

- FEBRUARY 20, 2018 -

Regenerating Soils with Adaptive, High-Stock Density Grazing



- PRESENTED BY -

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NRCS | USDA

- HOSTED BY -

FACT

Food Animal Concerns Trust

Introductions



Food Animal Concerns Trust (FACT) is a national nonprofit organization that advocates for the safe and humane production of meat, milk, and eggs.



Larissa McKenna

Humane Farming Program Director

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FACT's services for livestock and poultry farmers include:

- **Fund-a-Farmer Grants**
- **Conference scholarships**
- **Free webinars**
- **Humane Farming Mentorship Program**

Our Presenter



Justin Morris

Regional Soil Health Specialist
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USDA's Natural Resources
Conservation Service (NRCS)



United States Department of Agriculture



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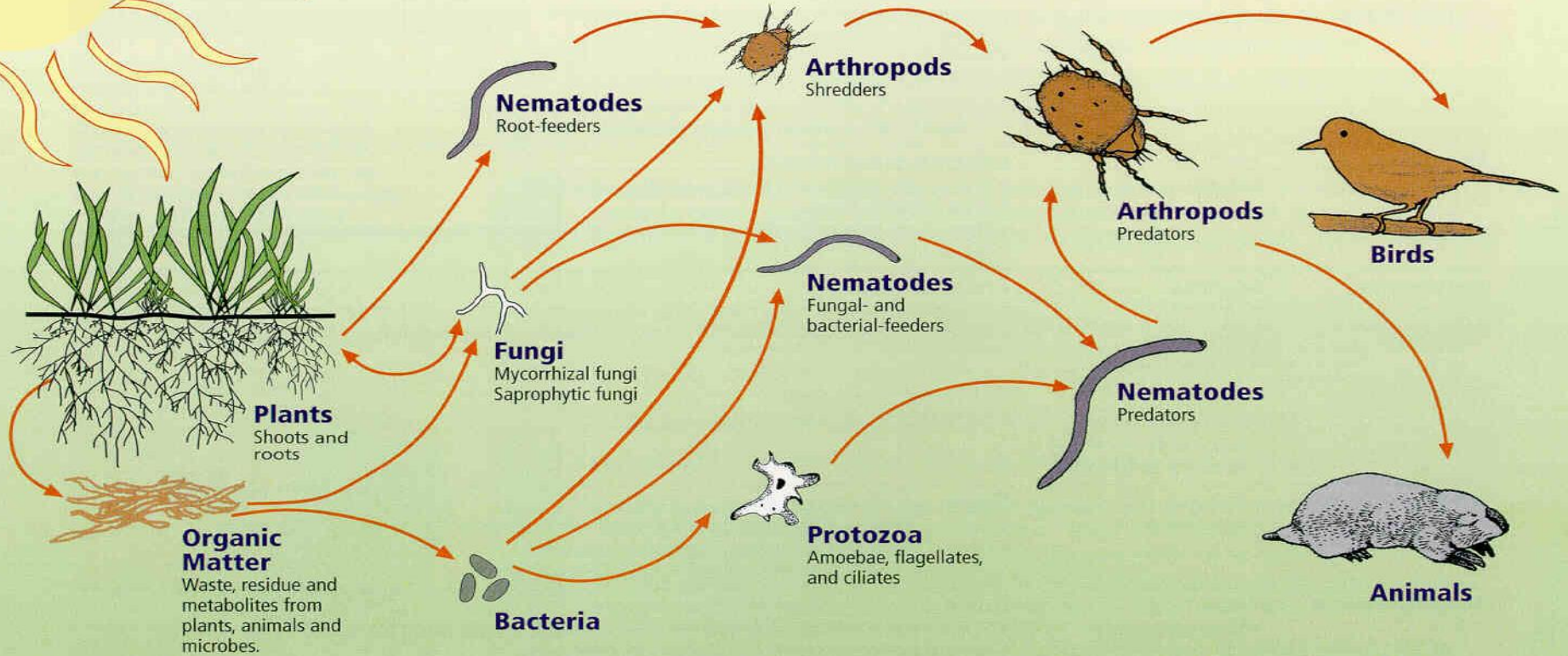
Feb 20, 2018 | Food Animal Concerns Trust Webinar

SOIL HEALTH:

The continued capacity of a soil to function as a vital, living ecosystem that sustains plants, animals, and humans.

The Soil Food Web

Is complex



First trophic level:
Photosynthesizers

Second trophic level:
Decomposers
Mutualists
Pathogens, parasites
Root-feeders

Third trophic level:
Shredders
Predators
Grazers

Fourth trophic level:
Higher level predators

Fifth and higher trophic levels:
Higher level predators



Soil Function

The Four Ecosystem Processes

- **Carbon Cycle:** Solar energy to chemical energy
- **Biocommunity Dynamics:** Soil life, plants, and animals
- **Water Cycle:** Infiltration and availability
- **Nutrient Cycle:** Soluble and plant available

Soil Health Principles Support High Functioning Soils



**Provide
Continuous
Living Roots**



**Minimize
"Chronic"
Disturbance**



**Maximize
Biodiversity**



**Maximize Soil
Cover**

Are we mimicking nature on our farms?

