



Soil Health & Grazing

Building Healthy Soils

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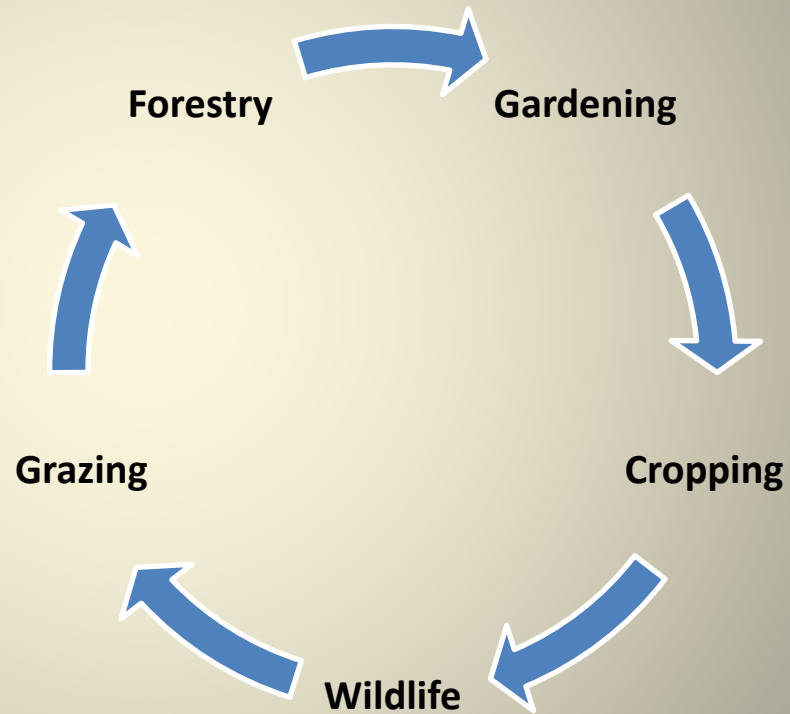
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**“Conservation is not enough.
Regenerative management is needed
to produce a sustainable future.”**

Common Denominator: *Soil Health*



**We are taught all the parts...
Now how do we put it all together?**

Holistic Planned Grazing

A wide-angle photograph of a herd of black and brown cows grazing in a vast, green field. The field is rolling and extends to a distant horizon under a blue sky with scattered white clouds. The cows are scattered across the field, some standing and some grazing. The overall scene is peaceful and rural.

**“Getting the animals to the right place,
at the right time,
for the right reasons.”**

Forage Chain for Livestock & Wildlife

Winter	Spring	Summer	Fall	Winter
J F	M A M	J J A	S O N	D

LEGUME – based perennial pastures

Winter Annuals

Winter Annuals

Summer
Annuals

High Quality Hays

Corn (grazing)

High Quality Hays

Diverse Native Perennial based pastures/forests

Forage Chain for Soil Microbes

Winter	Spring	Summer	Fall	Winter
J F	M A M	J J A	S O N	D

LEGUME – based perennial pastures

Winter Annuals

Winter Annuals

Summer Annuals

High Quality Hays

Warm Season Grass/BrdLeaf

High Quality Hays

Diverse Native Perennial based pastures/forests

Soil Food Web

The "Below Ground" Players...

- **Bacteria**
 - Feeds on root exudates; food for others
 - Decomposer of low carbon residue
 - Keeps nutrients in rooting zone and out of surface and groundwater
 - Enhance soil structure
 - Compete with disease causing organisms
 - Filter and degrade pollutants

Soil Food Web

The “Below Ground” Players...

- **Fungi**
 - **Decomposer of high carbon residue**
 - **Improve accumulation of organic matter**
 - **Helps retain nutrients**
 - **Food source for other members of food web**
 - **Compete with with plant pathogens**
 - **Mycorrhizal – transports nutrients**
 - **Forms the soil glue (glomalin)**

Soil Food Web

The “Below Ground” Players...

