

Adaptive Grazing and Relationship to Soil Health

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Soil Health Consulting, LLC



Three Principles

- Principle of Compounding
- Principle of Diversity
- Principle of Disruption

Principle of Compounding

- Never singular effects or impact
- Never Neutral – Always either positive or negative
- Everything we do creates a series of compounding & cascading events
- Also creates epigenetic effects

Principle of Diversity

- Want highly diverse and complex pastures and annual mixes – not monocultures.
- Grasses, Legumes, Forbs
- Primary nutrients, PLUS secondary & tertiary compounds.
- Creates series of positive compounding effects and benefits.

Principle of Disruption

- Nature has tremendous resilience and responds well to challenges.
- Planned, purposeful disruptions.
- Creates host of positive compounding effects.

Flexibility is Key

- Do NOT do things the same way every time!
- AMP/AHSD is NOT a system.
 - Alter stocking densities
 - Do not move through rotations in same pattern
 - Alter grazing heights
 - Alter rest periods
 - Alter species order
 - Alter time of season/year

Conventional Grazing





Adaptive Grazing

Adaptive or Flex Grazing

- Allows Practitioner to address multiple goals and objectives.
- Not a routine or rigid system
- Adapt to changing conditions

Principles of Adaptive Grazing

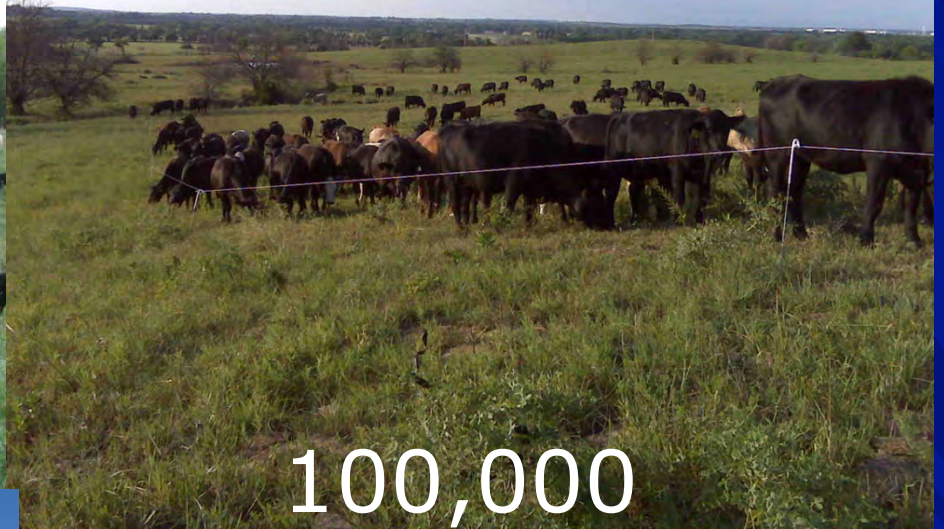
- Goal Oriented
- **Stock Density** vs. Stocking Rate
- Management and flexibility are key
- Frequent Movement & Frequent Rest
- Plant Root System Recovery
- Highly reliant on temporary fencing technology
- **Compounding & Cascading Effects**

Regenerative Grazing Research Shows:

- Ecological function and profitability increase with increasing number of paddocks.
- Short periods of grazing with adequate recovery gave the greatest profit and ecological function.
- Adjusting grazing management with changing conditions increases ecological function and profitability.
- Fixed management protocols reduced benefits.
- Profitability decreases if recovery is too short or too long.
- Stocking rates can be increased without damaging ecological function as number of paddocks is increased

Teague et al. 2015. Journal of Environmental Management

What Does It Look Like?



Simulate Nature



Mimic Nature: Biomimcry/Ecomimcry

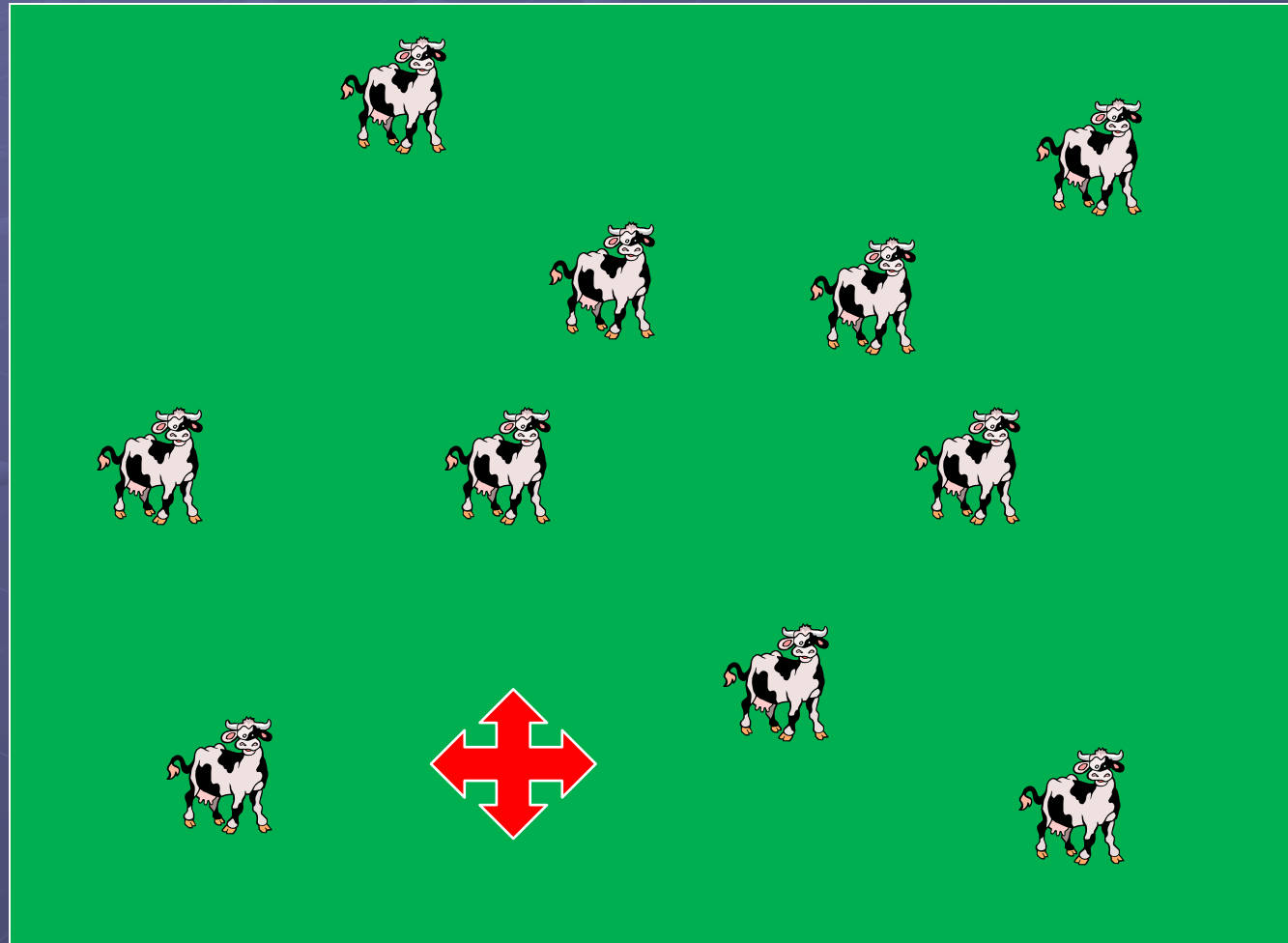


Nurtures Ecological Memory



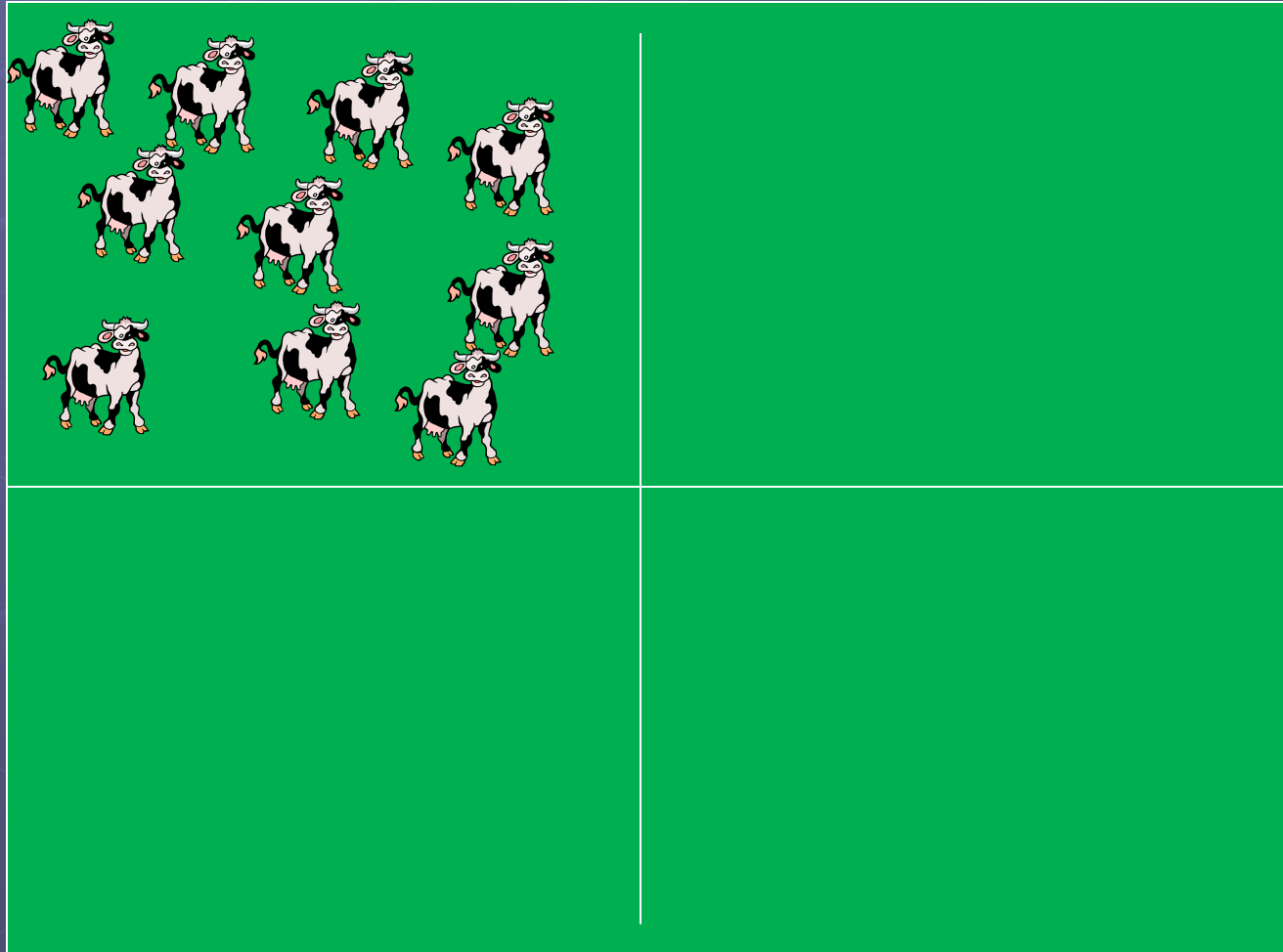
Stocking rate and stock density with continuous grazing

- Ten head on ten acres
- Stocking rate = 1 hd/acre
- With continuous grazing:
stock density =
stocking rate
- Both are still 1200 lb/acre



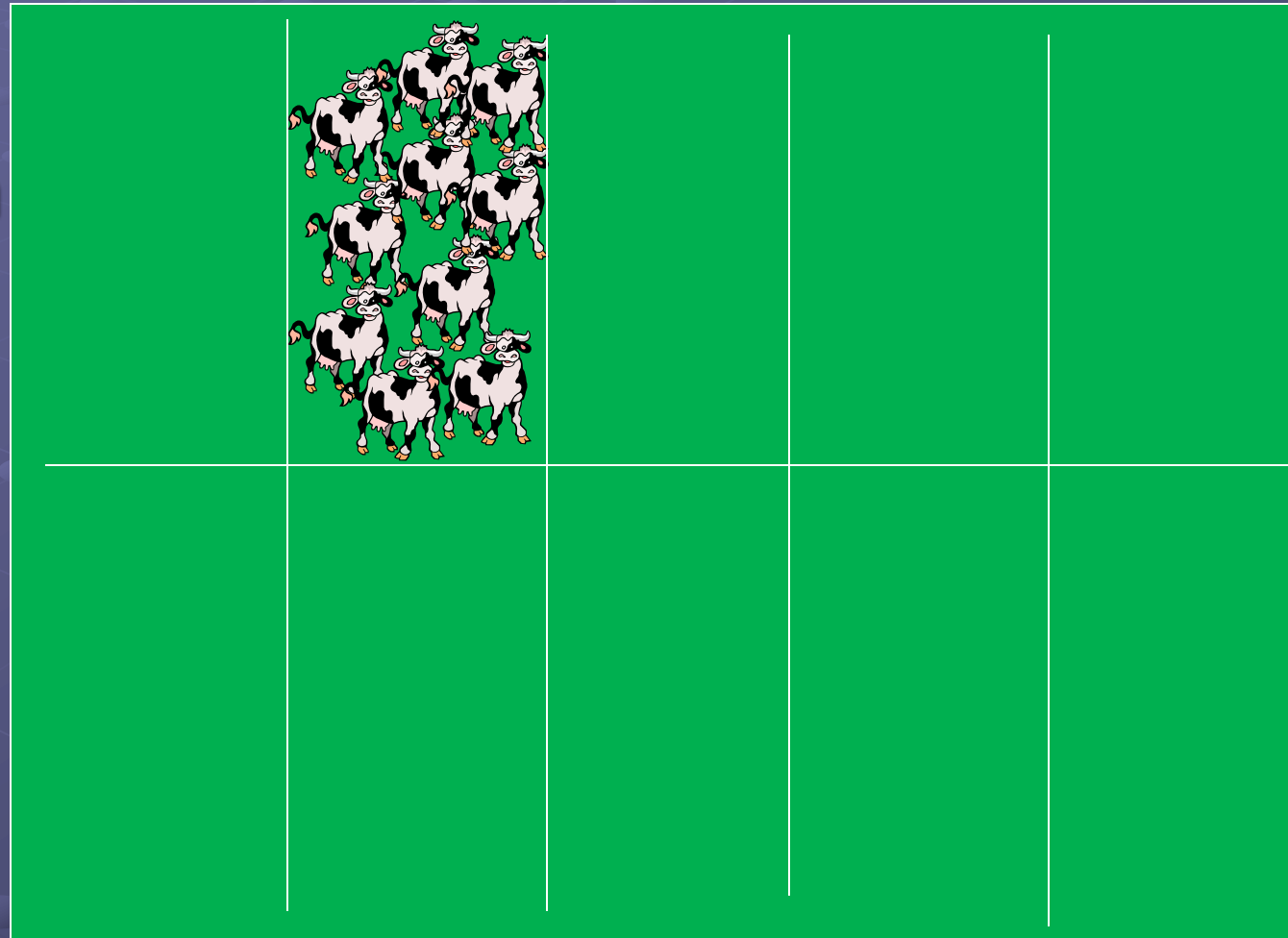
Pasture subdivision and stock density

- With pasture subdivision stocking rate may not change but stock density does !
- Stock density is 10 hd/2.5 acres or 4800 lb/acre



