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# Pasture Soil Health Management

Kaitlin Farbotnik, NRCS Northeast Regional Soil Health Specialist (Acting)  
Catskills Regional Agricultural Conference  
January 12, 2022

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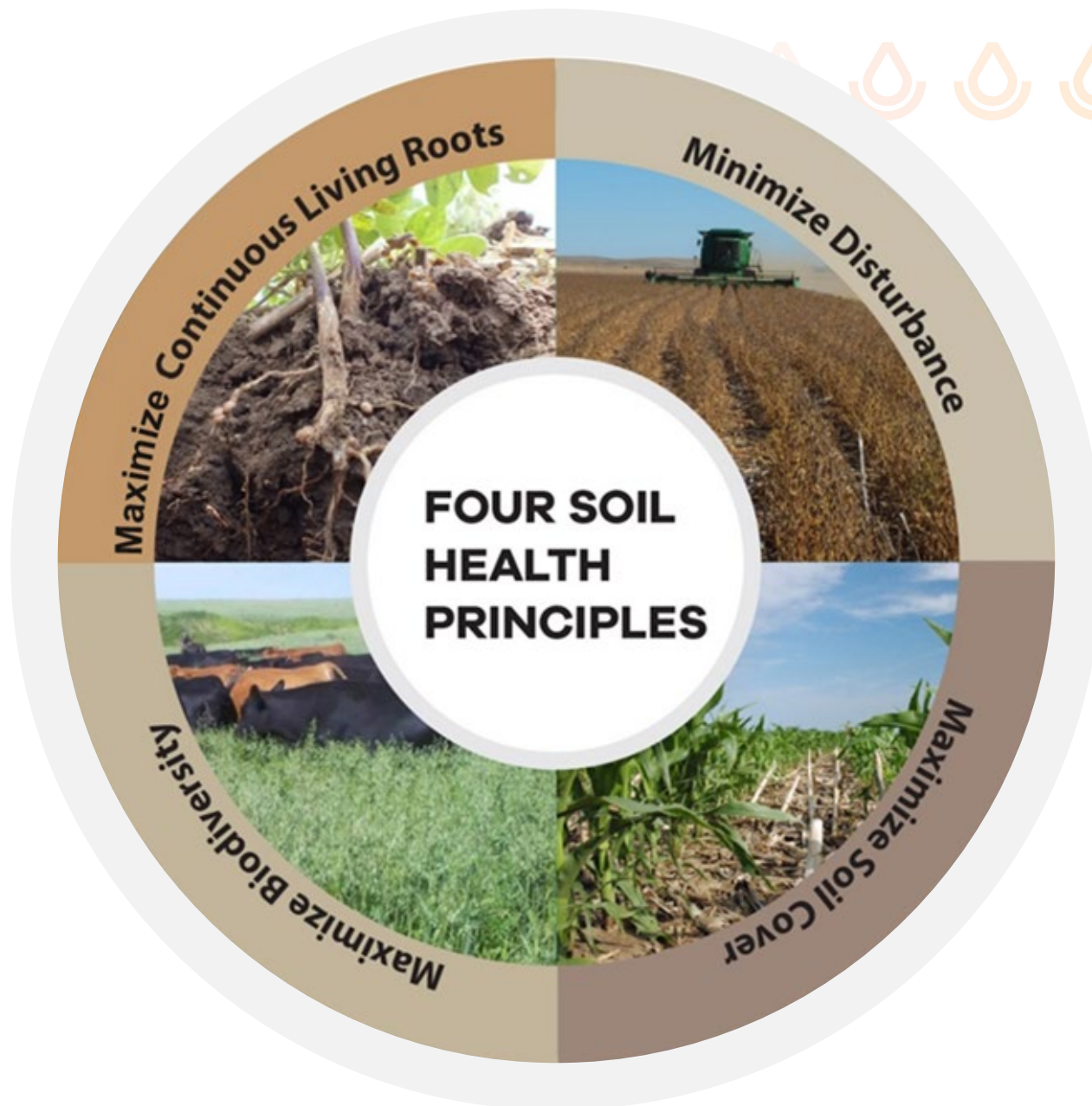
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# Grazing and Soil Health Principles



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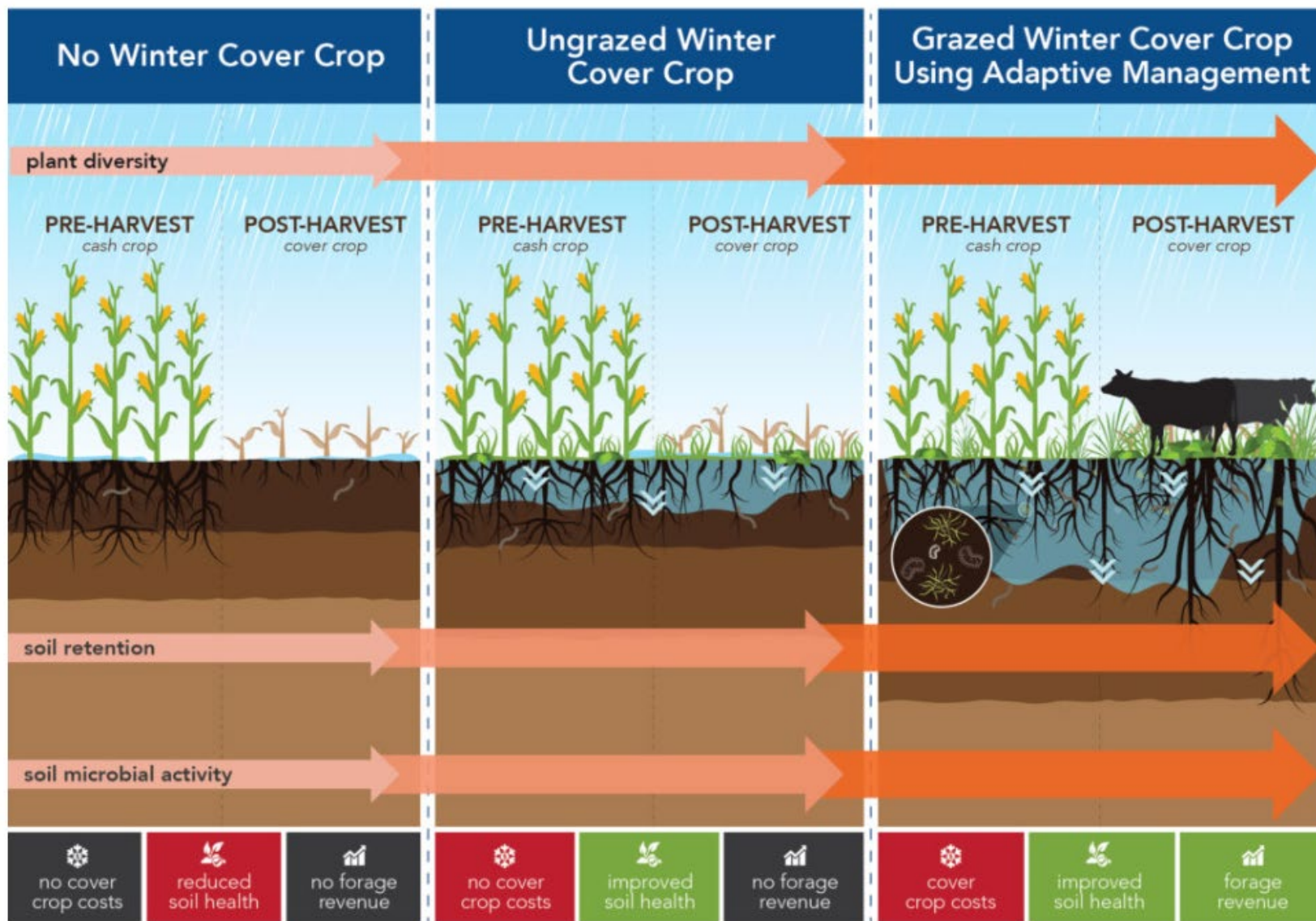
# What are we Talking About??