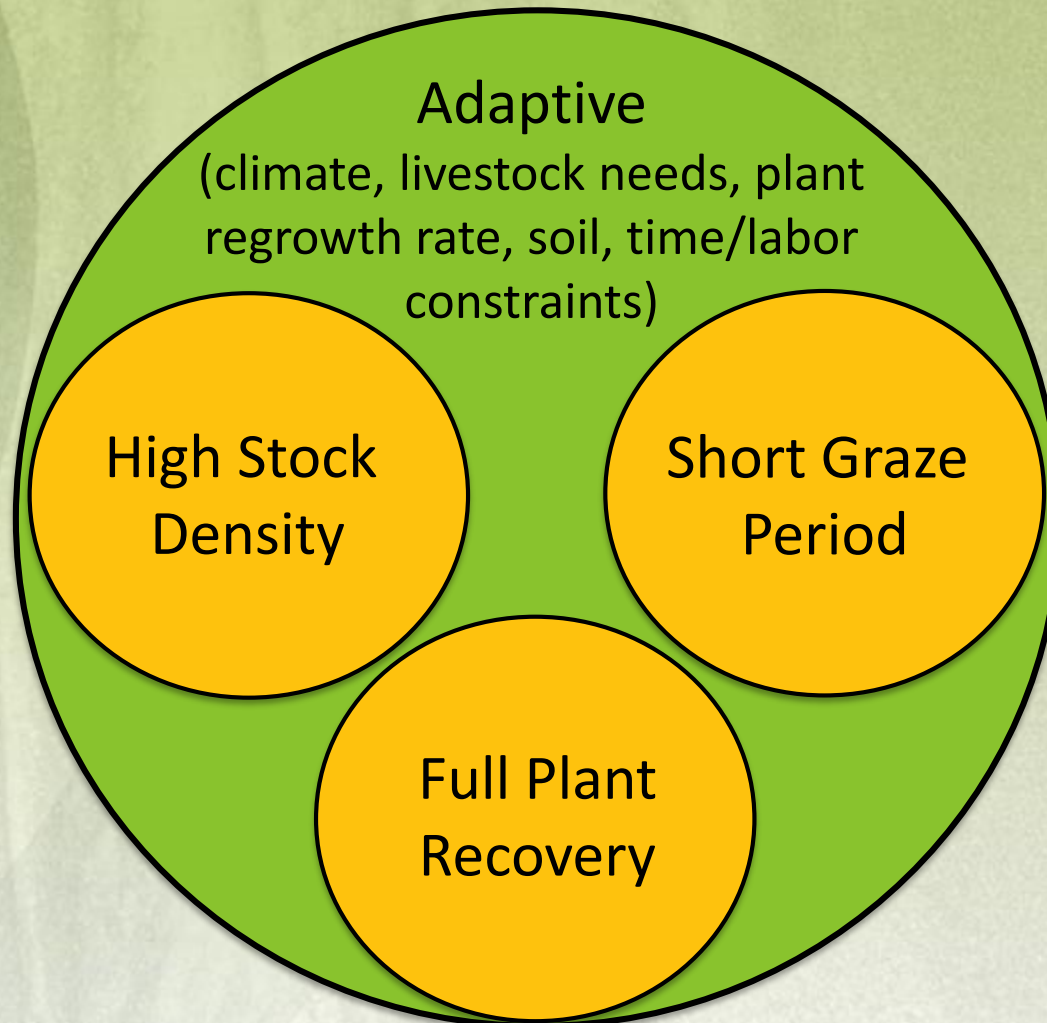


Nature's Template for Improving Soil Health



Doug Peterson, USDA-NRCS

Nature's Template for Improving Soil Health



Adaptive, High-Stock Density (AHSD) Grazing



Stock Density versus Stocking Rate

Stock Density

- Number of pounds of animals per acre at any given point in time
- Expressed as **Pounds of Animal per Acre** or **Animal Units per Acre**

Stocking Rate

- Number of animals that can be supported on a given area for a specified length of time
- Generally expressed as **Animal Unit Months per Acre** or **Cow Days per Acre**, **Grazing Days per Acre**, or **Animal Days per Acre**

Stock Density is Probably the Most Powerful Tool Livestock Producers Can Use To:



- Improve plant diversity
- Increase forage supply
- Improve nutrient cycling
- Improve livestock performance
- Use weeds as forage
- Eliminate need for herbicides and inorganic fertilizers



What Is Stock Density?

- Imagine we have 100 head of cows weighing 1,250 lbs each.
- $100 \text{ head} \times 1,250 \text{ lbs per cow} = 125,000 \text{ lbs of beef on the hoof}$



10 acre Field: $\frac{125,000 \text{ lbs of Beef (100 cows)}}{10 \text{ acres}}$

Stock Density = **12,500 lbs** live weight per acre

1 acre Field: $\frac{125,000 \text{ lbs of Beef (100 cows)}}{1 \text{ acre}}$

Stock Density = **125,000 lbs** live weight per acre

0.5 acre Field: $\frac{125,000 \text{ lbs of Beef (100 cows)}}{0.5 \text{ acre}}$

Stock Density = **250,000 lbs** live weight per acre

150,000 lbs live weight per acre

unlock the
SECRETS
IN THE
SOIL



09/19/2009

Stock Density Hierarchy

Longer



Relative Time
To Detect
Improvements



Shorter

Rotational System: less than 4,000 lbs. per acre

Management-intensive Grazing (MiG): 4,000 to 50,000 lbs per acre

High Stock Density (HSD): 50,000 to 250,000 lbs per acre

Ultra High Stock Density (UHSD) or Mob Grazing: greater than 250,000 lbs per acre

Soil Health Principles Support High Functioning Soils



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Disturbance**



**Maximize
Biodiversity**



**Maximize Soil
Cover**

Chronic disturbance



So is this!



Acute disturbance





Animals tend to regraze plants every 7-9 days!

Stocking Rate	Grazing Period	Number of times grazed						
		0	1	2	3	4	4+	
1 steer/ 10 ha	20 days	% 8	13	28	34	14	3	-----79%-----
1steer/ 5 ha	20 days	% 12	27	20	9	14	18	-----61%-----

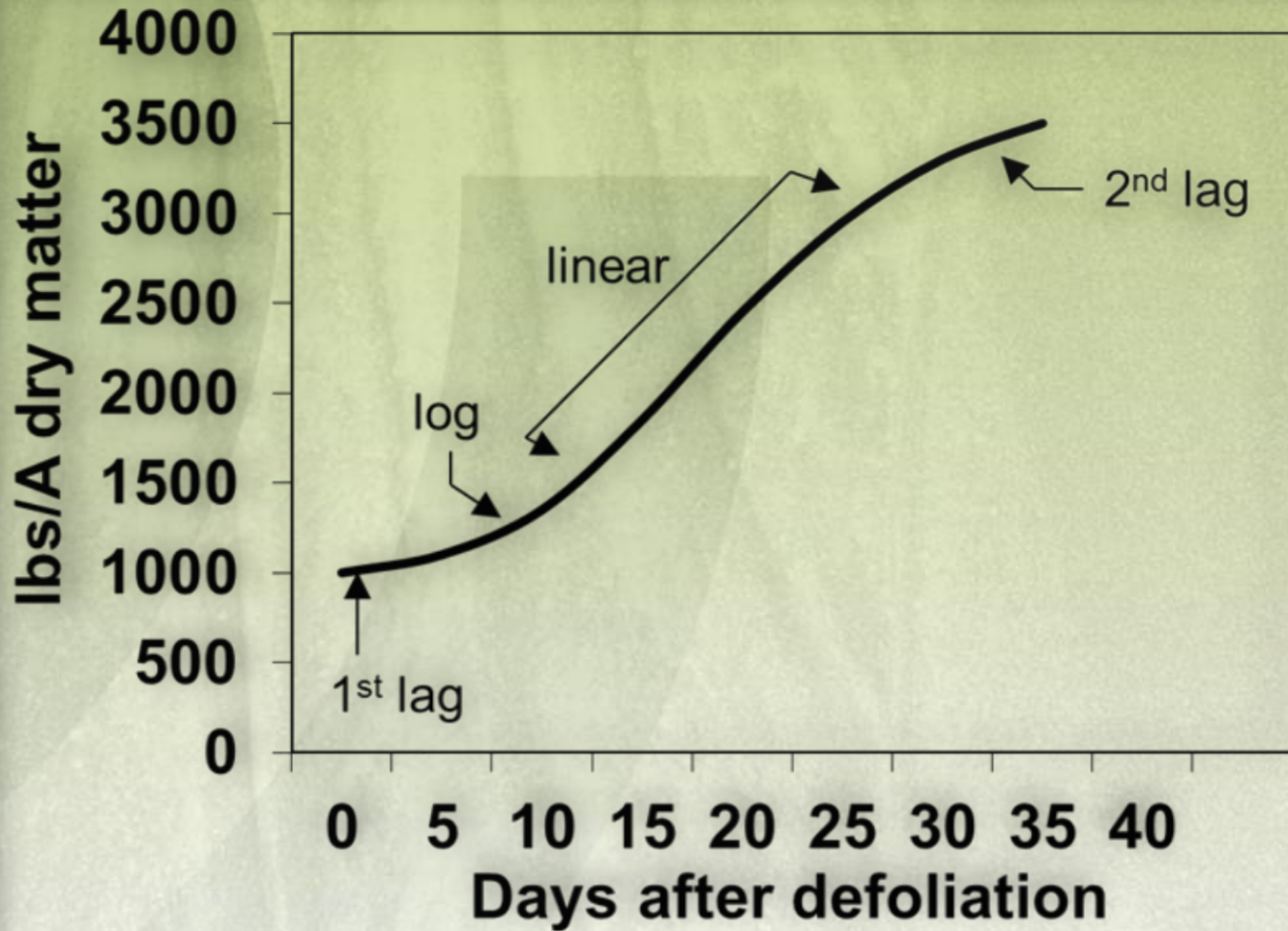
Hart and Balla 1982

Effect of frequent defoliation on forage production and soil cover

(5 year averages from Cook et al. 1958)

	Biting Interval	Average Yield (lbs)
April-June	7 days	1.4
	14 days	2.2
	28 days	3.1
May-July	7 days	1.6
	14 days	2.1
	28 days	2.9

Appropriate Recovery Periods Provide More Soil Cover and Forage



Soil Health Principles Support High Functioning Soils



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**Maximize
Biodiversity**



**Maximize Soil
Cover**

Lots of bare soil!