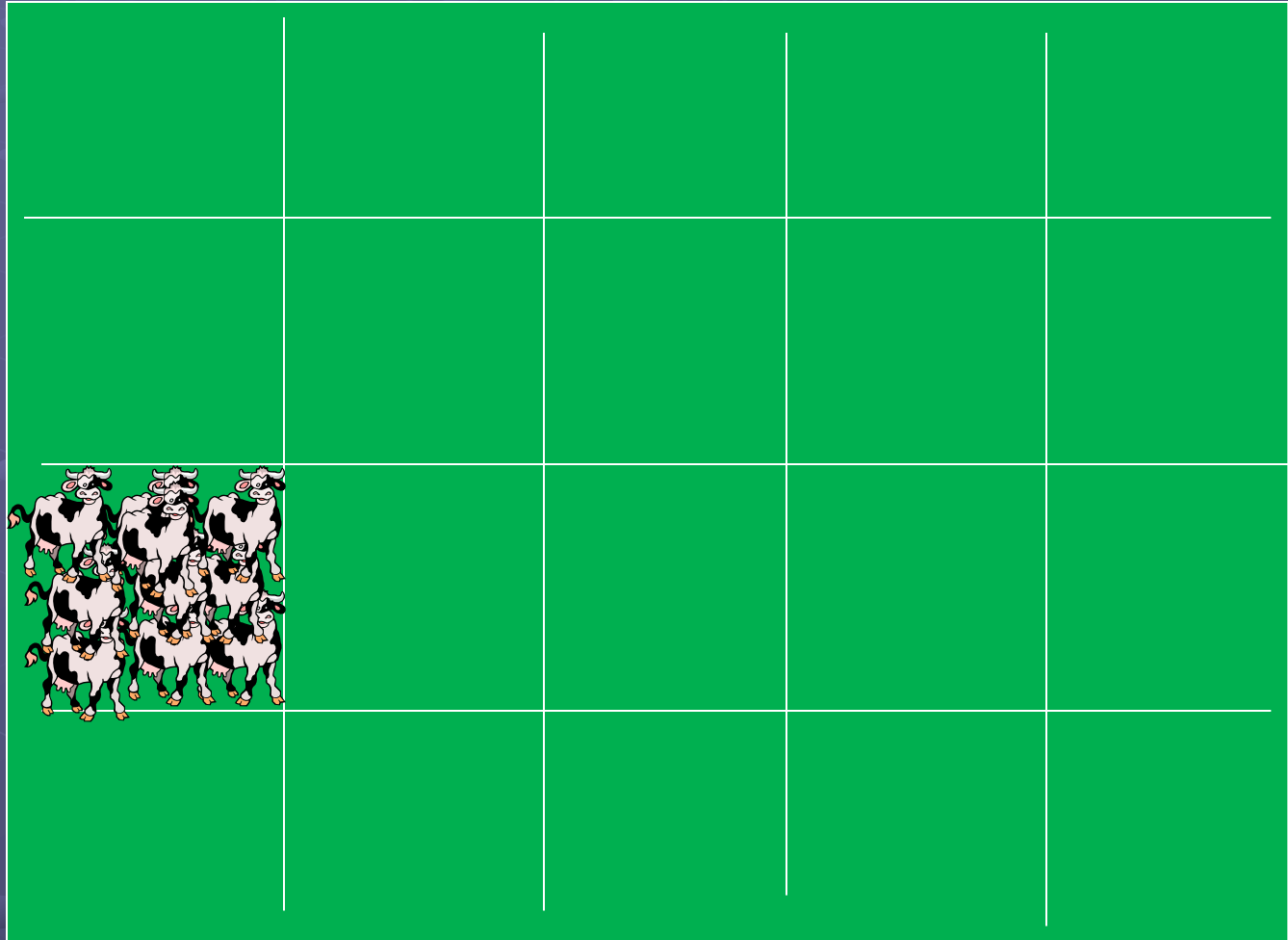
Pasture subdivision and stock density

- Each level of subdivision results in higher stock density
- Stock density is now 12,000 lb/acre



Pasture subdivision and stock density

- Stock density is now 24,000 lb/acre
- You've got it, right?



Stock Density Calculations

- If you have 3000 lbs per acre of available forage DM and want to utilize 50% and leave 50% trample:
- $3000 \times 50\% = 1500 \text{ lbs}$ DM available for 24 hour period.

Stock Density Calculations

- Assume 100 head of 1200 lb lactating beef cows.
- Assume 3.5% DM consumption needed daily.
- $1200 \times 3.5\% = 42$ lbs forage DM/hd/day.
- $100 \times 42 = 4200$ lbs DM needed daily for herd.

Stock Density Calculations

- If you have 1500 lbs DM available per acre and need 4200 lbs DM daily, then average paddock size:
- $4200/1500 = 2.8$ acres needed per day.
- Total Pounds = $1200 \times 100 = 120,000$ lbs
- Stock Density/Acre = $120,000 \text{ lbs}/2.8 = 42,857 \text{ lbs/acre}$.

What Is An Acre?

- 43,560 sq ft
- Roughly 208 feet x 208 feet in a square acre.
- Approximately 70 paces.

Stock Density Calculations

No. Moves Per Day	Stock Density Per Acre (lbs/ac)	Paddock Size (acres)
1	42,857	2.8
2	85,714	1.4
3	128,571	0.93
4	171,428	0.7
5	214,285	0.56
10	428,570	0.28

Soil Carbon Cowboy Series

- **Soil Carbon Cowboys** - 12 minutes; <https://vimeo.com/80518559>
- **One Hundred Thousand Beating Hearts** - 15 minutes; <https://vimeo.com/170413226>
- **A Fence and an Owner** - 9 1/2 minutes: <https://vimeo.com/201215707>
- **During The Drought** - 12 minutes: <https://vimeo.com/200109813>
- **Luckiest Places on Earth** - 25 minutes: <https://vimeo.com/181861077>
- **Soil Carbon Curious** - 6 minutes: <https://vimeo.com/130721684>
- Next.....**"Givers and Takers"**
- www.soilcarboncowboys.com

Additional Resources

■ www.pastureproject.org

- Grass Fed Beef Decision Calculator
- PowerPoint Presentations
- “How –To Video” series
- Webinars
- <http://www.stonebarnscenter.org/images/content/3/9/39629/Grassfed-MarketStudy-F.pdf>

■ “Before You Have A Cow”

- www.joyce-farms.com

■ <https://www.no-tillfarmer.com/topics/65>

Additional Resources

- <https://www.no-tillfarmer.com/articles/6809-evaluating-herbicide-carryover-on-cover-crops-deu>
- www.pasturemap.com
- www.vence.io

Case Studies

Mississippi Farm

■ Case Study

Condition at Purchase



Starting Point

- Soil OM – 1.3% to 1.6%
- Water Infiltration Rates – $< \frac{1}{2}$ in/hr
- Plant Brix – 2%
- Major forage species – 3-4
- Stocking Rate – 1 AU/6 acres

Implemented Strategy

- Bale Grazing 1st winter.
- High Stock Density/Short Duration Grazing.
- Long rest periods.
- Strategic use of microbial quorum sensing.

Year 1 Grazing Season



Grazing Weeds



Year 2 Grazing Season



Year 3 Grazing Season



Year 4 Grazing Season



Progress

- Soil OM – 5.2% to 5.6%
- Forage species – 43, including natives.
- Plant Brix – Avg 15 – 22%
- Water infiltration – 10+ in/hr
- Stocking Rate – 1 AU/1.5 acres.
- **FREE ACRES!!!**
- Significant increase in earthworms, soil level insects, pollinators, and wildlife.





Batt Latch









Multi-Paddock Construction for Multiple Daily Moves



Allen's Fencing Rig



Keeping Cattle Out Of Ponds





Livestock pipeline installation.



Quick Couplers.



Easy and Simple.







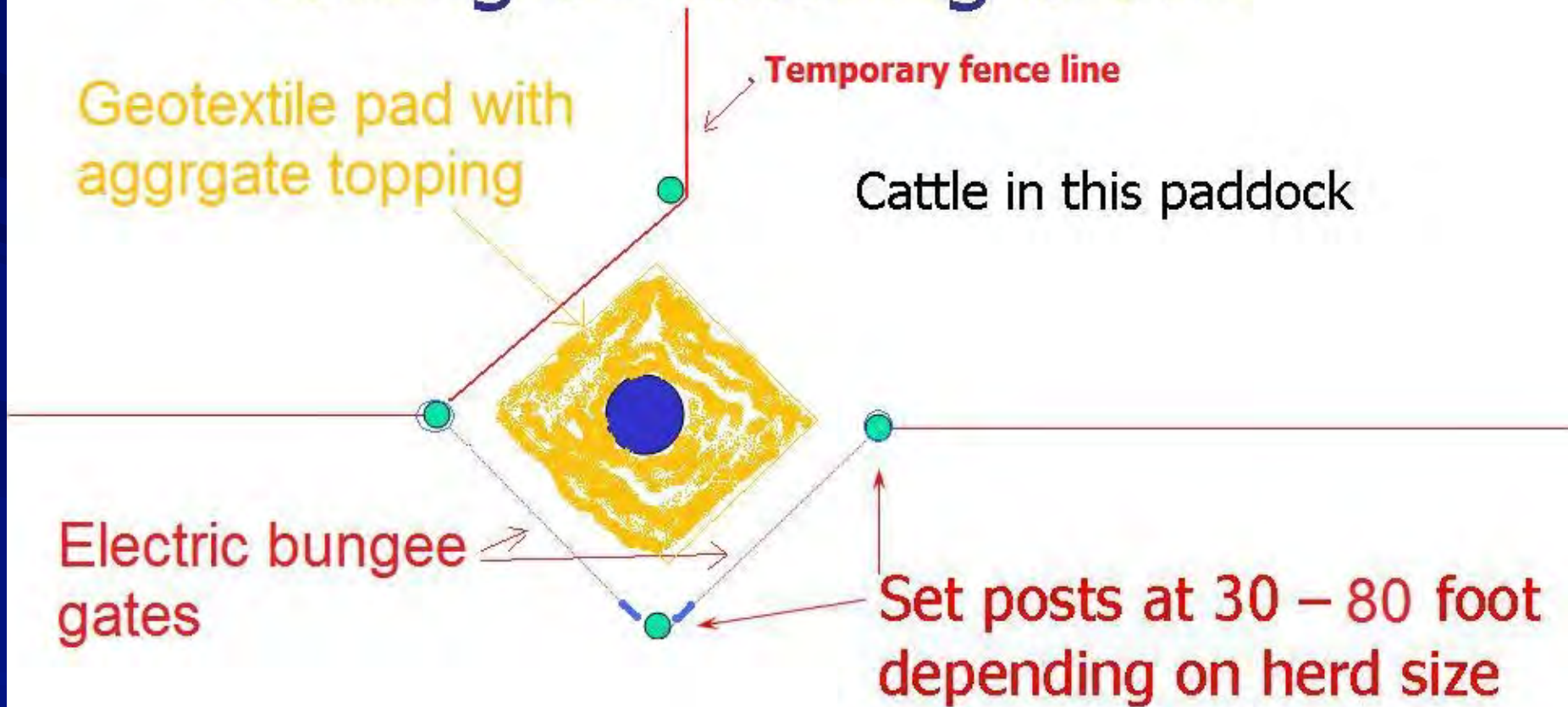








Making a watering block



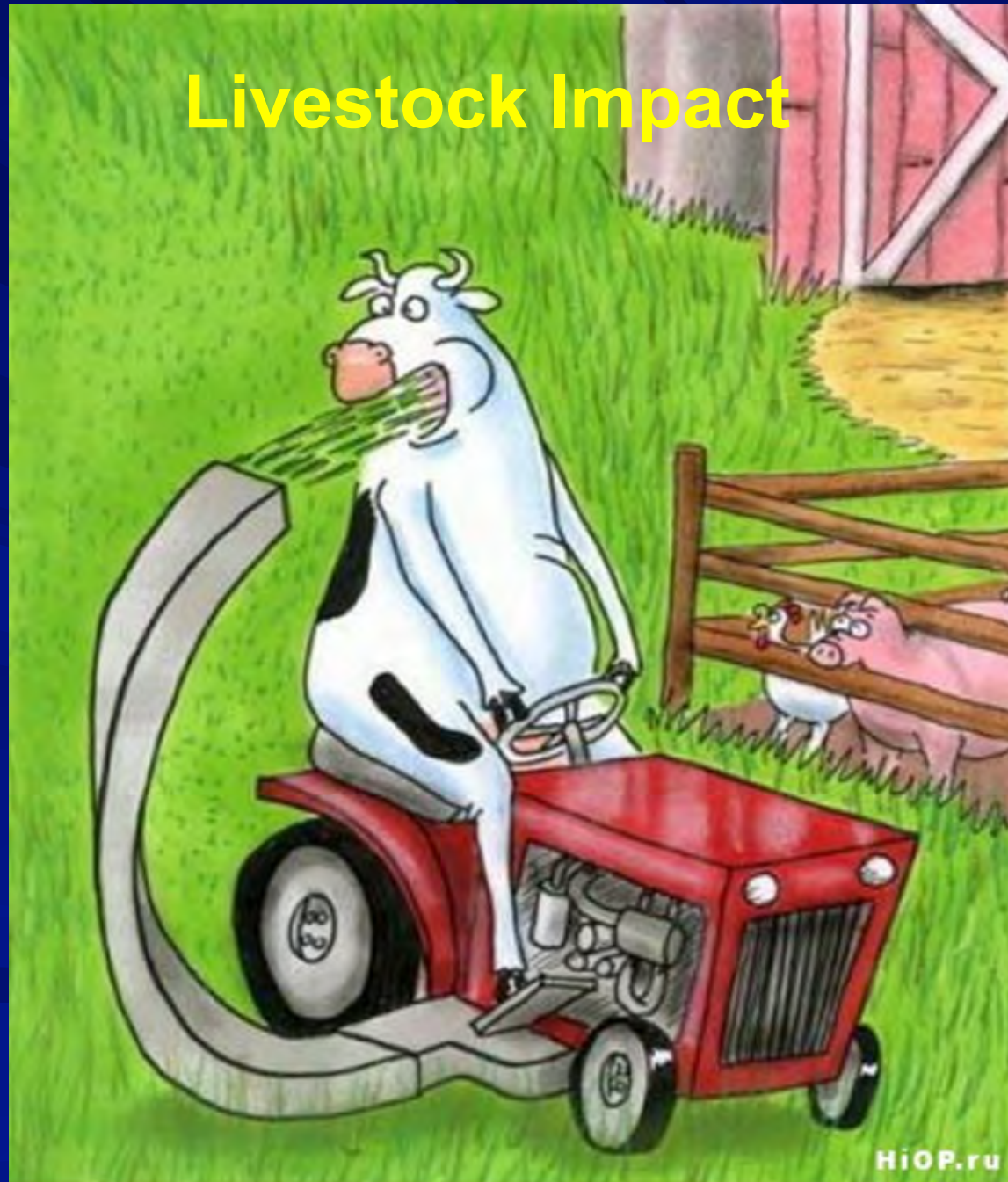
Stockpiled Prairie



Moving Cows to Fresh Stockpile



Livestock Impact



Cartoon by Dan Reynolds; used with permission. reynoldsunwrapped.weebly.com/

Slide Source:
Allen Williams



How Easy is it to Move Cattle?

- Lets follow Brad Dennis through a move of 700 head in 15 minutes....

Have pigtail posts and polywire reel
ready to go on ATV



Pigtail post rack ready to pull and put in the ground.



