

# GDEX - Grassland Destabilization Experiment

How do ET, soil moisture, drainage, and energy balance change as the state of the uplands changes from continuous grass cover to bare sand?

How does the soil ecosystem (roots, soil organic matter, fungi, bacteria) affect water/energy balance and physical stability once living vegetation is killed? How fast are these effects lost? How resilient is the belowground ecosystem to short-term or long-term disturbance?

How are soil moisture dynamics in the rooting zone coupled to the dynamics of the vadose zone and the water table?

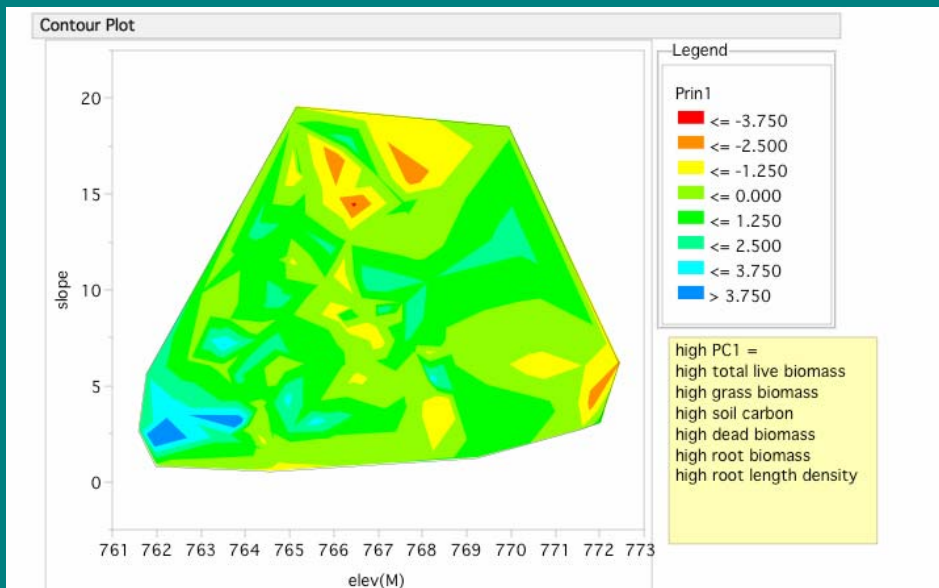
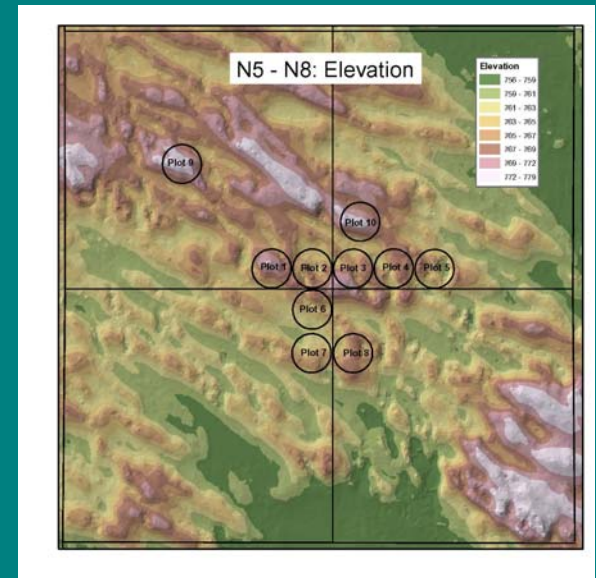


