WHAT REALLY MATTERS IN GRAZING MANAGEMENT

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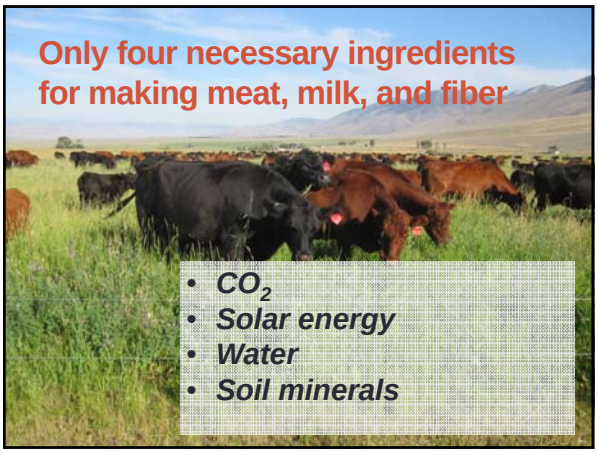
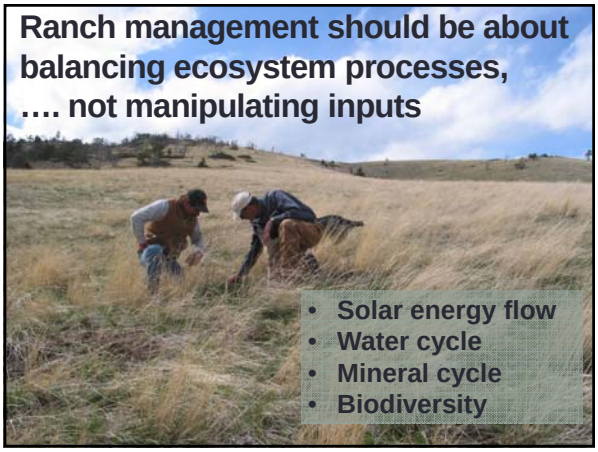
Only four necessary ingredients for making meat, milk, and fiber



- *CO_2*
- *Solar energy*
- *Water*
- *Soil minerals*

Ranch management should be about balancing ecosystem processes, …. not manipulating inputs



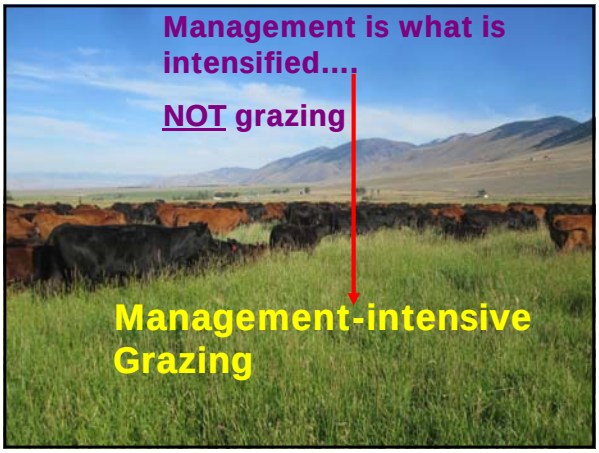
- Solar energy flow
- Water cycle
- Mineral cycle
- Biodiversity

Why Management-intensive Grazing?

- Cows "intensively graze" by nature, only people can "intensively manage"

Management is what is intensified….