Fence reel holder and post racks ready to build and pick up temporary fences.



Drive the perimeter of the new paddock to mark out the boundary with ATV tire tracks. Put down new post with power drill and a mallet.





Hook the polywire onto post and drive the length of the new fence, putting down pigtails at points if it's not a straight line. Attach the reel over on the other side. Brad just lets the reel hang down.



Cattle Lined Up and Ready to Move



Reeling in Polywire



- https://www.youtube.com/watch?v=79hvT_pVQ28
- <https://www.youtube.com/watch?v=M2IPSpyo-MI>
- <https://youtu.be/M2IPSpyo-MI>

Stoney Creek Farm

Grant, Dawn & Karlie Breitkreutz



- *Cow-Calf Producer – Rotational Grazing**
- *Cover Crops for fertility, grazing, forage**

**Sadly, this has become more common during
the spring in our area.**



Single-Species Cover

- 1 out of 3 was a success
- 2 out of 3 were a BIG failure for multiple reasons.
 - Lack of moisture
 - Financial- Rented ground, incorrect seed, herbicide residuals & ineffective
- In a dry year, the more species planted, the more likely something will germinate & grow.



Cover crop mix following wheat harvest.

Breitkreutz Mix #1

Mix	Variety/Crop	Germ.	Origin	Test Date
25%	Rymin Winter Rye	85%	SD	07/15
25%	Fridge Winter Tritic	95%	KS	05/15
19%	TillageMax Dover Oat/Radish	90%	CA/NZ	04/15
12%	VNS Winter Pea	79/1%	MT	02/15
6%	VNS Hairy Vetch	85%	AUS	05/15
6%	Medium Red Clover w/ Nitro	85/5%	OR	07/15
5%	Winfred Brassica	98%	OR	07/14
2%	Tillage Radish	90%	OR	05/15

96.77% Purity, 0.19% Crop, 3.03% Inert, 0.01% Weeds

Noxious Weeds: None Lot 5042 Wt. 50 lb.

Prairie Creek Seed, Inc., 21995 Fillmore Rd.,

Cascade, IA 52033 877-754-4019



**September 16, 2015, after wheat
harvested & straw baled.**

October 30, 2015, same field.





Ungrazed cover crop

03/12/2015



We were challenged to adapt a standard corn planter to no-till our corn crop.

Corn planter set up for no-till.



**We adapted our no-till drill to interseed
cover crop into corn.**



**Freshly seeded cover into standing corn
and surviving cover from fall.**



September 11th, chopping corn silage.





**Approved cover crop seeded
in corn crop on DNR-owned
land as part of the
cooperative farming
agreement.
Picture taken
November 8th.**

Study field root pit October 7th



**Live roots
3 ½ feet
in soil
March 2016**





Soil from our field.

**Soil from a tilled
field.**





Increased Soil Aggregation



Dollars & “Sense”

Wheat field cover cost: \$37.25/acre

Weight gained: 130-150# over 43 days

Cover crop feed cost: \$.46/lb. of gain

Weight gained: 2.4 lbs/day

Value Gained: \$217 - \$64 = \$153 Net

**Total Net Gain/Ac = \$190 (includes reduced
fertilizer & herbicide costs)**

One of the best rewards for our efforts!



CLEAN WATER!!!

George Lake - Pennsylvania

- 2016 Forage and Grassland Council Presentation.
- Turned ground adjacent to an abandoned sand quarry into productive soil with cattle.
- 20+ years ago ground averaged 37 bushels of corn/acre, with side dressing.
- Corn Yields now in the 170's with no fertilization. Non-GMO Corn.
- Picture shows soil taken about 10 yards apart. The one sample has been mob grazed for about 20 years. The other sample is from the other side of the fence.
- Runs 600 head of grass fed beef and about 100 sheep.
- Host about 15 tours a year. Just hosted a delegation from the Ukraine.

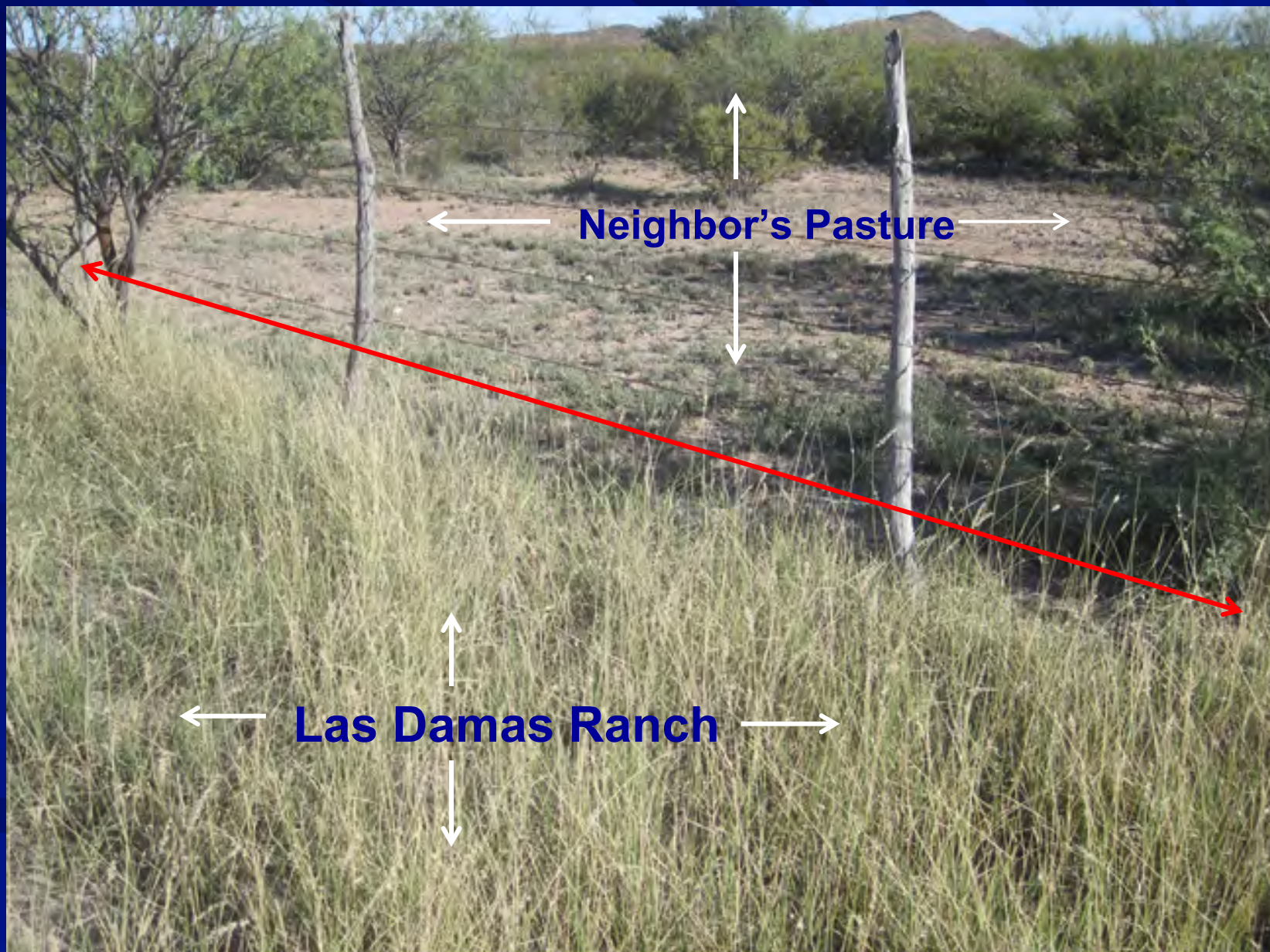
Mob Grazed

Across Fence



Las Damas Ranch

Mexico





Background & Results

- Typical 11 inch rainfall region.
 - Last 4 years – **10", 9", 8", 5" inches.**
- Started with a monoculture of tobosagrass
 - Now = More than **4 dozen** species.....
- Run 1 cow/calf per **40 acres.**
- **FREE ACRES!!!**
- Neighbor ranch runs 1 cow/calf per **200 acres.**

Results

- Since 2006 cattle sales have increased 2.5 times.
- Hay expenses reduced by one half.
- Net profits are 4 times greater.
- Pounds of calf produced per hectare has increased 3.7 times.

Luis Robles Ranch – Chihuahua, Mexico



Robles Ranch

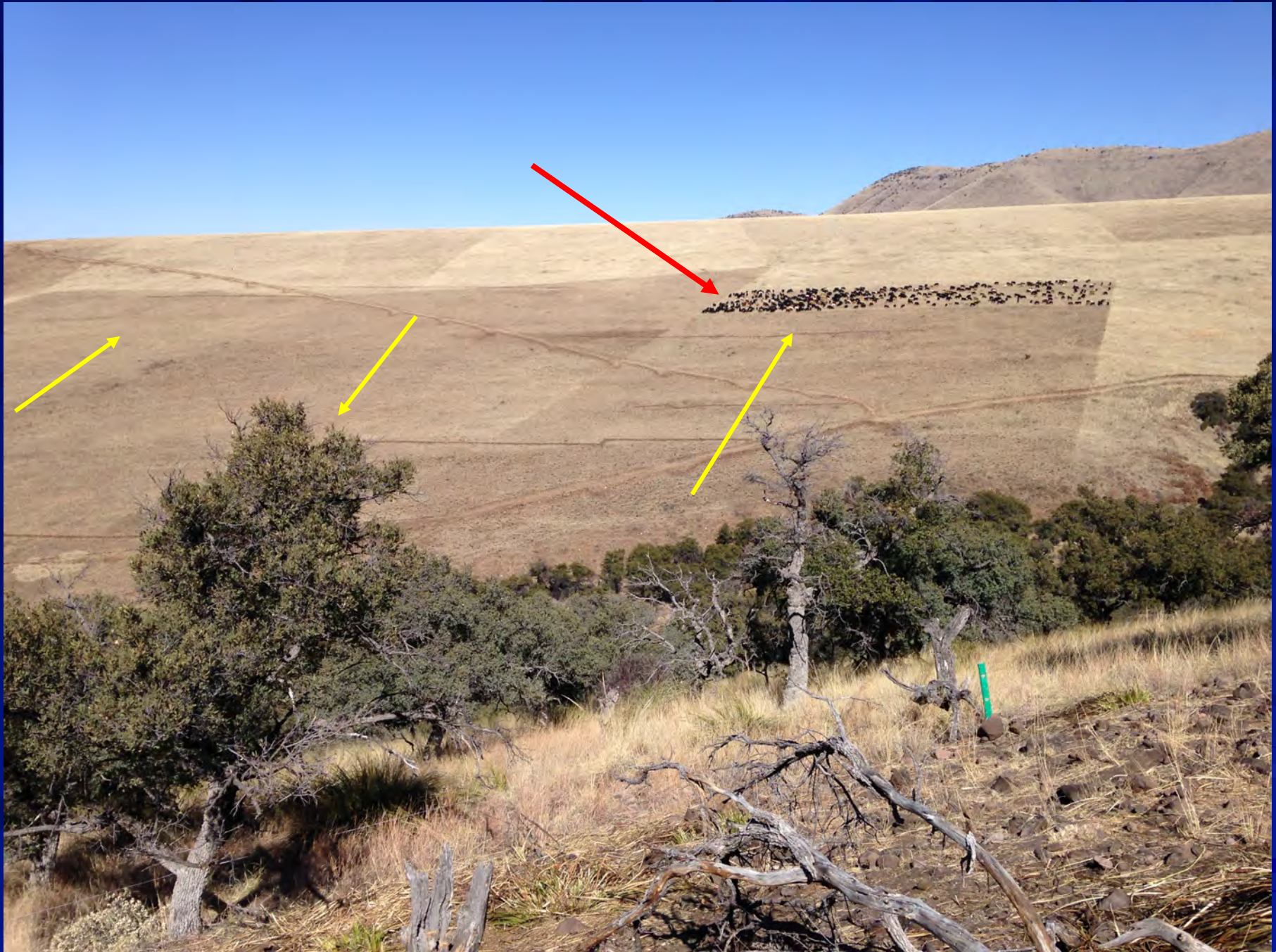
Neighbor's Ranch



Caterras Cattle Co. – Chihuahua, Mexico







Australia

Adaptive
Grazing

Set Stock
Grazing

Long-chain, non-
labile, stable
carbon

Short-Chain,
unstable, Labile
carbon



20 Inches

Comparisons

Set-Stock:

- Decades of combining conventional cropping with set-stock grazing.
- Used a range of chemical fertilizers and herbicides.
- Accelerated soil C loss at depth.
- Biodiversity loss.
- Significant mineral loss.
- Increase in metabolic diseases.

Comparisons

■ Adaptive Grazing:

- No fertilizer in last 30 years.
- Levels of total and available plant minerals have improved significantly.
- Solubilization of mineral fraction by microbes.
 - Energized by increase in liquid carbon.
- Stable, long-chain, humic substances formed via plant-microbe sequestration pathway.
 - Cannot disappear in a drought.

Data

- **68.2 tons more C** sequestered per acre from 1990 – 2010 vs. Set-stock.
- **78%** of new carbon was Stable, Non-labile.
- Mineral increases:
 - **Ca – 277%, Mg – 138%, K – 146%, Su -157%, P – 151%, Zn – 186%, Fe – 122%, Cu – 202%, B – 156%, Se – 117%.**
 - Mineral value increase: **\$208/ac/yr**
- Carrying capacity **doubled.**
- **High N & P applications inhibit formation of plant-microbe bridge.**

BENEFITS

Does Grazing Strategy & Methodology Matter?

Soil Carbon Data

- Three types of farms/ranches sampled:
 - 2014 – 2015
 - Farm/ranch Type Descriptions:
 - AHSD/AMP Grazing for minimum of 5 years
 - High Level Conventional Grazing Management
 - CG – Slow Rotation - 10+ years minimum
 - Low Level Conventional grazing management
 - CG – Continuous - 10+ years
 - All same soil types

Soil Carbon Data

- Soil pits dug in random locations at each farm. Same topography.
- Each pit 3 feet deep and 3 feet square.
- Collected soil samples within every 6 inch section.
- Noted root growth and structure.
- Noted soil life, texture, aggregation.