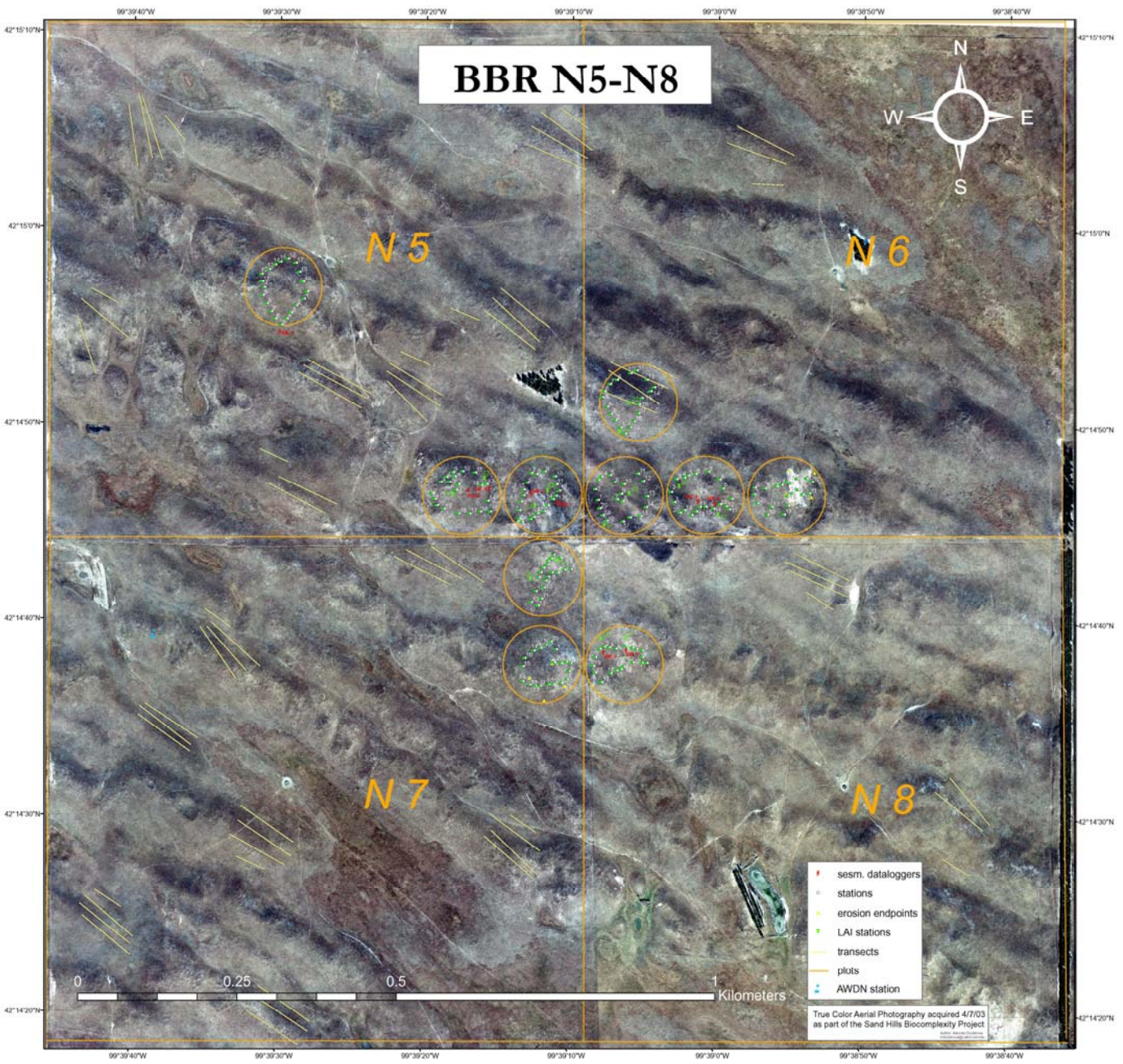


# GDEX - The Grassland Destabilization Experiment

## Research Plan:

- Lay out ten 120m diameter plots (2.7 acres) at UNL's Barta Brothers Ranch
- Collect baseline data on topography, vegetation, soils in a high resolution GIS
- Instrument the site to monitor microclimate (energy balance) and soil moisture





