Soil Health & Grazing

Case Studies

Joshua Dukart

Holistic Mgmt Certified Educator

Bismarck, ND

701.870.1184

joshua_dukart@yahoo.com

www.ndglc.com


Black Leg Ranch
McKenzie, ND


GOALS
Multi-Generational Ranch
Quality of Life
Profitability
Soil Health
Cow/Calf Operation
Yearling Contract Grazing
Wildlife Habitat & Guiding
Agri-Tourism
Cash Grain Farming
Education

Grazing Distribution

2000 yearlings on 80 acres


Adding Biology with
Animal Impact


2,000 Yearlings Grazed this 160 ac pasture for 4 days.
We are still harvesting solar energy.


Ground Cover After Grazing

Releasing Diversity

Landscaping


Healing Fragile Land

BALANCING PERFORMANCE

LAND PERFORMANCE

- Once-over grazing strategy
- Most pastures in a given year
- Increase recovery time
- Higher carbon plants
- Increase soil health
- Meet wildlife habitat goals

LIVESTOCK PERFORMANCE

- Twice-over grazing strategy
- Some pastures in a given year
- Decrease recovery time
- Lower carbon plants
- Increase gain *later in the season*
- Meet cattle performance goals

Bridging the gap between grazing & cropping

Addressing Resource Concerns

Crop	Vertical Structure	Legume	Nitrogen Scavenger	Wildlife	Pollinators	Carbon	Deep Rooted
Proso Millet				+		Med	
Pearl Millet	†					Med	
Sudan	†					Med	
Corn	†			+		High	
Soybean		♣			*	Low	
Cowpea		♣			*	Low	
Sweet Clover		♣				Low	
Radish			♦		*	Low	X
Turnip			♦			Low	X
Sunflower	†			+	*	Med	X

COVER CROP MIX 2010

300 ACRES

Pearl Millet 1 lb	@ $.74/lb
Proso Millet 2 lbs	@ $.25/lb
Sudan 4 lbs	@ $.45/lb
Soybean 15 lbs	@ $.53/lb
Cowpea 10 lbs	@ $1.13/lb
Sunflower 1 lb	@ $4.00/lb
Radish 2 lbs	@ $1.53/lb
Turnip 1 lb	@ $1.53/lb
Sweet Clover 1 lb	@ $1.40/lb
Corn 1 lb	@ $1.25/lb

$33.53 per acre

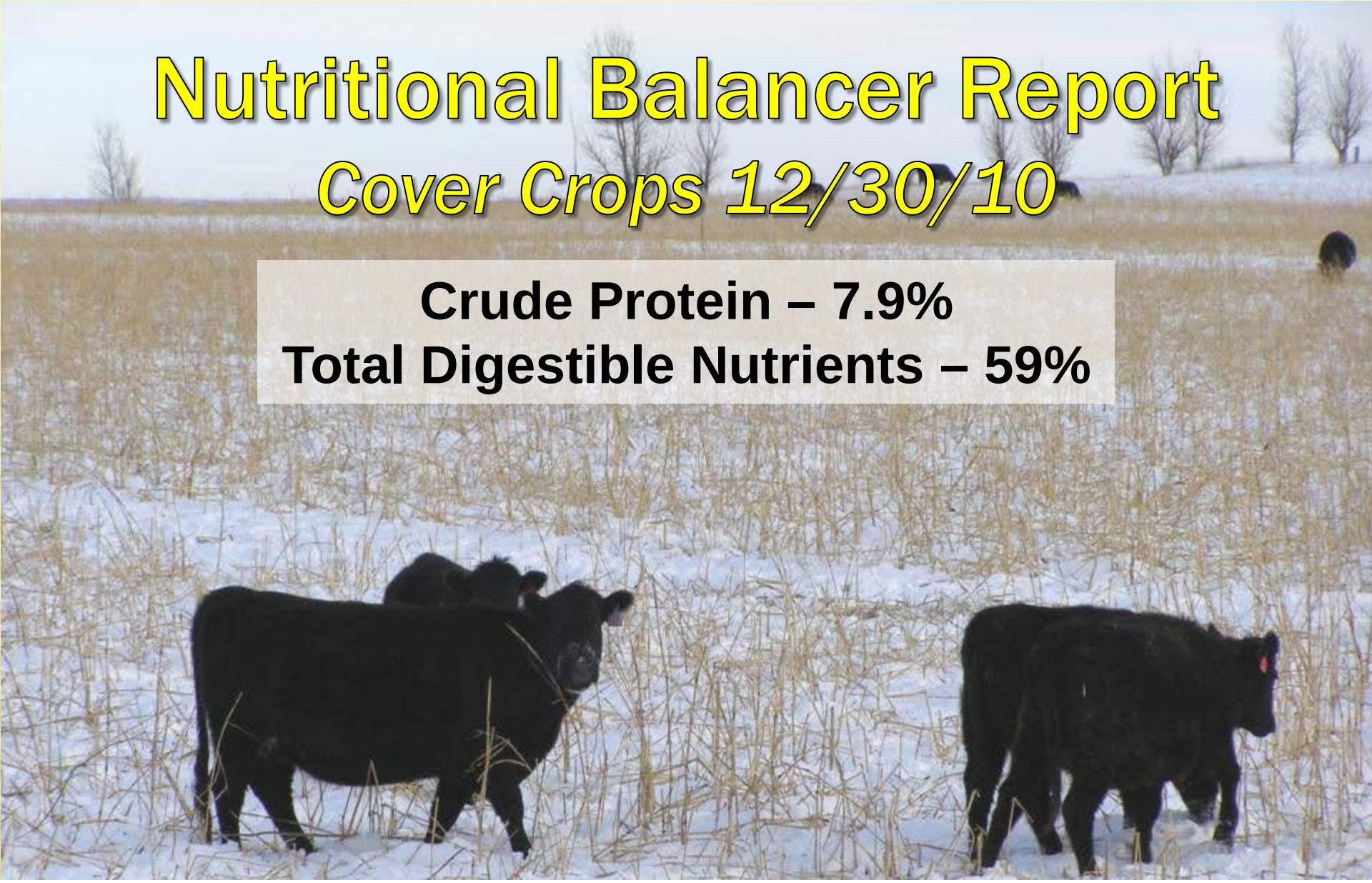
Managing to Increase Wildlife

Turned in 350 dry cows on
November 29, 2010
Grazed with no additional feed until
January 3, 2011

Nutritional Balancer Report

Cover Crops 12/30/10

Crude Protein – 7.9%
Total Digestible Nutrients – 59%



Cows can perform well with winter grazing when they calve in sync with nature

CORN ON COVER CROP

- Total Biology – 1774 ng/g soil
- Bacteria – 1473 ng/g soil
- Fungi – 147 ng/g soil
- Mycorrhiza – 37 ng/g soil

COVER CROP ON COVER CROP

- Total Biology – 3312 ng/g soil
- Bacteria – 2510 ng/g soil
- Fungi – 513 ng/g soil
- Mycorrhiza – 251 ng/g soil

BIOLOGICAL SOIL TESTS

Biological Ag Waste System

End of a Successful Hunt

Cover crops and intensive grazing provide the food and habitat.