Soil Carbon Data – Total Soil Carbon

Horizon	AHSD	CG - Rotation	CG – Cont.
1	4.67	1.64	1.36
2	4.00	1.88	1.37
3	2.95	1.03	0.40
4	2.04	1.02	0.54
5	1.71	0.38	0.40
6	1.42	0.41	0.34

Soil Carbon Data – Soil Organic Matter

Horizon	AHSD	CG - Rotation	CG – Cont.
1	4.26	3.28	2.72
2	3.22	3.76	2.74
3	3.10	2.06	0.80
4	2.98	2.04	1.08
5	2.80	0.76	0.80
6	1.98	0.82	0.68

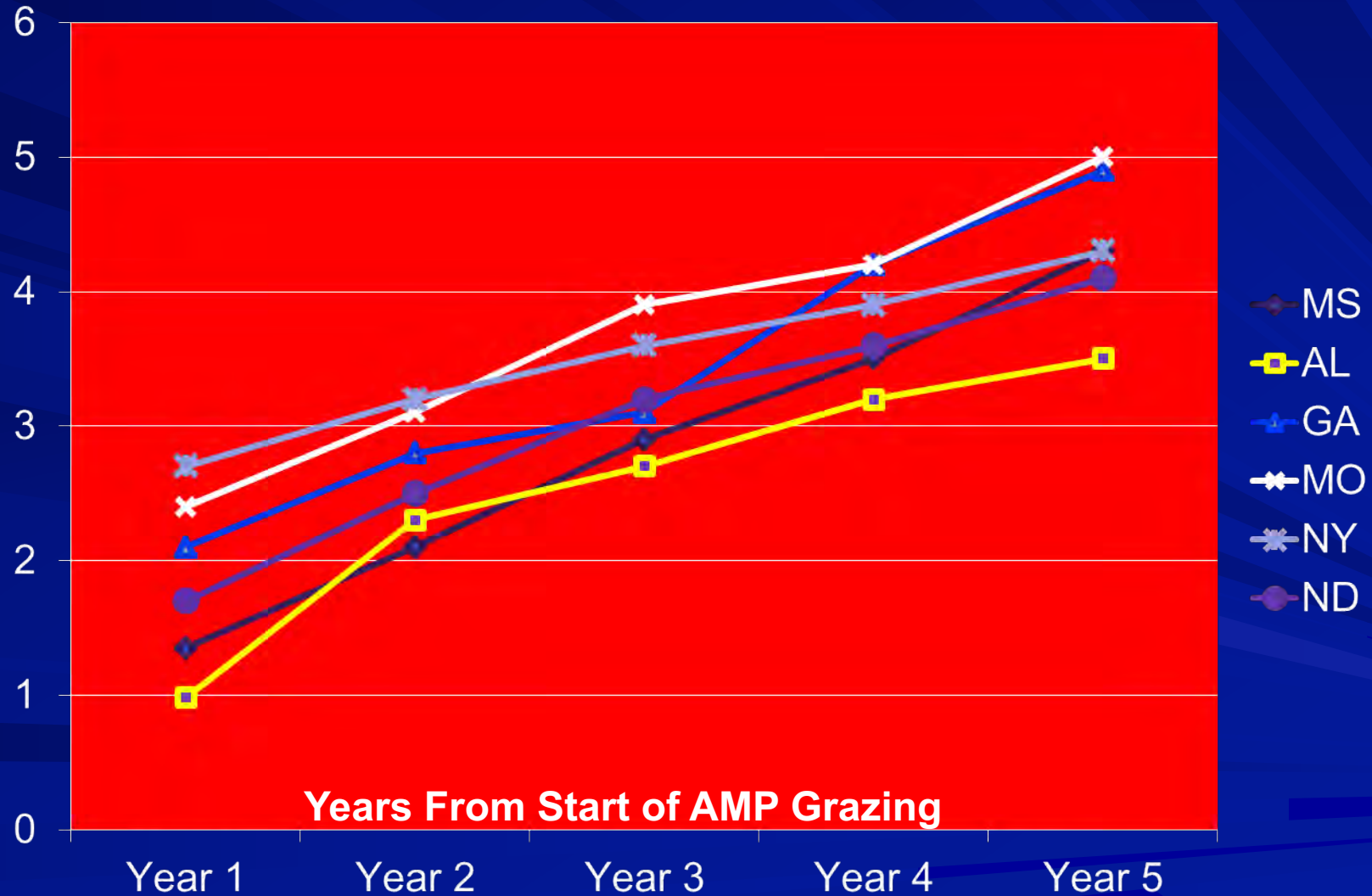
Soil Carbon Data – Carbon Assessment Per Acre

Farm Descrip	Carbon (kg/sq meter	Carbon (Ton/ac)	Carbon (Ton CO2 Equiv)
AHSD	12.69	51.41	188.13
CG – Rotation	7.09	28.71	105.07
CG – Cont.	5.47	22.16	81.09

Can Make Rapid Improvements in Soil Organic Matter and Total Soil Carbon

Improvement in Soil Organic Matter Using AMP Grazing

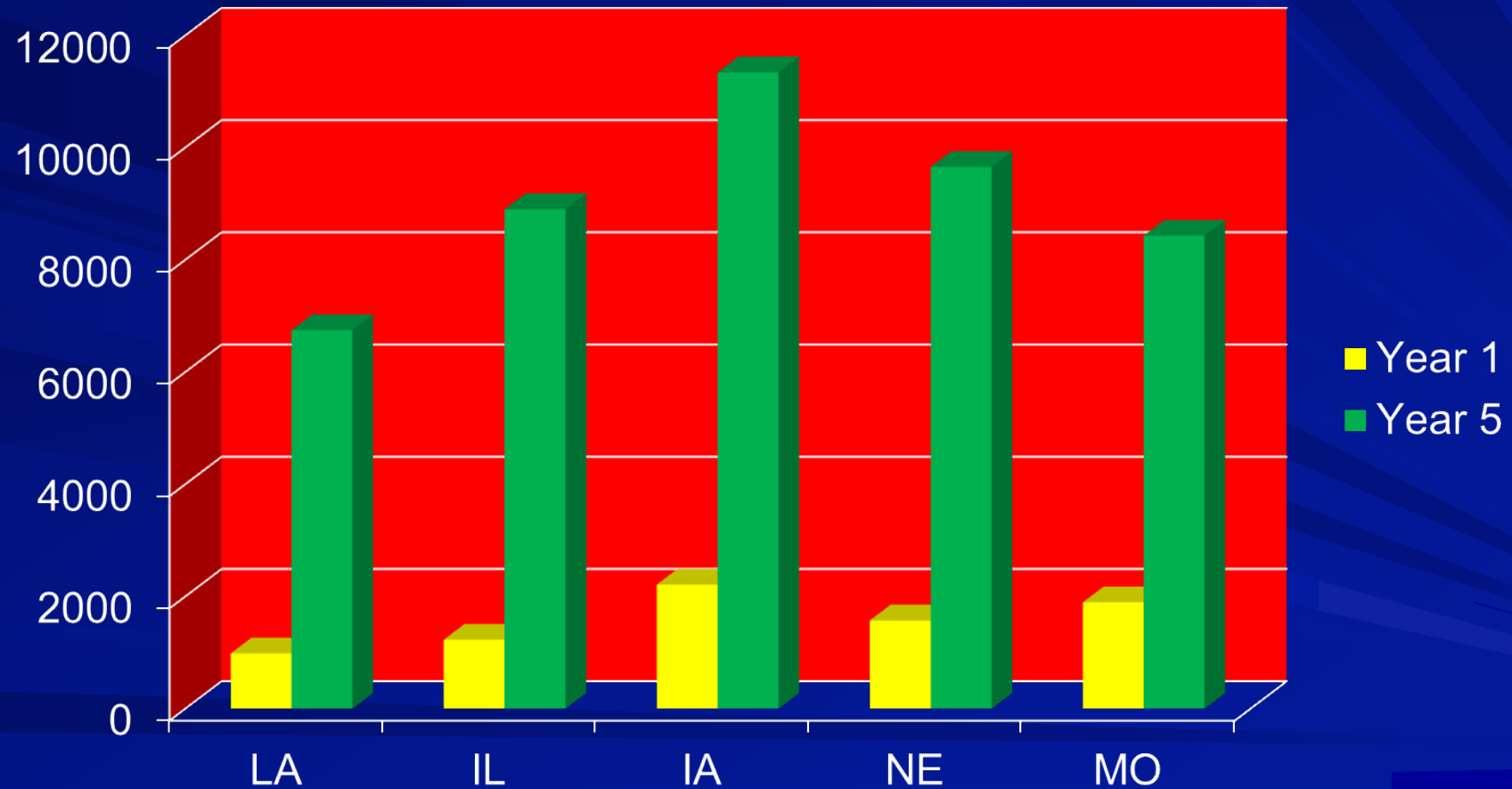
Soil Organic Matter (%)



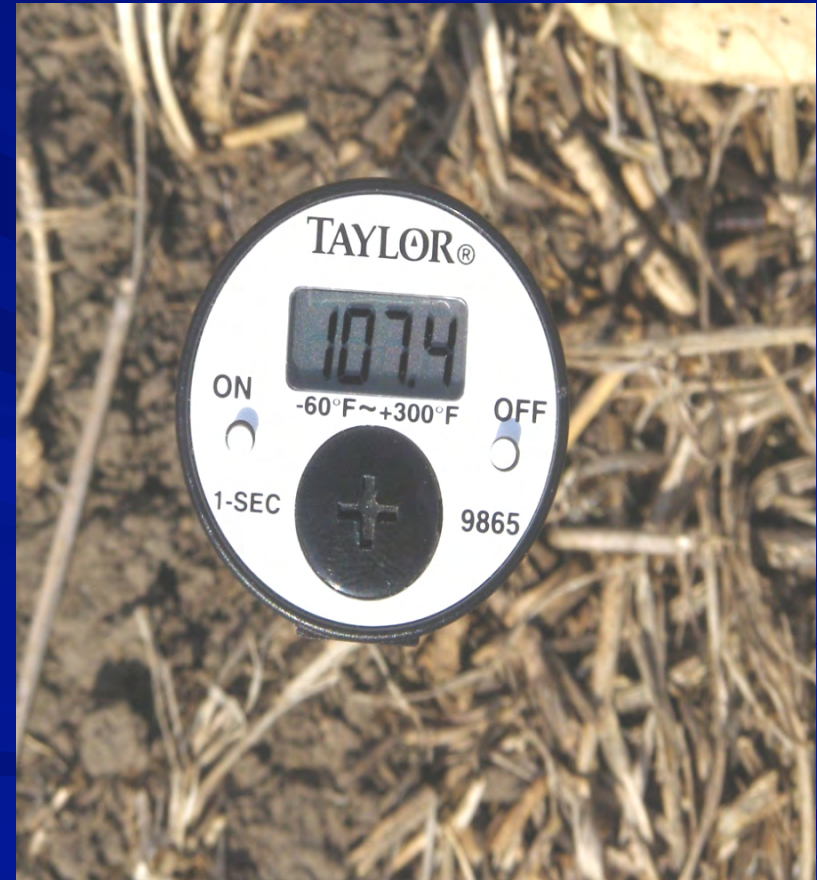
Source: Grass Fed Insights, LLC

Rebuilds Soil Microbial Biomass and Restores Microbial Balance

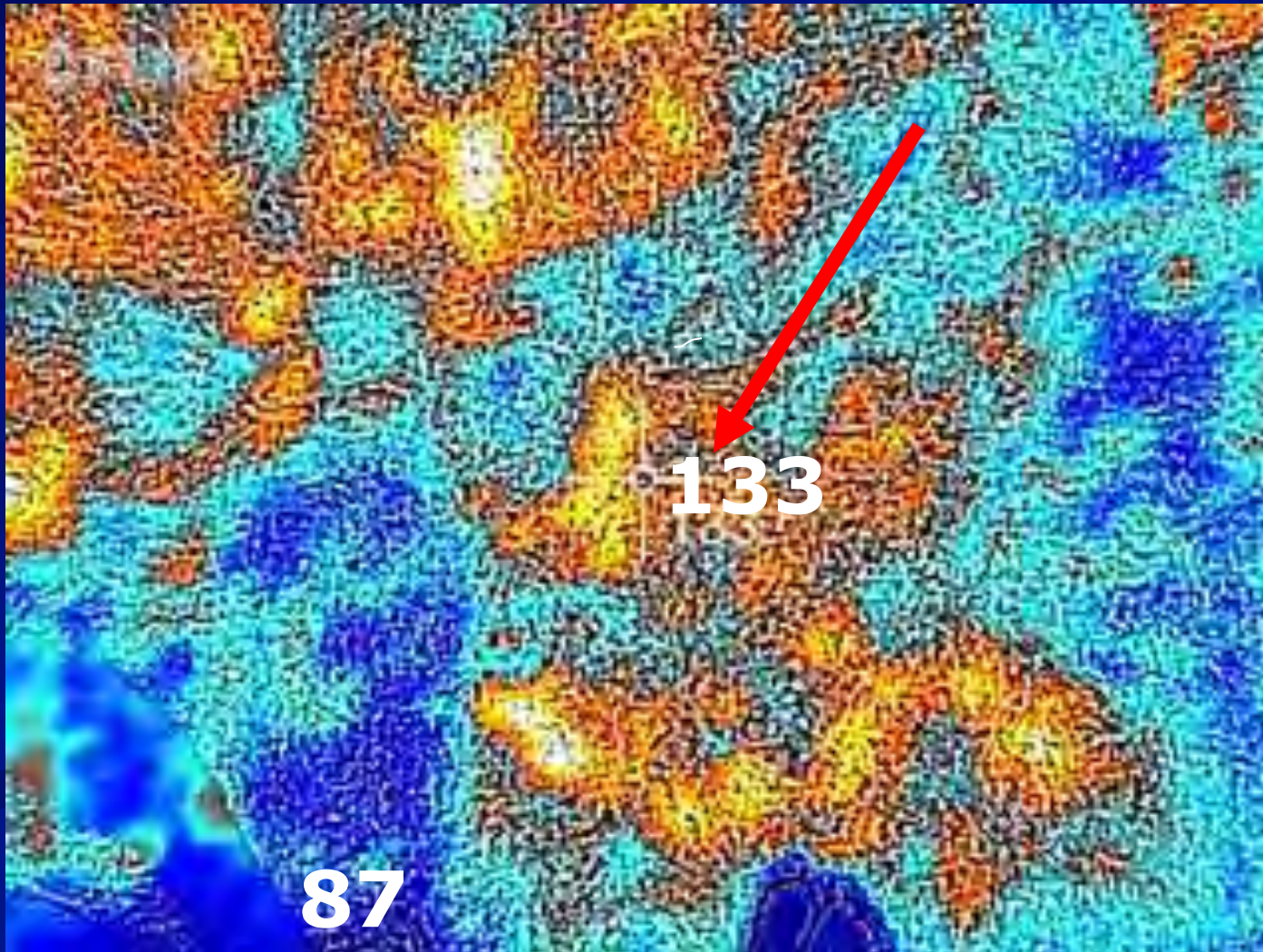
Building Microbial Biomass (ng/g of Soil)