# BBR N5-N8



N5

N6

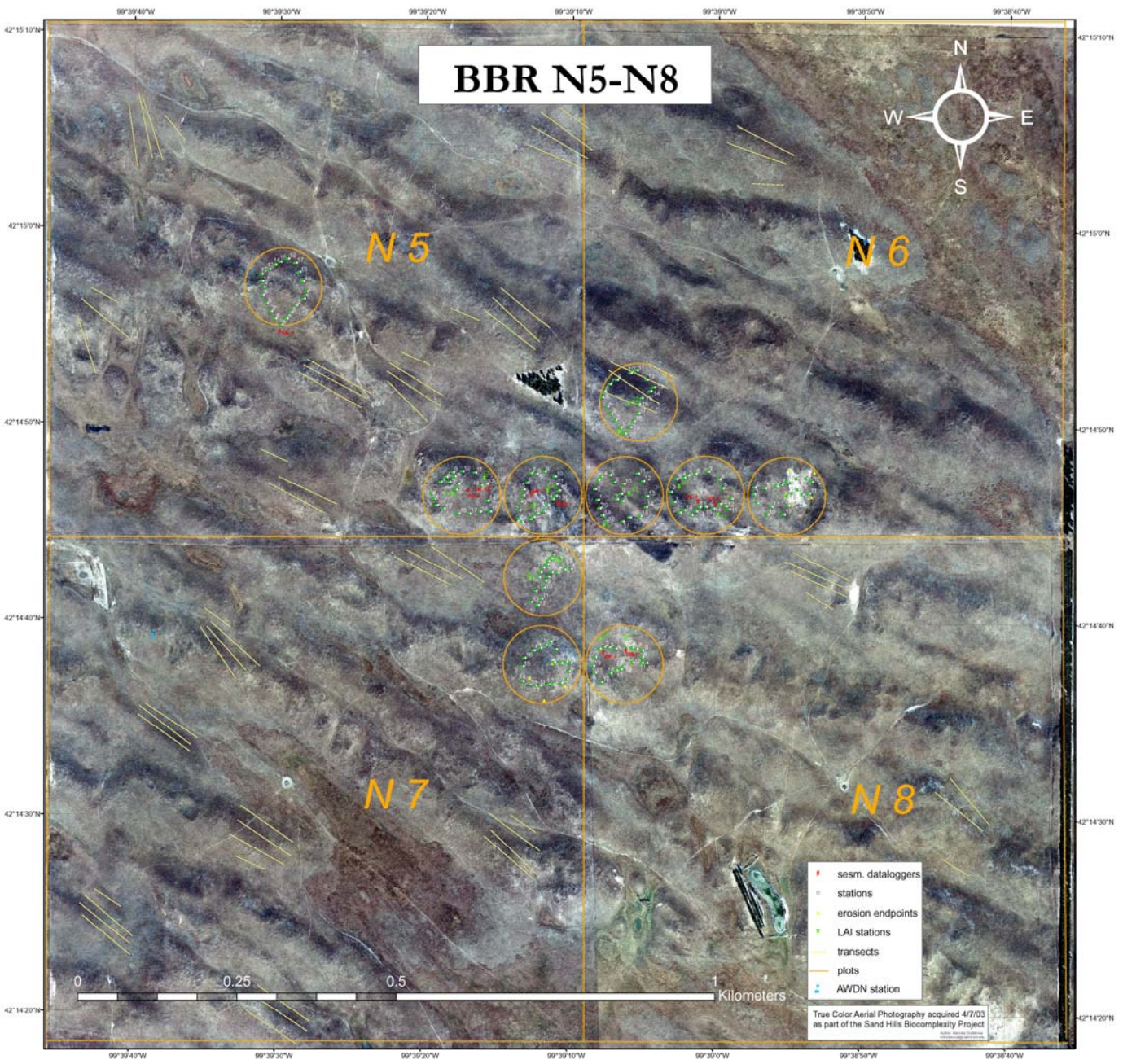
N7

N8

- sesm. dataloggers
- stations
- erosion endpoints
- LAI stations
- transects
- plots
- AWDN station

0 0.25 0.5 1 Kilometers

True Color Aerial Photography acquired 4/7/03  
as part of the Sand Hills Biocomplexity Project



The data stream from this sensor array is online at  
<http://gdex.unl.edu>

## GDEX Project

[home](#)

### Welcome to the GDEX Project Homepage

#### Login

Username

Password

Login

[Click here](#) for more information about the Grasslands Destabilization Experiment (GDEX) and protocols.



Sand Hills Biocomplexity Project

UNIVERSITY OF  
**Nebraska**  
Lincoln

## Create a report

### Report Type

- Table (Aggregated by station)
- Table (Aggregated by variable)
- Chart

### Date Range

From  (mm/dd/yyyy)

To  (mm/dd/yyyy)

### Station Selection

ID	Latitude	Longitude	Plot	Location	Treatment	Logger ID	Start Date	End Date	Last Upload Date
<input type="checkbox"/> 1	46.78	44.57	9	0	1	SESM1	2004/1/1	2005/11/16	2006/2/23
<input type="checkbox"/> 2	46.77	44.60	1	1	3	SESM2	2004/1/1	2005/11/16	2006/2/23
<input type="checkbox"/> 3	46.77	44.61	2	1	1	SESM3	2004/1/1	2005/11/16	2006/2/24
<input type="checkbox"/> 4	46.77	44.64	4	1	2	SESM4	2004/1/1	2005/11/16	2006/2/24
<input type="checkbox"/> 5	46.77	44.62	8	1	3	SESM5	2004/1/1	2005/11/16	2006/2/24
<input type="checkbox"/> 6	46.77	44.60	1	0	3	SESM6	2004/1/1	2005/11/16	2006/2/24
<input type="checkbox"/> 7	46.77	44.61	2	0	1	SESM7	2004/1/1	2005/11/16	2006/2/24
<input type="checkbox"/> 8	46.77	44.63	4	0	2	SESM8	2004/1/1	2005/11/16	2006/2/24
<input type="checkbox"/> 9	46.77	44.62	8	0	3	SESM9	2004/1/1	2005/11/16	2006/2/24