Cover influences soil temperatures



69° F



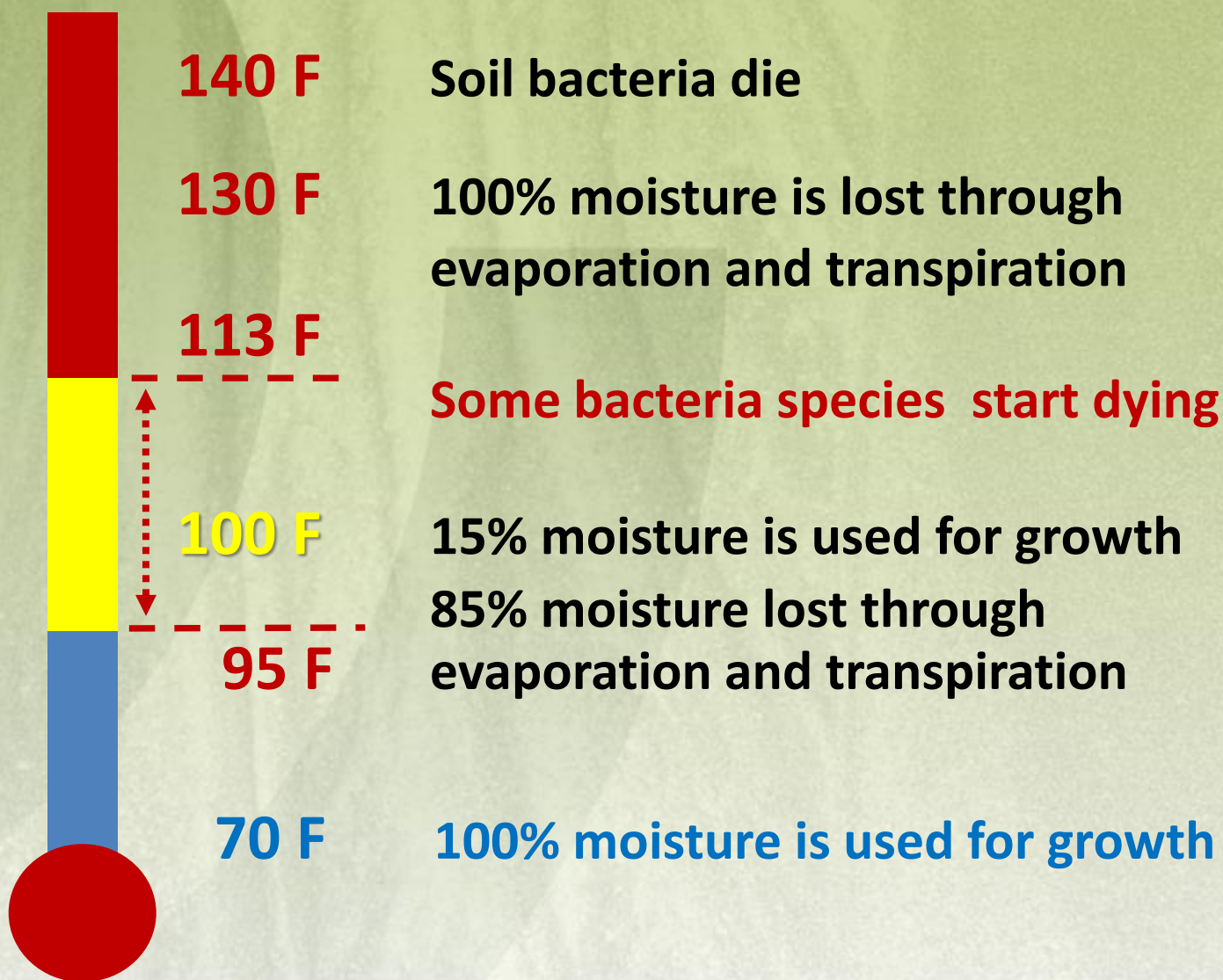
85° F



92° F

Air temperature was 88° F
Same soil type

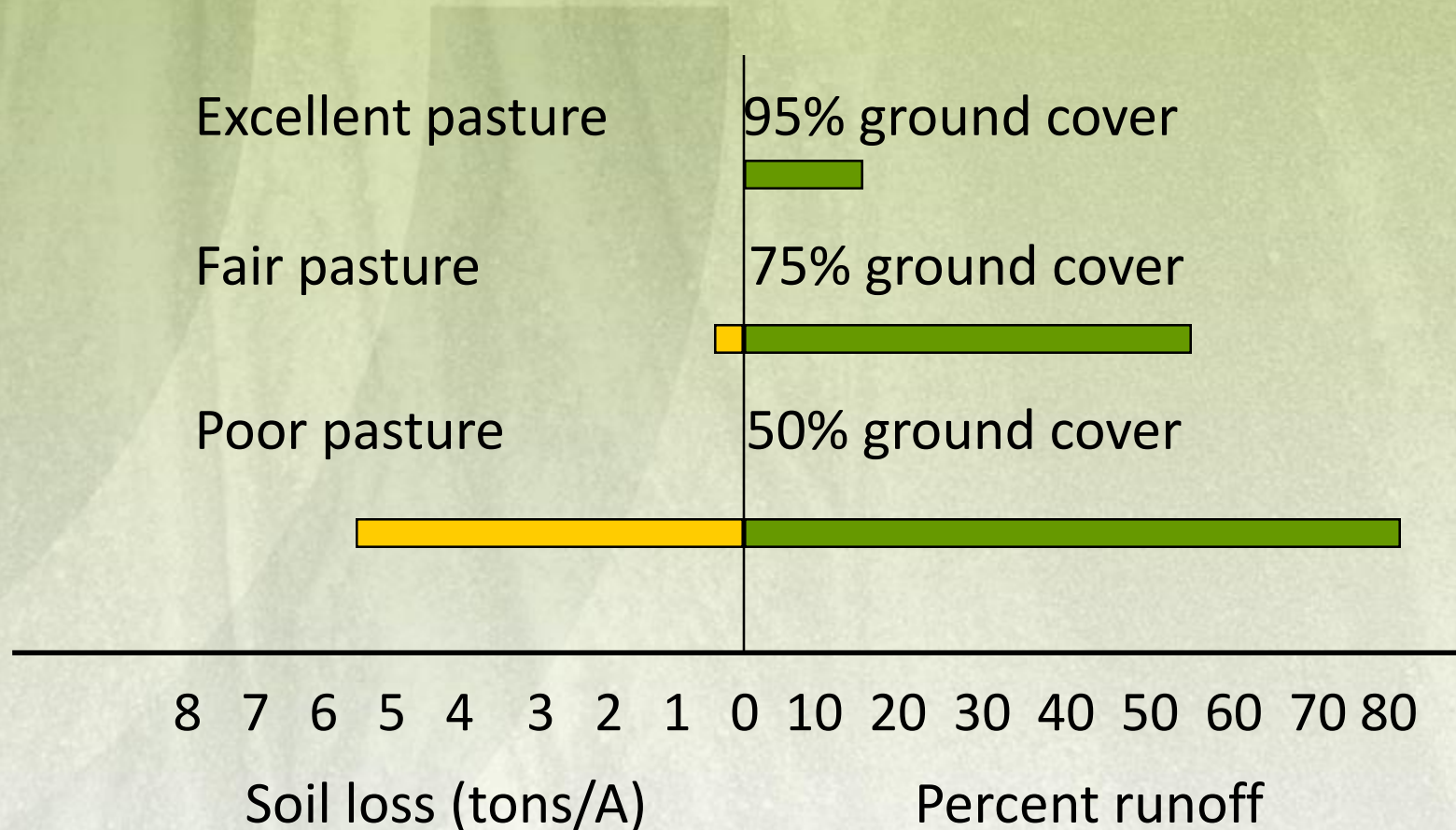
When Soil Temperature Reaches..



