# Salt Distribution in Sandy Loam Soils:
Soil Solution Mixing through Capillary Rise

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GEO 628:
Geochemistry
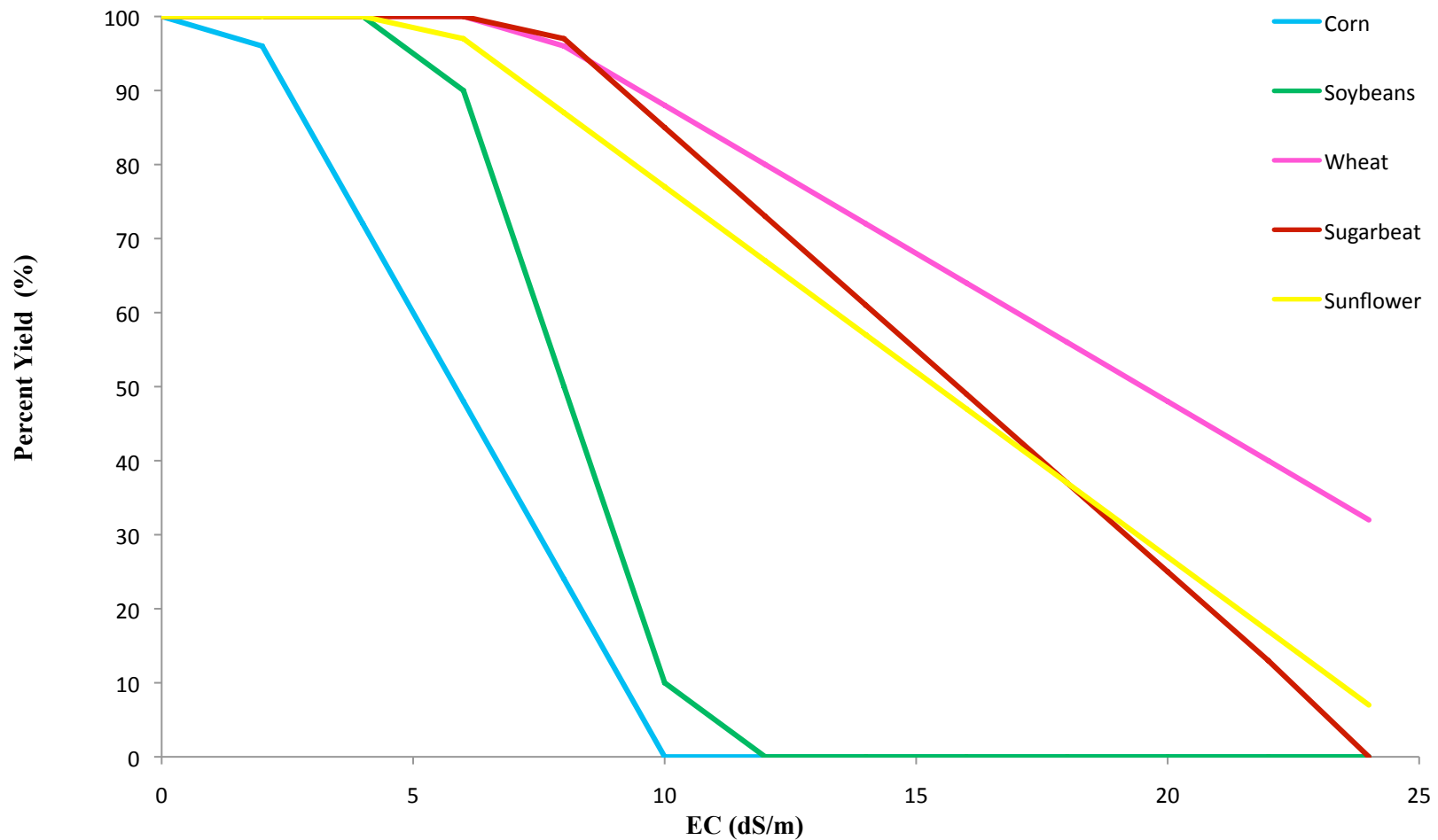Saini Eidukat
4th December 2014

Background:

- **Soil Salinity**

  -Excess of soluble salts in soil profile

- **Common Salts in North Dakota**

  -Sulfates (magnesium, calcium, sodium)