### Variable Selection

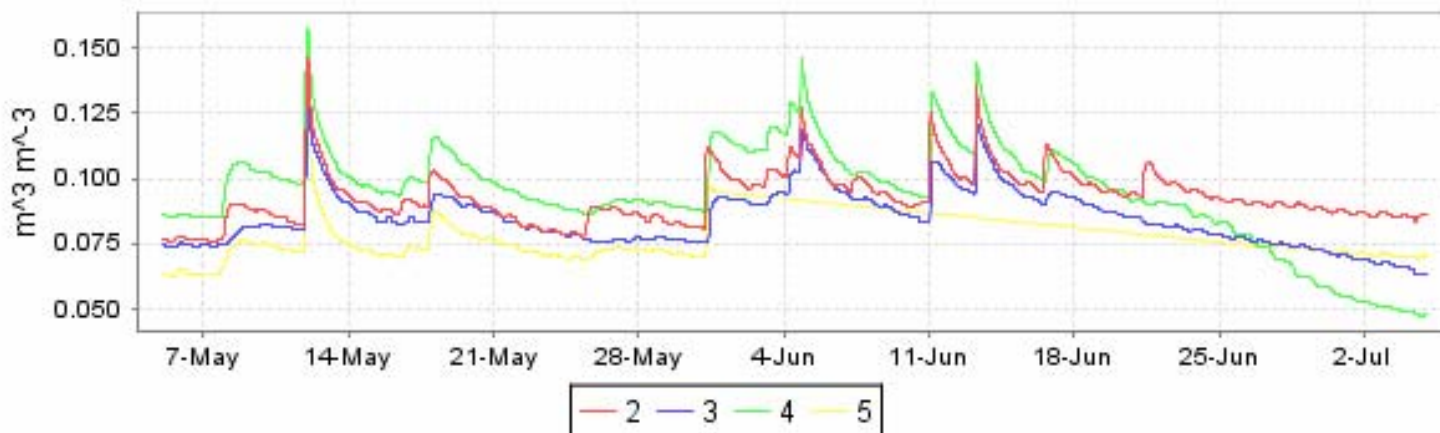
- |  |   |  |
|--|---|--|
| <input type="checkbox"/> Battery Voltage   | <input type="checkbox"/> Heat Flux 1        | <input type="checkbox"/> Raw Volumetric Moisture (25cm)  |
| <input type="checkbox"/> Internal Temp.    | <input type="checkbox"/> Heat Flux 2        | <input type="checkbox"/> Volumetric Moisture (25cm)      |
| <input type="checkbox"/> Windspeed         | <input type="checkbox"/> Temperature (10cm) | <input type="checkbox"/> Raw Volumetric Moisture (50cm)  |
| <input type="checkbox"/> Air Temp.         | <input type="checkbox"/> Temperature (25cm) | <input type="checkbox"/> Volumetric Moisture (50cm)      |
| <input type="checkbox"/> Relative Humidity | <input type="checkbox"/> Temperature (50cm) | <input type="checkbox"/> Raw Volumetric Moisture (100cm) |