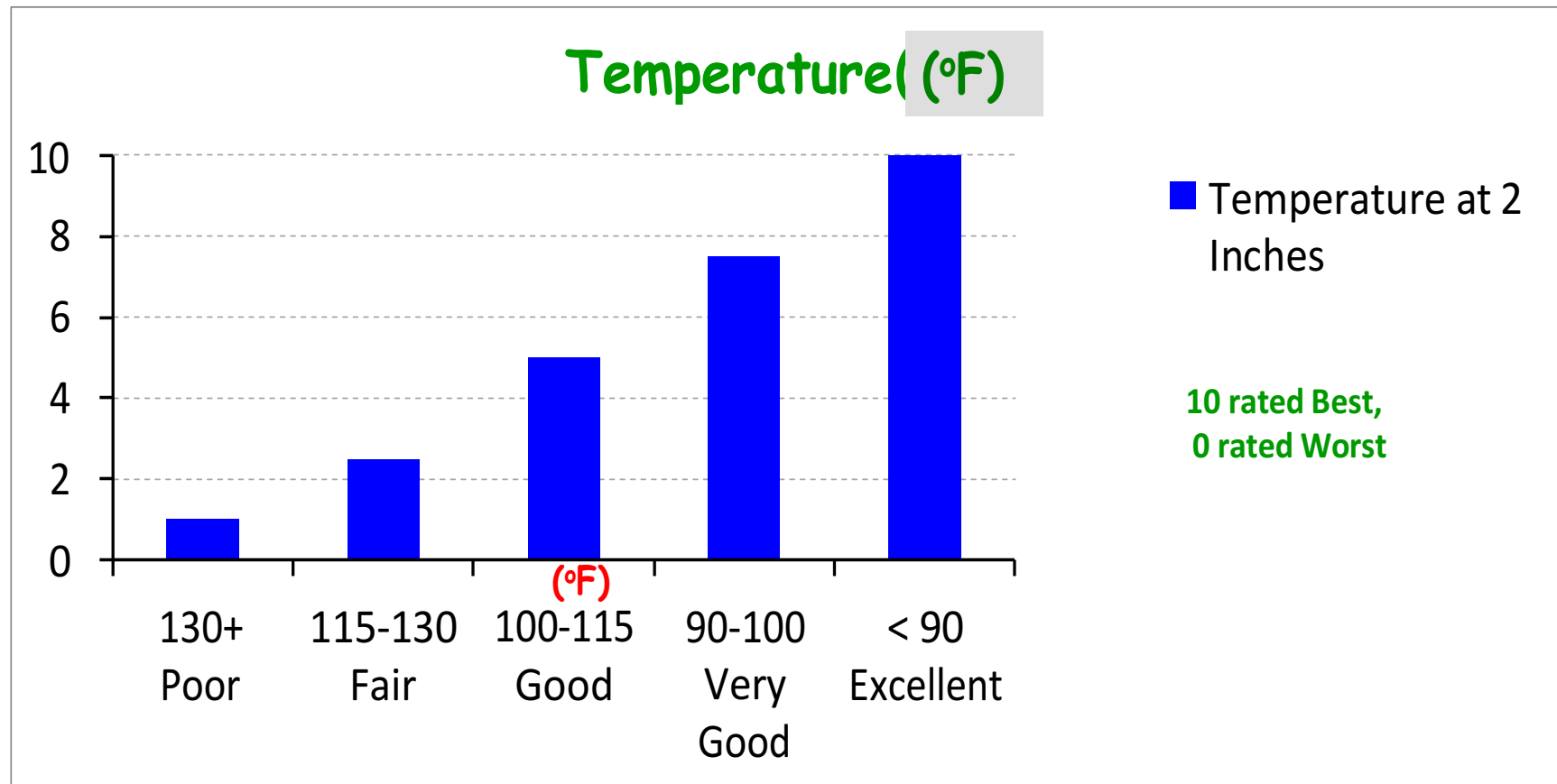
Protect Soil Temperatures



FLIR – Air Temp 96°

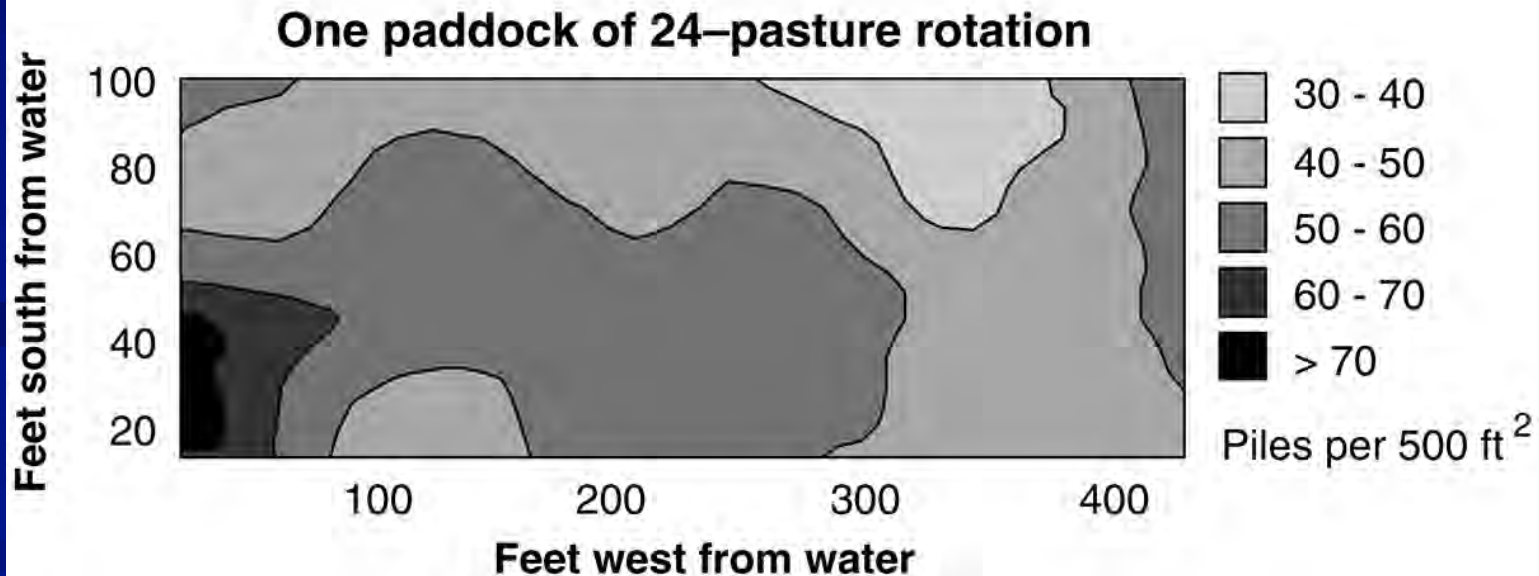
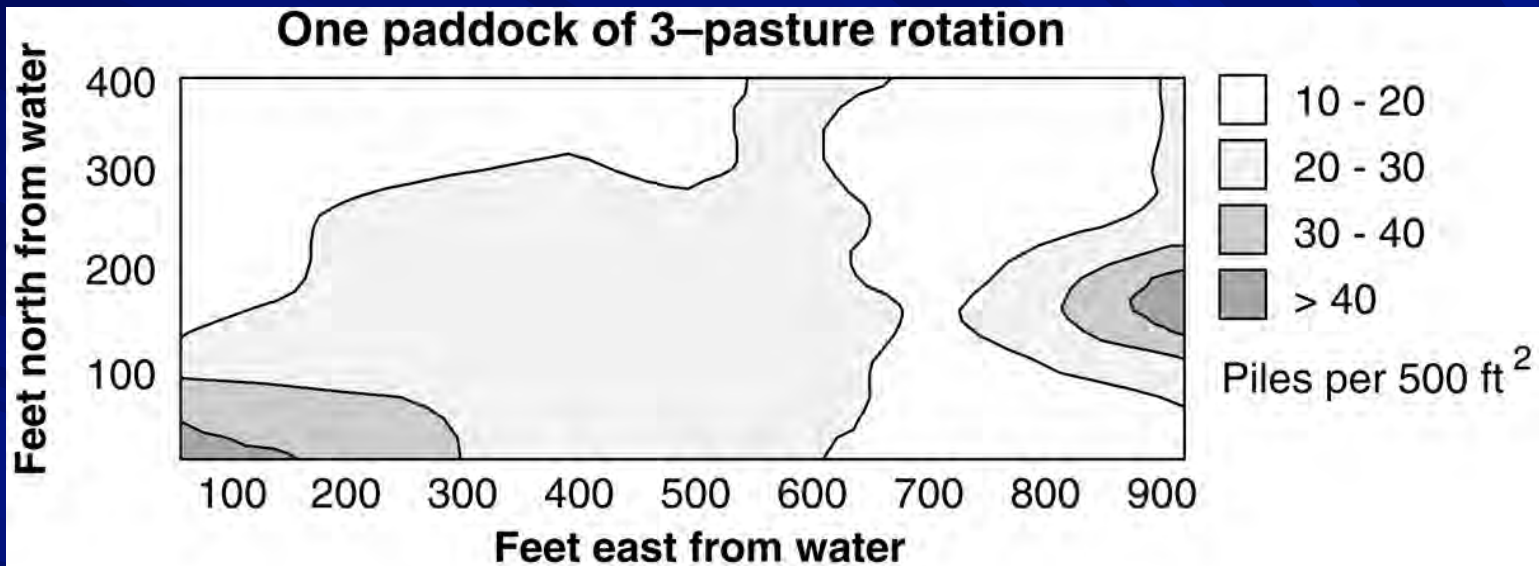


Indicator: Soil Temperature



1. At 70 °F, 100% of Soil moisture is used for growth.
2. At 100 °F, 85% of Soil moisture is lost and 15% is used for growth.
3. At 115 °F, microbes begin to breakdown, and
4. At 140 °F they die.

Even Manure Distribution



Manure Distribution

Rotation Frequency	Years to Get 1 Pile/sq. yard
Continuous	27
14 day	8
4 day	4 – 5
2 day	2
1 time a day	1

Cattle Manure Fertilizer Value is:



In Units of nitrogen (N), Phosphorus (P), and Potassium(K):

84N – 54P – 189K per year or **0.23N-0.15P-0.52K** per cow/day

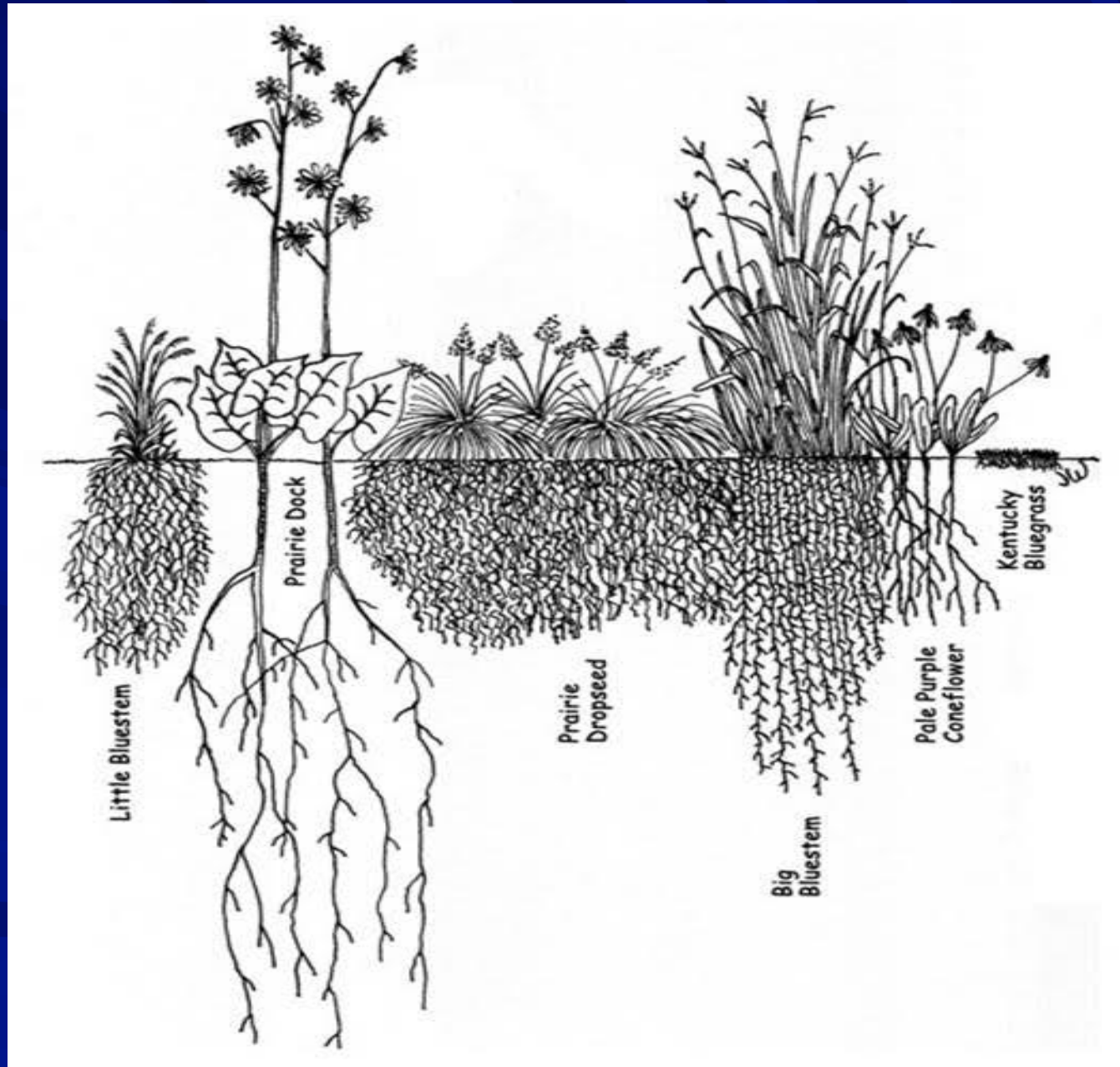
So, How long does it take to fertilize a pasture using AMP Grazing?

100 cows x's **1,000 lbs**/hd x's **1 day** grazing/**1 acre** = **23N-15P-52K/ac**

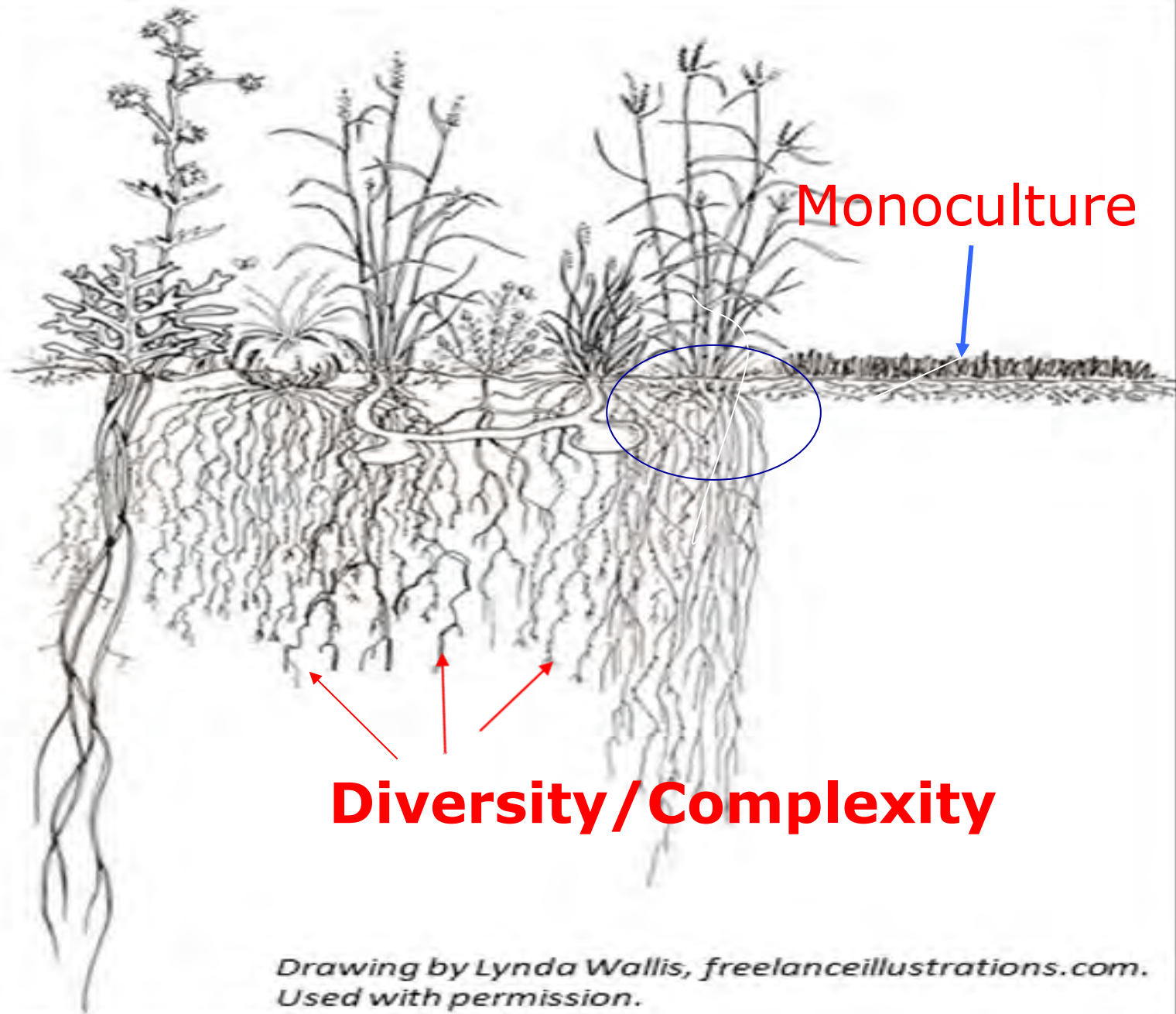
3 Days Grazing/Acre = **69N-45P-156K/ac**