Photos Clockwise from top left:  
 USDA - NRCS, University of Illinois, Beef  
 Magazine, Speerd Duiker - Penn State, Center  
 Matthew Denton - NRCS SHD



# Complete Utilization of Crops



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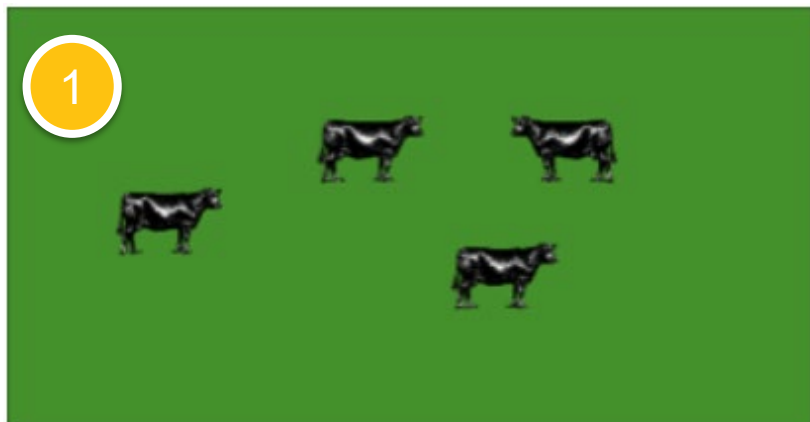
# Grazing Strategies



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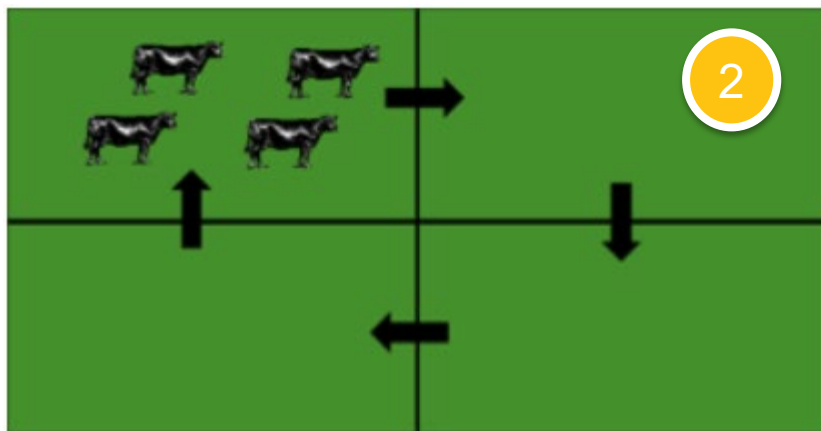
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# Types of Grazing Systems



## 1. Continuous Grazing

- Single or few large pastures
- Very little rest

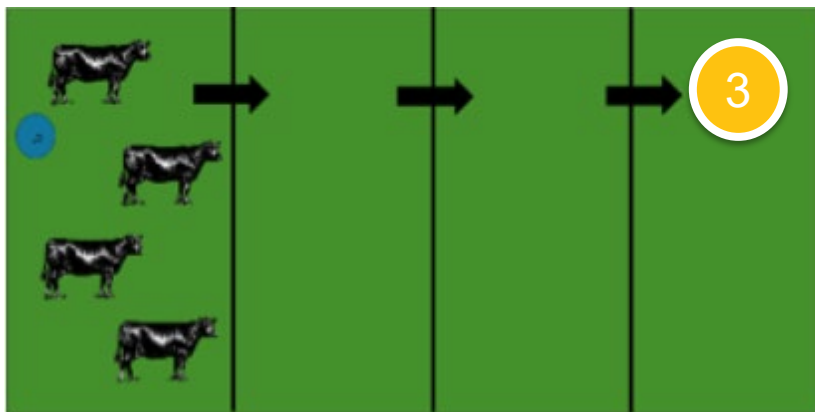


## 2. Rotational Grazing

- Multiple pastures in a set rotation are used
- More permanent pastures, moved based on days.
- Intermediate length rest periods



# Types of Grazing Systems



## 3. Strip Grazing

- Shorter rotations
- Smaller pastures
- Mainly using temporary fences



## 4. Mob Grazing

- Very high density
- Very long rest periods
- High amounts of trampling and nutrient deposition

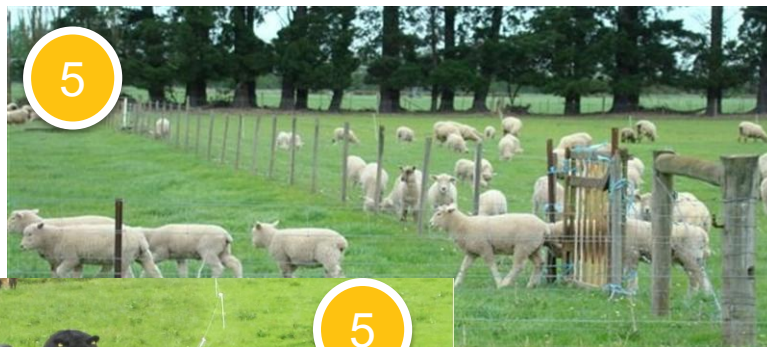
Bottom photo: <https://www.beefmagazine.com/pasture-range/ranchers-sing-praises-mob-grazing-cattle>  
Top photo: Tom Chapman