Pasture Cover Impacts Infiltration and Runoff

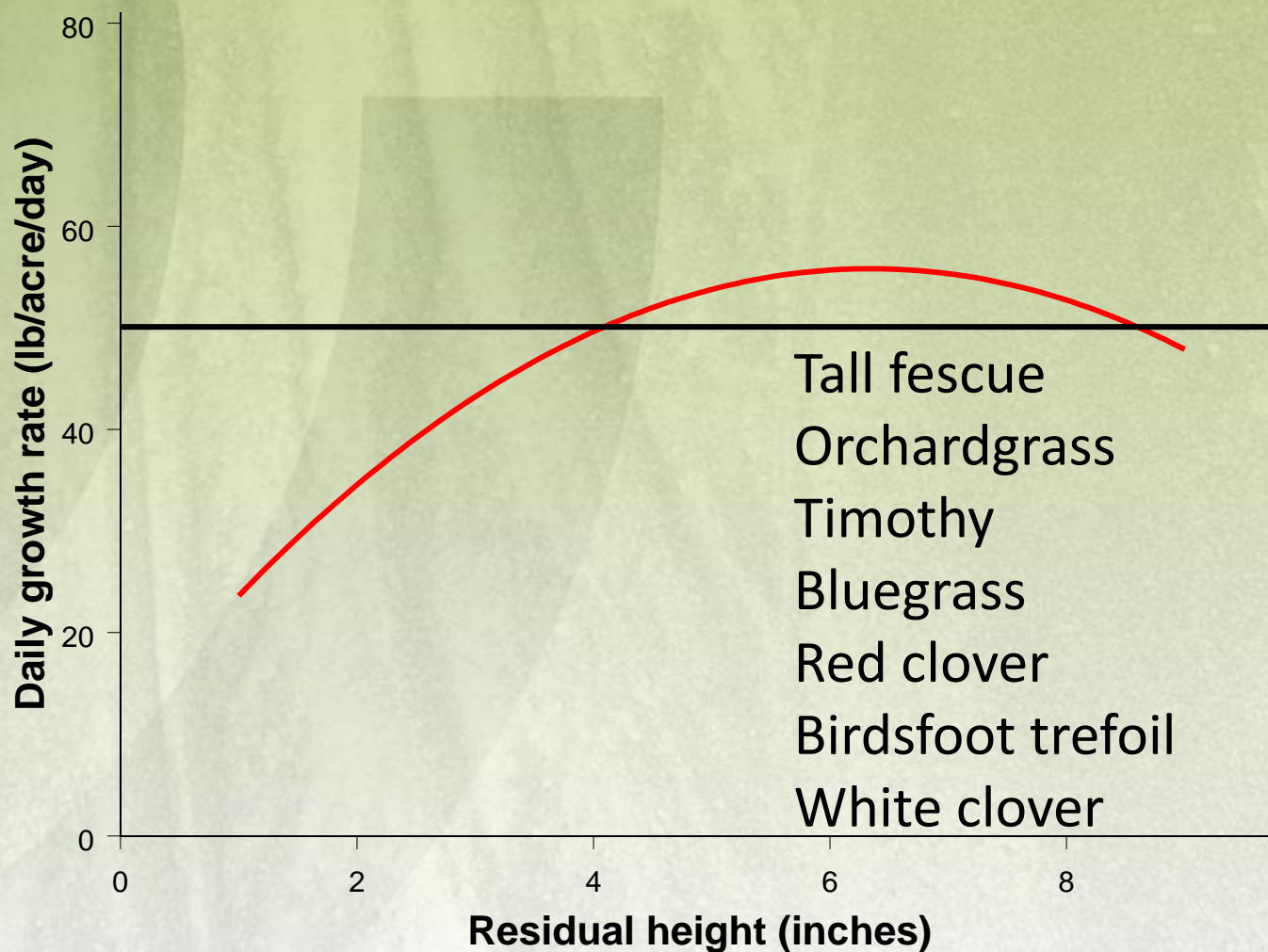


3 inches of rainfall in 90 minutes, 10% slope, silt loam soil
(University of Nebraska & USDA-SCS, 1937)

