70	114	88.50
0	10	26.64	70	113	87.40
0	20	26.97	75	118	88.48
0	30	27.23	58	96	89.34
0	40	27.21	105	112	89.26
0	50	27.26	78	125	89.42
0	60	27.40	70	109	89.9
0	70	27.46	109	157	90.1
0	80	27.51	76	123	90.24
0	90	27.57	76	124	90.44
10	0	27.27	70	99	89.48
10	10	27.29	90	141	89.52
10	20	27.22	117	160	89.32
10	30	27.35	100	150	89.74
10	40	27.43	108	161	90
10	50	27.51	67	108	90.26
10	60	27.59	66	109	90.52
10	70	27.70	95	146	90.88
10	80	27.69	65	105	90.86
10	90	27.71	76	120	90.9
20	0	27.41	59	95	89.94
20	10	27.59	90	131	90.52
20	20	27.52	131	166	90.3
20	30	27.61	80	132	90.58
20	40	27.70	81	130	90.88
20	50	27.76	79	130	91.08
20	60	27.83	69	113	91.3
20	70	27.86	85	137	91.42
20	80	27.90	83	138	91.52
20	90	27.91	80	123	91.56
30	0	27.82	72	113	91.26
30	10	27.91	79	125	91.58
30	20	27.89	88	144	91.5
30	30	27.93	82	135	91.64
30	40	28.04	80	131	92
30	50	28.12	85	134	92.26
30	60	28.11	118	158	92.22
30	70	28.21	75	126	92.56
30	80	28.17	79	125	92.42
30	90	28.24	78	126	92.66
40	0	28.17	75	125	92.42
40	10	28.28	72	119	92.78
40	20	28.23	76	130	92.62
40	30	28.33	79	130	92.96
40	40	28.39	79	121	93.14
40	50	28.46	88	127	93.36
40	60	28.45	124	168	93.34
40	70	28.52	80	131	93.58
40	80	28.56	76	126	93.7
40	90	28.56	77	123	93.7

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Site #4 (Angelina County)

ALL MEASUREMENTS IN METERS OR MS/M

PASTURE SITE

X	Y	ELEV. (m)	EM38H	EM38V	ELEV. (FT)
50	0	28.48	92	145	93.44
50	10	28.50	95	149	93.5
50	20	28.58	98	153	93.76
50	30	28.58	102	154	93.76
50	40	28.61	119	168	93.86
50	50	28.75	104	159	94.34
50	60	28.69	104	162	94.12
50	70	28.80	101	156	94.48
50	80	28.76	95	149	94.36
50	90	28.79	91	143	94.44
60	0	28.88	94	147	94.74
60	10	28.83	96	151	94.58
60	20	28.97	100	153	95.06
60	30	28.98	95	150	95.08
60	40	29.04	97	149	95.28
60	50	29.06	111	163	95.34
60	60	29.11	116	162	95.5
60	70	29.16	83	135	95.66
60	80	29.17	82	124	95.7
60	90	29.23	95	149	95.9
70	0	29.27	86	137	96.04
70	10	29.41	84	138	96.48
70	20	29.41	89	143	96.48
70	30	29.41	84	137	96.48
70	40	29.46	82	132	96.66
70	50	29.52	83	134	96.84
70	60	29.58	87	143	97.04
70	70	29.63	80	130	97.2
70	80	29.68	75	123	97.36
70	90	29.61	82	132	97.16
80	0	29.44	100	157	96.58
80	10	29.52	100	162	96.86
80	20	29.63	95	152	97.22
80	30	29.61	104	155	97.16
80	40	29.62	99	153	97.18
80	50	29.71	104	159	97.48
80	60	29.74	103	161	97.58
80	70	29.83	101	157	97.88
80	80	29.90	94	154	98.1
80	90	29.83	94	146	97.86
90	0	29.72	104	156	97.52
90	10	29.90	97	151	98.1
90	20	30.01	100	153	98.46
90	30	30.02	89	147	98.5
90	40	30.05	91	147	98.58
90	50	30.01	110	166	98.46
90	60	29.95	117	170	98.26
90	70	30.10	111	167	98.76
90	80	30.17	127	169	98.98
90	90	30.17	102	158	98.98

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Site #5 (Angelina County)

ALL MEASUREMENTS IN METERS OR MS/M

PASTURE SITE

X	Y	ELEV. (m)	EM38H	EM38V	ELEV. (FT)
0	0	2.93	61	98	9.60
0	10	3.02	62	98	9.90
0	20	3.08	61	99	10.1
0	30	3.14	78	113	10.3
0	40	3.23	72	110	10.6
0	50	3.41	76	120	11.2
0	60	3.41	67	108	11.2
0	70	3.51	72	116	11.5
0	80	3.60	74	116	11.8
0	90	3.60	80	123	11.8
10	0	2.87	66	100	9.4
10	10	2.93	63	101	9.6
10	20	3.02	69	109	9.9
10	30	3.17	69	112	10.4
10	40	3.11	66	112	10.2
10	50	3.23	73	112	10.6
10	60	3.32	71	112	10.9
10	70	3.38	71	115	11.1
10	80	3.47	82	123	11.4
10	90	3.44	74	112	11.3
20	0	2.80	64	104	9.2
20	10	2.87	66	105	9.4
20	20	2.93	66	100	9.6
20	30	3.05	70	108	10
20	40	3.05	66	105	10
20	50	3.11	71	111	10.2
20	60	3.17	67	111	10.4
20	70	3.26	73	115	10.7
20	80	3.38	74	120	11.1
20	90	3.41	73	117	11.2
30	0	2.65	63	104	8.7
30	10	2.74	65	100	9
30	20	2.80	64	104	9.2
30	30	2.90	64	104	9.5
30	40	2.99	65	108	9.8
30	50	2.99	69	113	9.8
30	60	3.08	74	120	10.1
30	70	3.14	72	117	10.3
30	80	3.29	80	129	10.8
30	90	3.29	66	101	10.8
40	0	2.62	71	108	8.6
40	10	2.65	69	110	8.7
40	20	2.74	63	103	9
40	30	2.83	64	107	9.3
40	40	2.90	72	115	9.5
40	50	2.96	80	128	9.7
40	60	2.93	75	118	9.6
40	70	3.05	74	125	10
40	80	3.11	68	103	10.2
40	90	3.23	76	118	10.6