# Types of Grazing Systems

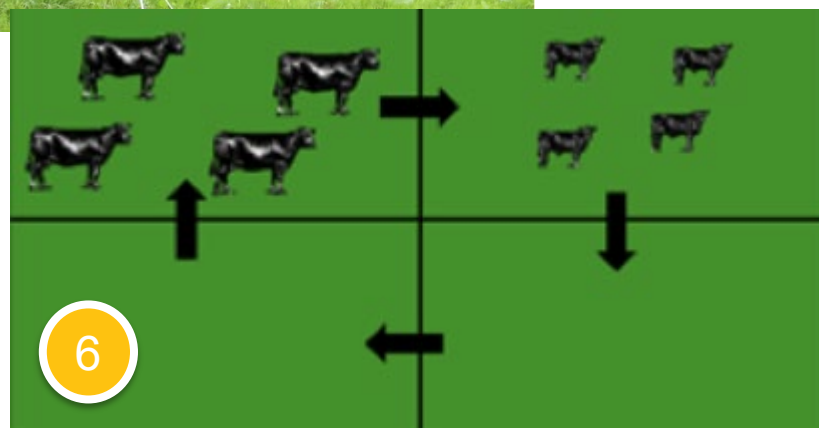
## 5. Creep Grazing

- Higher need animals are given access to forward pastures
- Facilitated by gates or elevated fence posts
- Low-stress and gradual weaning



## 6. Forward Grazing

- Different grazing groups
- Higher need animals graze first and followed with lower need animals



# Nutrient Distribution of Managed Grazing



Evenly distribute manure across a pasture



75-90% of nutrients from manure are redistributed in the pasture. Even distribution = even grazing.

Number of Paddocks	Rotation Frequency	Years to get 1 pile/sq. yard
1	Continuous	27
3	14-day	8
12	4-day	4-5
24	2-day	2



# Bale Grazing



PHOTO BY BRIAN VOLLAND, UK AGRICULTURAL COMMUNICATIONS

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Photo: [http://www.angusbeefbulletin.com/extra/2017/05may17/0517mg\\_bale-graze.html#.YdW1OmjMKM8](http://www.angusbeefbulletin.com/extra/2017/05may17/0517mg_bale-graze.html#.YdW1OmjMKM8)

# Proper Utilization



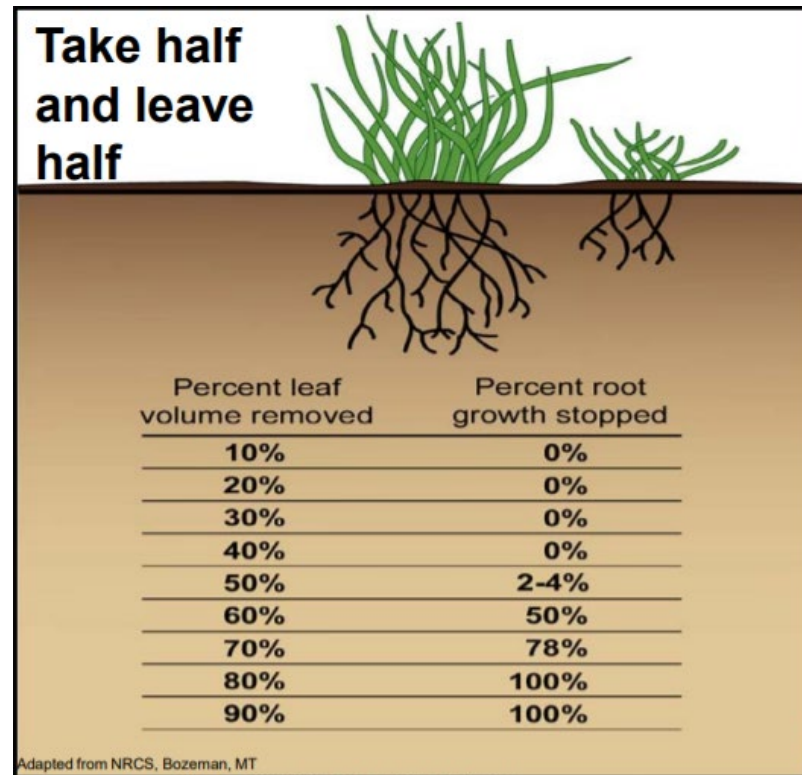
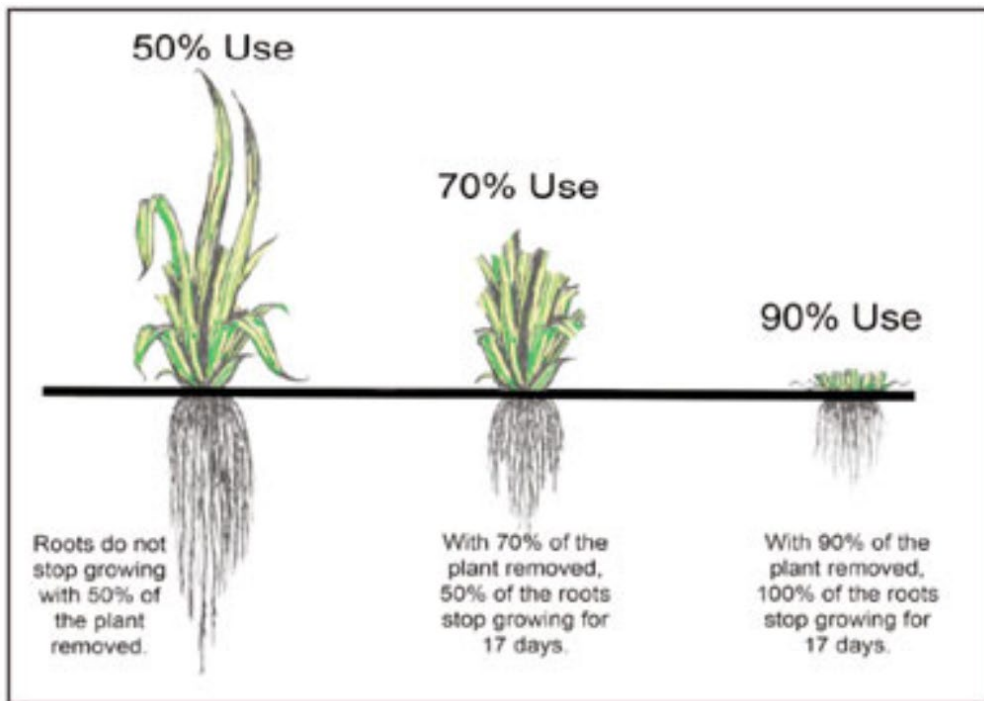
## WHY DOES THE UTILIZATION RATE ↓ WHEN THE LENGTH OF OCCUPATION INCREASES?