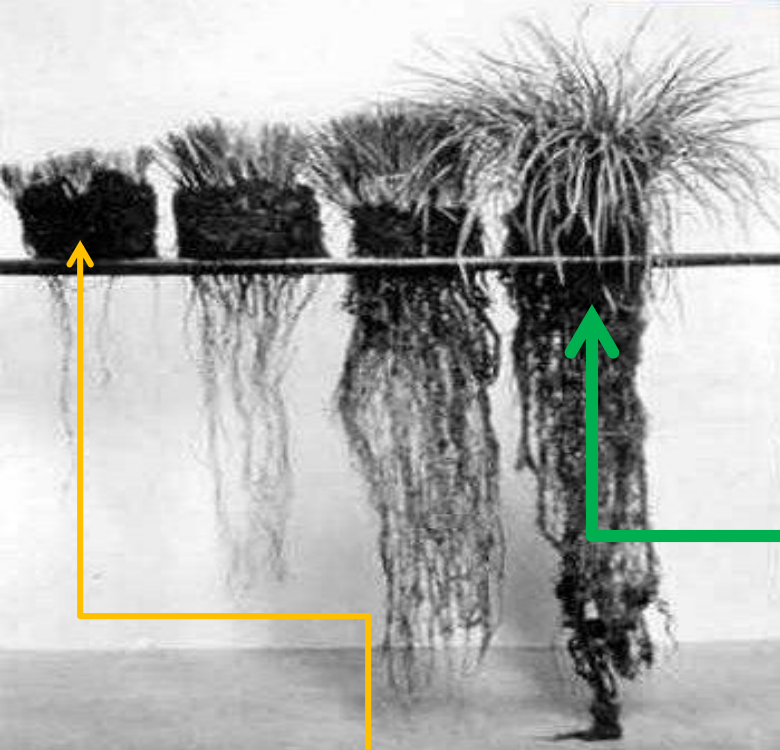




Effect of Post-Grazing Residual on Pasture Daily Growth Rate



Jim Gerrish
MU-FSRC

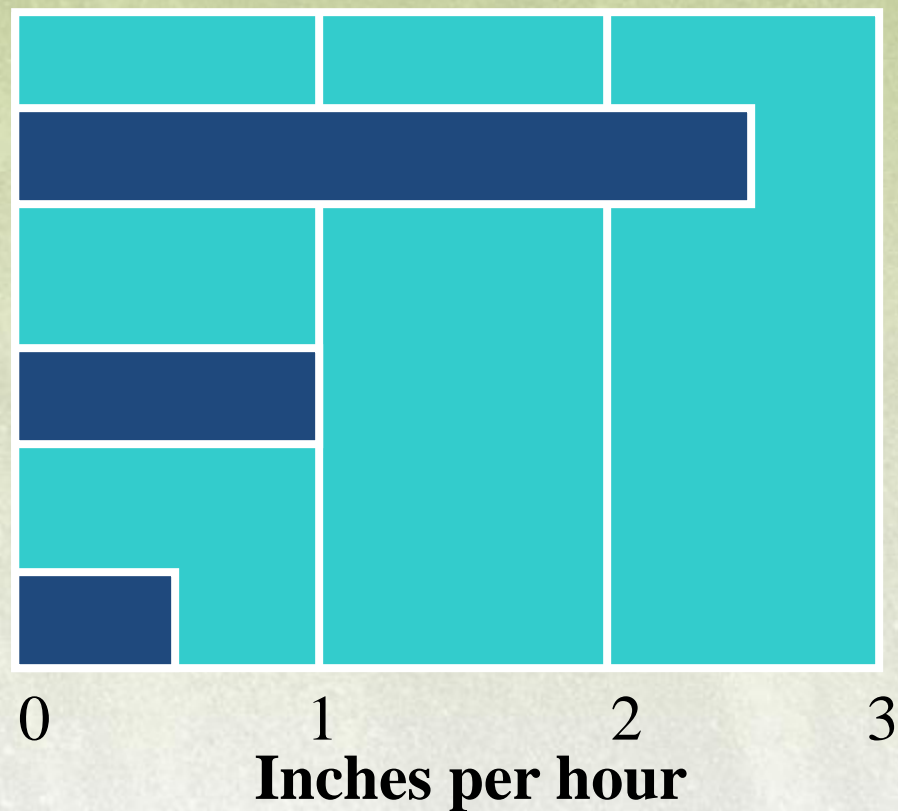


Effect of litter on infiltration rate

Grass and litter present

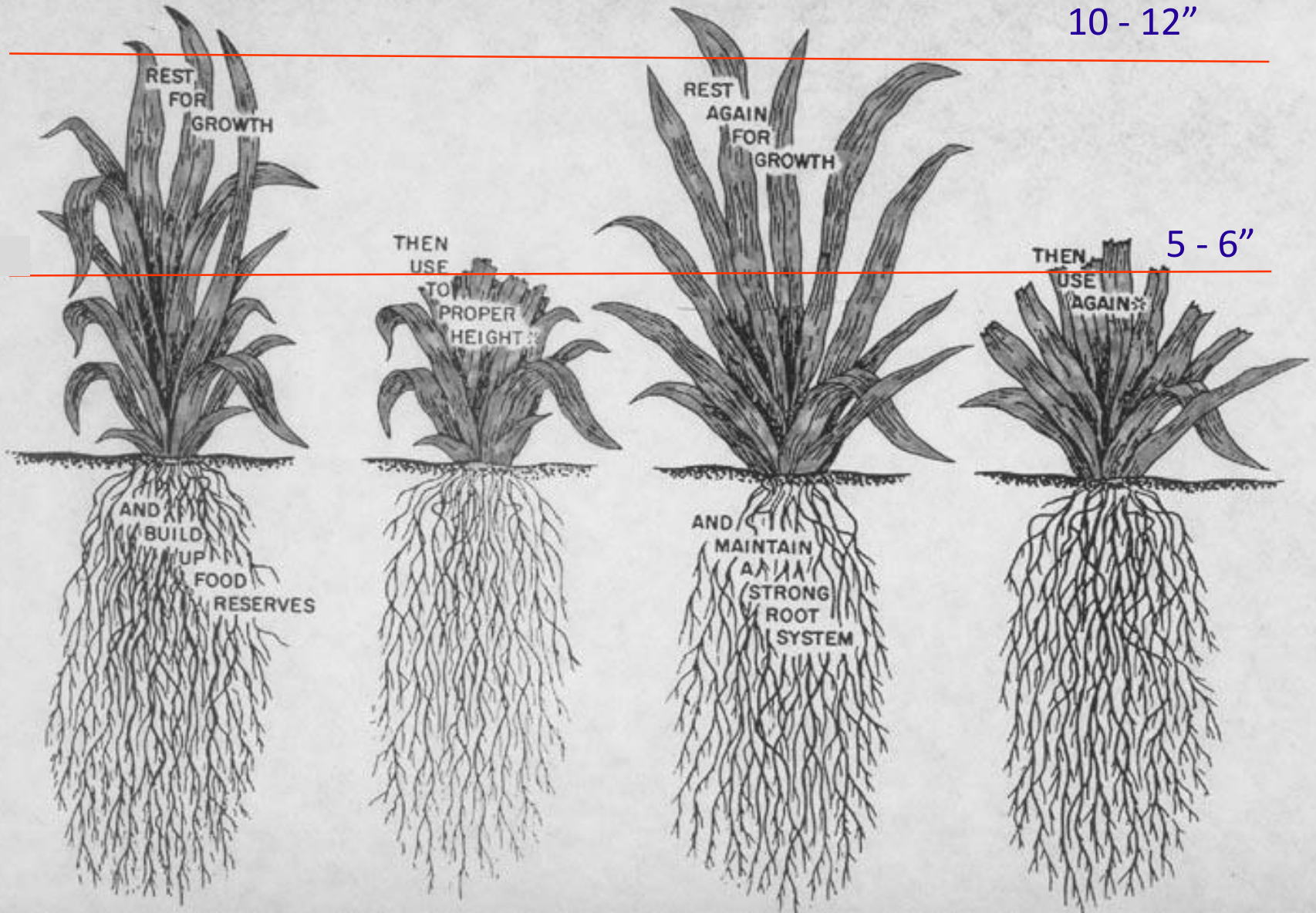
Grass with litter removed

Grass and litter removed
(bare soil)