# GDEX Project

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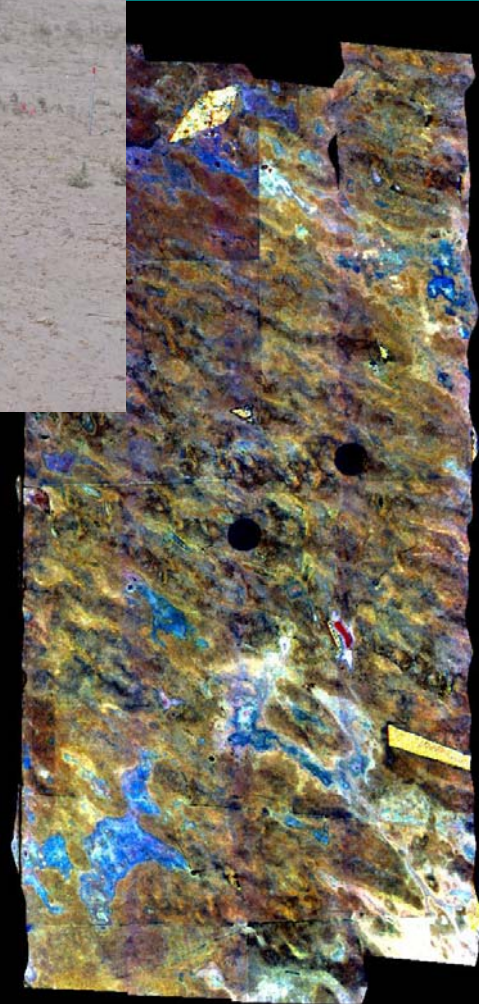
## Volumetric Moisture (25cm)

### 25 cm soil moisture (std. Mineral soil cal.)



## GDEX Treatments:

- 2 grazed control plots - part of BBR's grazing study (SESM)
- 2 ungrazed control plots - exclosure constructed May 2004 (SESM)
- 2 short-term (**pulse**) disturbance - killed May 2005, kept dead 06-07
- 2 long-term (**press**) disturbance - killed May 2005, recovery in 2006 (SESM)
- 2 aggressive bare sand (including former blowout) - killed and disked 2004, kept dead 06-07



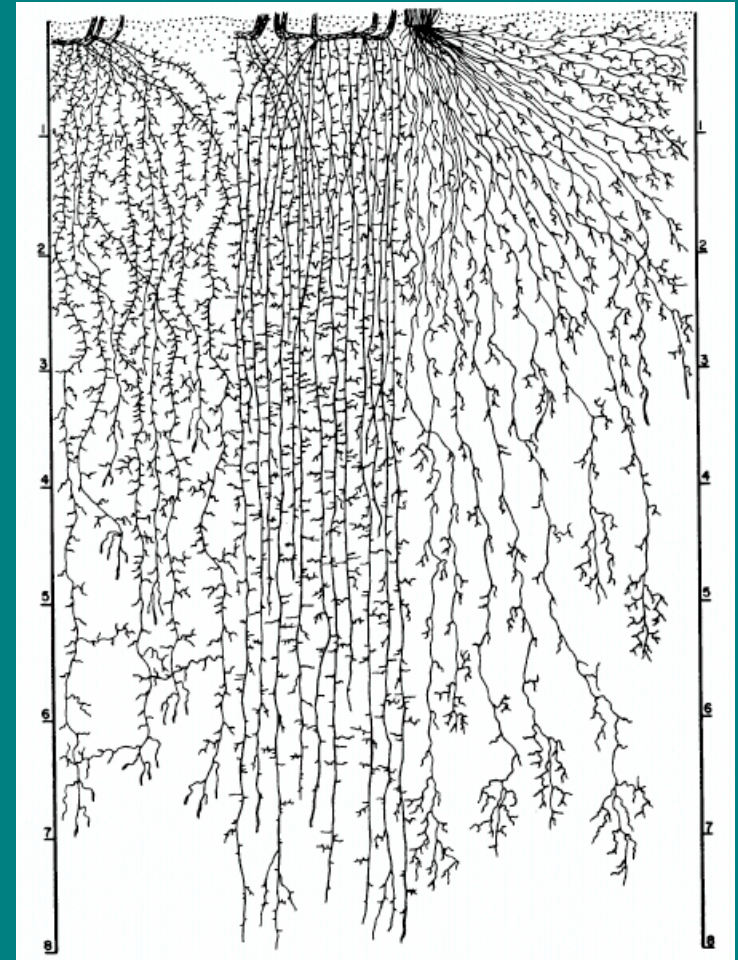
# GDEX Datasets

- Aboveground vegetation and LAI
- Soil organic matter, soil texture
- Sand movement (erosion pins)
- Soil respiration (CO<sub>2</sub> flux)
- Watertable dynamics
- Root biomass and length
- Soil nitrogen availability
- Soil microbial abundance and comp.
- Soil hydraulic conductivity
- Soil moisture (3 meter, surface, SESM)
- Remote sensing of land cover
- Targets of opportunity (nematodes, mammals)



