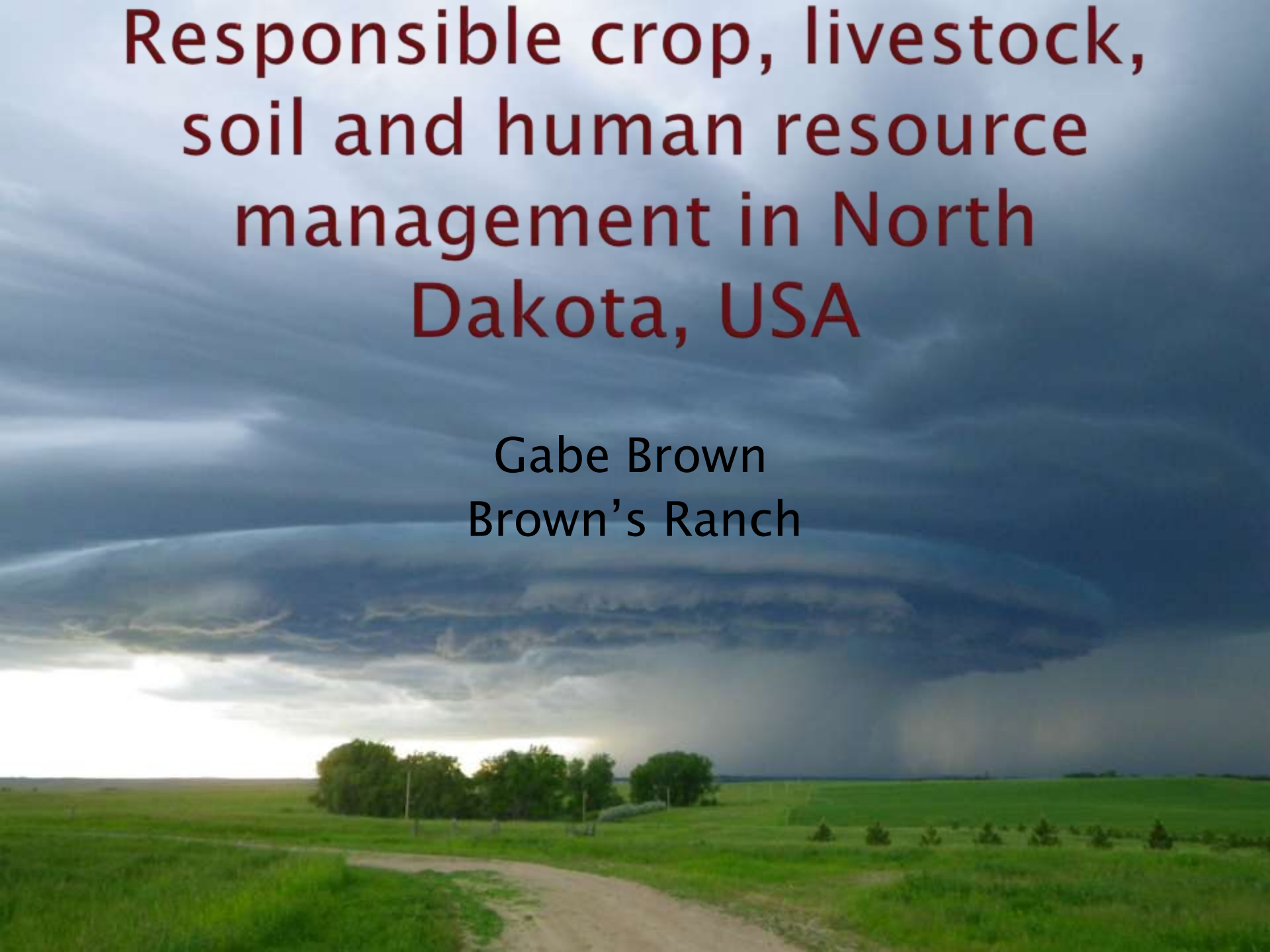


# Responsible crop, livestock, soil and human resource management in North Dakota, USA

Gabe Brown  
Brown's Ranch