- **Primary and Secondary Causes**

  -Natural and Anthropogenic

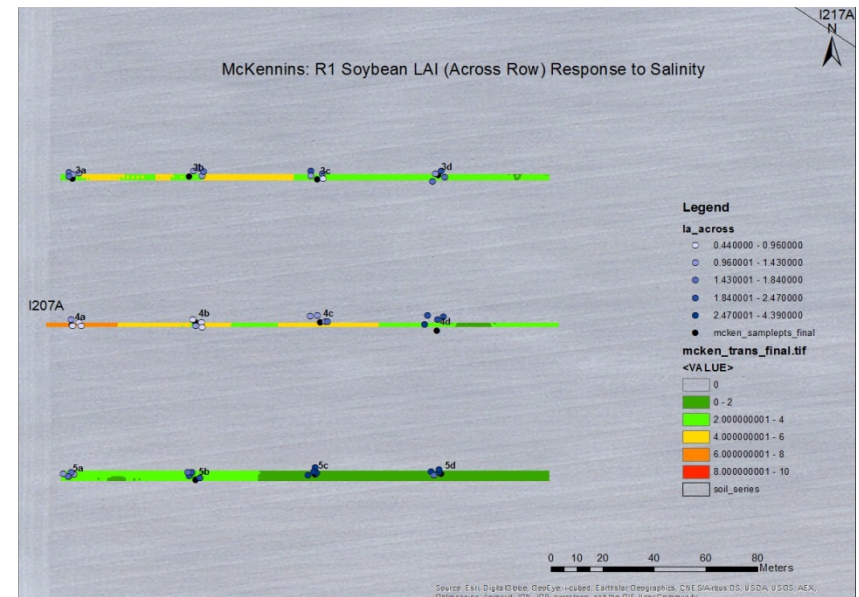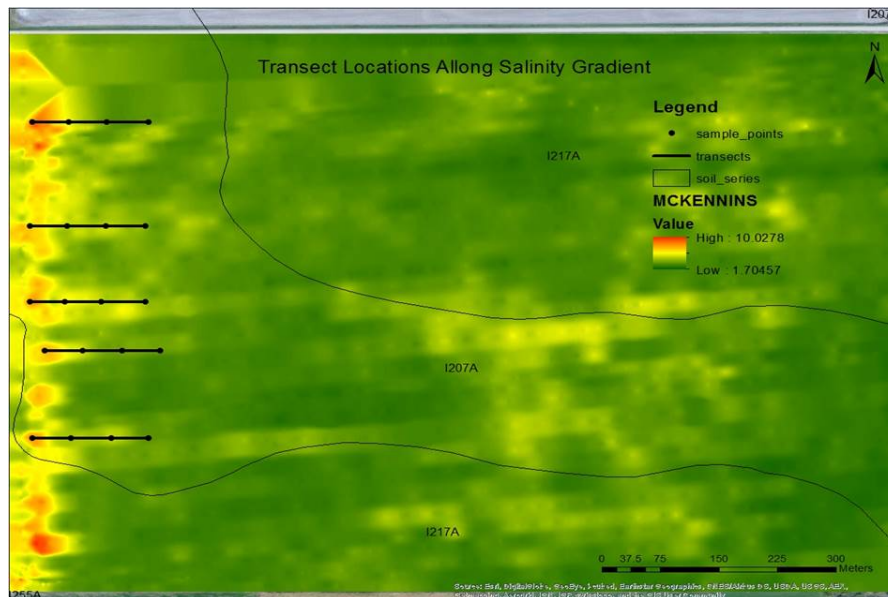 -Rise via Capillary Action   fr