- **Protozoa**

- Mineralize nutrients by eating the little guys
- Release nutrients stored in microbial biomass for plant use
- Increase decomposition rates
- Increase soil aggregation
- Prevent some pathogens from establishing on plant roots
- Provide prey for larger soil organisms

A microscopic view of several nematodes in soil. The nematodes are long, thin, and thread-like, with a distinct head and tail. They are shown in various orientations, some curved and some straight. The background is a light, yellowish-brown color, representing the soil.

Soil Food Web

The "Below Ground" Players...

- **Nematodes**

- Mineralize nutrients by eating the little guys (fungi & bacteria)
- Regulate populations of other soil organisms
- Taxi-cab for fungi & bacteria
- Consume disease causing organisms
- Large in size so compacted soil restricts their travel

Soil Food Web

The “Below Ground” Players...

- **Arthropods**

- Shred organic material
- Stimulate microbial activity
- Enhance soil aggregation by leaving fecal pellets behind
- Mineralize and distribute nutrients to plants
- Control pests



Soil Food Web

The “Below Ground” Players...

- **Earthworms**

- Bury and shred plant residue
- Mix and aggregate soil
- Increase infiltration
- Improve water holding capacity
- Create channels lined with nutrients
- Process nutrients to make them plant available

What Do They Weigh?

- **Bacteria** 2,000 - 2,500 Lbs/Ac
- **Fungi** 1,000 - 15,000 Lbs/Ac
- **Protozoa** 20 - 300 Lbs/Ac
- **Nematodes** 10 - 300 Lbs/Ac
- **Microbes in Humans** 3 lbs/Person

Source:

The Nature and Properties of Soils

Brady and Weil, Fourteenth Edition

Soil Biology Primer

National Geographic, Nathan Wolfe, January 2013

December 19, 2012
Texas Panhandle
23 Vehicles in Chain Reaction Crashes





Picture from Past or Present?



What Grazing Model do you have?

Continuous, Season long

Switchback Rotation

Deferment

Hay – Graze Rotation

Rest Recovery

Simple Rotation

Management Intensive Grazing

Mob Grazing

Grazing for Ecosystem Health

What Cropping Model do you have?