# Ranch Location: Tundra?



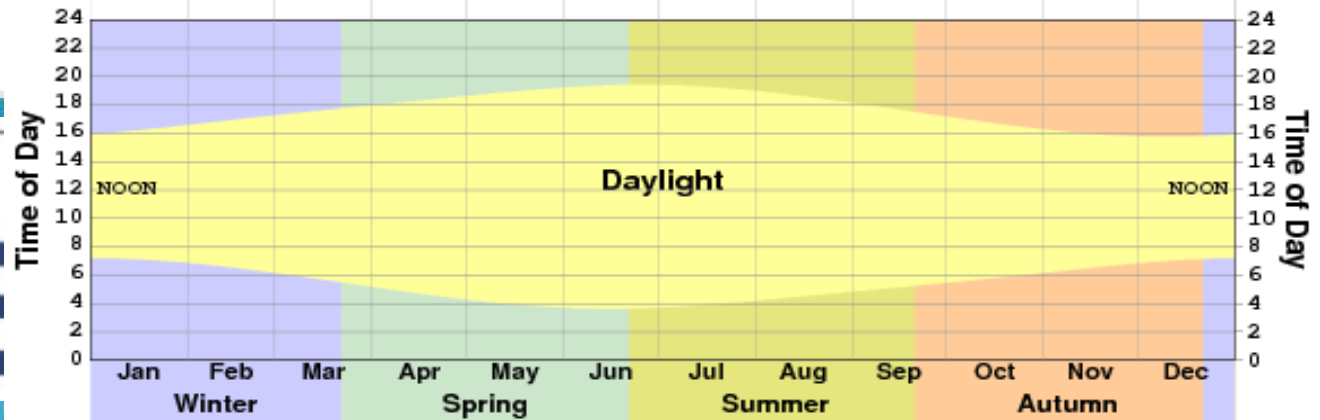
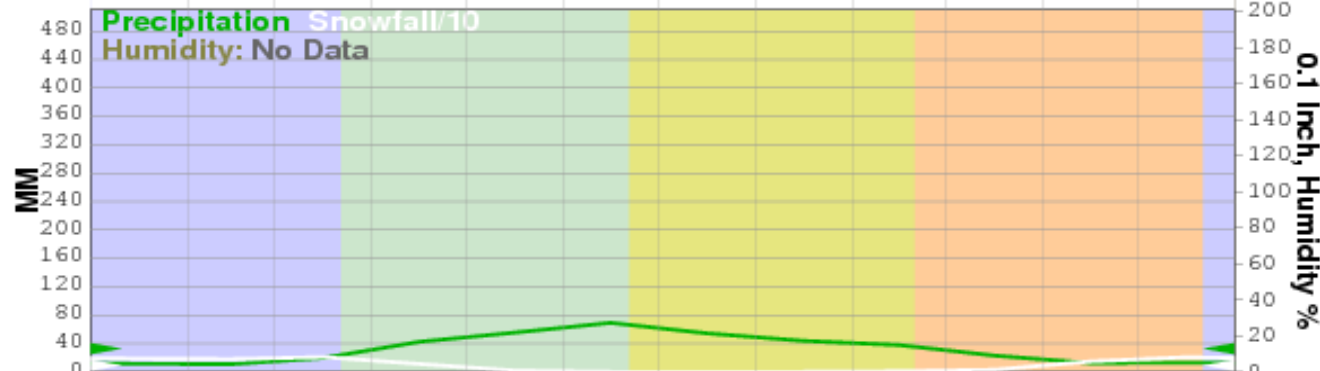
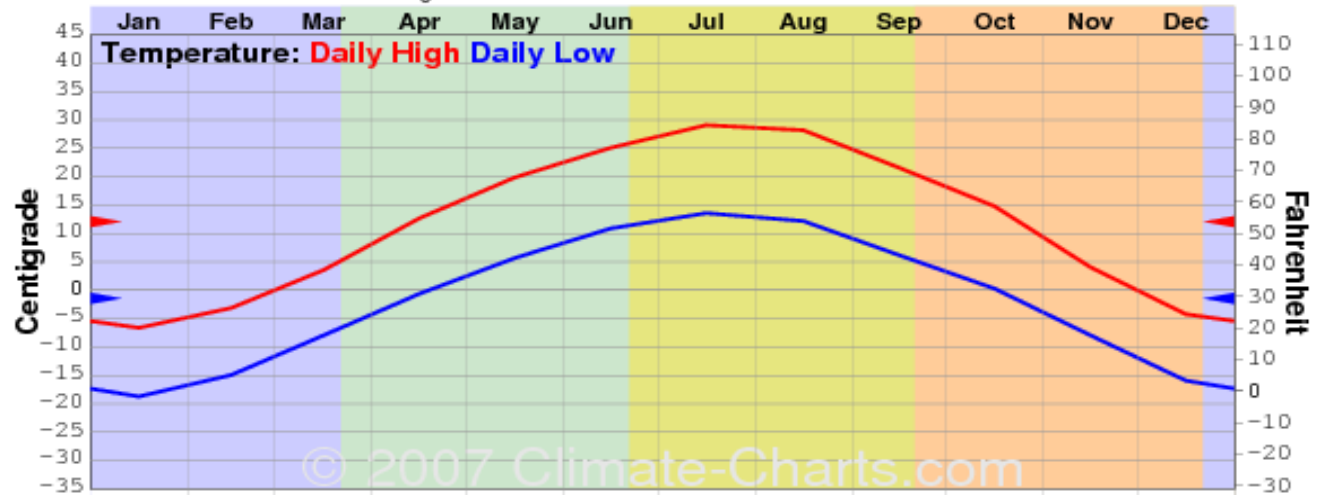