Management has allowed for more livestock, while allowing for the wildlife population to increase and flourish.

Agri-tourism offers another opportunity to stack enterprises


Browns Ranch
Bismarck, ND

Opportunities with CRP


Total Rest Represents
an
Incomplete Whole

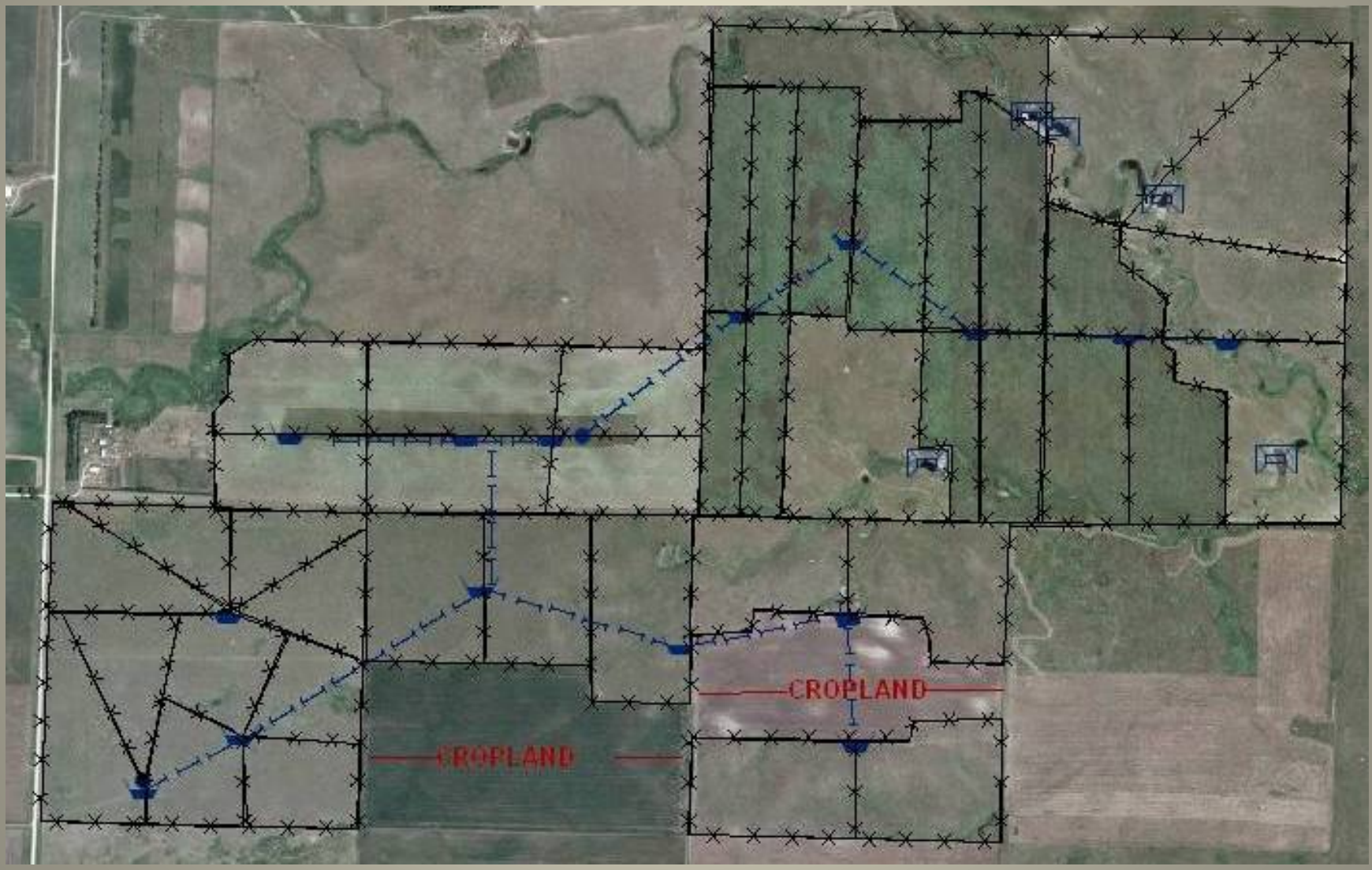
Limited Diversity

2007

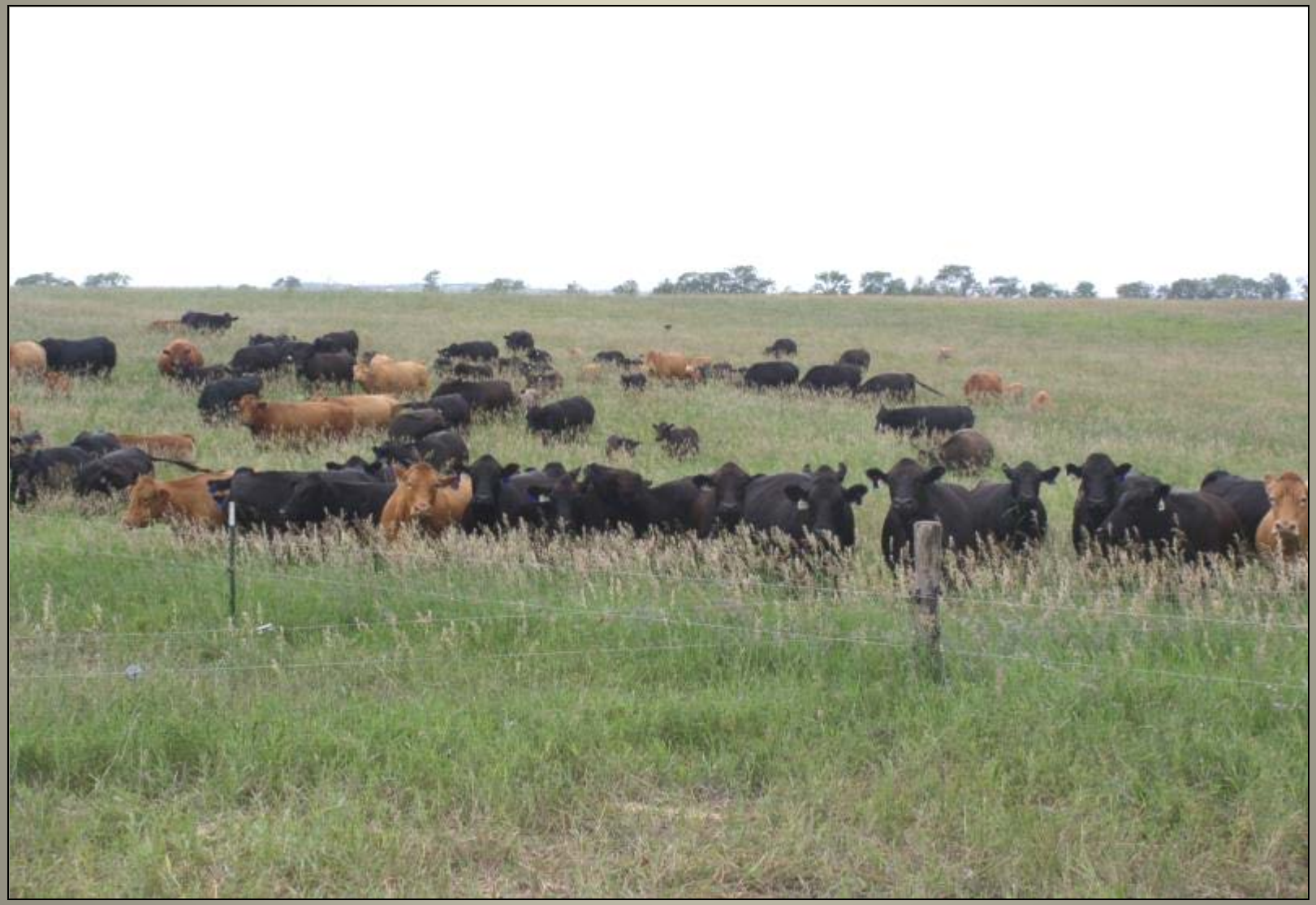
Livestock Pipeline & Tanks