# How deep is the root zone of Sandhills grasslands?

- All of our atmospheric and hydrologic models assume we know the rooting depth from which plants use moisture
- Classic studies of Weaver are still the “benchmark” for our understanding of grass roots
- Example - the Sandhills Atlas says little bluestem roots to 8 feet depth (maximum depth)

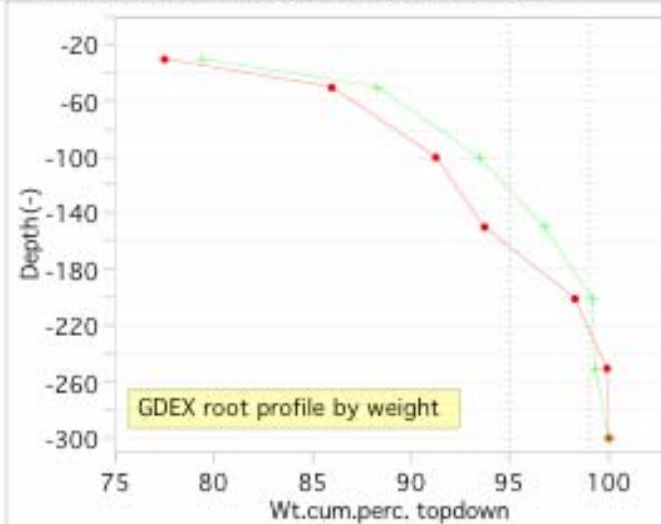


# Observed rooting depth in GDEX (Nick Dobesh)



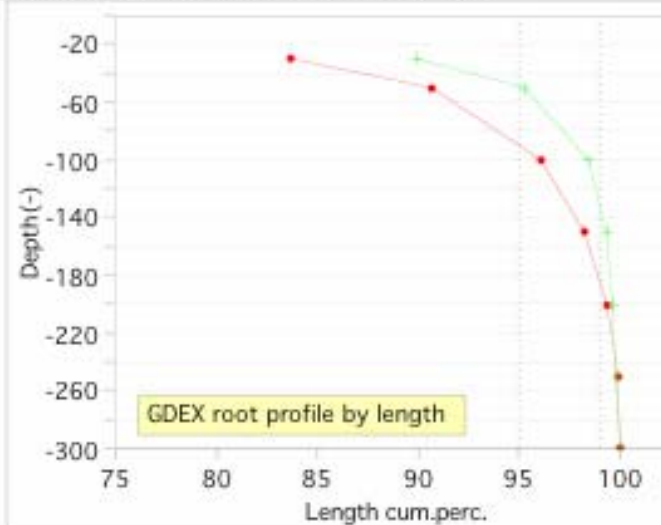
Fit Y by X Group

Bivariate Fit of Depth(-) By Wt.cum.perc. topdown



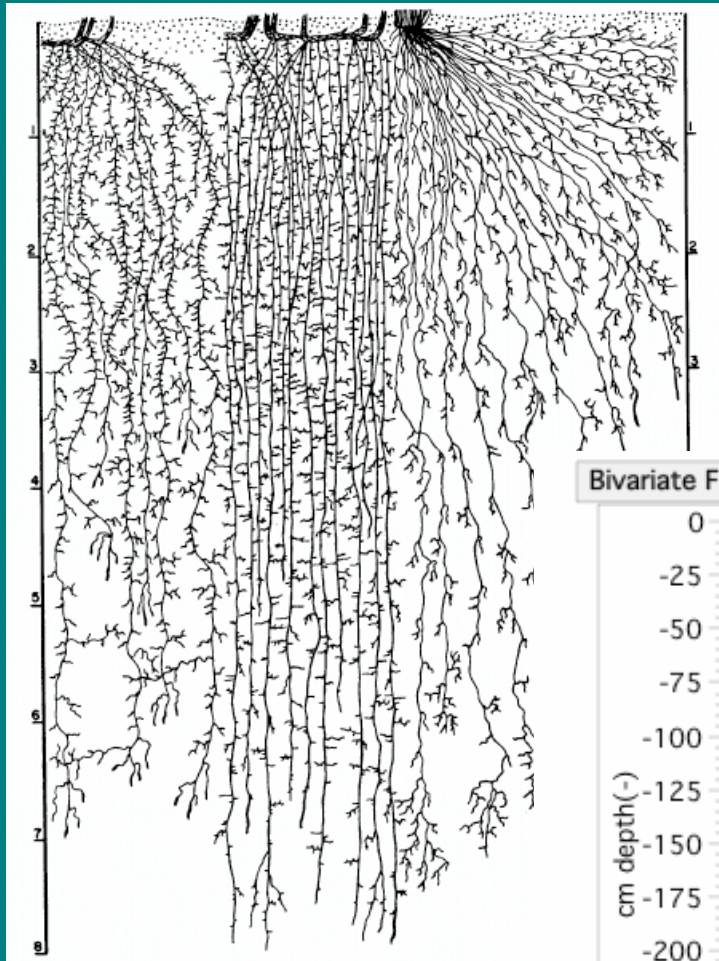
— Fit Each Value topo=="summit"  
— Fit Each Value topo=="toeslope"