Conventional

Organic

Tillage

Strip Till/Mulch Till

Recreational Tillage

No-Till

Continuous No-Till

Biological Cropping

Cropping for Ecosystem Health

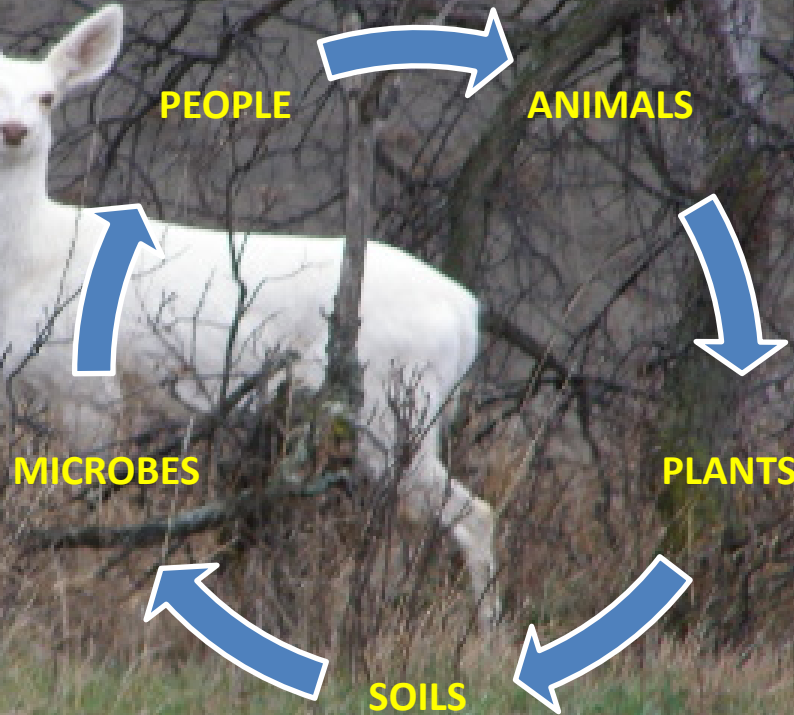
Nature as a Reference

Water Cycle

Mineral Cycle

Bio-Succession

Energy Flow

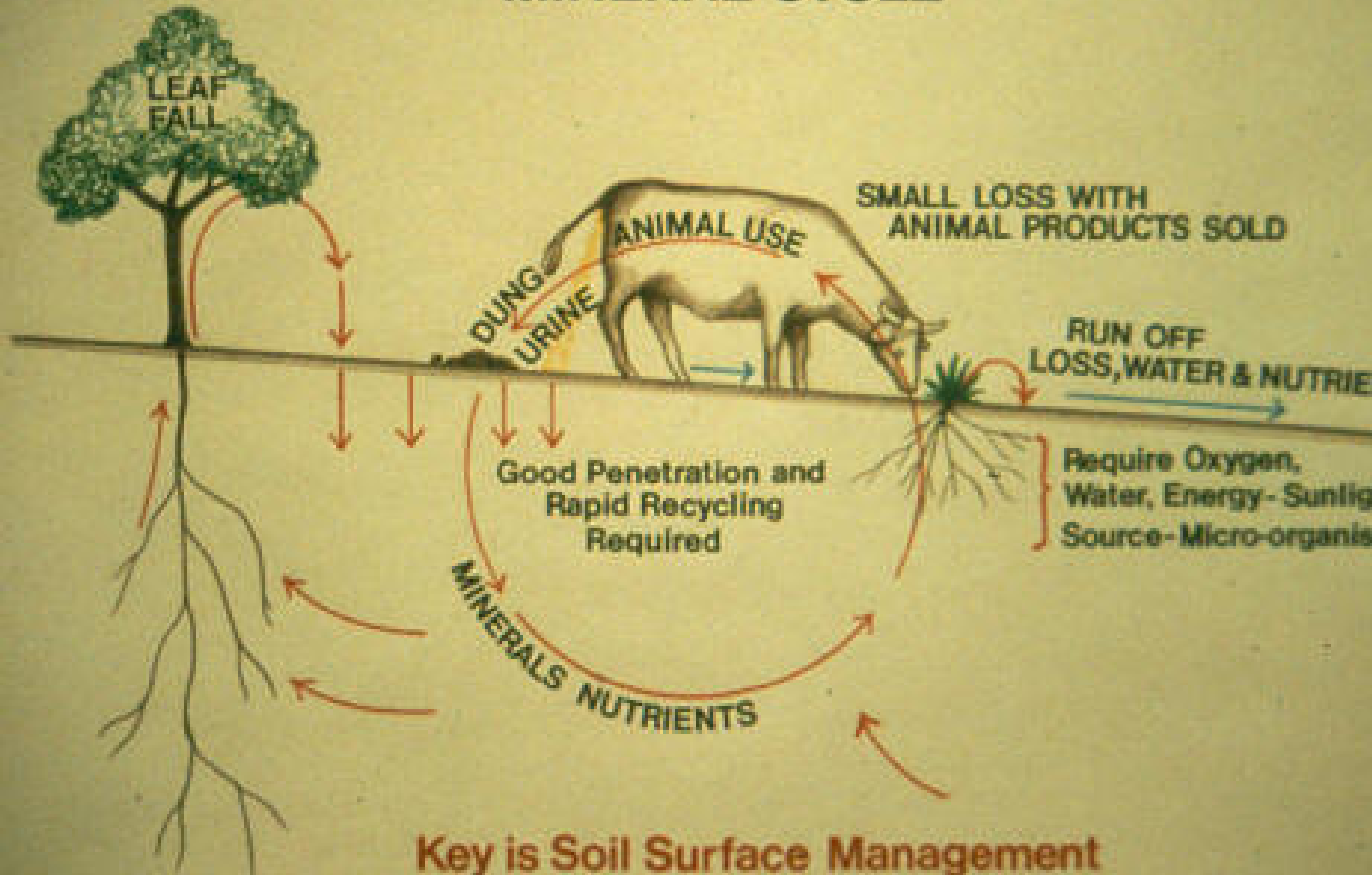


*“Can’t manage for any one thing
and maintain balance”*

Cause or Effect?