Season-long to Rotational Grazing

Recovery Based Grazing

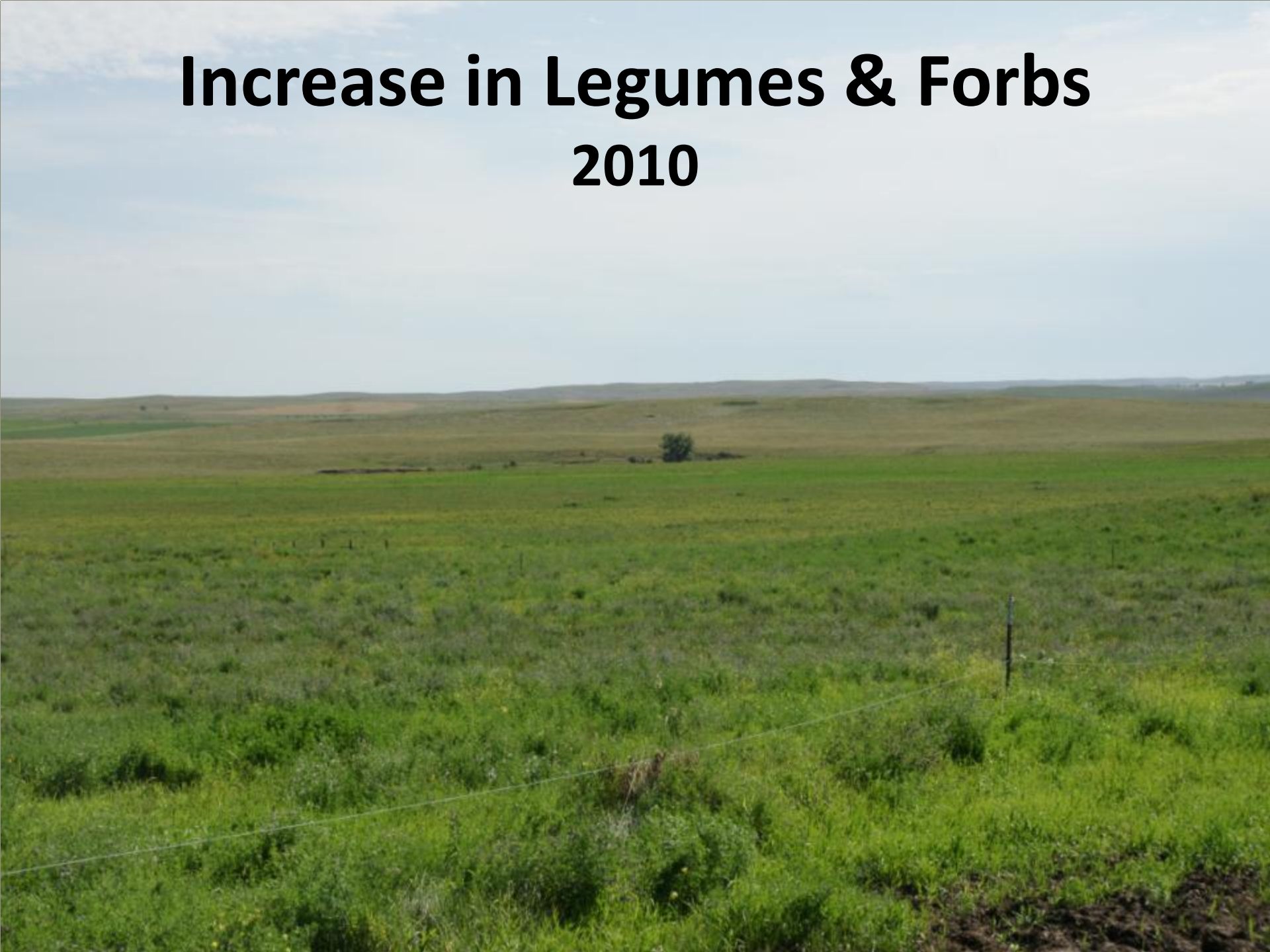


Stock Density



Increase in Legumes & Forbs

2010



Cowbirds


Dung Beetles

Nature's Pest Control

Ramping up soil health with a biological primer

Stock Density

300 yearlings on 1/3 acre

675 AU/acre


Before
• 7 species mix
– Oats
– Triticale
– Peas
– Hairy Vetch
– Turnips
– Radish
– Sugarbeet