**TABLE 5: UTILIZATION RATE BASED ON LENGTH OF OCCUPATION**

Length of Occupation (days)	Utilization Rate (%)
1 or less	80
2 – 3	75
4	70
5	65
6	60
7	50
14	40
Continuous – low stocking density	35
Continuous – high stocking density (overgrazed)	90



# Root Response to Grazing



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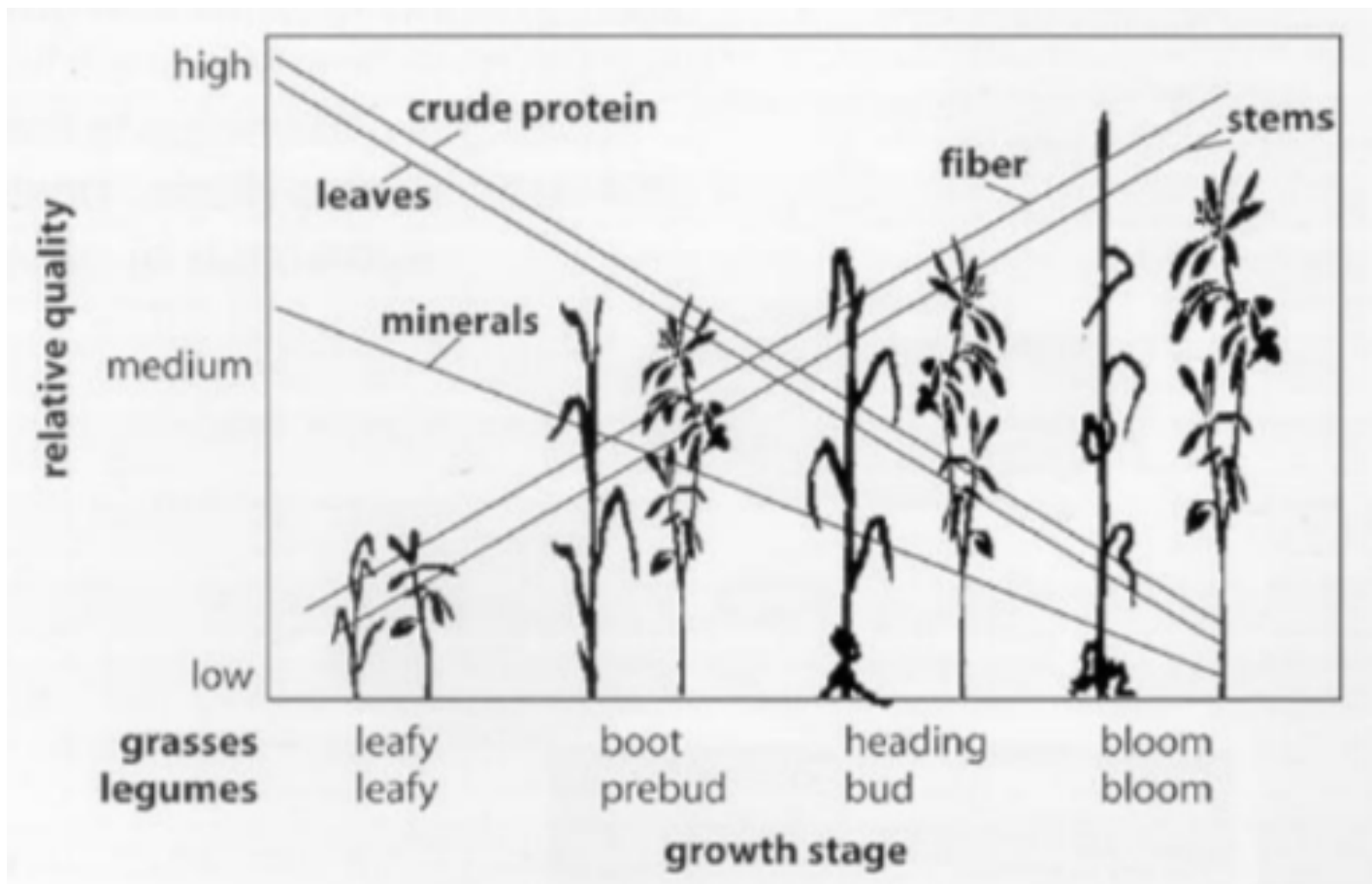
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Left Photo Source: OnPasture.com

Right Photo Source: Crider, F. J., 1955, Root Growth Stoppage, Technical Bulletin No. 1102, USDASCS, Government Printing Office, Washington D.C. Graphic adapted by A. Miller, Black Dog Graphics, from Grass: The Stockman's Crop by H. E. Deitz.

# Balancing Forage Quantity and Quality





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# Interactions Between Grazers, Forages, and Micro/Macro Organisms



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# Compaction



## Pressures Created by Different Stressors

Stressor	Pressure (Psi)
Sheep	12
Human	14
Utility terrain vehicle	14
50-ton bulldozer	16
Cattle	27
Walking Cattle	48
Horse	27
Walking Horse	48
Tractor	175

**Studies done in sandy loam soils showed an increased bulk density by 8% when heavily grazed**



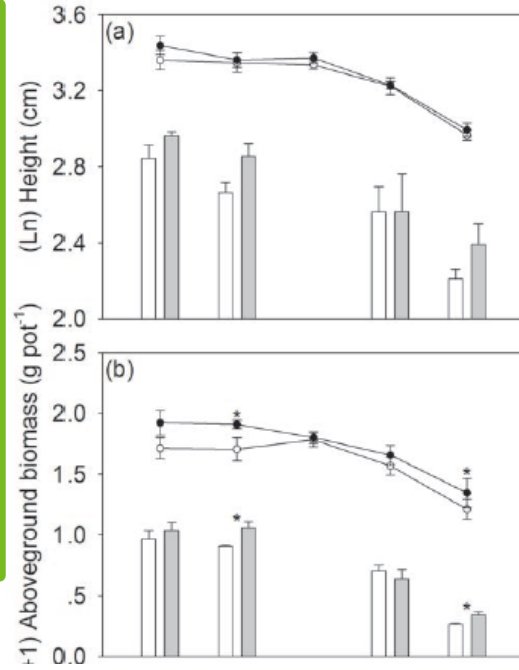
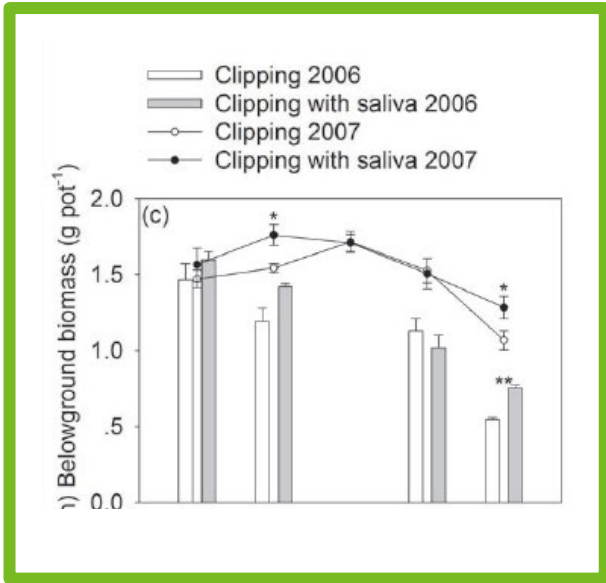
*Higgins et al. Revised 2017  
Trimble, W.S and A.C. Mendel, 1995*