MINERAL CYCLE



Key is Soil Surface Management



The Power of
Diversity
changes all
the rules



Putting the “Sun” to work

Larger Plants
More Plants
Longer Growing Plants



Building the Soil

Our Influence

1. **Armor**
 2. **Diversity**
 3. **Continual Live Plant Root**
 4. **Minimal Disturbance**
 5. **Adequate Recovery Time**
 6. **Take your Reward....please!**
- 
- A black and white dog, possibly a Border Collie, is sitting in a field of tall, green grass. The dog is looking towards the camera with its mouth slightly open. The background shows a vast, open landscape with rolling hills under a clear sky.

No Wind Erosion on the Covered Field



Oilseed Radish - July 31



Cover Crop Mix - July 31



When soil temperature reaches...



140 F

Soil bacteria die

130 F

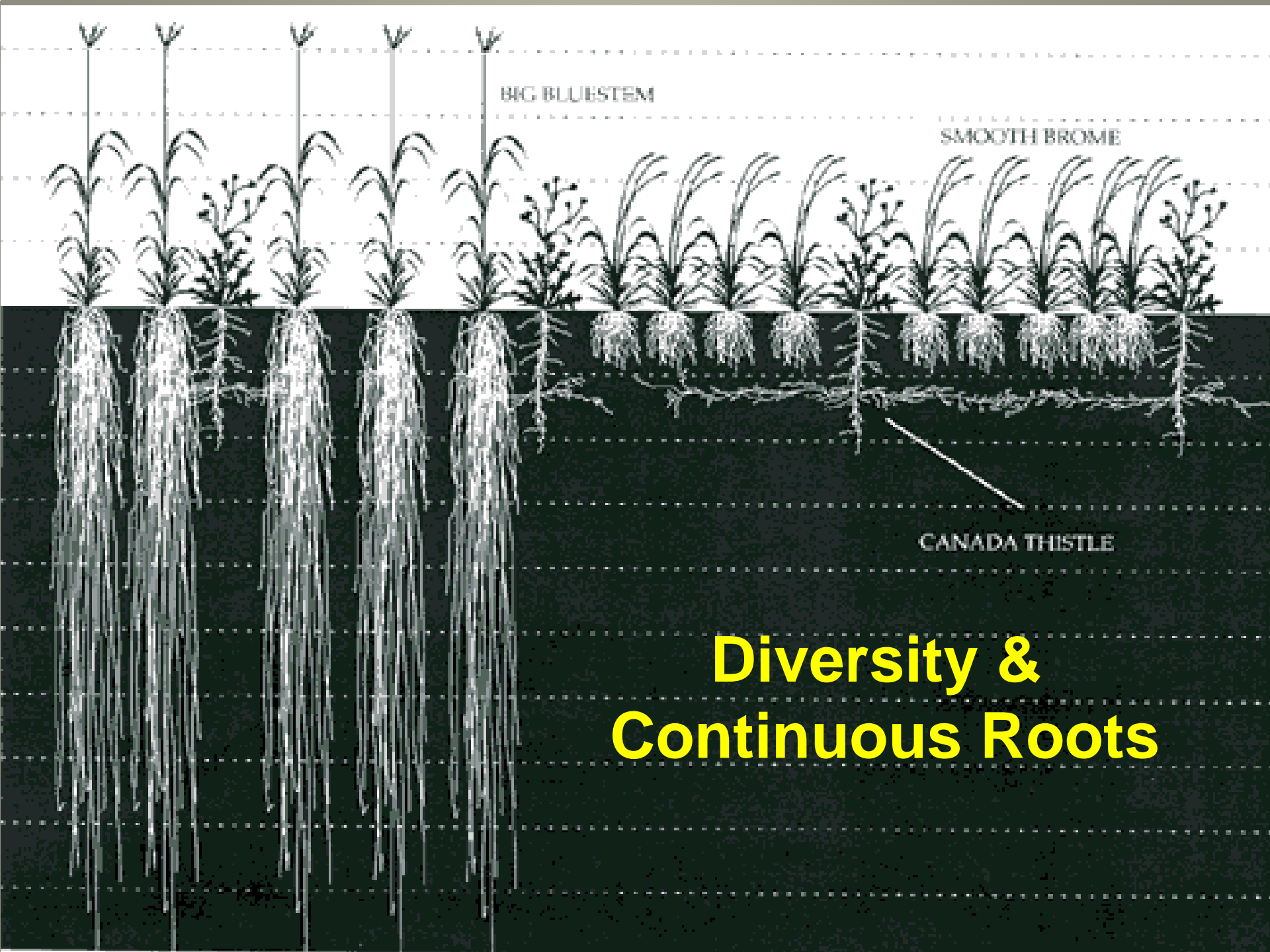
100% moisture is lost through evaporation and transpiration