Bivariate Fit of Depth(-) By Length cum.perc.

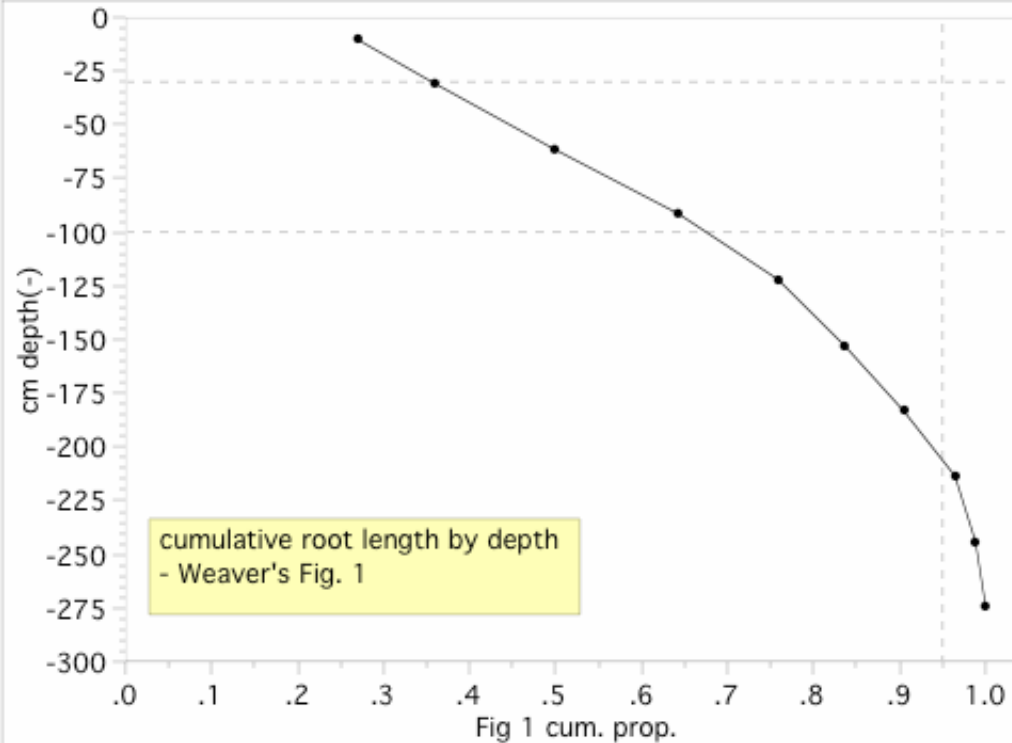


— Fit Each Value topo=="summit"  
— Fit Each Value topo=="toeslope"

Weaver - 95% cumulative root length at 225cm  
Our data - 95% cumulative root length at 50-90cm



Bivariate Fit of cm depth(-) By Fig 1 cum. prop.