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Site #5 (Angelina County)

ALL MEASUREMENTS IN METERS OR MS/M

PASTURE SITE

X	Y	ELEV.(m)	EM38H	EM38V	ELEV.(FT)
50	0	2.53	73	112	8.3
50	10	2.59	70	113	8.5
50	20	2.62	72	117	8.6
50	30	2.77	84	120	9.1
50	40	2.80	77	122	9.2
50	50	2.87	84	131	9.4
50	60	2.99	91	144	9.8
50	70	2.90	74	122	9.5
50	80	3.08	71	108	10.1
50	90	3.08	89	136	10.1
60	0	2.59	76	118	8.5
60	10	2.53	77	122	8.3
60	20	2.59	77	124	8.5
60	30	2.68	88	132	8.8
60	40	2.74	83	130	9
60	50	2.77	82	135	9.1
60	60	2.87	95	153	9.4
60	70	2.90	100	154	9.5
60	80	2.93	106	164	9.6
60	90	2.99	122	174	9.8
70	0	2.35	85	127	7.7
70	10	2.41	79	127	7.9
70	20	2.50	80	125	8.2
70	30	2.56	87	136	8.4
70	40	2.65	91	140	8.7
70	50	2.65	86	136	8.7
70	60	2.74	98	156	9
70	70	2.80	104	160	9.2
70	80	2.90	127	172	9.5
70	90	2.93	108	163	9.6
80	0	2.29	88	132	7.5
80	10	2.32	85	129	7.6
80	20	2.38	92	141	7.8
80	30	2.50	89	142	8.2
80	40	2.53	91	143	8.3
80	50	2.56	99	155	8.4
80	60	2.65	105	159	8.7
80	70	2.71	108	162	8.9
80	80	2.74	116	165	9
80	90	2.80	135	176	9.2
90	0	2.19	95	148	7.2
90	10	2.29	92	148	7.5
90	20	2.29	96	151	7.5
90	30	2.44	103	160	8
90	40	2.47	106	158	8.1
90	50	2.44	96	153	8
90	60	2.53	108	163	8.3
90	70	2.56	108	155	8.4
90	80	2.53	80	136	8.3
90	90	2.68	81	129	8.8

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Site #5 (Angelina County)

ALL MEASUREMENTS IN METERS OR MS/M

WOODED SITE

X	Y	EM38H	EM38V
0	0	32	55
0	10	38	66
0	20	38	63
0	30	34	56
0	40	38	64
0	50	50	85
0	60	46	78
0	70	38	65
0	80	36	59
0	90	35	59
10	0	35	59
10	10	39	58
10	20	39	66
10	30	35	59
10	40	35	61
10	50	40	68
10	60	38	64
10	70	39	66
10	80	36	60
10	90	36	59
20	0	35	62
20	10	35	61
20	20	34	58
20	30	33	58
20	40	43	69
20	50	47	79
20	60	40	68
20	70	33	56
20	80	35	56
20	90	35	58
30	0	35	61
30	10	37	63
30	20	38	64
30	30	37	61
30	40	34	62
30	50	39	67
30	60	40	71
30	70	35	58
30	80	32	53
30	90	37	60
40	0	44	71
40	10	44	74
40	20	40	63
40	30	37	61
40	40	38	65
40	50	35	59
40	60	35	60
40	70	39	66
40	80	38	64
40	90	39	65

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Site #5 (Angelina County)

ALL MEASUREMENTS IN METERS OR MS/M

WOODED SITE

X	Y	EM38H	EM38V
50	0	35	67
50	10	31	51
50	20	37	64
50	30	35	56
50	40	35	60
50	50	33	55
50	60	35	59
50	70	38	60
50	80	35	60
50	90	36	62
60	0	38	63
60	10	37	59
60	20	34	59
60	30	37	60
60	40	36	60
60	50	32	55
60	60	35	60
60	70	38	64
60	80	34	59
60	90	37	65
70	0	38	67
70	10	35	62
70	20	36	62
70	30	37	63
70	40	35	57
70	50	32	54
70	60	37	65
70	70	36	62
70	80	34	58
70	90	38	61
80	0	35	57
80	10	37	62
80	20	36	64
80	30	38	64
80	40	36	60
80	50	41	68
80	60	35	59
80	70	39	65
80	80	38	65
80	90	35	63
90	0	37	62
90	10	38	66
90	20	42	57
90	30	38	66
90	40	38	65
90	50	40	63
90	60	39	63
90	70	40	67
90	80	40	67
90	90	38	65