       the water table
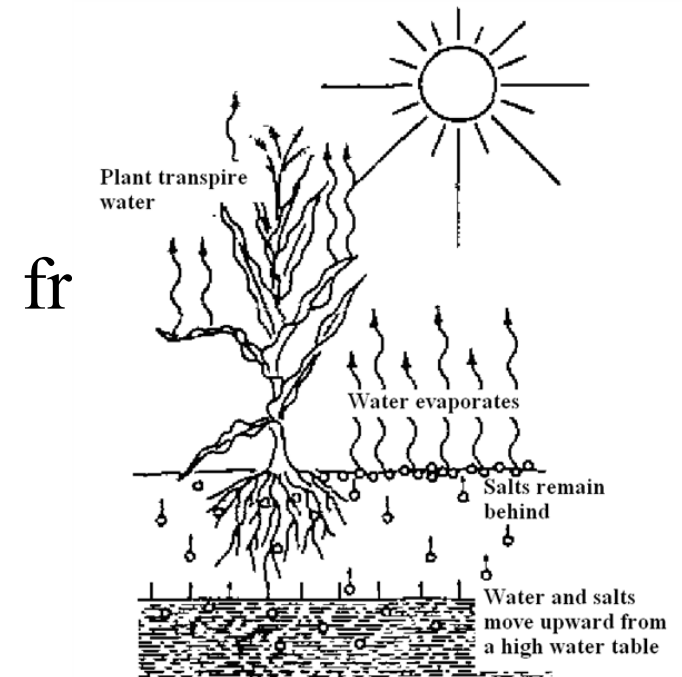
Purpose and Importance:
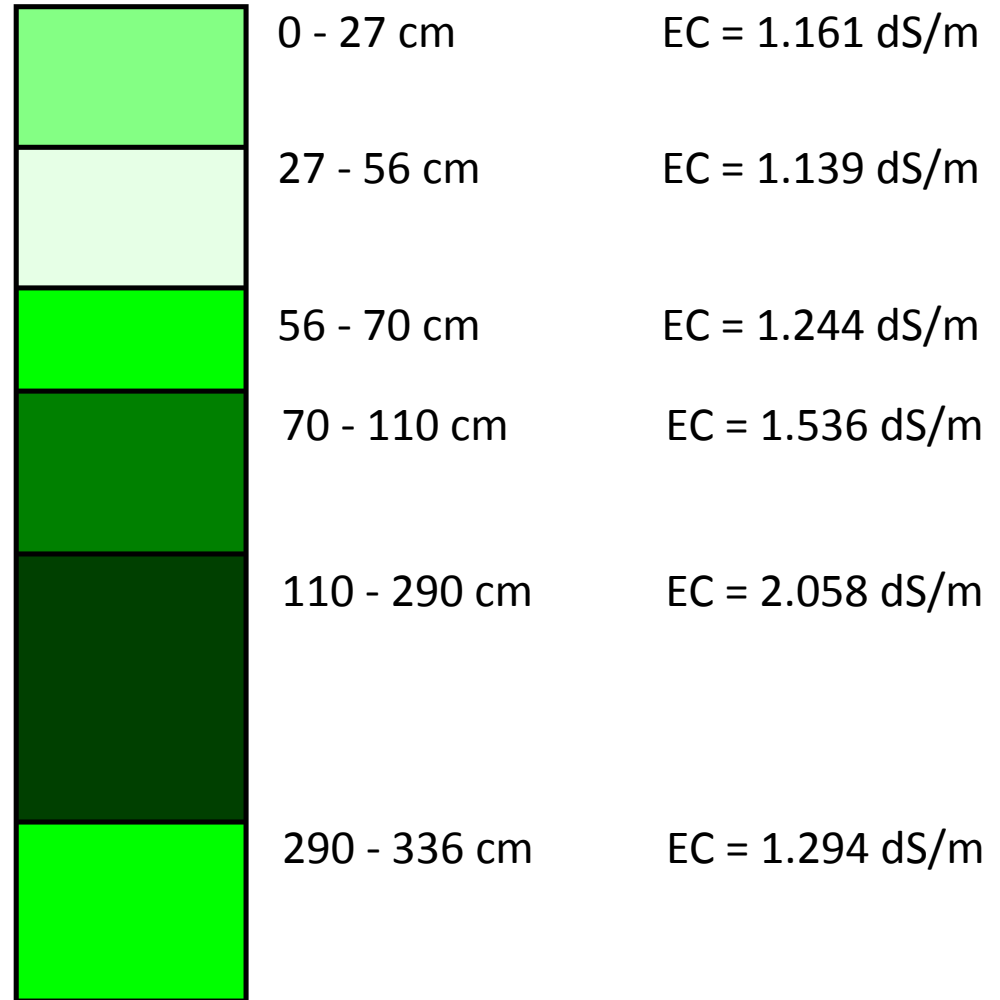

Percent Yield as a Function of Soil Salinity

Methods:

- **Laboratory Analysis of Soil Samples**

  -Soil cores extracted with a Giddings probe truck at five depths: 0-15 cm, 15-30 cm, 30-60 cm, 60-90 cm, and 90-120 cm

