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QUICK ESTIMATION OF SALINITY IN FIELD SOILS AND IRRIGATION WATER WITH LANDMAPPER® ERM-02

Soil salinity is routinely evaluated in the labs from electrical conductivity of liquid soil saturation extract (ECe). The resulted total salinity is reported either directly in conductivity units (dS/m) or converted to TDS (total dissolved solids) concentration in ppm (parts per million) using formula:

1 dS/m = 640 ppm = 640 mg/L= 0.64 g/L=0.064%

But **now EC of soil and waters can be measured directly in the field** using highly accurate method of four-electrode probe and Landmapper ERM-02 measuring device. Best of all, probes can be build to sense different soil layers down to 30 ft! Probes are simple and inexpensive to make from common materials available at any hardware store.

For irrigation water and soil solutions: To measure ECw just put 4-electrode probe of Landmapper used for mapping into a ditch, canal, or other water source. Make sure that all 4-electrodes are in contact with water. Take a reading in EC (conductivity) mode. Display will read (example):

K0*C= 150m - which indicates milli Siemens (mS/m)

To convert to dS/m, divide display number by 100, i.e.

150 mS/m=1.5 dS/m.

Use the table below to quickly evaluate salinity of irrigation or surface water:

Salinity Class	Electrical Conductivity, ECw (dS/m)	Total dissolved solids, TDS (ppm)
Nonsaline water	<0.7	<500
Saline water	0.7-42	500-30,000
Slightly saline	0.7-3	500-2000
Medium saline	3-6	2000-4000
Highly saline	6-14	4000-9000
Very highly saline	14-42	9000-30,000
Brine	>42	>30,0000

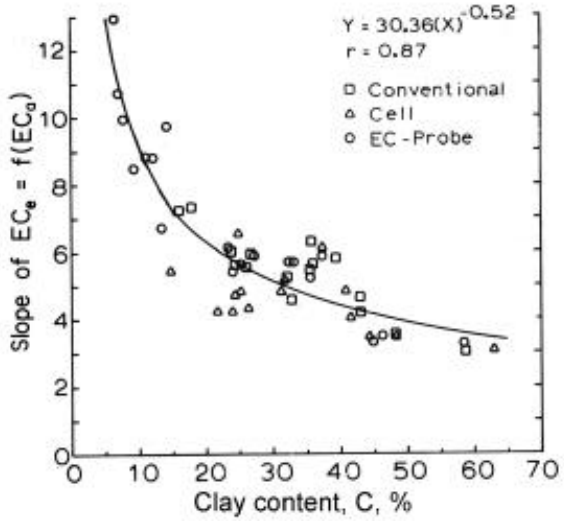
For field soils: Conventional analysis of soil salinity is cumbersome, since it requires collecting big soil samples, preparing soil paste and using vacuum extract apparatus to collect soil solution extract for measuring ECe. Farmer usually had to wait up to 10 days to get back results from the lab. Also salinity is highly variable across the fields and with soil depth. Soil salinity is also highly dynamic and can drastically change during growing season depending on rain, irrigation and other management practices.

Landmapper ERM-02 can be used to check for dangerous salinity levels at different locations and soil layers directly in the field very quickly – one EC reading takes only 4 sec! Few samples can be collected from areas with extreme min-max levels of EC and salinity values can be double-checked at the laboratory using Landmapper ERM-02, optional laboratory 4-electrode box and

simple and accurate procedure described in separate flyer. Scale for weighting soil and distilled water is the only additional equipment needed.

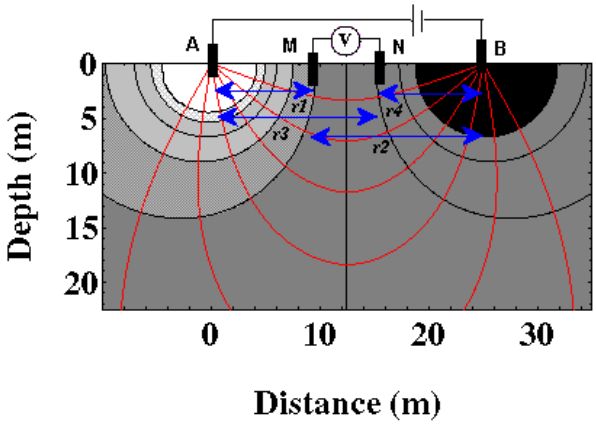
However, **usually ECa measured directly in the field is enough to delineate spots of dangerous salinity** within the field and design management/remediation plan.

ECa or apparent (bulk) electrical resistivity measured with LandMapper in the field can be related back to ECe by multiplying ECa*$K_{texture}$. The $K_{texture}$ varies from 3 to 6 for typical loam and clay loam soils, and can be estimated from soil clay content and a graph at the left. However, those $K_{texture}$ for recalculation of ECa to ECe were derived for relatively dry California soils and if one is measuring ECa in wet situations like after heavy rain in saturated or flooded soil (also possible with Landmapper ERM-02!), $K_{texture}$ multiplication is not necessary. Recent measurements on rice paddies in TX have shown that at ECa=1.5 dS/m at 6" and 16" depth rice is thriving under full flood.



Remember, ECe or electrical conductivity of soil saturation extract is MAXIMUM soil salinity, and one should not be alarmed of high ECe values, especially if growing relatively salt-tolerant crops without excess water. ECa or bulk soil electrical conductivity is much more valuable as its shows amount of ACTIVE or MOBILE salts in soil profile under field soil moisture conditions.

Bulk soil electrical conductivity (ECa) is measured from soil surface to the depth in the big soil volume determined by the distance among four electrodes (ABMN) and therefore is more representative of field conditions than measurements in small soil sample or soil ECa insertion probe. The depth and volume of measurement may be varied by changing the spacing between electrodes. When the distance between the outside pair of electrodes (the current electrodes, AB) is small, the flow of electricity is shallower. The **effective depth** of measurement **is about one-third** of the distance between AB electrodes. The calculation of ECa from field measurements done with different size probes will be done automatically by LandMapper ERM-02 if geometrical coefficient Kg is set in device for specific probe. Kg can be calculated from distances among ABMN electrodes using formula below (input distances in meters):



$$K_g = \pi \frac{[AM]\cdot[AN]}{[MN]} \qquad \pi = 3.1416$$

Four-electrode probes supplied by us will have Kg printed on the probe and saved in LandMapper ERM-02 memory. Device can store nine Kg (K1-K9) coefficients to facilitate quick changes in the field for up to 10 probes for different depths. Default K0=1 and cannot be changed. K0 is used with a probe to the depth ~6" where AM=MN=NB=a=16 cm or for resistance/conductance measurements.

Reference: Rhoades, J.D., F. Chanduvi, S. Lesch. 1999. Soil salinity assessment – Methods and interpretation of electrical conductivity measurements. FAO irrigation and drainage paper #57. FAO UNESCO Rome. ISBN 92-5-104281-0