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# Herbivory Response of Plants



**Plants have a response to herbivore saliva!**

Liu J, Wang L, Wang D, Bonser SP, Sun F, et al. (2012) Plants Can Benefit from Herbivory: Stimulatory Effects of Sheep Saliva on Growth of *Leymus chinensis*. PLoS ONE 7(1): e29259. doi:10.1371/journal.pone.0029259



Photo: <https://www.agriculture.com/livestock/cattle/get-pastures-off-to-a-good-start-for-adequate-feed-all-year>

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# Dung Beetles and Soil Health

Dung beetles do a lot more than eating dung. They recycle nutrients by breaking the dung up, improving soil quality.



Dung beetles protect cattle from pests such as hornflies, by removing the dung that hosts these pests.



- Recycle nutrients by breaking up manure into smaller more reactive pieces
- Can bring organic matter down 18" below the surface
- Reduces the amount of refuse areas within a pasture

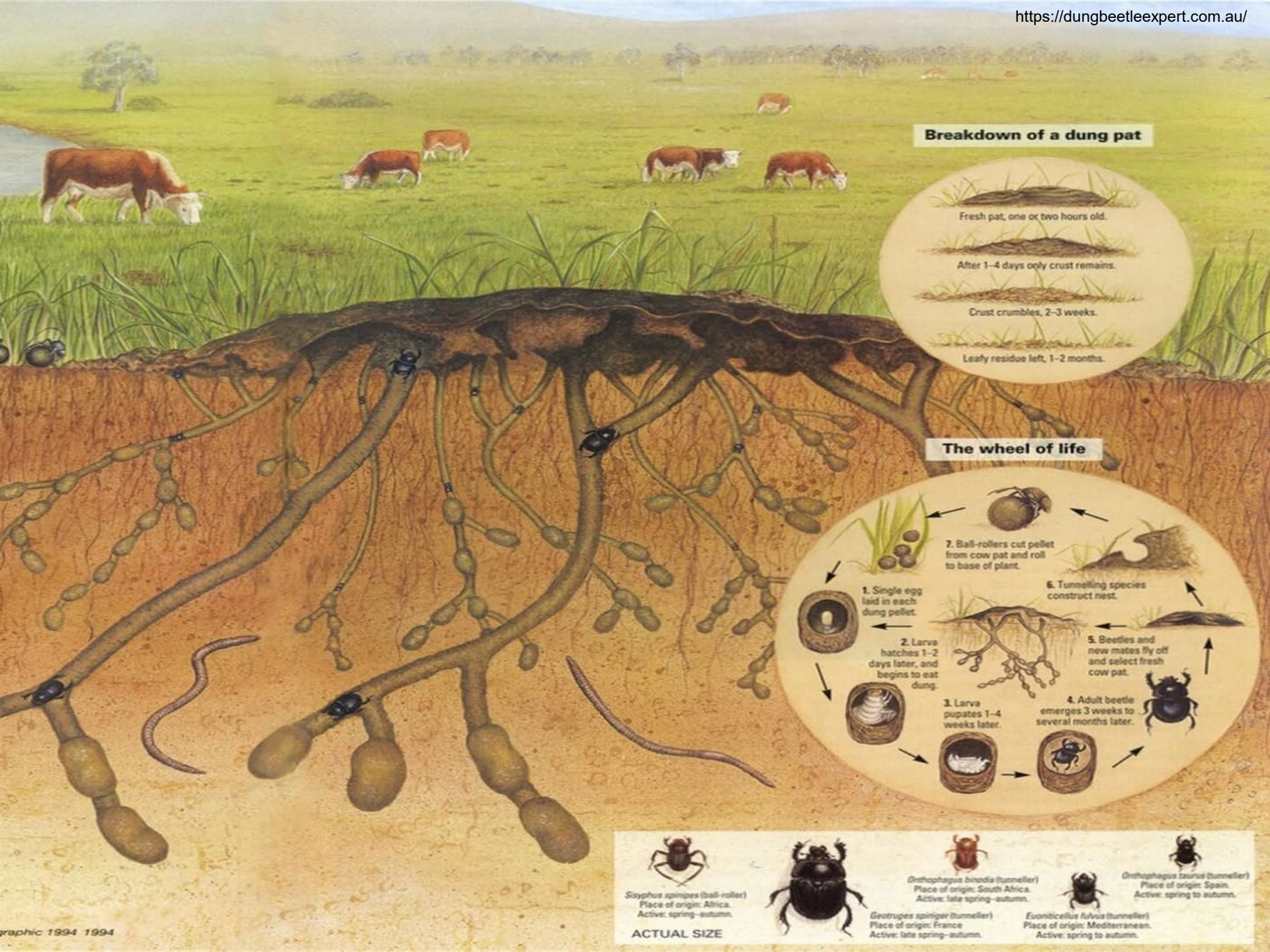
Dung beetles evolved millions of years ago when truly enormous creatures roamed the earth!



Dung beetles derive all their nutrition & moisture from dung, and don't need to drink!

IT'S A 1985  
CHATEAU DÉ ELEPHANTÉ.