100 F

15% of moisture is used for growth
85% moisture lost through evaporation and transpiration

70 F

100% moisture is used for growth



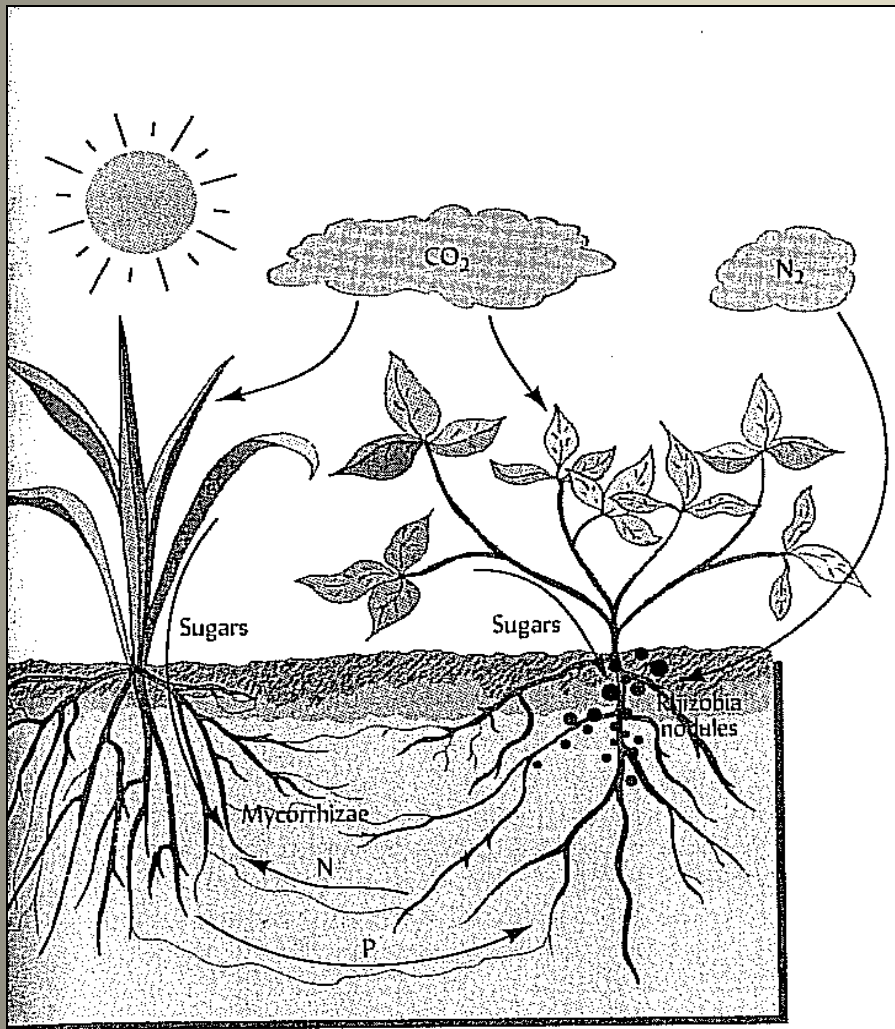
BIG BLUESTEM

SMOOTH BROME

CANADA THISTLE

Diversity & Continuous Roots

Plants Interacting with Mycorrhizal Fungi



- Assists with P uptake from the soil
- Moves P from the non-legume plant to the legume plant
- Moves N from the legume plant to the non-legume plant