# North Dakota Plains



# Bismarck, ND, USA

Latitude: 46°46'N Longitude: 100°46'W Elevation: 502m Station: US72764003208191



Avg. January Temp. -11  
Avg. July Temp. 21

Avg. Total Precip. 450mm  
Low January 11mm  
High June 80mm

# Same Soils: Dynamic Soil Properties Changed!

62.8% loss  
of SOM after  
17 yr  
intensive  
tillage






# Monocultures: A Detriment to Soil Health



I came to the  
conclusion that I was  
disconnected from the  
land!





- ▶ I had come to accept a degraded resource!!!
  - ▶ I NEEDED TO REGENERATE MY LANDSCAPE!!!
- 

# How do we improve soil health?





# The Answer is to Imitate Native Rangeland





# Diversity!





# Diversity *in the Cropping System*

Cool-Season Grass



Cool-Season Broadleaf



Warm-Season Grass



Warm-Season Broadleaf



# Brown's Ranch Cash Crops 2011

**Wheat – CSG**  
**Oats – CSG**  
**Triticale – CSG**

**Hairy Vetch – CSB**  
**Red Clover – CSB**  
**Peas – CSB**

**Corn – WSG**

**Alfalfa – WSB**  
**Sunflower – WSB**



The greatest roadblock in solving a problem is the human mind!