### Breakdown of a dung pat



### The wheel of life



 <i>Sisyphus spinipes</i> (ball-roller) Place of origin: Africa. Active: spring-autumn.	 <i>Geotrupes spingeri</i> (tunneller) Place of origin: France Active: late spring-autumn.	 <i>Onthophagus binodis</i> (tunneller) Place of origin: South Africa. Active: late spring-autumn.	 <i>Eoonthophilus fulvus</i> (tunneller) Place of origin: Mediterranean. Active: spring to autumn.	 <i>Onthophagus taurus</i> (tunneller) Place of origin: Spain. Active: spring to autumn.
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**ACTUAL SIZE**

# Benefits of Dung Beetles



*Credit: Oklahoma Forage and Pasture Fertility Guide*



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# Promoting Dung Beetles

- High intensity grazing
- Parasite management – longer rest periods

Chemical	Common Names	Likelihood of Beetle Toxicity
Abamectin	Avomec, Cattlegard, Duotin, Genesis, Paramectin, Virbamec, Endomec	High
Doramectin	Dectomax	High
Eprinomectin	Eprinex, Longrange, Broadline	High
Ivermectin	Baymec, Bomectin, Cevomec, Ecomectin, Genesis, Ivomec, Noromectin, Virbac	High
Moxidectin	Cydectin	Unlikely

Source: Consider Your Dung Beetles when Using Parasiticides (<http://www.dungbeetle.com.au/considerbeetles.pdf>), [parastipedia.net](http://parastipedia.net), and Dr. Shaun Forgie (<https://dungbeetles.co.nz/establishing-dung-beetles-and-using-chemicals-for-internal-external-control-of-livestock-pests/>)

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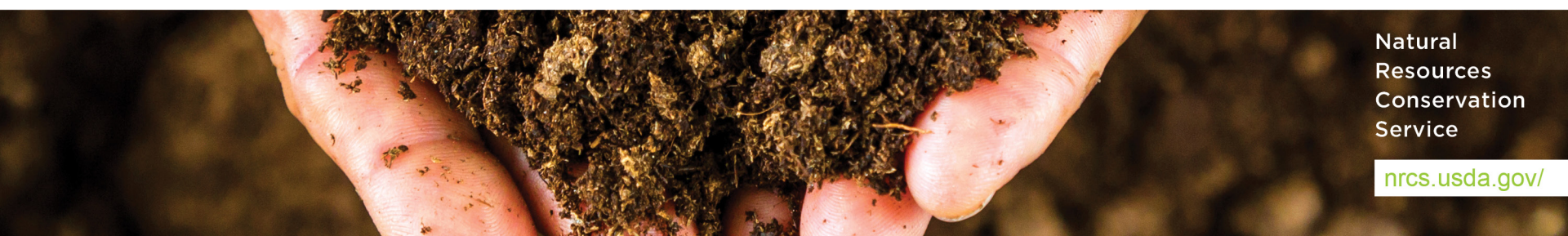
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# Benefits of Maximizing Biodiversity



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# Diversity throughout agriculture is a good thing

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Grazing systems that only utilize one species, such as cattle, leave additional grazing opportunities on the table.



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# Benefits of Multi-Species Grazers



Plant	Horse	Cattle	Sheep	Goat
Grass	90	70	60	20
Weed	4	20	30	20
Browse	6	10	10	60

## Grazing Preferences by Species:

Horse .... grass

Cattle .... grass > legumes

Sheep .....legumes > forbs = grass

Goat .....forbs > grass > legumes

Deer..... forbs > grass

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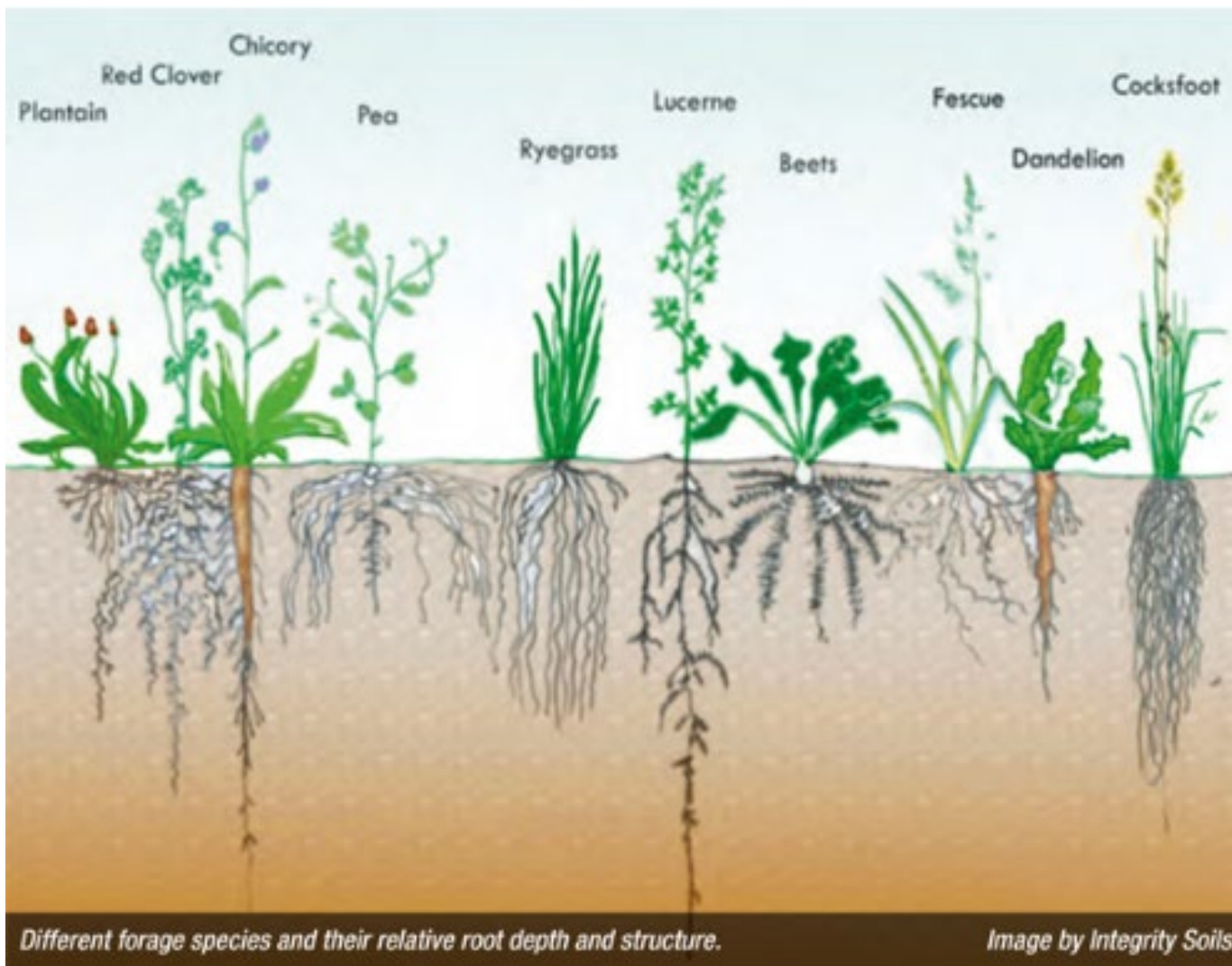