Diversity Is Key

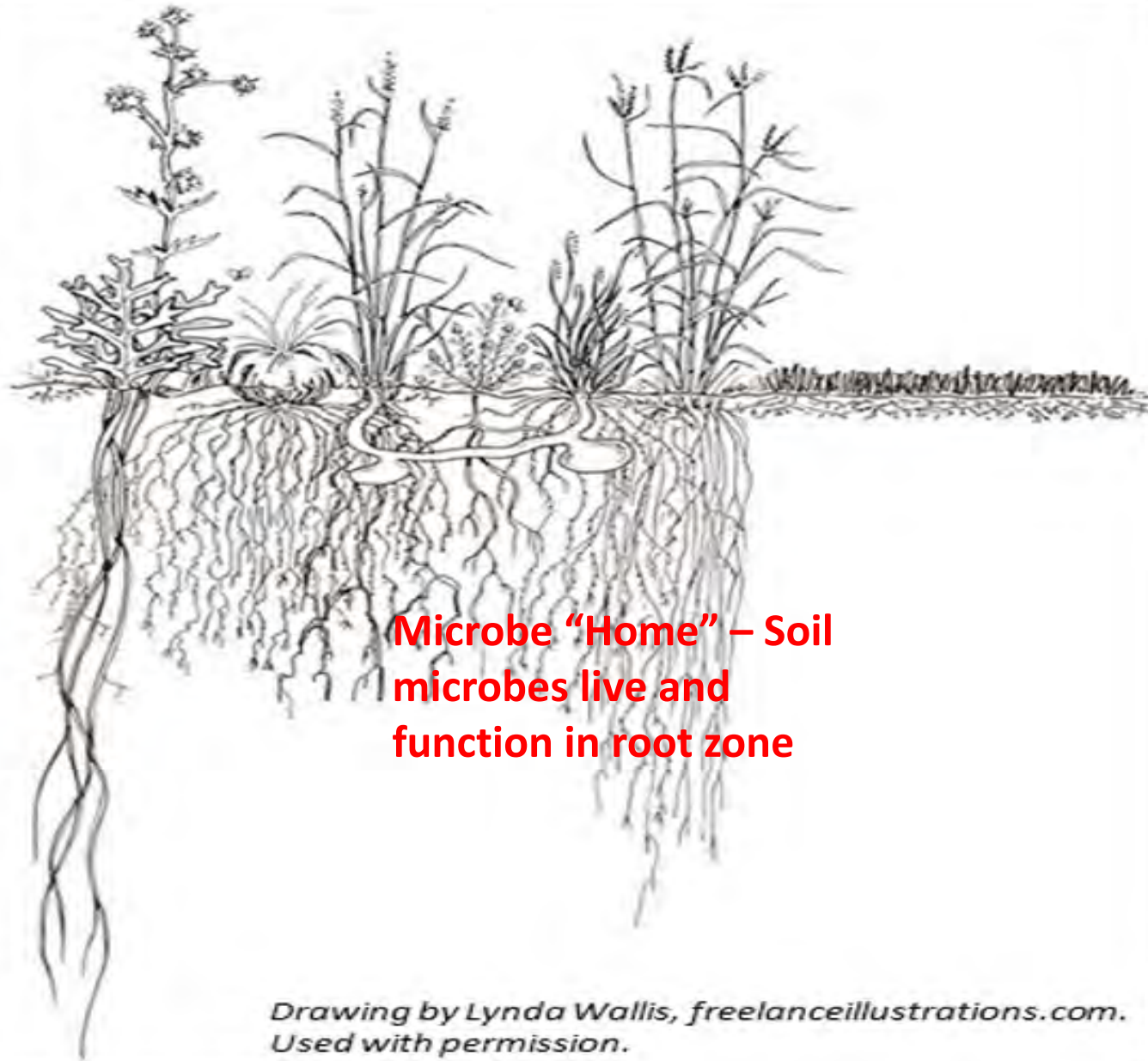








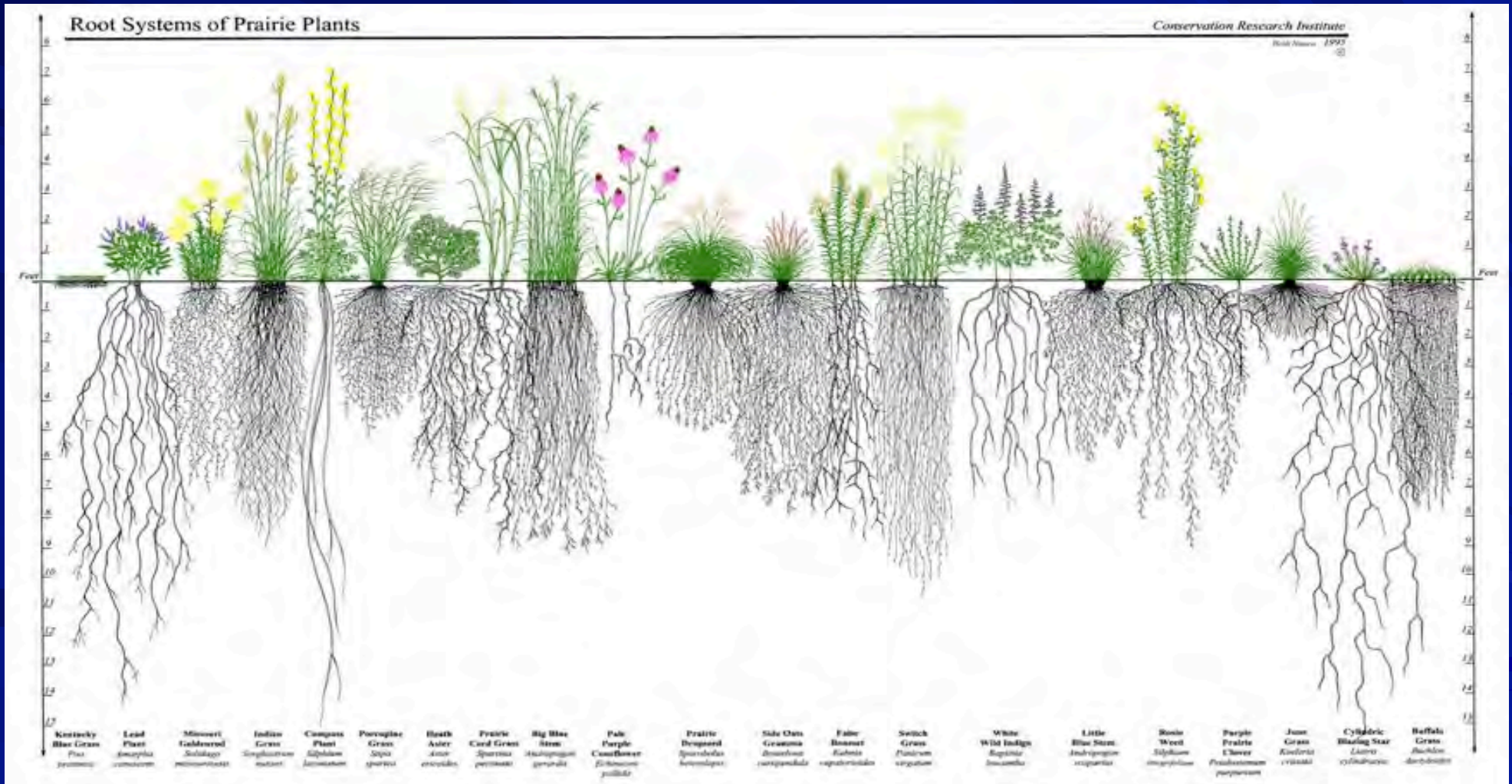
Where Do Majority of Soil Microbes Live & Function?



**Microbe “Home” – Soil
microbes live and
function in root zone**

*Drawing by Lynda Wallis, freelanceillustrations.com.
Used with permission.*

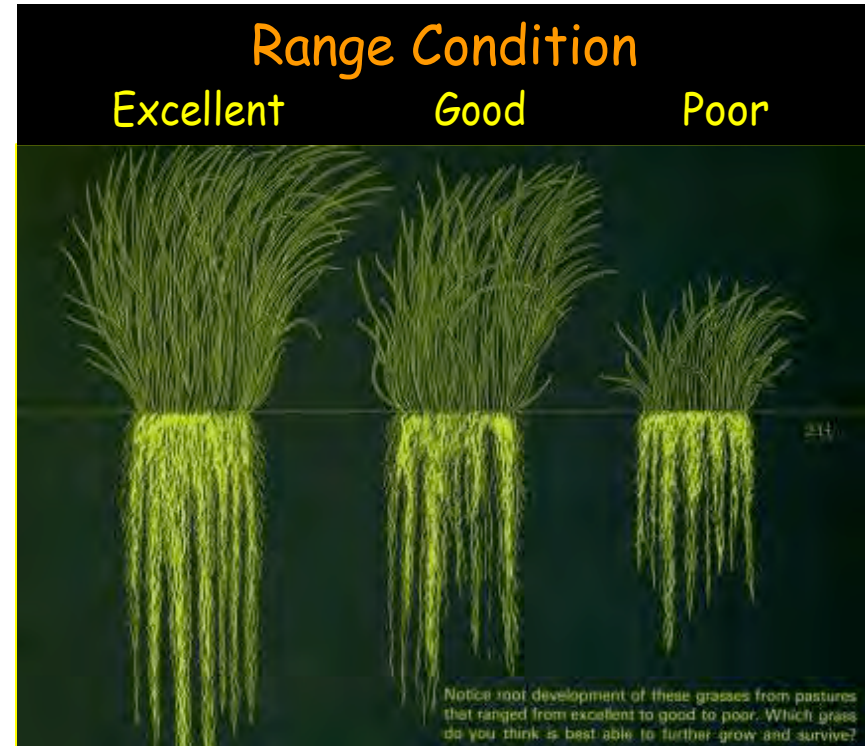
Approximately 2/3 Of Your OM Increase Will Come From Roots!



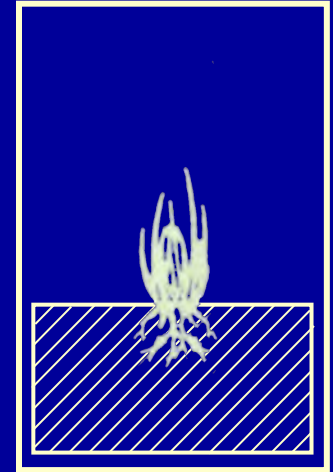
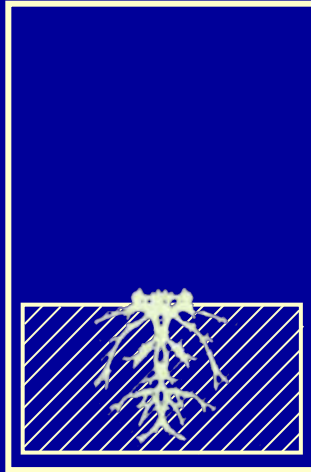
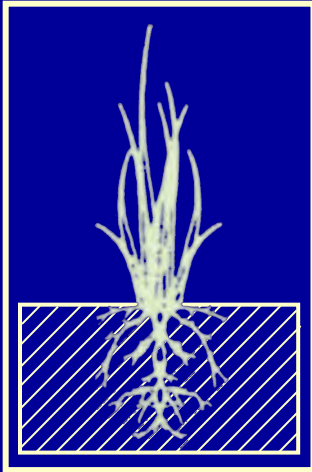
Decrease drought impacts

% Leaf Volume Removed	% Root Growth Stoppage
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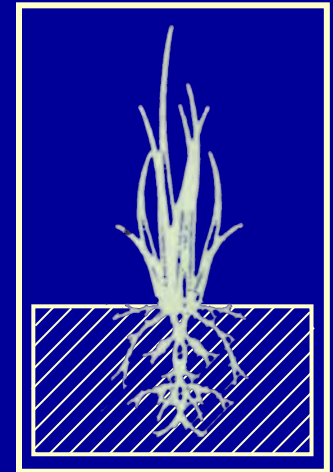
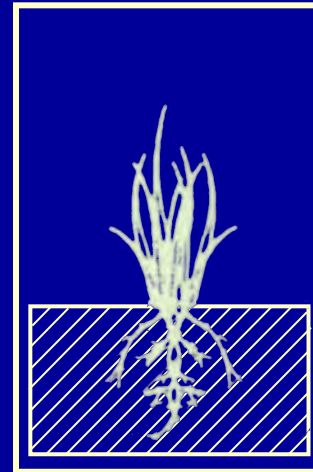
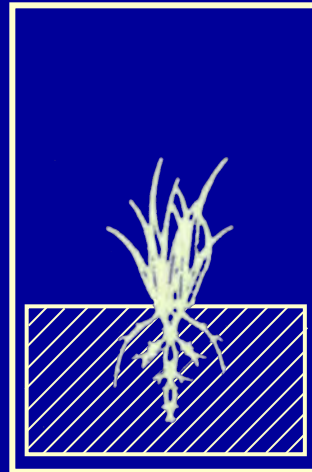
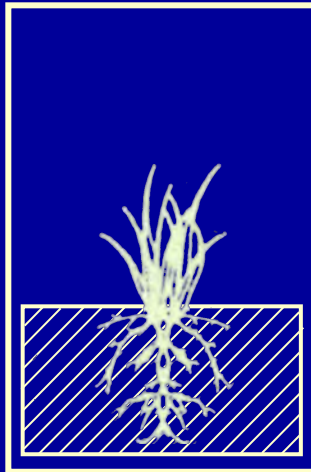
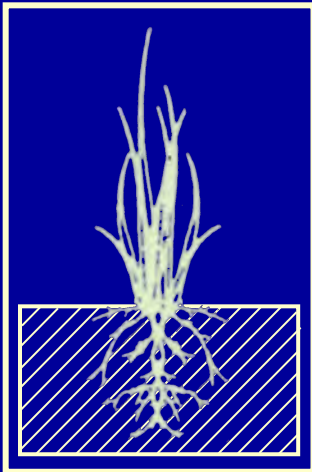
10%	0%
20%	0%
30%	0%
40%	0%
50%	2-4%
60%	50%
70%	78%
80%	100%
90%	100%