# Turnip July 31





# Oilseed Radish July 31





# Cocktail July 31



# 2006 Production On District Plot

▶ Oilseed Radish	1415 kg/ha
▶ Purple Top Turnip	1699 kg
▶ Pasja Turnip	2325 kg
▶ Soybean	1680 kg
▶ Cowpea	2149 kg
▶ Lupin	1384 kg
▶ Cocktail Mix (1 / 2 Rate)	5374 kg
▶ Cocktail Mix (Full Rate)	4885 kg



# Cover Crops!





# Cover Crops 2011

## Annual Ryegrass – CSG

Canola – CSB  
Radish – CSB  
Turnip – CSB  
Lentil – CSB  
Sweet Clover – CSB  
Phacelia – CSB  
Sub Clover – CSB  
Buckwheat – CSB  
Kale – CSB

Hybrid Pearl Millet – WSG  
German Millet – WSG  
Sorghum/Sudangrass –  
WSG

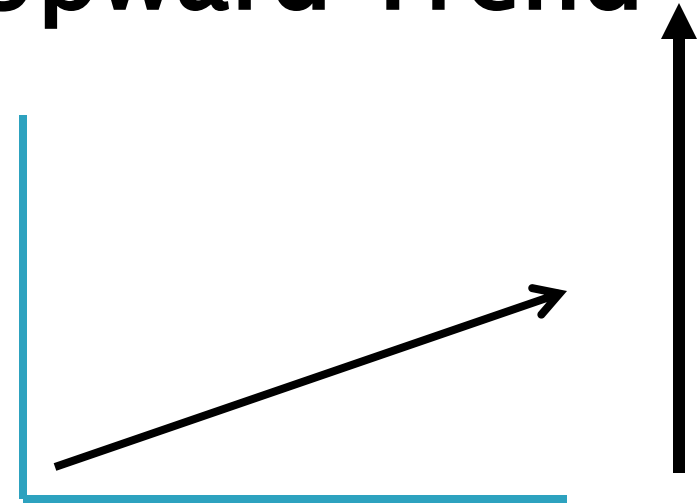
Sugarbeet – WSB  
Cowpea – WSB  
Soybean – WSB  
Sunn Hemp – WSB

# Soil Organic Matter

Cover Crops provide a continual live root to harvest additional sunlight



## Upward Trend



1993

1.7 to 2%

Present

4.3 to 5.3%



# Organic Matter and Available Water Capacity

## MM of Water/30.48 cm of Soil

Percent SOM	Sand	Silt Loam	Silty Clay Loam
▶ 1	25.40	48.26	35.56
▶ 2	35.56	60.96	45.72
▶ 3	43.18	73.66	55.88
▶ 4	53.34	88.90	66.04
▶ 5	63.50	101.60	76.20

Berman Hudson

Journal Soil and Water Conservation 49(2) 189–194

March – April 1994

Summarized by:

Dr. Mark Liebig, ARS, Mandan, ND

Hal Weiser, Soil Scientist, NRCS, Bismarck, ND

# Value of SOM

Assumptions: 2,241 mt of soil in top 6".

1% OM = 22.41 mt./ha

Nutrients:

Nitrogen: 2471# \$.56/lb. N = \$1383.

Phosphorus: 247# \$.67/lb. P = \$165.

Potassium: 247# \$.54/lb. K = \$133.

Sulfur: 247# \$.50/lb. S = \$123.

Carbon: 24710# \$4/T = \$49.

Value of 1% SOM nutrients/ha = \$1853.

**5% SOM**

**= \$9,265**



# Cool Season Cocktail



# Providing Plant Diversity for the Whole: Above and Below Ground

- ▶ Forage Pea
  - ▶ Forage Oats
  - ▶ Triticale
  - ▶ Hairy Vetch
  - ▶ Red Clover
  - ▶ Turnips
  - ▶ Radish
  - ▶ Kale
- 



# Diversity!





# Phacelia and a Native Pollinator





# Optimizing Solar Energy





Before Grazing





# High Stock Density



Grazing initiates plants to release root exudates thus feeding soil biology.





After – Litter on the Soil Surface





# Fertility! (Natural vs. Synthetic)





# Fall Seeded Biennials





# Winter Triticale/Hairy Vetch/ Sweetclover/Canola





# Mob Grazing High Carbon Biennials





# Cattle?





# Next Move





# Carbon!