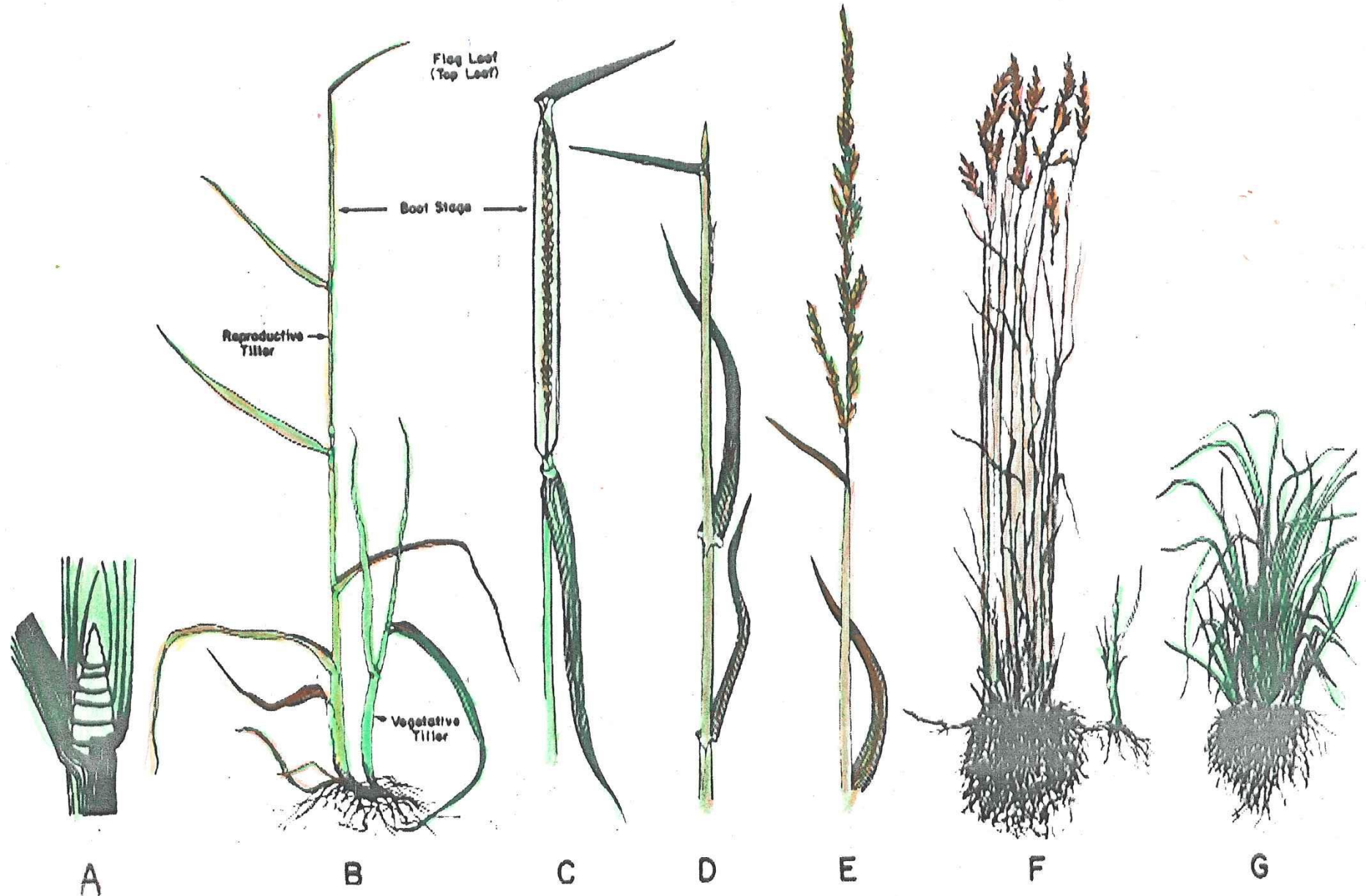


GRAZE AND REST PASTURE

10 - 12"