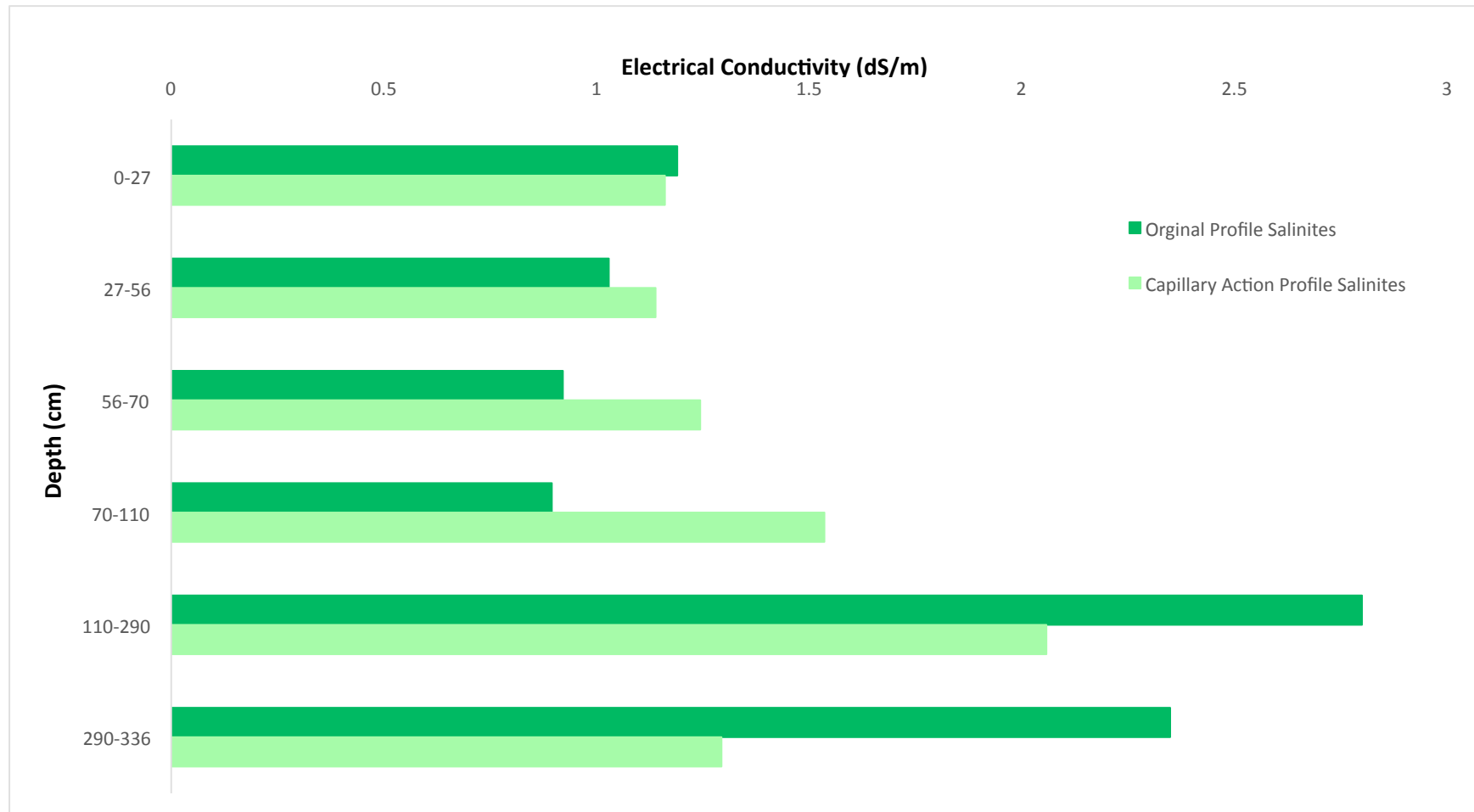 -Soil salinity ($EC_{1:1}$) determined from 1:1 soil