Return Plant Material to the soil surface


Mulch & Seedbed prepared by Livestock

Food & a Home for Soil Biology


June 16th, 2009


July 1, 2009
Residue disappearing too quickly


October 2009

Nutrient Cycling

Carbon/Nitrogen Ratios

• Soil Microorganisms, Bacteria*	5/1
• Soil Organic Matter*	11/1
• Young Alfalfa Hay*	13/1
• Rotted barnyard manure*	20/1
• Mature Alfalfa Hay*	25/1
• Protozoa**	30/1
• Corn Stover*	57/1
• Wheat Straw*	80/1
• Newspaper*	120/1
• Deciduous Wood**	300/1

Source:

* The Nature and Properties of Soils, fourteenth Edition. Nyle C. Brady and Ray R. Weil

** Elaine R. Ingham, Soil Food Web

Build SOM (Carbon)

Live Root 24/7/365

Value of SOM

Assumptions: *** 2,000,000 pounds of soil in top 6"*
*** 1% OM = 20,000 pounds*

Nitrogen:	1000# $.50/lb. N	= $500
Phosphorus:	100# $.48/lb. P	= $48
Potassium:	100# $.42/lb. K	= $42
Sulfur:	100# $.50/lb. S	= $50
Carbon:	10000# $4/T	= $20
Value of 1% SOM nutrients/acre		= $650
4% SOM nutrients/acre		= **$2,600**

Soil Organic Matter and Available Water Capacity
Inches of Water/One Foot of Soil

Percent SOM	Sand	Silt Loam	Silty Clay Loam
1	1.0	1.9	1.4
2	1.4	2.4	1.8
3	1.7	2.9	2.2
4	2.1	3.5	2.6
5	2.5	4.0	3.0

Berman Hudson

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

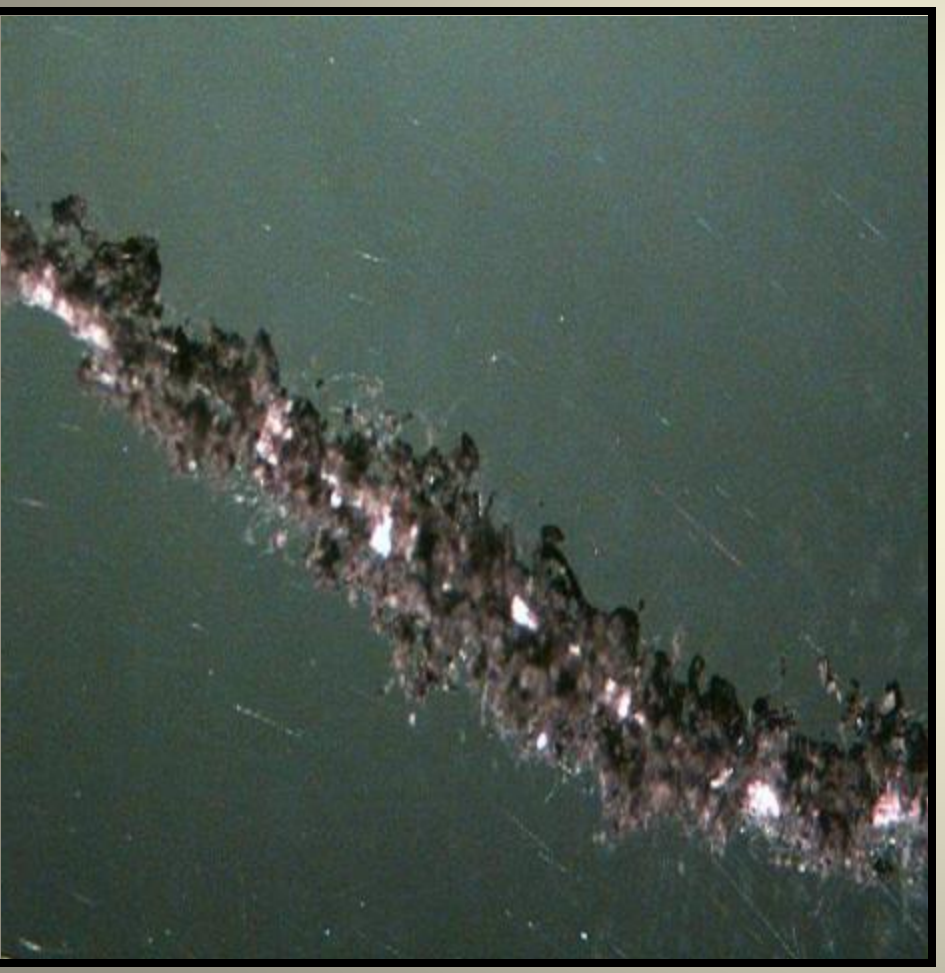
March – April 1994

Summarized by:

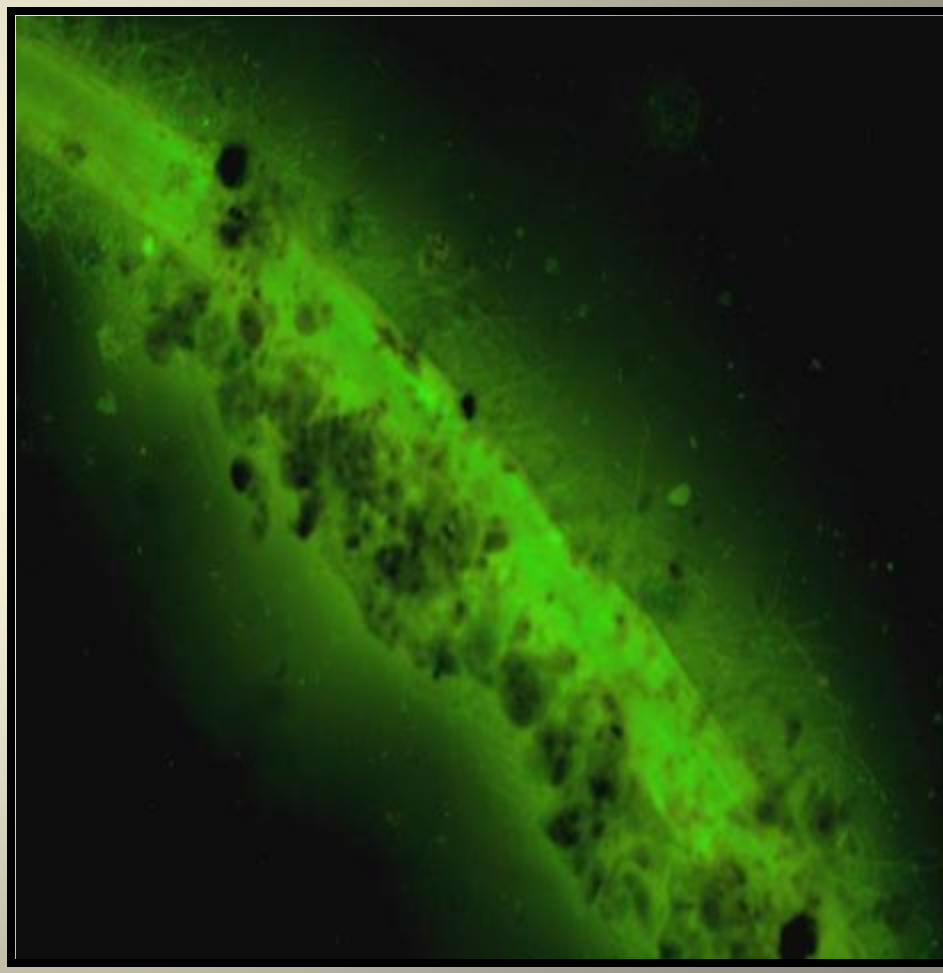
Dr. Mark Liebig, ARS, Mandan, ND

Hal Weiser, Soil Scientist, NRCS, Bismarck, ND

Soil Aggregates

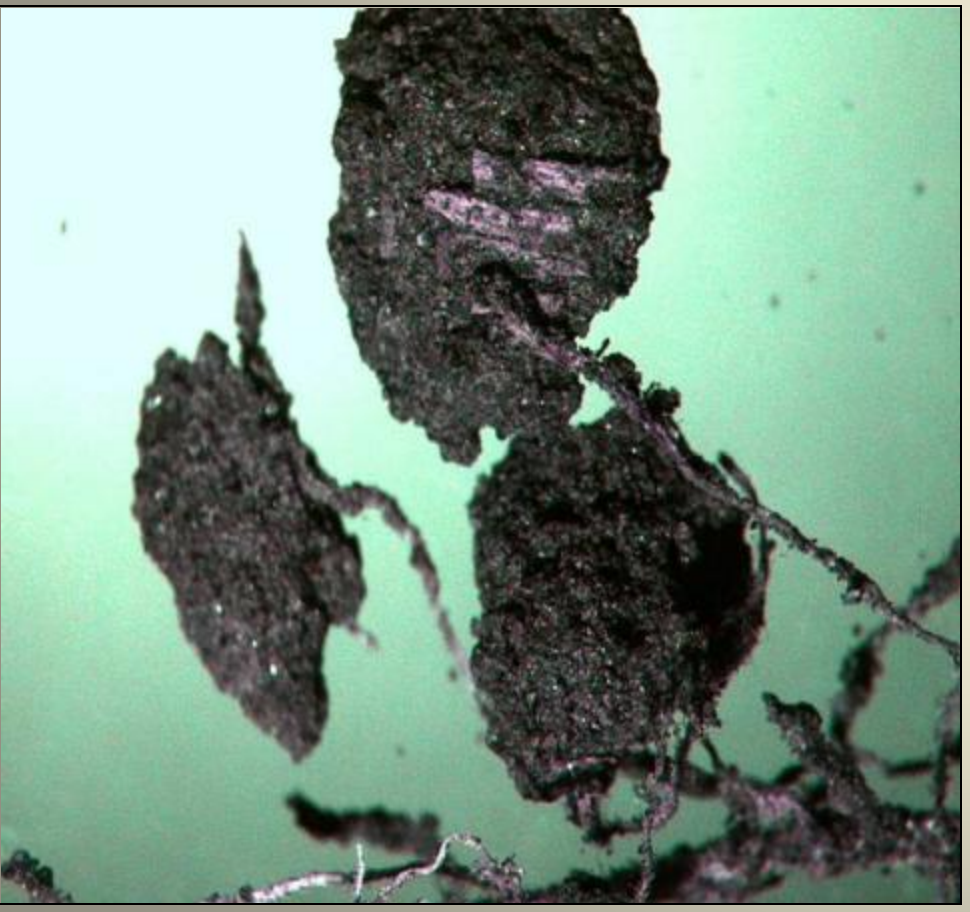


Glomalin & Hyphae

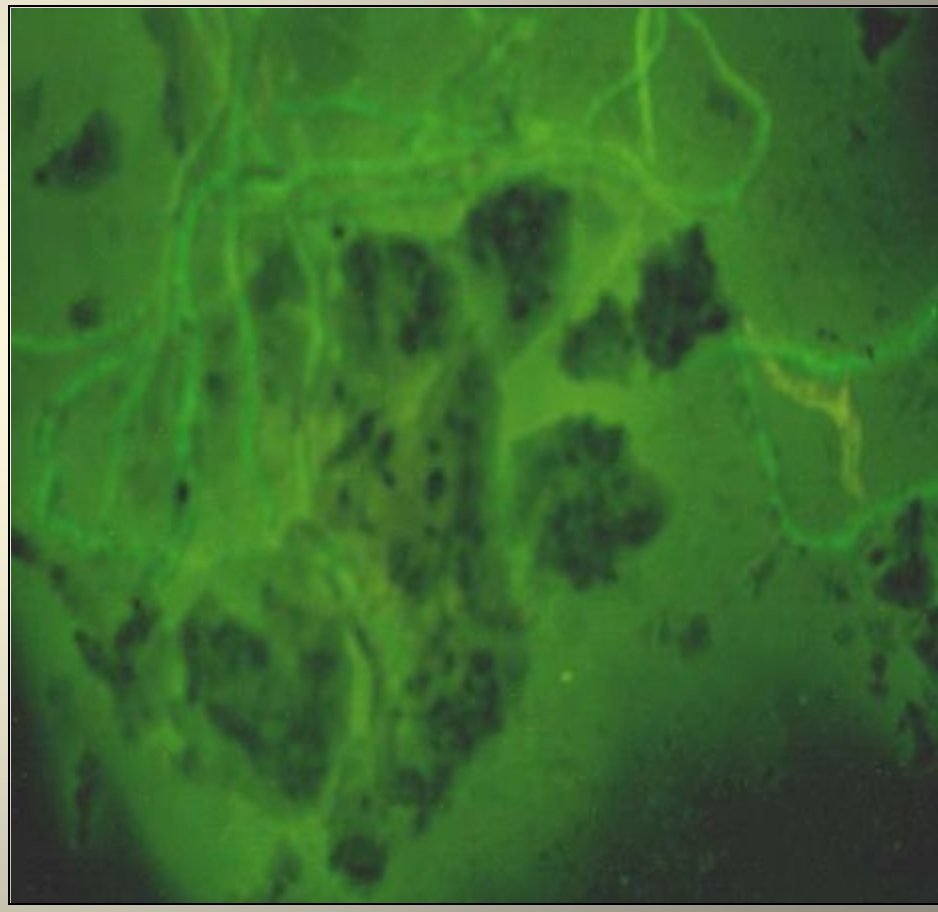


Dr. Kris Nichols, Microbiologist, ARS, Mandan, ND

Enlarged Soil Aggregates



Glomalin and Hypae



Dr. Kris Nichols, Microbiologist, ARS, Mandan, ND


12.2 inches
in
5.5 hours


159 Bu Corn
0 Commercial Fertility
2011

Tissue Sample

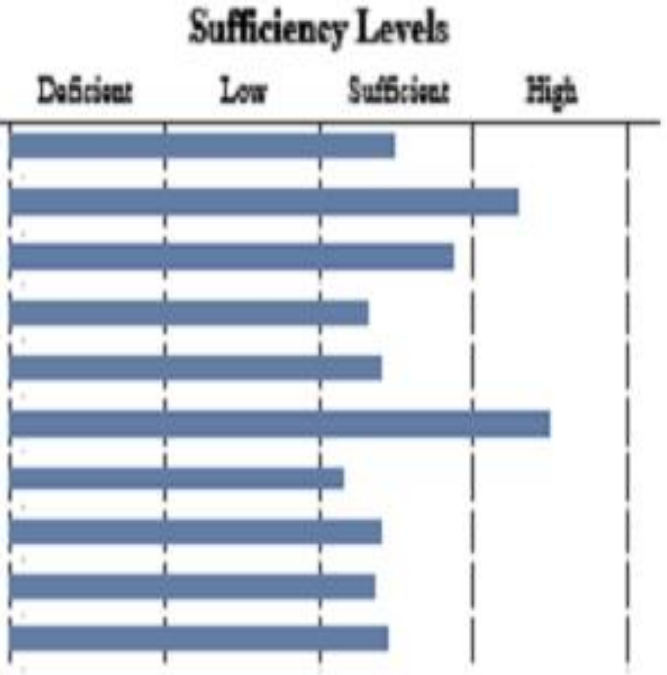
Taken from Non-Fertilized Corn

Results For : GABE BROWN
Location :
Sample ID : CORN

Plant Type : Corn
Stage : Tassel

WARD Laboratories, Inc

	Result Dry Basis
Nitrogen ,% N	3.05
Phosphorus, % P	0.42
Potassium, % K	2.52
Calcium, % Ca	0.43
Magnesium, % Mg	0.22
Sulfur, % S	0.33
Zinc, ppm Zn	25
Iron, ppm Fe	143
Manganese, ppm Mn	67
Copper, ppm Cu	11.8



Soil Foodweb Analysis

Long Term No-Till w/ High Diversity

Report prepared for:
Burleigh Co. Soil Conservation
Vicki Bailey
1511 E. Interstate Avenue
Bismarck, ND 58503-0560 US
(701) 250-4363
vicki.bailey@nd.nacdnet.net

Report Sent: 07/29/2005
Sample#: 01-100984
Unique ID: GB1
Plant: Corn
Invoice Number: 8357
Sample Received: 07/14/2005

For interpretation of this report please contact:
Local Advisor: or regional lab
Soil Foodweb, Inc
info@soilfoodweb.com
(541) 752-5066
Consulting fees may apply

Organism Biomass Data	Dry Weight	Active Bacterial (µg/g)	Total Bacterial (µg/g)	Active Fungal (µg/g)	Total Fungal (µg/g)	Hyphal Diameter (µm)
Results	**0.850**	46.3	405	**5.24**	274	2.5
Comments	To Wet	Excellent	Excellent	Low	Good	
Expected Range Low	0.45	15	100	15	100	
Expected Range High	0.85	25	300	25	300	