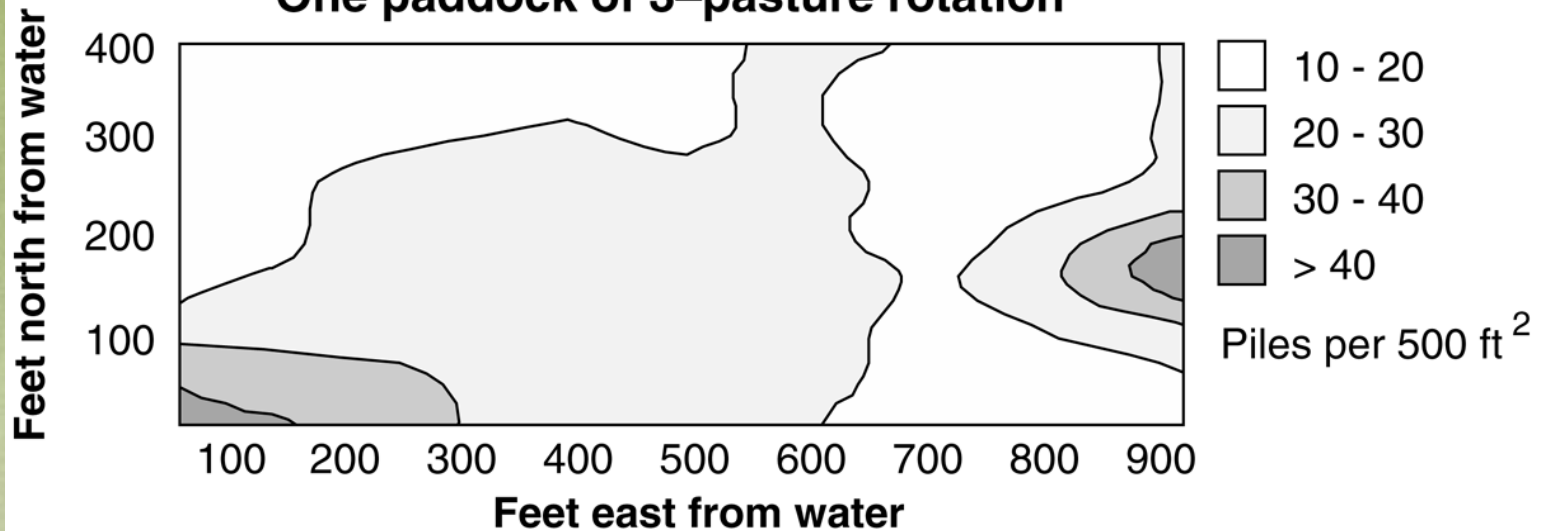


Grazing More Mature Forage

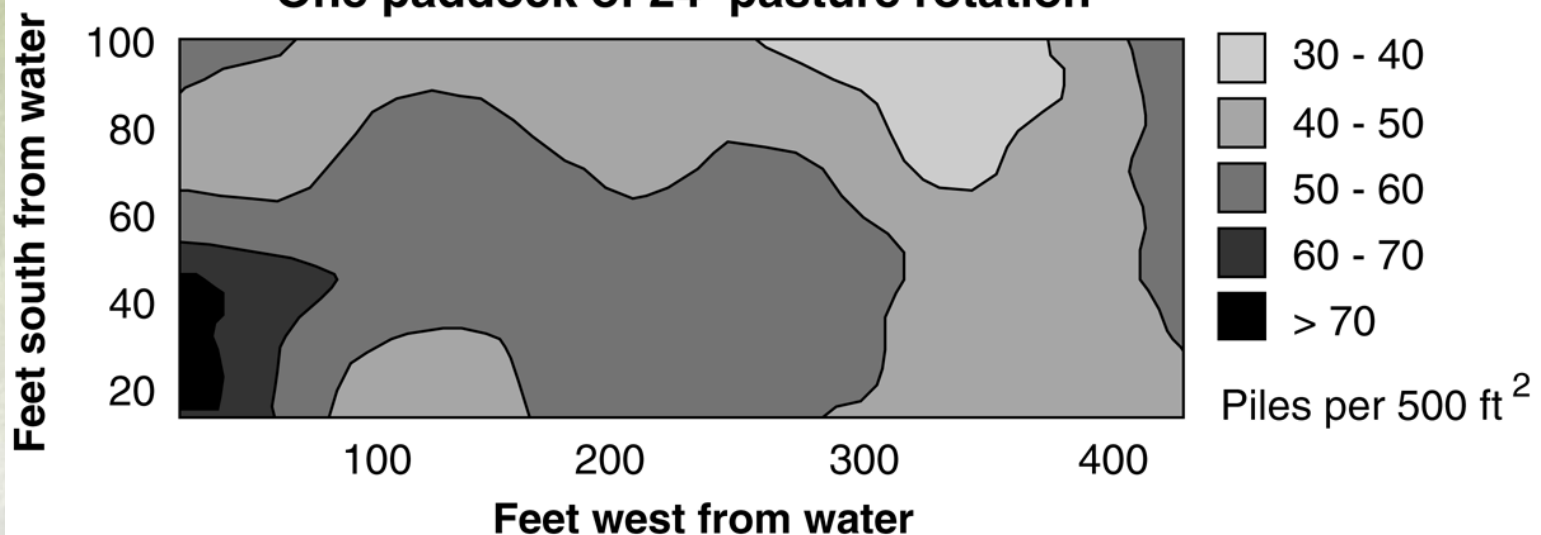


Manure Distribution

One paddock of 3-pasture rotation



One paddock of 24-pasture rotation



Soil Health Principles Support High Functioning Soils



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Living Roots**



**Minimize
“Chronic”
Disturbance**

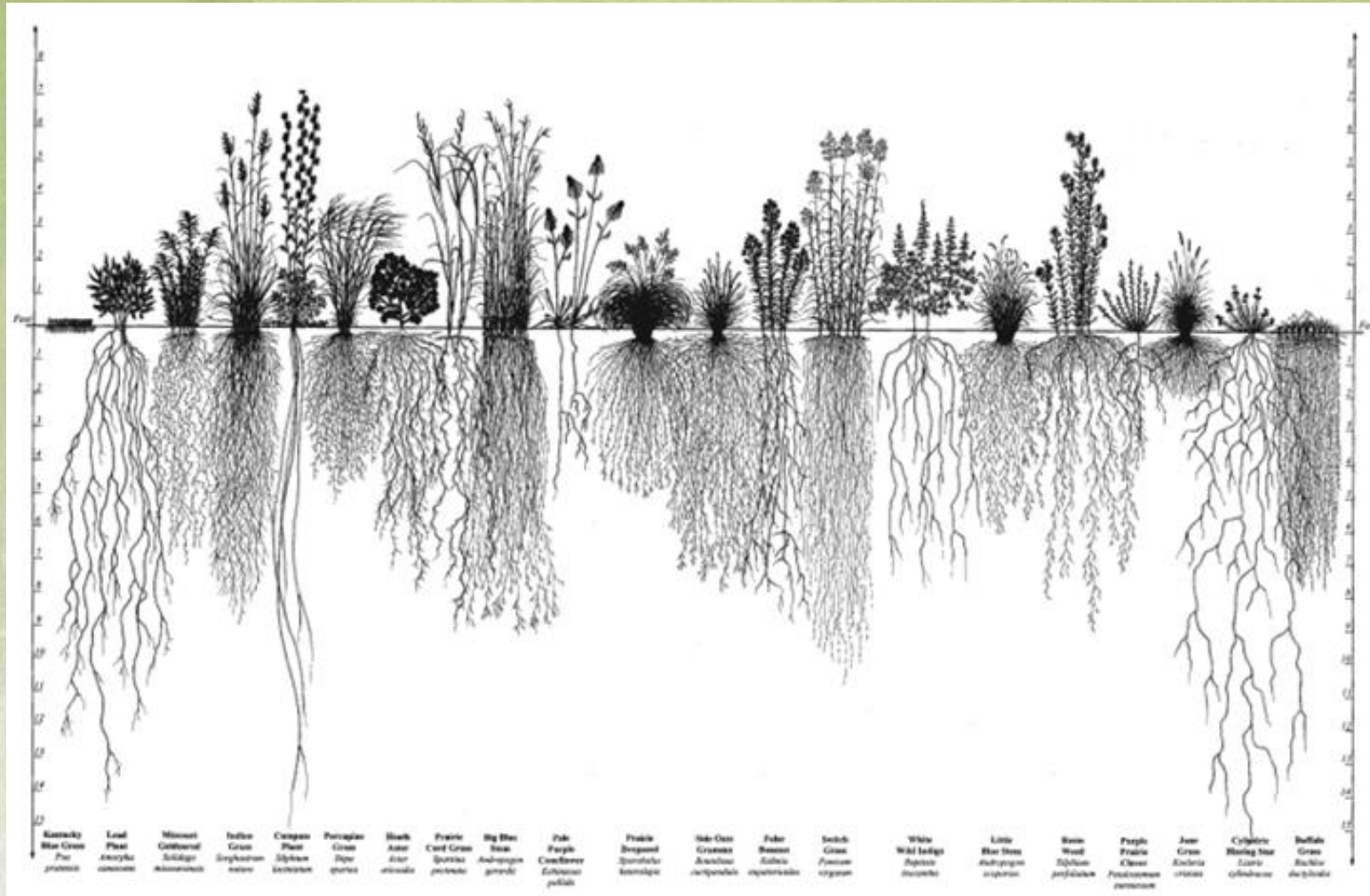


**Maximize
Biodiversity**



**Maximize Soil
Cover**

Diversity of plants aboveground feeds diversity of soil organisms belowground!





The Underground Livestock Herd

<u>Type of Organism</u>	<u>Number/Acre</u>	<u>Pounds/Acre</u>
Bacteria	800,000,000,000,000,000,000	2,600
Actinobacteria	20,000,000,000,000,000	1,300
Fungi	200,000,000,000,000	2,600
Algae	4,000,000,000	90
Protozoa	2,000,000,000,000	90
Nematodes	80,000,000	45
Earthworms	40,000	445
Insects /arthropods	8,160,000	<u>830</u>
		8,000



How Do We Encourage More Diversity In Our Pastures?

- Don't overgraze
- Shorten the graze period so livestock take just one bite off each plant (the faster plants are re-growing, the shorter time they should be in one spot)
- Allow long enough recovery for all plants
- Reduce diet selectivity by increasing stock density, not stocking rate

Soil Health Principles Support High Functioning Soils



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Corresponding Root Growth



% Leaf Removed	% Root Growth Stopped
10	0
20	0
30	0
40	0
50	2 to 4
60	50
70	78
80	100
90	100

If you overgraze the shoot, you overgraze the root!