to water salinity tests
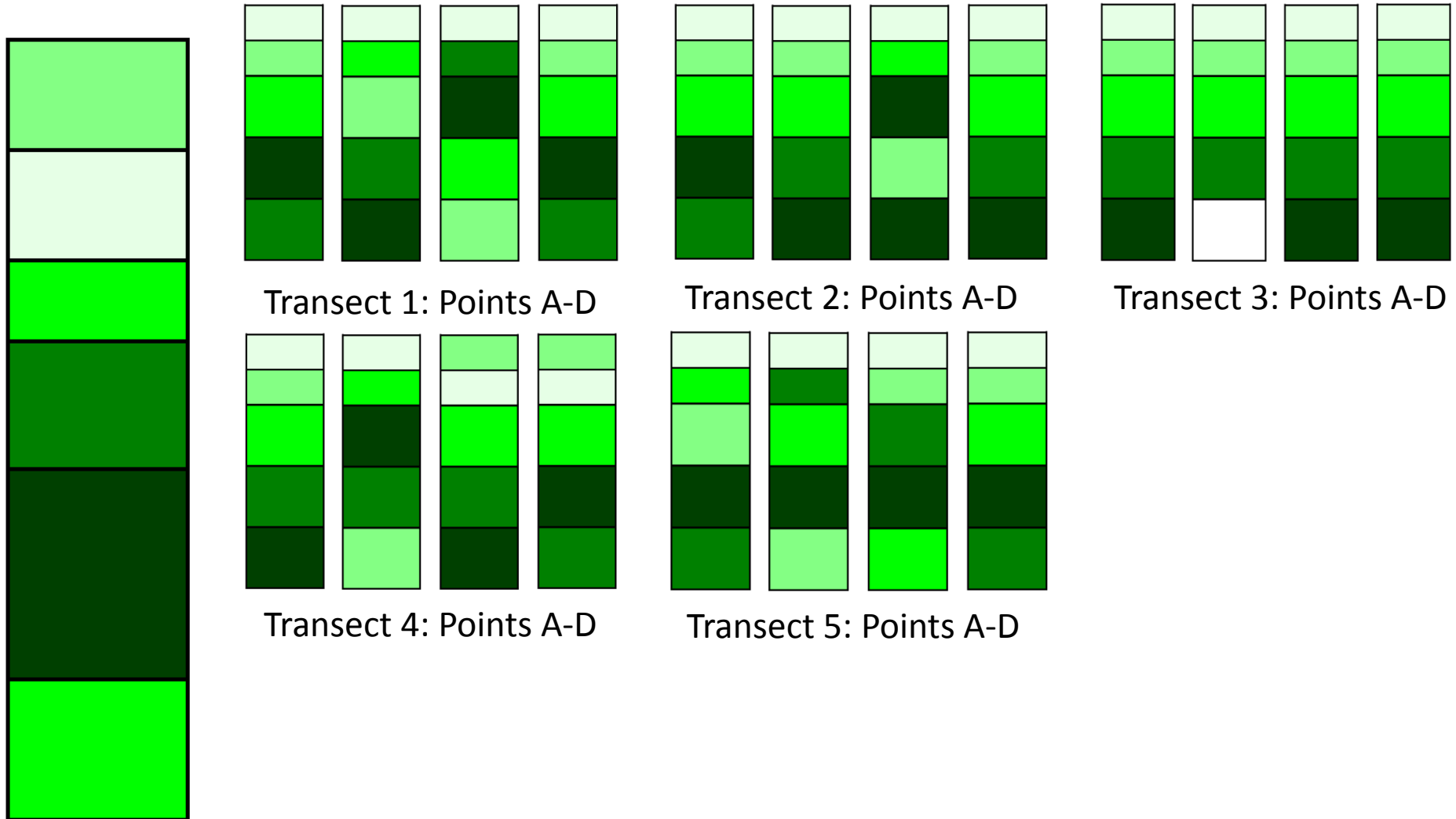
Methods and PHREEQC Model:

1) Use of KSSL data to determine concentrations
2) Model mixing of first solution in 1:1 ratio
3) Modeling of adjacent layer above with solution found from previous mixing simulation
4) Construct depth model for typical profile with salts originating from the water table through capillary rise

5) Compare output with EC data collected from soil cores

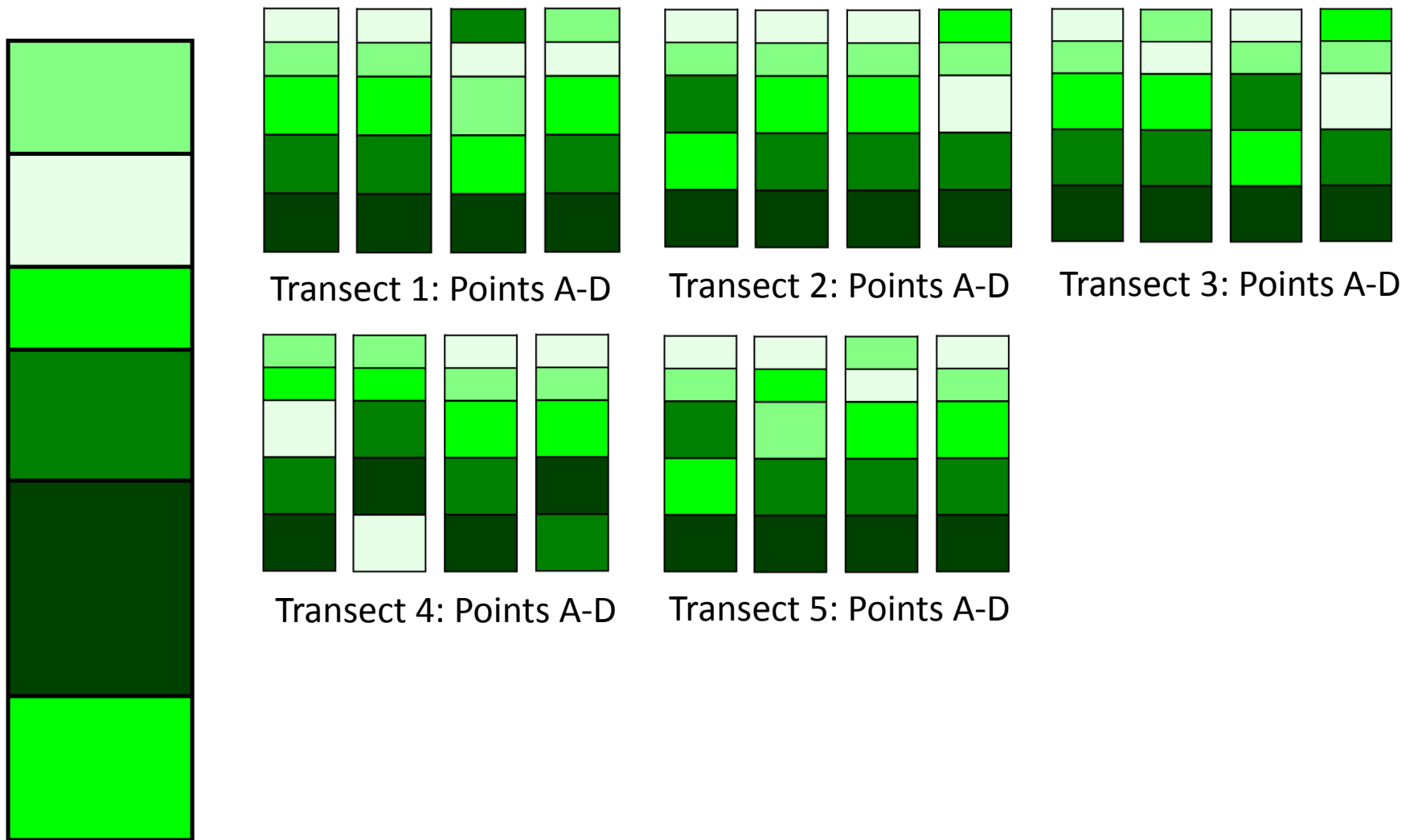| Depth	EC
0 - 27 cm	EC = 1.161 dS/m
27 - 56 cm	EC = 1.139 dS/m
56 - 70 cm	EC = 1.244 dS/m
70 - 110 cm	EC = 1.536 dS/m
110 - 290 cm	EC = 2.058 dS/m
290 - 336 cm	EC = 1.294 dS/m