Source: Joel Poore, Pastureland Ecology, 2018

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# Benefits of Multi-Species Forages

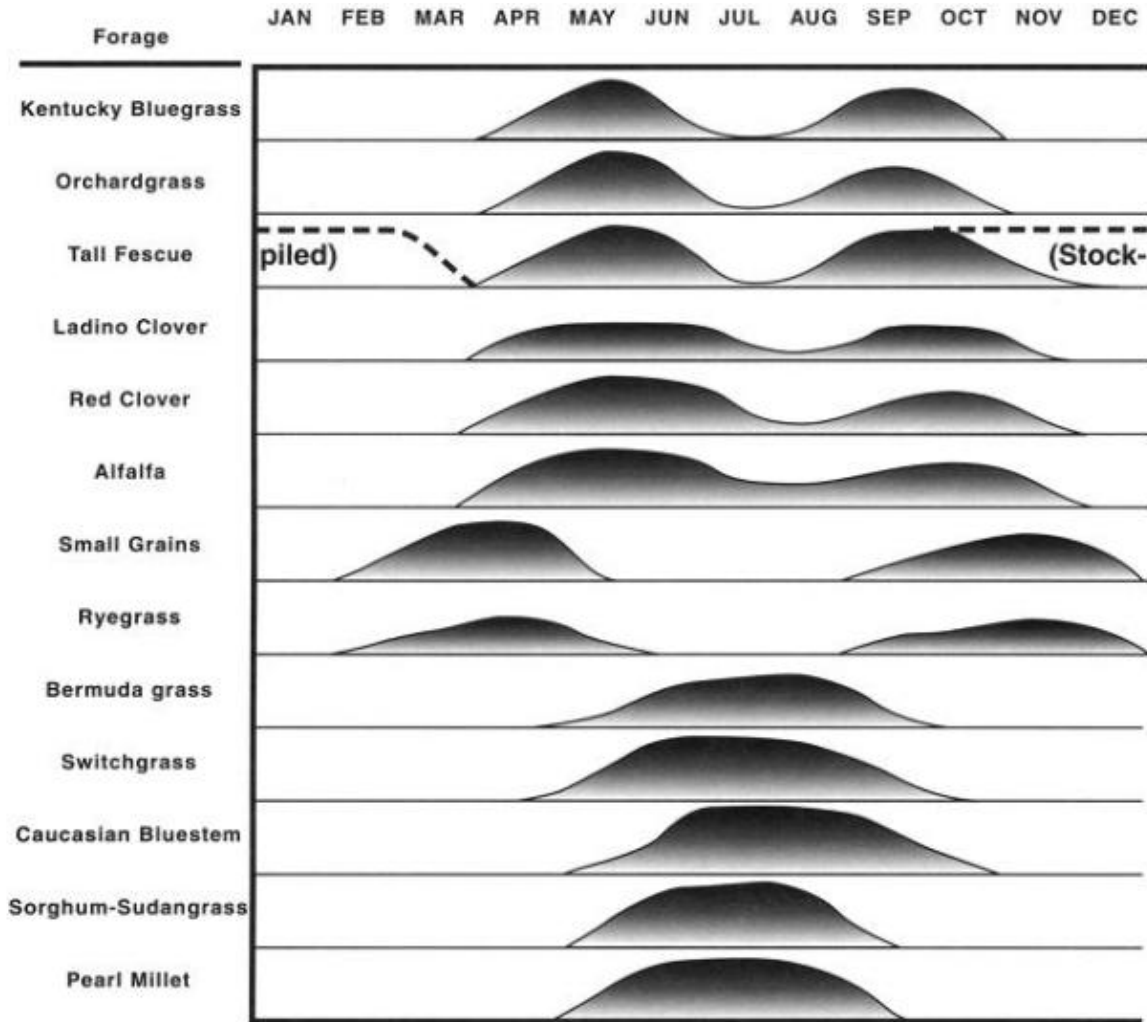


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# Diversity in Growing Seasons





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# Tools and Techniques for Improving Soil Health



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# Mitigating Grazing Impacts

# CONTINGENCY PLAN

**Only graze if you have, understand and are willing and able to follow a contingency plan**



# Soils Information from Web Soil Survey



## Helpful interpretations

- Capability and capability subclass
- Organic matter depletion
- Susceptibility to compaction
- Vegetative productivity?
- Depth to water table
- Ponding/flooding frequency

**\* The accuracy of the Web Soil Survey relies on the soil mapping**



# Monitoring Tools - Animals



**Managing Herefords**  
**Body Condition Scoring**

Jack Ward, PhD, chief operating officer and director of breed improvement • P.O. Box 6189 • Kansas City, MO 64116 • 816.342.3737 • [www.hereford.org](http://www.hereford.org) • [jack@hereford.org](mailto:jack@hereford.org)

**BCS 5**  
**Moderate**  
Good overall appearance. Palpable fat cover on the ribs.

**BCS 7**  
**Good**  
Fleshy condition. Carries considerable spongy fat over ribs and around tailhead.

— Page 4 of 5 —

Body Condition Scoring

Department of Entomology and Zoology Studies

**BCS-1 (Emaciated)**

**BCS-2 (Thin)**

**BCS-3 (Average)**

**BCS-4 (Fat)**

**BCS-5 (Obese)**

*Elva A. Muehlen-Eustace, Effort, DVM*



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# Monitoring Tools - Plants



## Natural Resources Conservation Service Guide to Pasture Condition Scoring



## ATTRA Grazing Planning Manual and Workbook

By Lee Rinehart  
NCAT Program Specialist  
Published August 2017  
©NCAT  
IP538

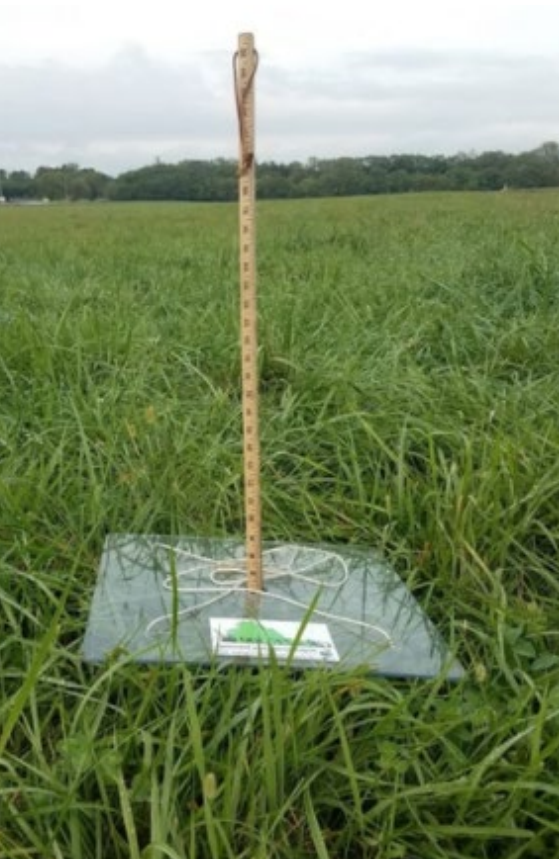
**Contents**

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- Writing the Grazing Plan.....7
- Grazing System Operation.....9
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  - Grazier's Math: Matching forage to animal demand.....17
  - Clip-and-Weigh Forage Measurement.....18
  - Grazing Plan Template.....18
  - Monitoring Checklist.....22