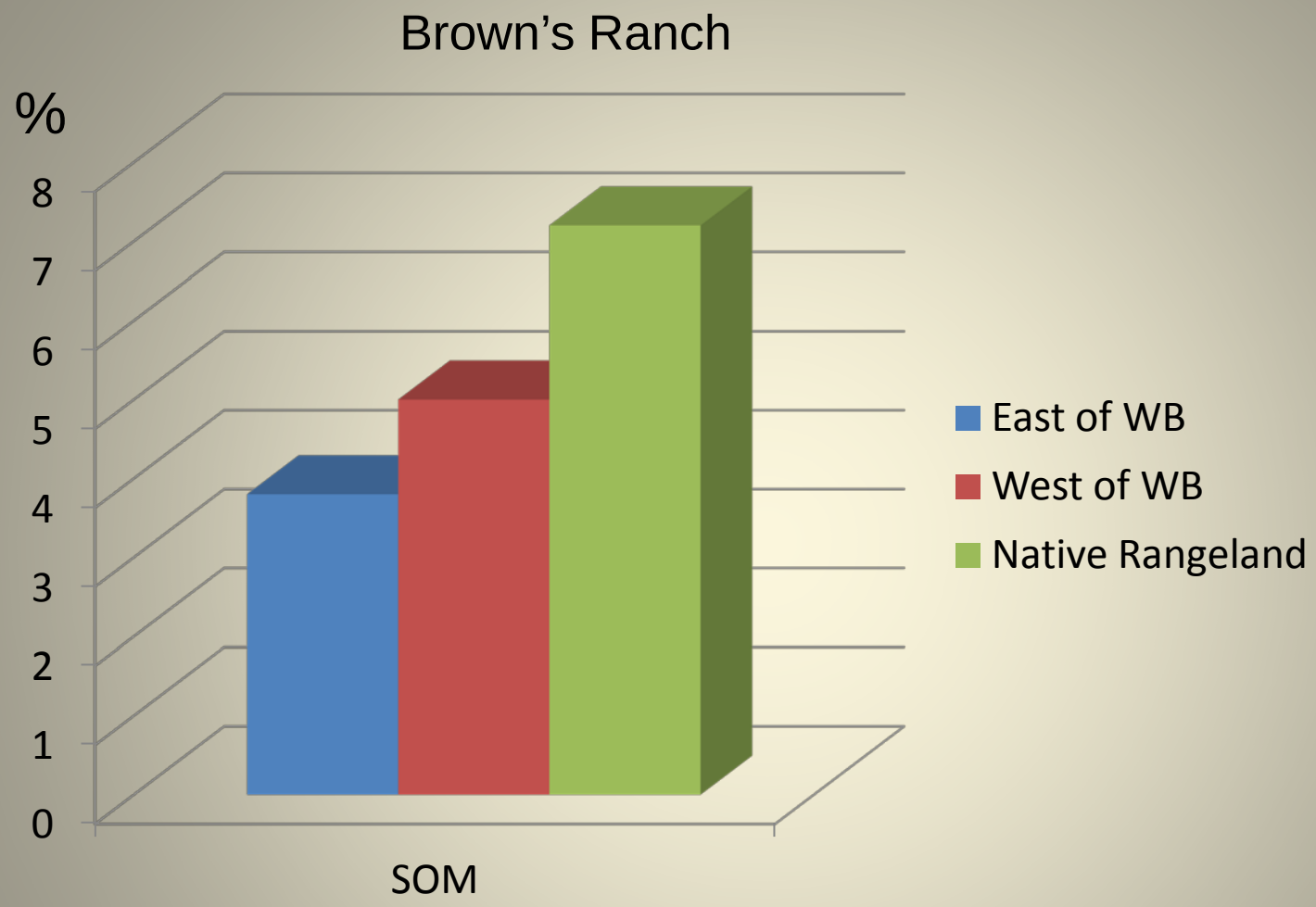
	Protozoa Numbers/g			Total Nematodes #/g	Percent Mycorrhizal Colonization	
	Flagellates	Amoebae	Ciliates		ENDO	ECTO
Results	178500	**9736**	331	**4.45**	**31%**	**0%**
Comments	High	Low	High	Low	Low	Low
Expected Range Low	10000	10000	50	20	40%	40%
Expected Range High			100	30	80%	80%

Organism Biomass Ratios	Total Fungal to Total Bacterial	Active to Total Fungal	Active to Total Bacterial	Active Fungal to Active Bacterial	Plant Available N Supply
Results	**0.68**	**0.02**	**0.11**	**0.11**	200+
Comments	Low	Low	Low	Low	
Expected Range Low	0.8	0.25	0.25	0.75	
Expected Range High	1.5	0.95	0.95	1.5	

Nematodes per Gram of Soil
Identification to genus

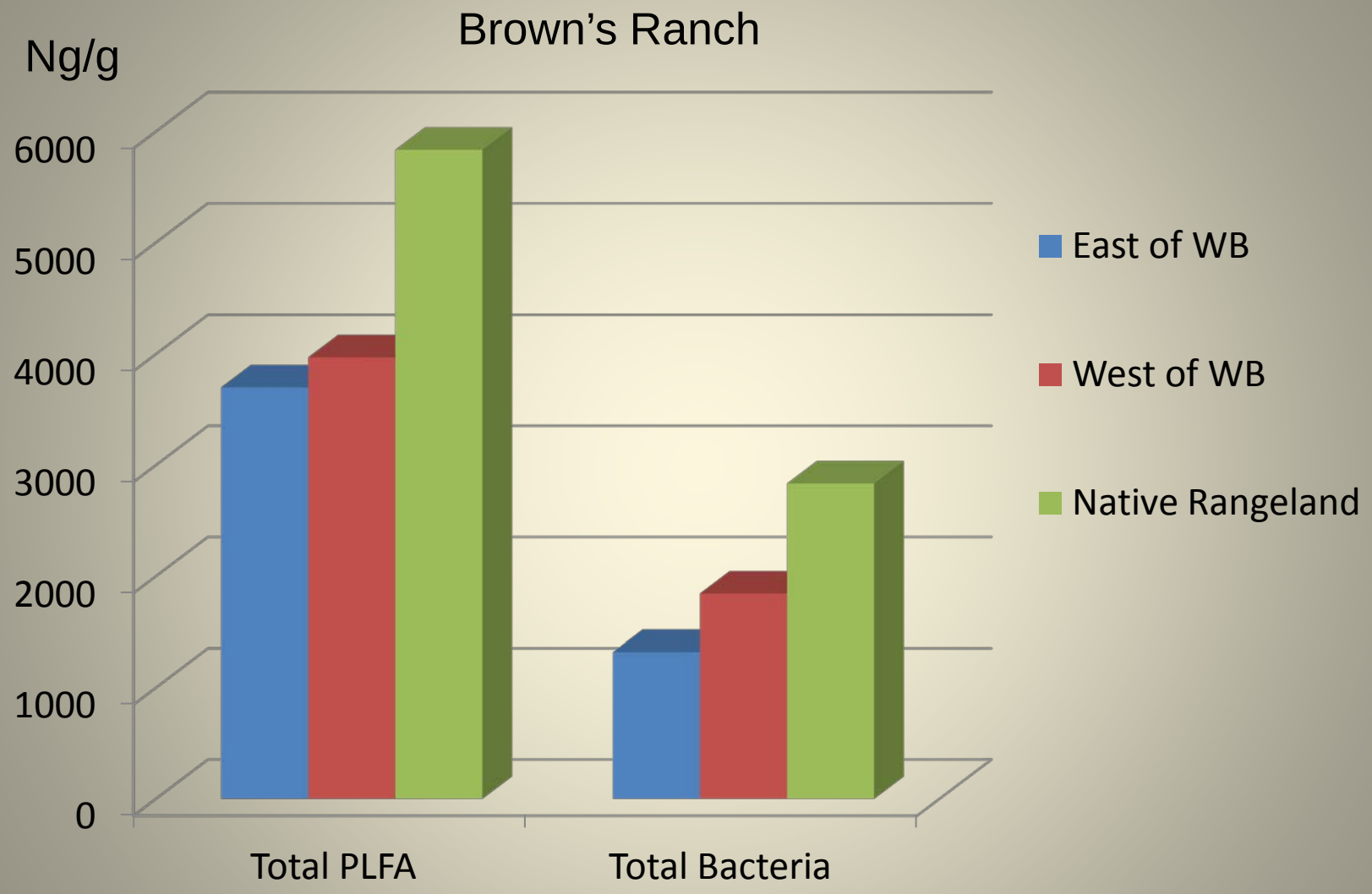
Bacterial Feeders		
Acrobeles		0.81
Acrobeloides		0.18
Cephalobus		0.45
Cervidellus		0.18
Rhabditidae		0.45
Fungal Feeders		
Eudorylaimus		0.09
Fungal/Root Feeders		
Aphelenchoides	Foliar nematode	0.54
Aphelenchus		0.45
Ditylenchus	Stem & Bulb nematode	0.54
Filenchus		0.09