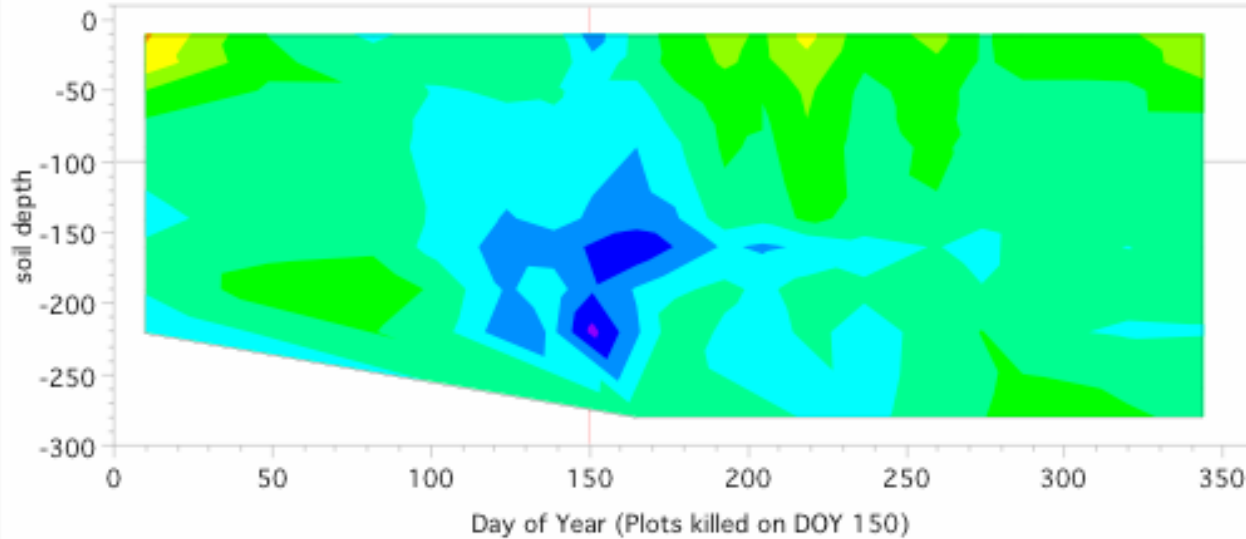


Fit Each Value

# soil moisture to 3 meters depth in live and dead plots

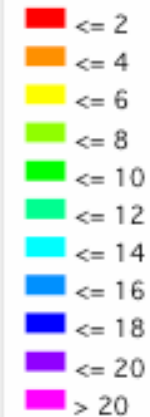
Live/Dead=dead

Contour Plot



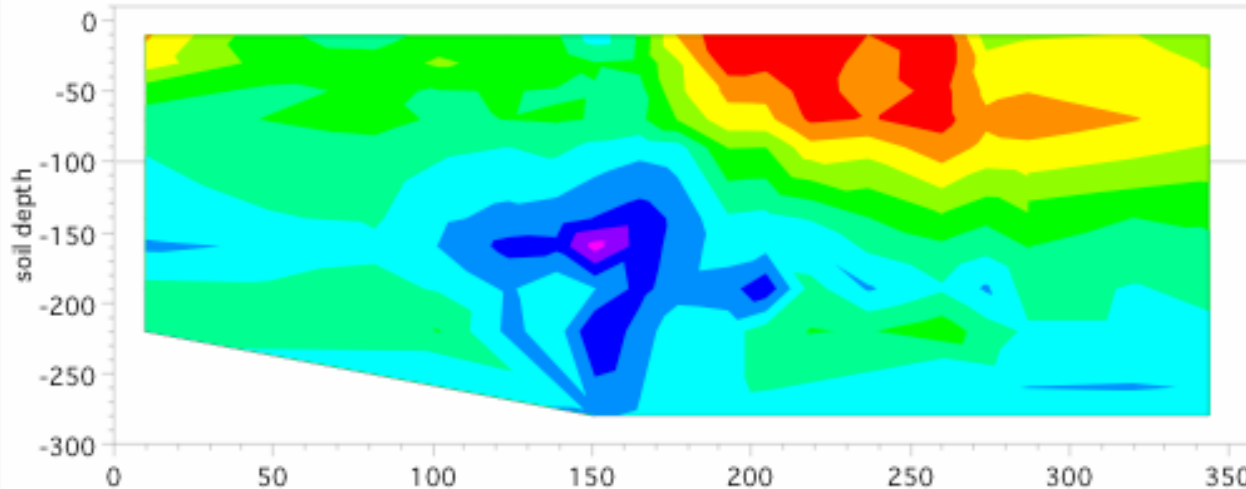
GDEX 2005, all dead plots volumetric soil moisture (high and mid topography)

%VSM



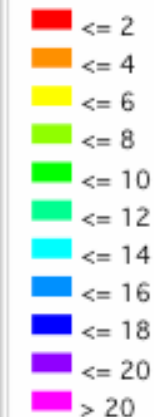
Live/Dead=live

Contour Plot



GDEX 2005, all live plots volumetric soil moisture (high and mid topography)

%VSM



Soil moisture  
to 3m depth  
in control  
plots: high,  
low and mid  
slope  
positions.

GDEX 2005