This manual provides all the resources you need to write your own grazing plan, monitor your management throughout the grazing season. Periodically reviewing you will help you assess how well you are working toward your goals, and will suggest next season. The manual starts with a discussion of grazing principles and how to assessment, followed by a step-by-step process for writing a grazing plan. A template are provided. This manual covers the importance of developing a simple pasture-mo provides further resources to assist producers with planning, charting, and recording out the season. Additional resources help you understand grazing concepts, as well some good, online tools for recordkeeping and monitoring.



ATTRA ([attra.ncat.org](http://attra.ncat.org)) is a program of the National Center for Appropriate Technology (NCAT). The program is funded through a cooperative agreement with the United States Department of Agriculture's Rural Business-Cooperative Service. Visit the NCAT website ([www.ncat.org](http://www.ncat.org)) for more information on our other sustainable agriculture and energy projects.



### Introduction

Planning is the first step in any successful farm enterprise. The benefits that accrue to graziers from having a grazing plan include greater forecasting ability for grazing decision-making, extension of the grazing season, more consistent supply of forage, greater dry-matter intake from pasture, and increased pasture sustainability.

Implementing an effective grazing plan requires applying observation to management, and some more, adjusting as necessary, and recording your plan in a simple, easy-to-access format. There are five steps in developing a grazing plan: (1) set goals; (2) inventory resources; (3) match available forage to animal needs; (4) develop a grazing schedule; and (5) monitor the effectiveness of the grazing plan.



# Monitoring Tools - Soil



## Cropland In-Field Soil Health Assessment Worksheet

### Soil Health Resource Concerns

- CPT = Compaction
- SOM = Soil Organic Matter Depletion
- AGG = Aggregate Instability
- HAB = Soil Organism Habitat Loss or Degradation

Location
Field/CMU
Tract#
Client/Customer
Planner
Date
Soil Map Units
Soil Moisture
Topsoil Texture

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**PENN STATE**

SOIL TEST REPORT FOR:		ADDITIONAL:	
[Redacted]		[Redacted]	
DATE	LAB #	SERIAL #	COUNTY
04/13/2016	S16-19262	48309	Bucks
SOIL NUTRIENT LEVELS		Below Optimum	Optimum
Soil pH	7.0		
Phosphorus (P)	57 ppm		
Potassium (K)	161 ppm		
Magnesium (Mg)	234 ppm		
RECOMMENDATIONS: (See back message for important information)			
Limestone*: NONE		Magnesium	
*Calcium Carbonate equivalent			
Plant Nutrients: (If manure will be applied, adjust these recommendations as follows)			
Year	Crop	Expected Yield	Nitrogen (lb N/A)
			Phosphate (lb P <sub>2</sub> O <sub>5</sub> /A)
1	Established Pasture (without legume)	3 T/A	150
			0
For optimum efficiency, the recommended N should be split and applied between grazing forage growth in the pasture. As an example apply 1/3 to 1/2 of the N in the spring, 1/4 early fall. Recommended P and K can be applied between grazings any time after the first			
2	Established Pasture (without legume)	3 T/A	150
			0
For optimum efficiency, the recommended N should be split and applied between grazing forage growth in the pasture. As an example apply 1/3 to 1/2 of the N in the spring, 1/4 early fall. Recommended P and K can be applied between grazings any time after the first			
3	Established Pasture (without legume)	3 T/A	150
			0
For optimum efficiency, the recommended N should be split and applied between grazing forage growth in the pasture. As an example apply 1/3 to 1/2 of the N in the spring, 1/4 early fall. Recommended P and K can be applied between grazings any time after the first			

ADDITIONAL RESULTS:				Optional Tests:			
Calcium (ppm)	Acidity (meq/100 g)	CEC (meq/100 g)	% Saturation of the CEC	Organic Matter %	Nitrate-N ppm		
2197	0.0	13.3	K Mg Ca 3.1 14.6 82.3				

Test Methods: \*1:1 soil:water pH, Mehlich 3 (OCPI), Mehlich Buffer pH, Summation of Cations

Cornell Soil Health Assessment				
1 Background Info		Sample ID: S_1		
Corey Corn 123 Horizon Rd New Iowa, NY, 13026		Field/Treatment: West Upper		
Agricultural Service Provider: Doe, John john@doe.com		Tillage: 7-9 inches		
		Crops Crowned: COG, COG, COG		
		Date Sampled: 5/1/2015		
		Given Soil Type: Lima		
		Given Soil Texture: Silt Loam		
		Coordinates: 42.44790 °N, 76.47570 °W		
Measured Soil Textural Class: Silt Loam Sand: 37% Silt: 53% Clay: 10%				
Test Results				
2	Indicator	3 Value	4 Rating	5 Constraint
Physical	Available Water Capacity	0.15	42	
	Surface Hardness	87	84	
	Subsurface Hardness	290	50	
	Aggregate Stability	22.0	22	Aeration, Infiltration, Rooting, Crusting, Sealing, Erosion, Runoff
	Organic Matter	2.9	32	
Biological	ACE Soil Protein Index	4.5	26	Organic Matter Quality, Organic N Storage, N Mineralization
	Respiration	0.39	23	Soil Microbial Abundance and Activity
	Active Carbon	450	27	Energy Source for Soil Biota
	pH	6.9	100	
Chemical	Phosphorus	4.5	100	
	Potassium	67.8	93	
	Minor Elements Mg: 419 Fe: 1.1 Mn: 12.9 Zn: 1.9		100	
6 Overall Quality Score	58		Medium	

FIGURE 2.53. Sample Soil Health Assessment Report with (1) Background info, (2) Measured indicator, (3) Indicator value, (4) Rating, (5) Constraints, and (6) Overall quality score.



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Know where you are, where you want to be, and how you're going to get there





# QUESTIONS??

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