Changes in Salinity with Modeled Capillary Rise and Consequent Mixing

Comparison to Field Data: Plot 1

Transect 1: Points A-D

Transect 2: Points A-D

Transect 3: Points A-D

Transect 4: Points A-D

Transect 5: Points A-D

Comparison to Field Data: Plot 2

Transect 1: Points A-D

Transect 2: Points A-D

Transect 3: Points A-D

Transect 4: Points A-D

Transect 5: Points A-D

Comparison to Field Data: Plot 3

Transect 1: Points A-D

Transect 2: Points A-D

Transect 3: Points A-D

Transect 4: Points A-D

Transect 5: Points A-D
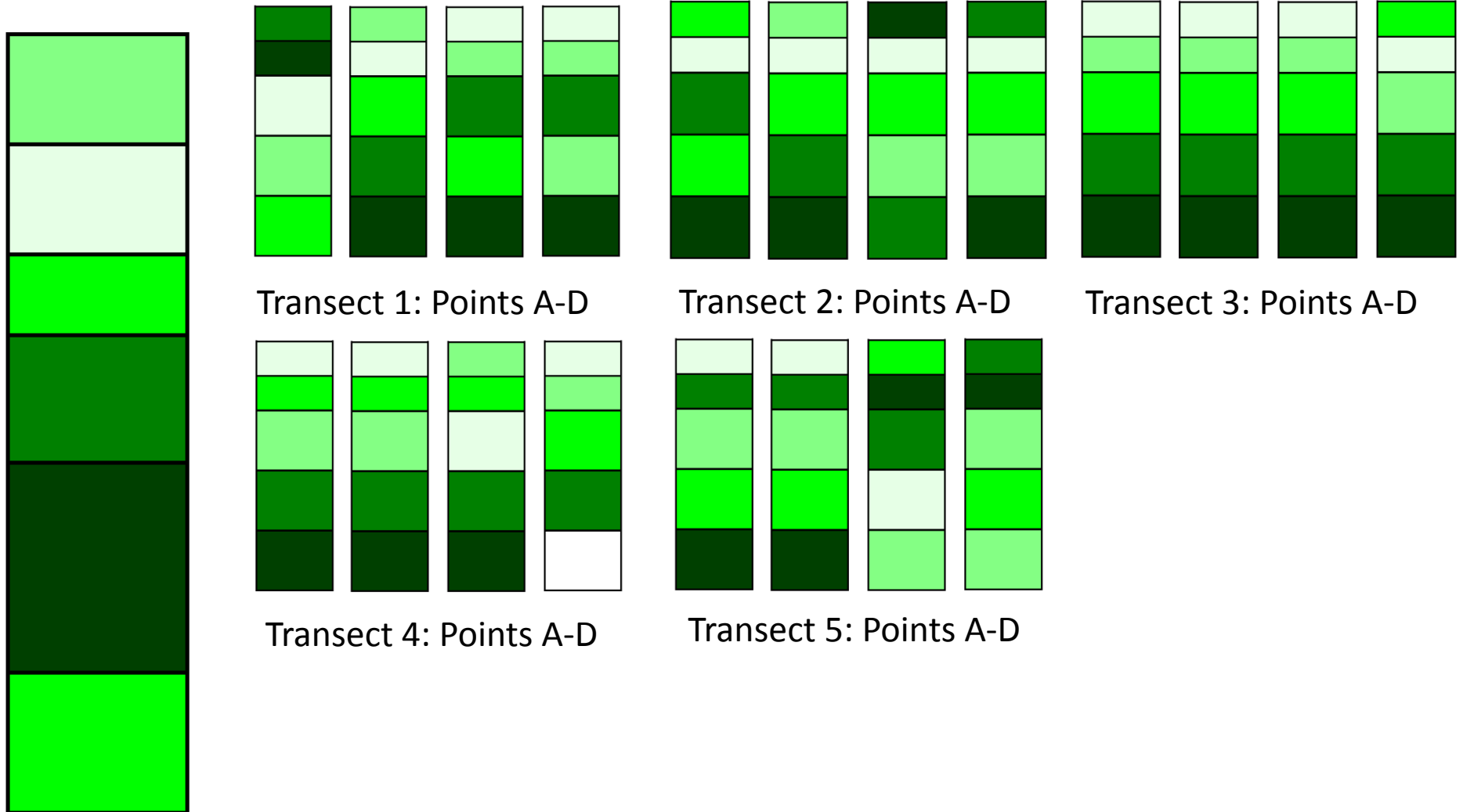
Locations of Comparable Profiles
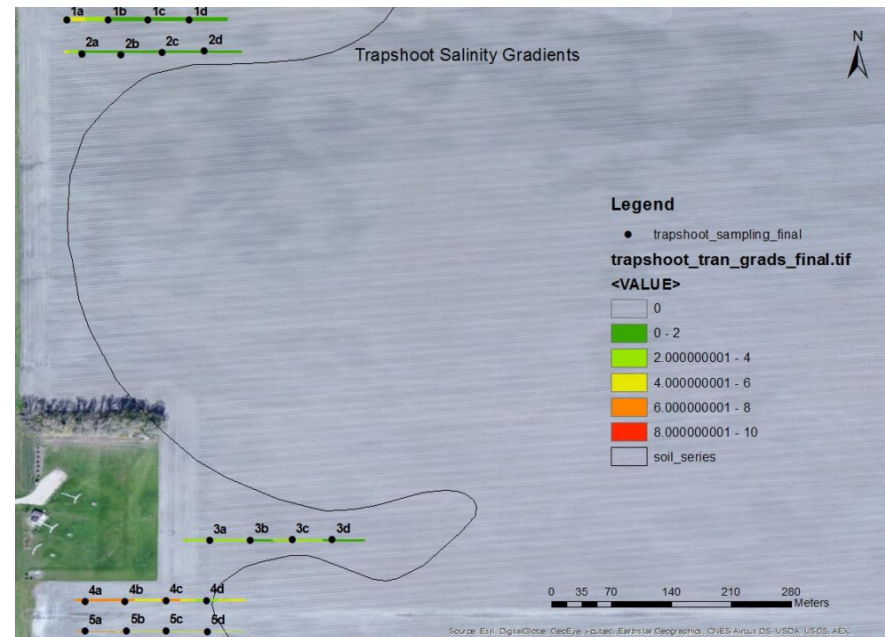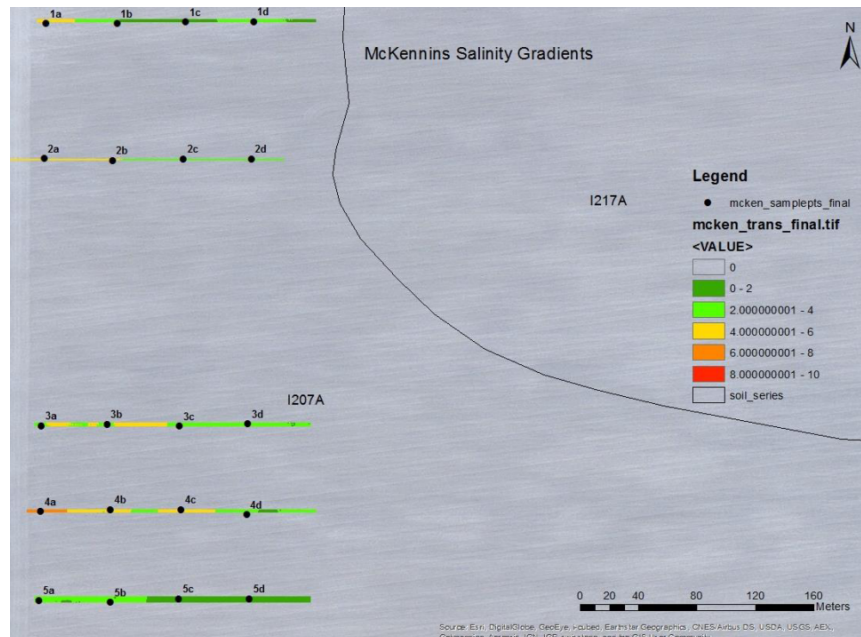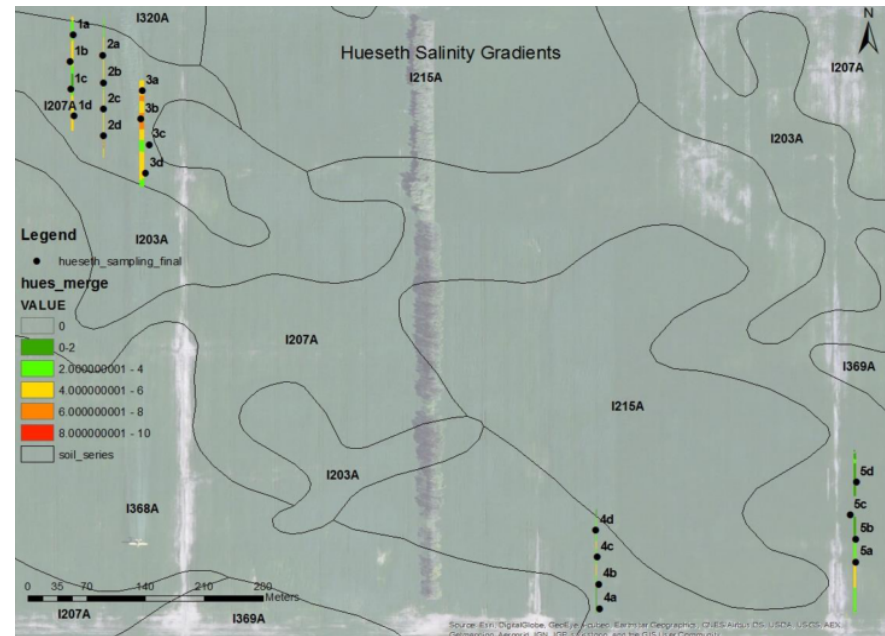
- Hueseth (Plot 1)
    - Transect 4, Point C
- McKennins (Plot 2)
    - Transect 1, Point D
    - Transect 3, Point B
    - Transect 5, Point C
- Trapshoot (Plot 3)
    - Transect 1, Point B
    - Transect 2, Point C

Conclusions and Future Studies:

- Relevance to producers
    - -Determine sources of soil salinity and focus remediation efforts on these areas
- Extrapolation to field soil salinity; simplicity of model
    - -Solute movement in soils is extremely complex
    - -Salinity issues are water management issues; modeling salinity must incorporate models of water movement in soils
- Data
    - -No chemical data has been obtained yet (salt concentrations) from collected field samples; analysis of solutes based on KSSL data, which is outdated
    - -Actual patterns of solute distribution for current field conditions is unknown

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