Ward Laboratories, Inc
Test Date 10/2012



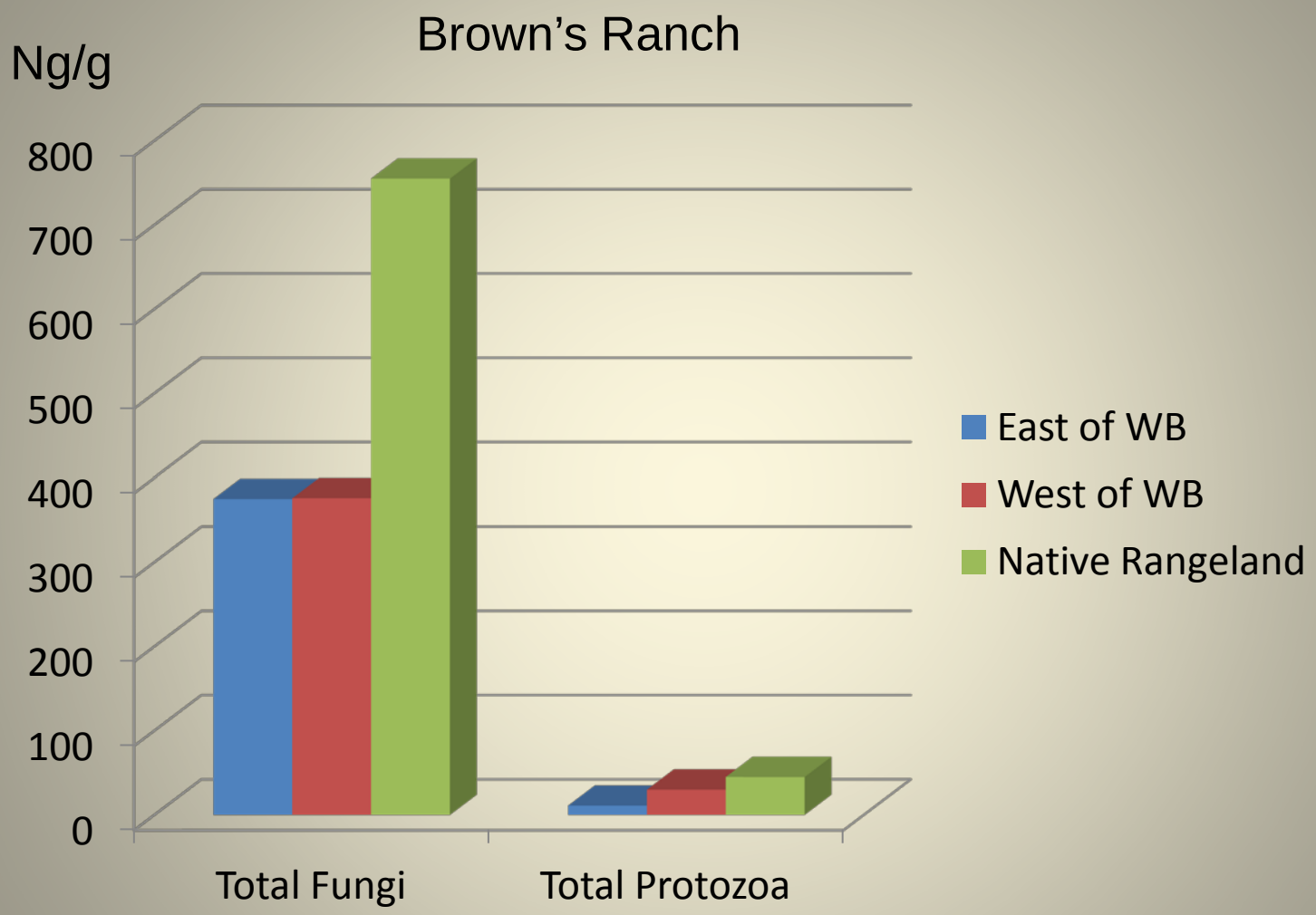
Huge Carbon Sink

Ward Laboratories, Inc
Test Date 10/2012



Below Ground Diversity

Ward Laboratories, Inc
Test Date 10/2012



Below Ground Diversity

Browns Ranch

(Native Rangeland SOM: 7.2)

Two Years Mob Grazing
West Side of Shelterbelt

Total Biology: 6105 ng/g soil

Actinomycetes: 213 ng/g soil

Bacteria: 4417 ng/g soil

Fungi: 786 ng/g soil

Ratio Bacteria/Fungi: 5.6

Mycorrhiza: 230 ng/g soil

SOM: 5.0

No Mob Grazing
East Side of Shelterbelt

Total Biology: 4228 ng/g soil

Actinomycetes: 418 ng/g soil

Bacteria: 3349 ng/g soil

Fungi: 386 ng/g soil

Ratio Bacteria/Fungi: 8.7

Mycorrhiza: 145 ng/g soil

SOM: 3.8

Soil Health & Grazing

Case Studies

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Holistic Mgmt Certified Educator

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www.bcscd.com/hm