A



B



**PLANTS
AT START**

**EXTENT OF
GRAZING**

**5 DAYS
RECOVERY**

**10 DAYS
RECOVERY**

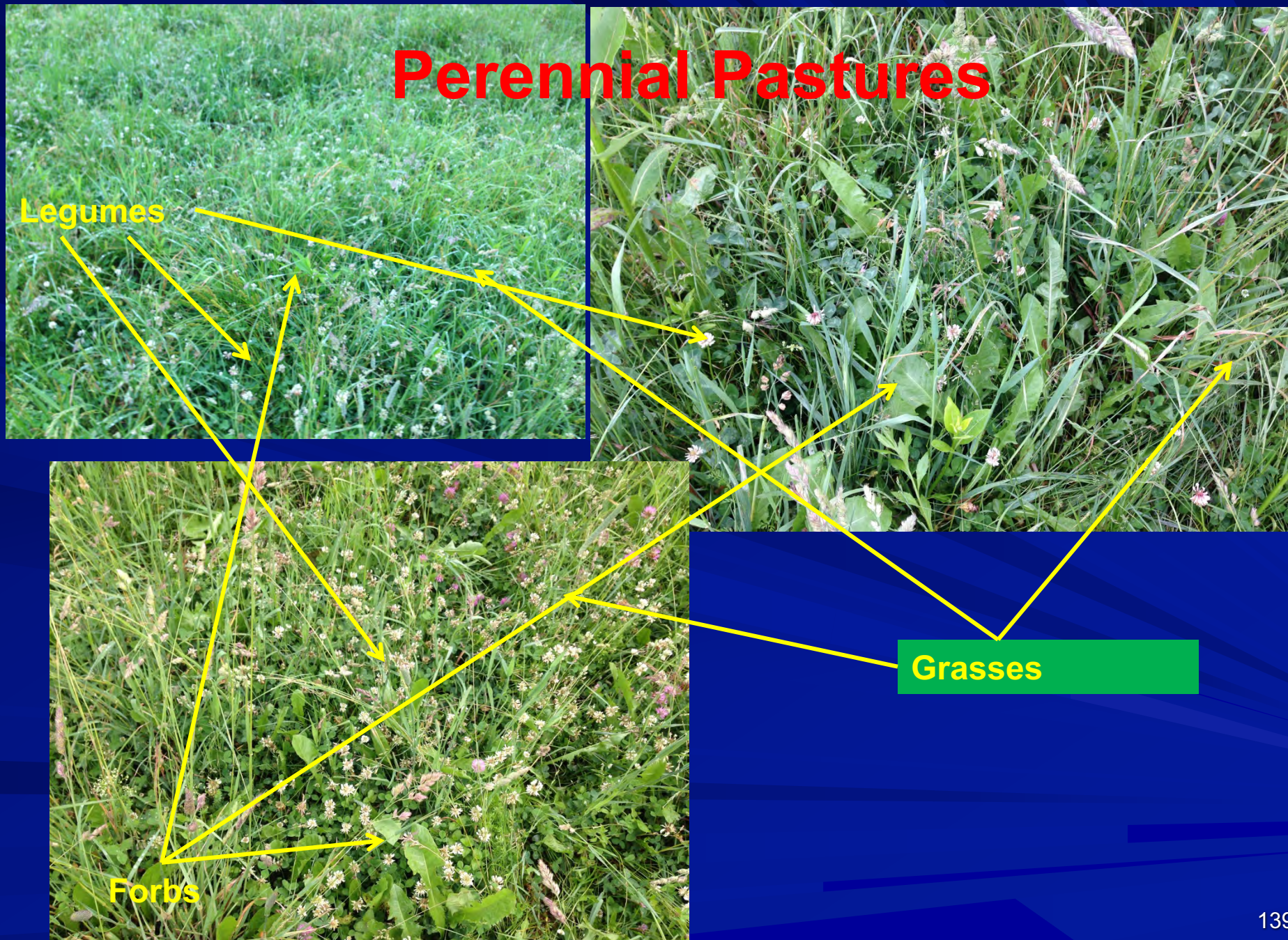
**15 DAYS
RECOVERY**

Desired Mix

■ Rule of Three

- Grasses
 - Legumes
 - Forbs
-
- Strive for minimum of three grasses, three legumes, and three forbs in mix, whether perennial or annual.

Perennial Pastures



Warm Season Annuals



Cool Season Annuals



Why Complexity & Diversity?

■ Compounding & Cascading Effects

- Always occur – Positive or negative?
- Secondary & Tertiary compounds
 - Dr. Fred Provenza & Others
- Diversity in microbial species
- Diversity in macroorganisms
- Exponential rather than linear

■ *“No effect or impact is singular”*

Perennial Mix

- Bromegrass, Orchardgrass, MeadowFescue, Tall Fescue, Bluegrass, Reeds Canary, Timothy, Natives,
- White Clover, Red Clover, Trefoil, Hairy vetch, Milk vetch, lespedezas, Sweet Clover, Tick Clover, Alfalfa, Sainfoin....
- Chicory, Plantains (Narrow & Broadleaf), Yarrow, Sheep's parsley, Burette, Dandelion, Docks,

Winter Forage Management



Bale Grazing in Nova Scotia









Winter Stockpile Grazing



Value of Winter Stockpile

<u>Variable</u>	<u>Suggested Value</u>	<u>Sample Value</u>
TDN	>60	65
NFD_d	60-70	62
NE_L	0.65 – 0.70	0.68
RFQ	140-170	179

Millet: 9% CP 50% TDN
Sorghum/Sudan: 12% CP 72% TDN





Hairy Vetch: 18% CP 70% TDN

A photograph showing a single radish root lying on a snowy surface. The radish is partially covered in snow, with its green leafy top visible. It is surrounded by dry, yellowed grass stalks. The background is a mix of snow and dry grass.

Radish: 14% CP 70% TDN

BRIX

- Higher Brix – Result of improving SOM and soil microbial populations.

BRIX

- Dissolved plant solids include **sugars** (such a sucrose and fructans), **minerals**, **amino acids**, **proteins**, **lipids** and **pectins**.
- **Higher Brix** – Result of improving SOM and soil microbial populations.

Simple To Measure

- Can use either Optical or Digital Refractometer.



Measuring Brix – Sample Prep



Measuring Brix - Refractometer



Why High Brix in Forages?

■ Research shows

- **increase animal gains**
- Increase Milk/components

■ High Brix Forages are:

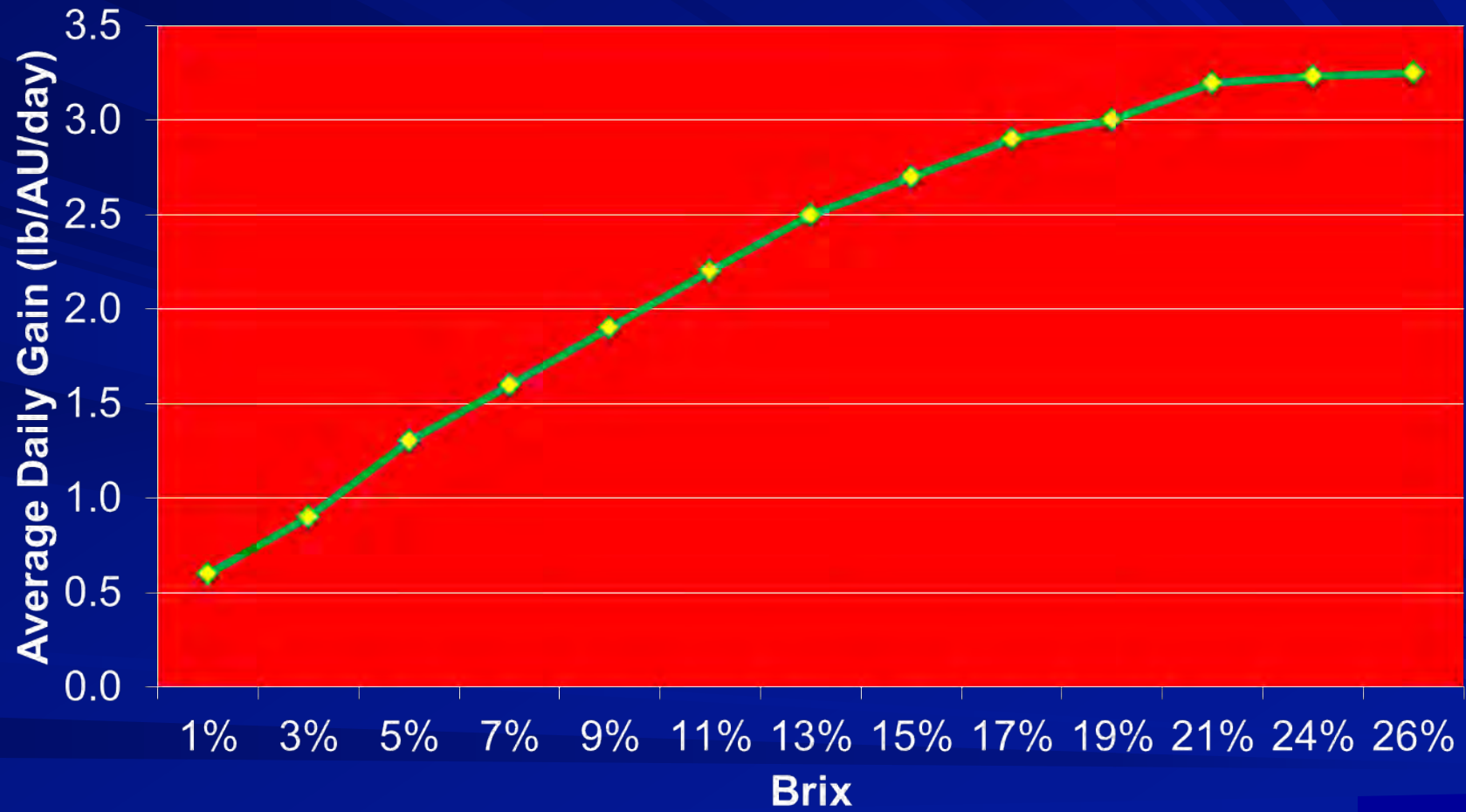
- More drought resistant
 - Freeze tolerant,
 - More resistant to plant disease and pests
-
- **References:**
 - (Moorby, 2001).
 - (Moller, 1996).
 - (Downing & Gamroth, 2007; Miller, et al, 1999).
 - (Allison, 2007).
 - (McKenzie, 2007).



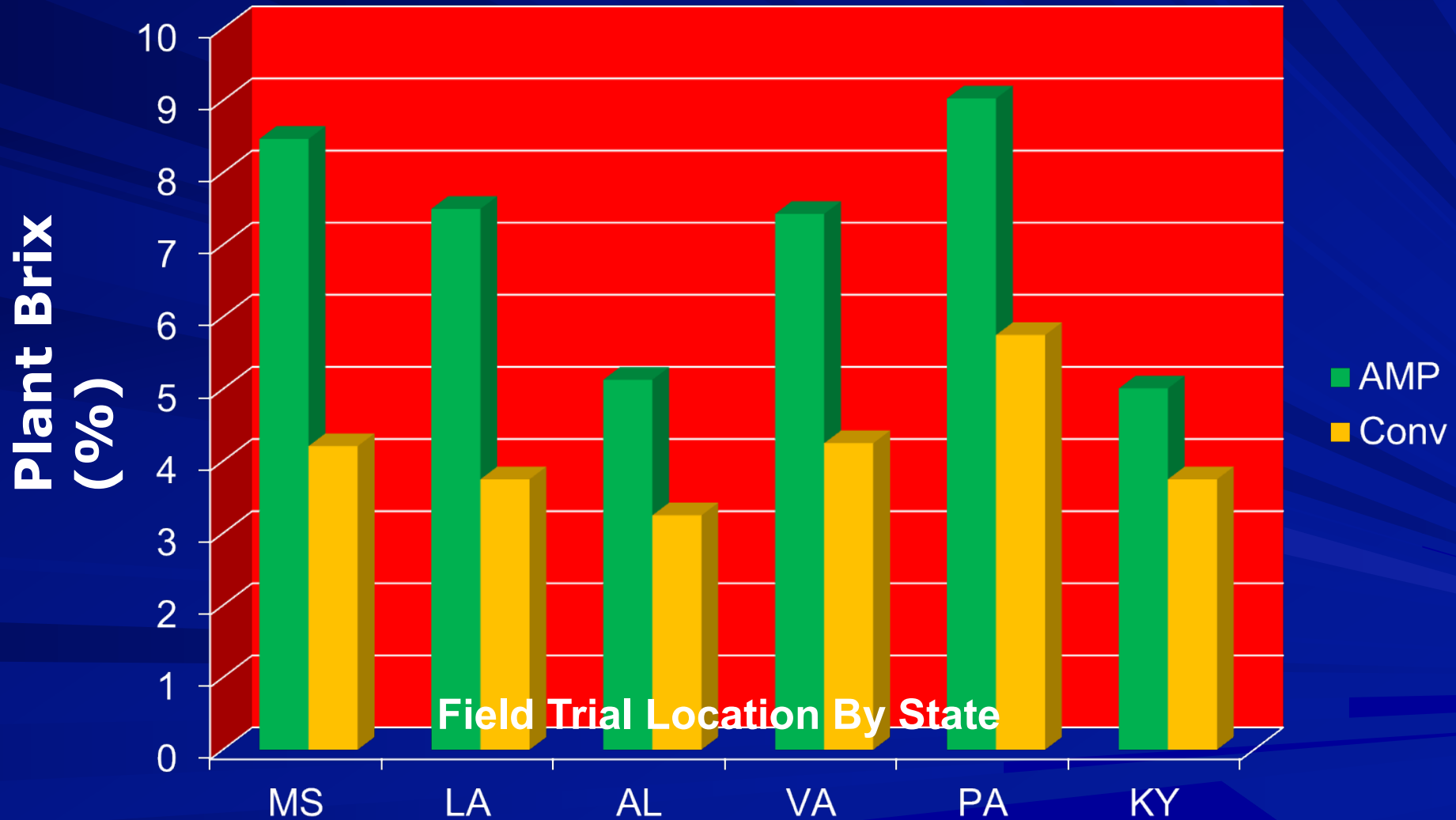
- Brix 5.0% or less = ADG in low 1's.
- Brix 8-12% = ADG in low to mid-2's.
- Brix 12 – 15% = ADG in mid-high 2's.
- Brix > 15% = ADG in high 2's to 3's.
- Every 1.0% increase in Brix adds 0.1 to 0.3 ADG.
- Going from 3% to 6% Brix in dairy pastures adds between 10-20% milk production.