Appropriate Disturbance

- Infiltration
- Compaction
- Surface Saturation



Sweep layer

Plow layer



**Root breaking
compaction layer**

A wide-angle photograph of a rural landscape. The foreground and middle ground are dominated by a large field of grass. A distinct path of shorter, mowed grass runs diagonally from the lower center towards the horizon. To the right of this path, the grass is shorter and greener, indicating it has been grazed. The rest of the field is taller and has a golden-brown hue, suggesting it is mature or has been mowed but not grazed. The horizon is flat, with a few distant trees and a utility pole visible on the left. The sky is a clear, bright blue with scattered, light white clouds.

Is MOWING the same as GRAZING??

McPeak Ranch, Sterling, ND

Does Harvesting Method Matter?

Grazing 2007

- 91 bu/ac Corn ('08)
- 1 Herbicide Application
- Value of additional nutrients from manure?



Chopping 2007

- 68 bu/ac Corn ('08)
- 2 Herbicide Applications
- Value of nutrients hauled away?



Recovery...more than we realize



Biological Recovery

Soil Aggregate Formation





Feeding a Balanced Diet with a Constant Stream of Solar Energy

*Soil organisms are like animals...they
require a balanced diet to attain high
performance and survivability*



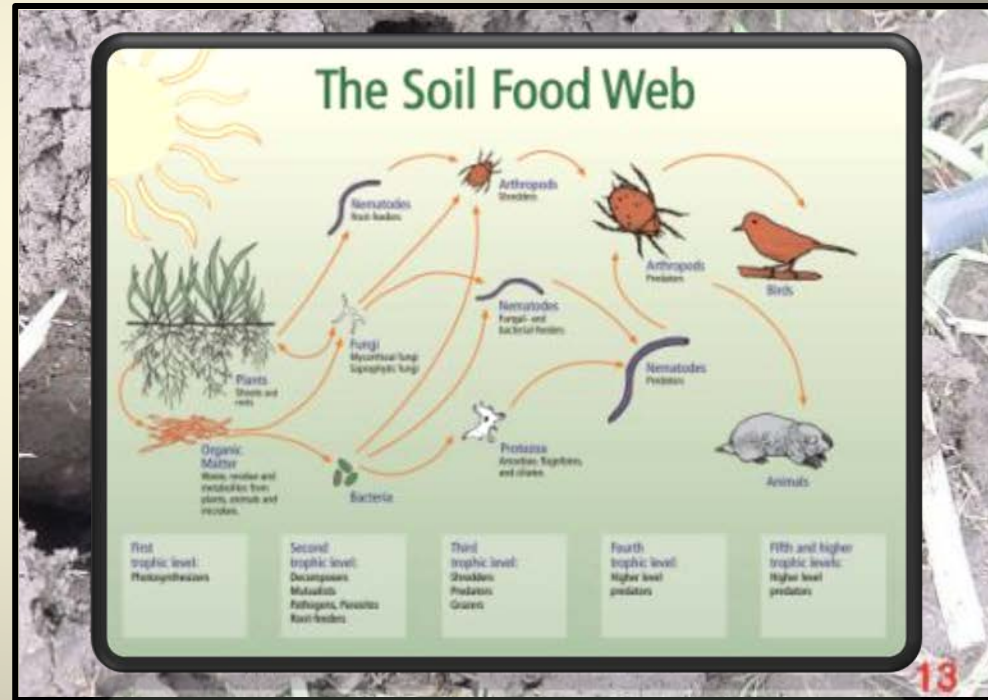
High Crop Diversity
Cover Crop
Animal Impact

Low Crop Diversity
No Cover Crop
No Animal Impact



Your Reward

Harvest The Sunlight = Feed The Soil





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