**Tall Fescue
Rotational**

**Tall Fescue
Continuous**

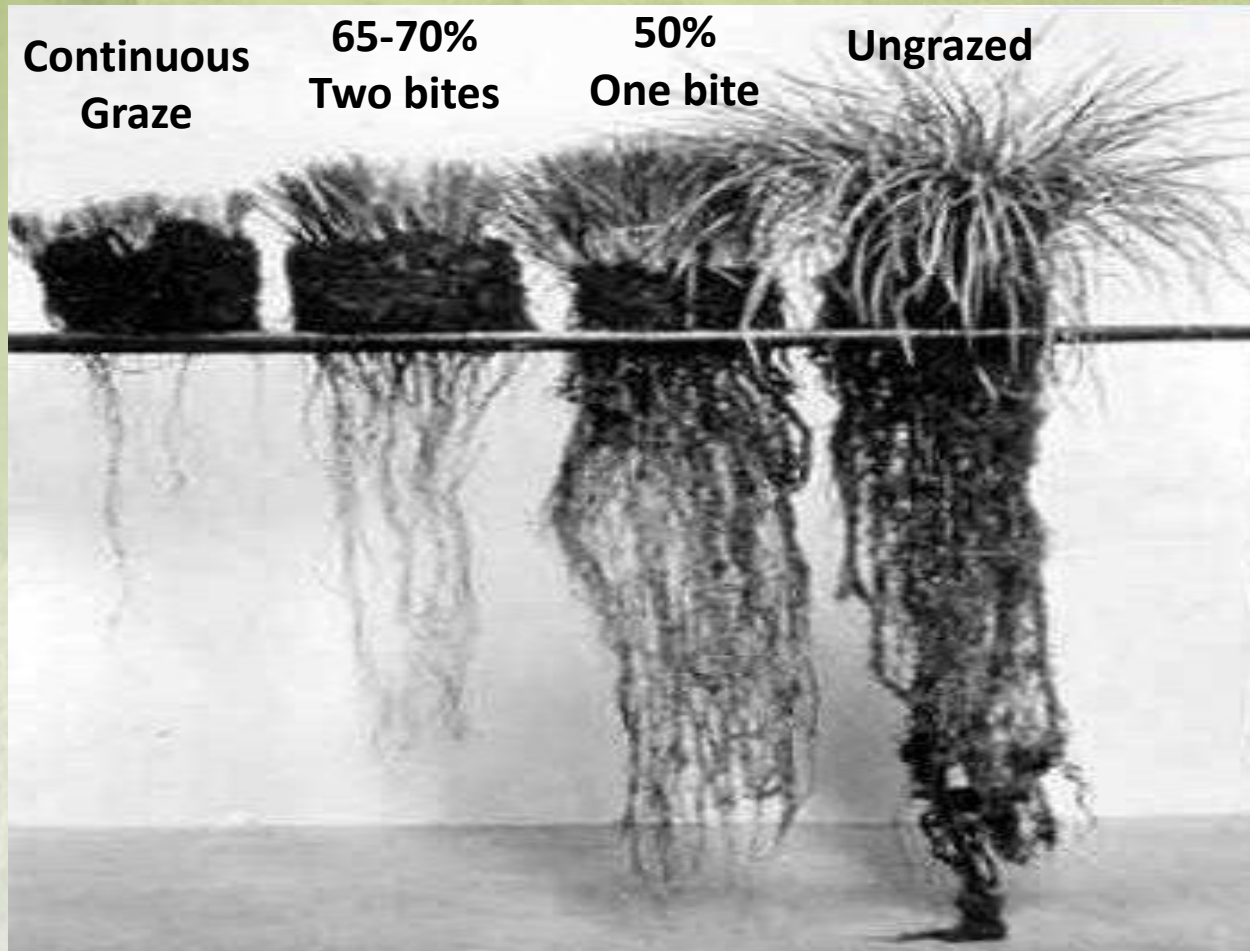
**Tall Fescue
Continuous**

**Orchardgrass
Rotational**

**Orchardgrass
Rotational**

**Fescue/Bluegrass
Rotational**

Know What's Happening When Livestock Take That Extra Bite!





How does grazing management affect soil biology?

Research from W.R. Teague (2011)

Treatments

- Heavy continuous
- Light continuous
- Graze exclosure
- Multi-paddock
 - 40-day recovery: fast growth
 - 80-day recovery: slow growth



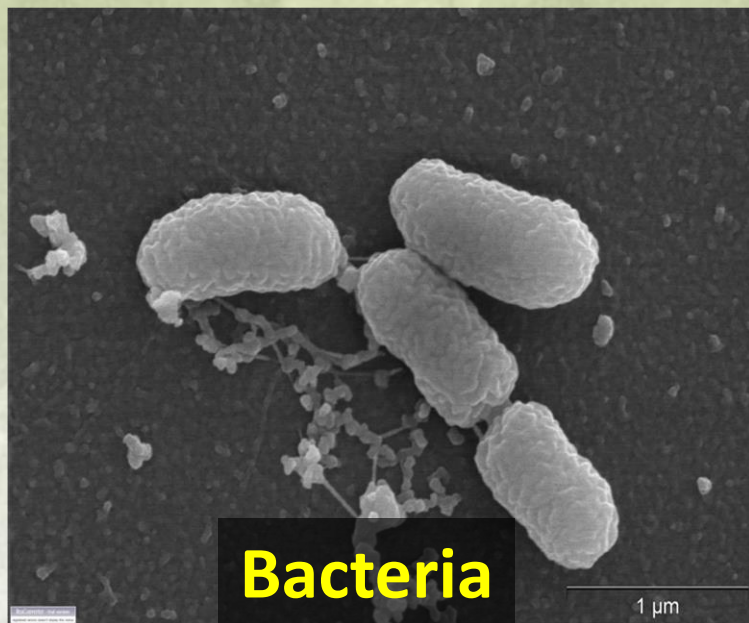
How does grazing management affect soil biology?

Results

- Total bacteria: No change
- Total fungi: Multi-paddock was highest
- Ratio of total fungi to total bacteria: Multi-paddock was highest (3:1) versus all other treatments (1:1)

What does a high fungi to bacteria ratio indicate?

- High water-holding capacity
- High nutrient availability
- High nutrient retention





AHSD Grazing Positively Impacts Soil Organic Matter Levels on Cropland

- 1993: No-till only → 1.7% OM
- 1995: Cash crop diversification → 2.0% OM
- 1997: Cover crop integration → 3.1% OM
- 2006: Multi-species covers → 4.2% OM
- 2006 – 2013: Multi-species covers with AHSD grazing → 6.1% OM



AHSD Grazing on Cropland Dramatically Improves Nutrient Availability for Plants and Food for Soil Biology

Management	N (lbs/ac)	P (lbs/ac)	K (lbs/ac)	WEOC (ppm)
Organic	2	156	95	233
No-Till, Low Diversity	27	244	136	239
No-Till, Med Diversity, High Synthetic Fert.	37	217	199	262
No-Till, High Diversity, No Synthetic Fert., Livestock.	281	1006	1749	1095

Gabe Brown, 2016

Soil testing done by Dr. Rick Haney, ARS



What About AHSD On Perennial Pastures?

- Three farms sampled in Mississippi (Fall 2014)
- Farm 1: AHSD grazing for 5 years
- Farm 2: Continuous Grazing – Slow Rotation for 50+ years
- Farm 3: Continuous Grazing – Continuous for 30+ years
- All same soil types

AHSD and Total Soil Carbon (kg/m²)

Soil Depth	AHSD	CG – Slow Rotation	CG – Cont.
0 – 6"	4.67	1.64	1.36
6 – 12"	4.00	1.88	1.37
12 – 18"	2.95	1.03	0.40
18 – 24"	2.04	1.02	0.54
24 – 30"	1.71	0.38	0.40
30 – 36"	1.42	0.41	0.34

AHSD: Adaptive, High Stock Density grazing

CG: Continuous Grazing

AHSD and Soil Organic Matter (kg/m²)

Soil Depth	AHSD	CG – Slow Rotation	CG – Cont.
0 – 6"	4.26	3.28	2.72
6 – 12"	3.22	3.76	2.74
12 – 18"	3.10	2.06	0.80
18 – 24"	2.98	2.04	1.08
24 – 30"	2.80	0.76	0.80
30 – 36"	1.98	0.82	0.68

AHSD: Adaptive, High Stock Density grazing

CG: Continuous Grazing

AHSD and Storing Carbon

Farm Description	Carbon (kg/m²)	Carbon (ton/ac)	Carbon (ton/CO₂ Equiv)
AHSD	12.69	51.41	188.13
CG – Rotation	7.09	28.71	105.07
CG – Continuous	5.47	22.16	81.09

AHSD: Adaptive, High Stock Density grazing

CG: Continuous Grazing

Fast Track to Soil Health



- Get the pH and fertility balanced in medium category
- Manage for cover: green and brown
- High density grazing minimum 4,000 lb to over 100,000 lb/ac
- Leave at least half of forage behind; 2/3 is better
- Recovery period of at least 30 days, 45-day average, but in general not over 90 days in growing season.

How To Make It Work Easily



Doug Peterson, USDA-NRCS



Doug Peterson, USDA-NRCS

How To Make It Work Easily



stafix.com



powerflexfence.com



msffarm.com



Stock Density Basics

- Stock density will vary over time depending on forage conditions and animal production status.
- Make changes gradually in stock density over a period of time.
- Monitor daily to see how contented the animals are.
- Because forage conditions and animal nutrient demands are constantly in flux, monitor daily to gauge if forage is being over- or under-allocated for the herd and adjust the paddock size accordingly.
- Always focus on animal performance. Never stress the animals by limiting intake or gains and health will suffer.



“If you want to make small changes, change how you do things. When you want to make major changes, change how you see things.”

-Don Campbell



For More Information

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Questions & Answers

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