Brix Advantage

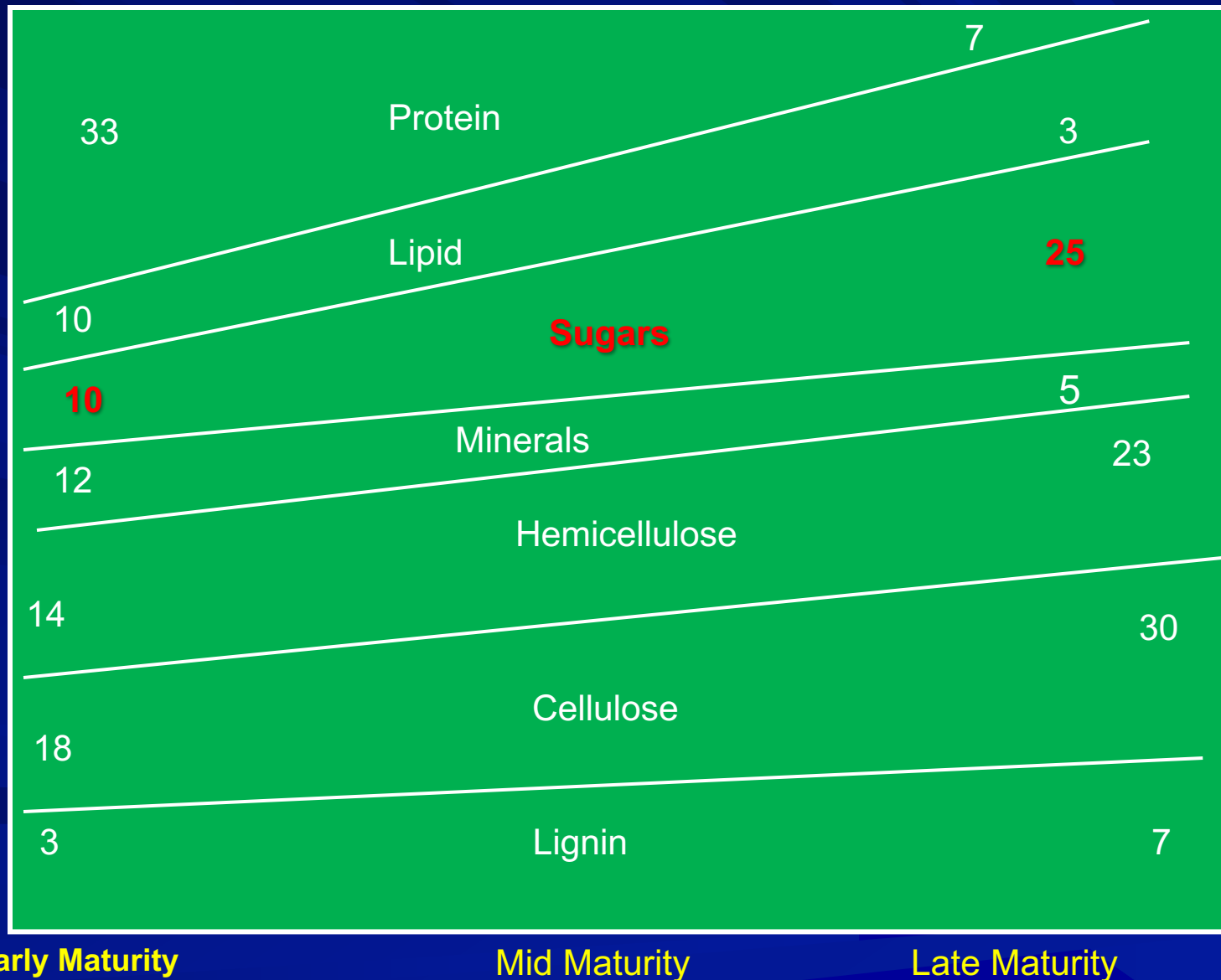
Impact of forage quality on ADG



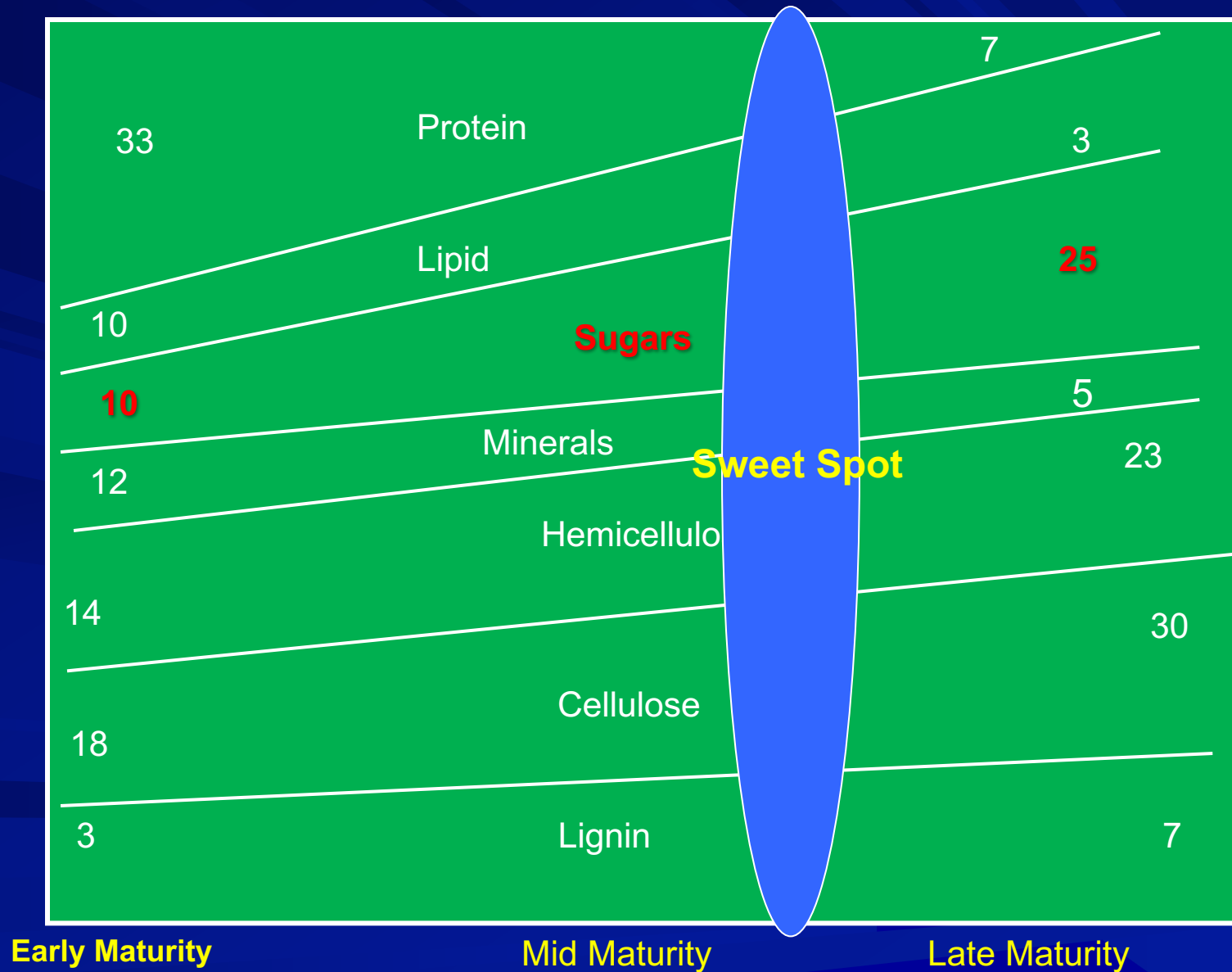
Single Season Forage Brix Impact: AMP Grazing Vs. Conventional Grazing



Effects of Stage of Maturity on Pasture Composition



Effects of Stage of Maturity on Pasture Composition



Too Big to Ignore

■ Two Keys to Better Gains:

- Stage of maturity of forage when grazed
- Timing of daily moves
- Paying attention will result in ADG improvements of **0.25 to 0.5 lbs/hd/day**.

Important Grazing Tips

- Know DM availability and allow 3.0% - 3.5% DM per head daily.
- Take no more than 30%- 50% available DM in a single grazing.
- Move forward rapidly to not allow too many bites of the same plant.
- Know the brix content.
- Turn into new paddocks in early to mid-afternoon (peak brix or plant sugars).
- Stage of forage maturity critical – Mid-stage to slightly beyond...

Future of Agriculture

- More Stacked Enterprises
 - Multispecies livestock
 - Beekeeping, beneficial insect raising
 - Integration of higher value crops
 - Specialty grains
 - Fruits and nuts
 - Vegetable and herbs
 - Recreational & entertainment
 - On Farm restaurants, cooking & canning schools, etc....

The "New" Farm

Bee
Hives

Mixed fruit & nut
orchards -
interspersed

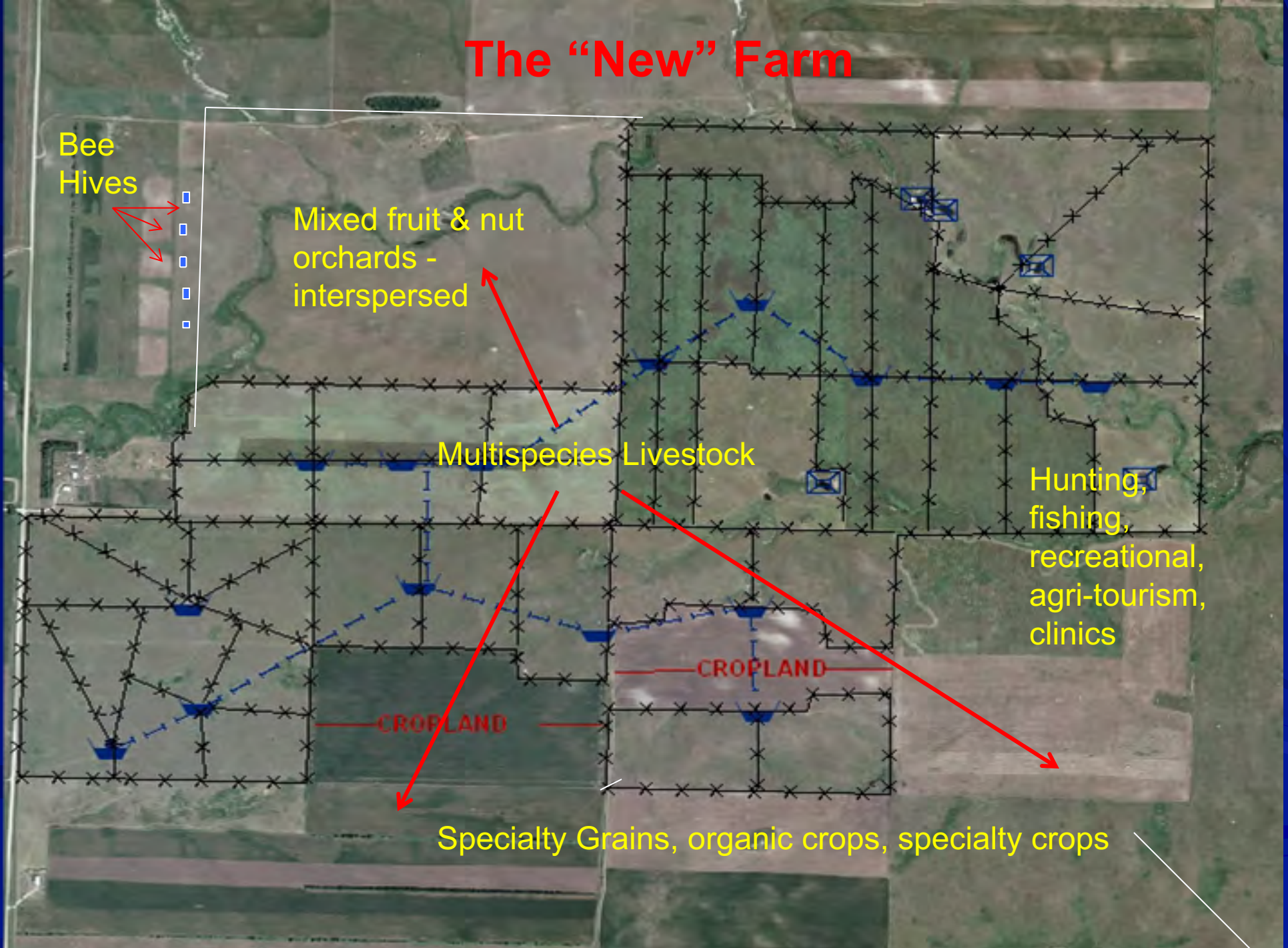
Multispecies Livestock

Hunting,
fishing,
recreational,
agri-tourism,
clinics

CROPLAND

CROPLAND

Specialty Grains, organic crops, specialty crops



Equipment

Equipment



Variety of Ways to Get Job Done



Allen's Fencing Rig



Fencing In Mississippi





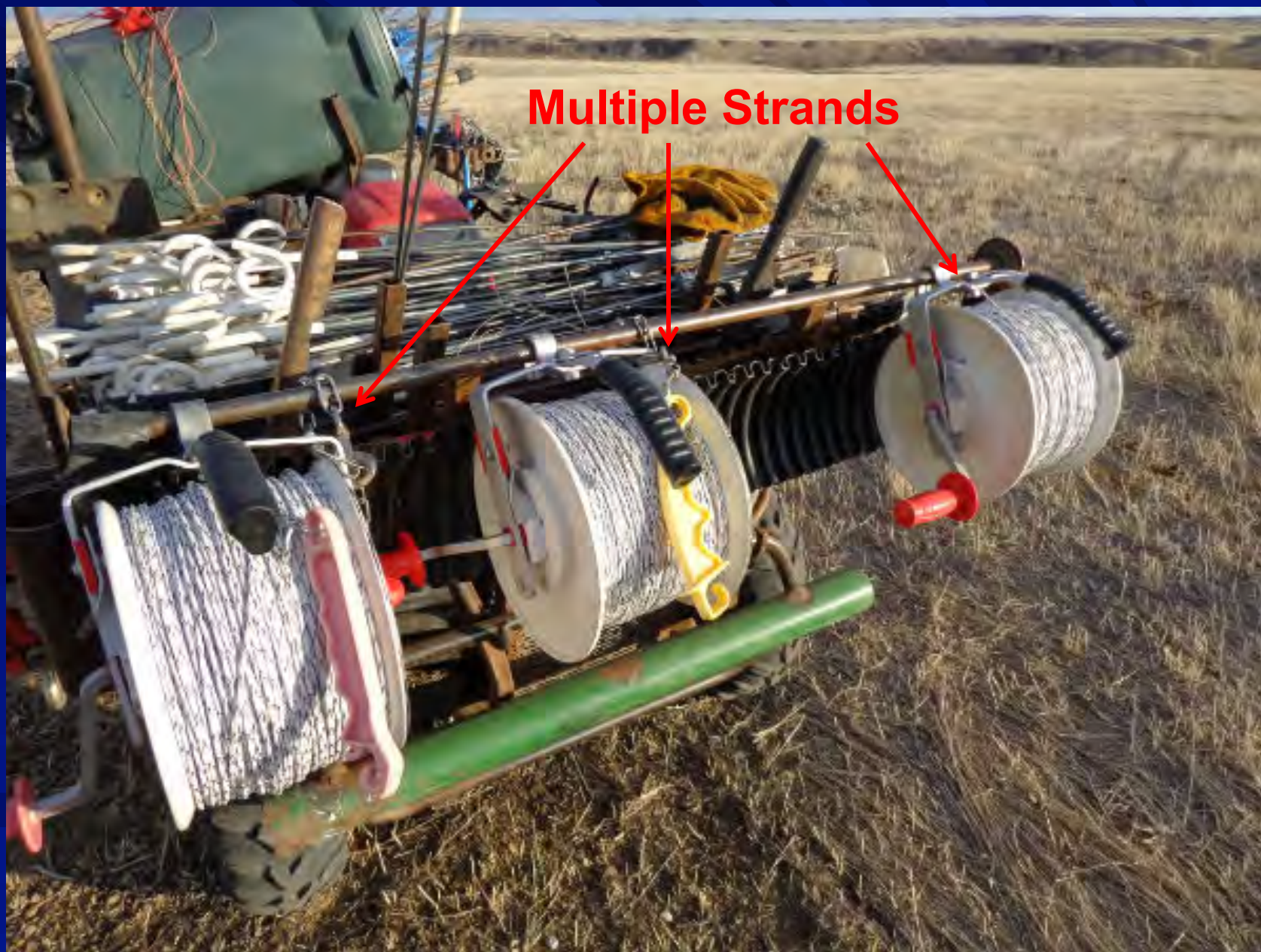
Pigtail Post Rack



Wire Crossing Bar









Getting Serious in the Sandhills



Solar Power Fencing



Solar Power Fencing



Creative Corrals



Temporary (and Edible) Corral