NOT grazing



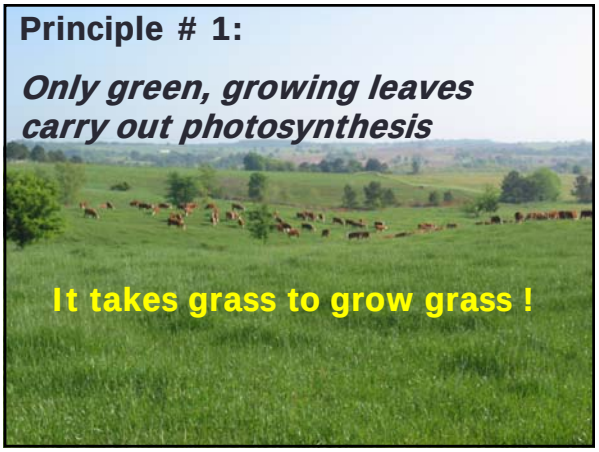
Management-intensive Grazing

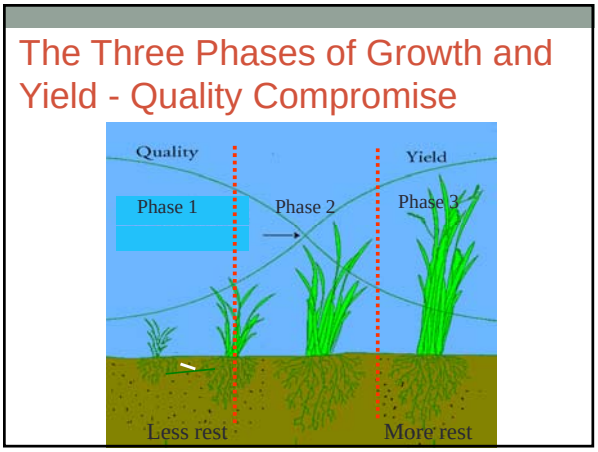
Getting the most out of your pastures

- **Step 1: Build a better solar panel**

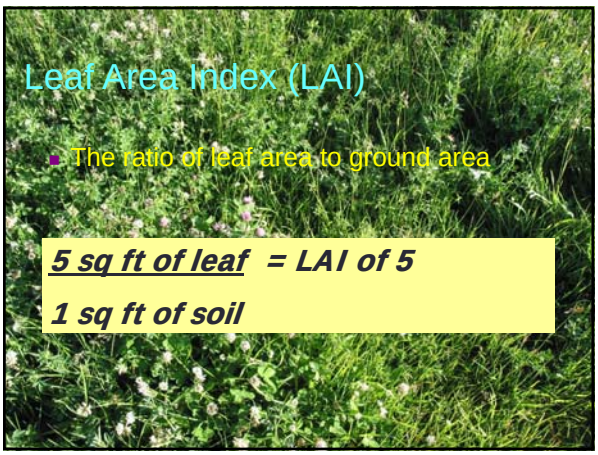

Bare soil does not make
a good solar panel !


Mature plants don't make a very
good solar panel !


Principle # 1:
Only green, growing leaves
carry out photosynthesis
It takes grass to grow grass !

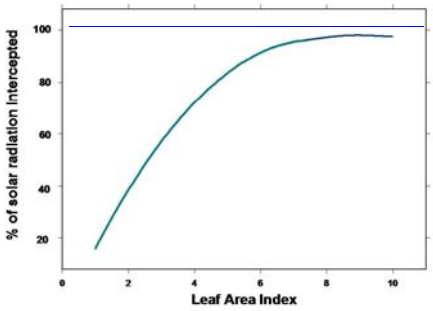

The Three Phases of Growth and
Yield - Quality Compromise
Quality
Yield
Phase 1
Phase 2
Phase 3
Less rest
More rest


Leaf Area Index (LAI)
The ratio of leaf area to ground area
1 sq ft of leaf = LAI of 1
1 sq ft of soil


Leaf Area Index (LAI)
The ratio of leaf area to ground area
5 sq ft of leaf = LAI of 5
1 sq ft of soil

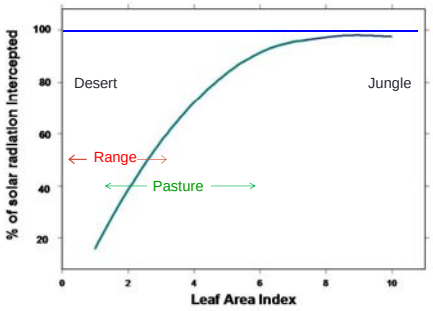
Example of LAI response

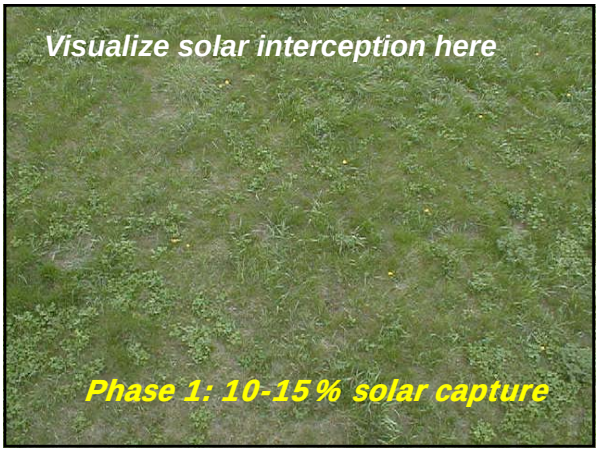
Solar energy capture will approach 100% but will never actually be achieved

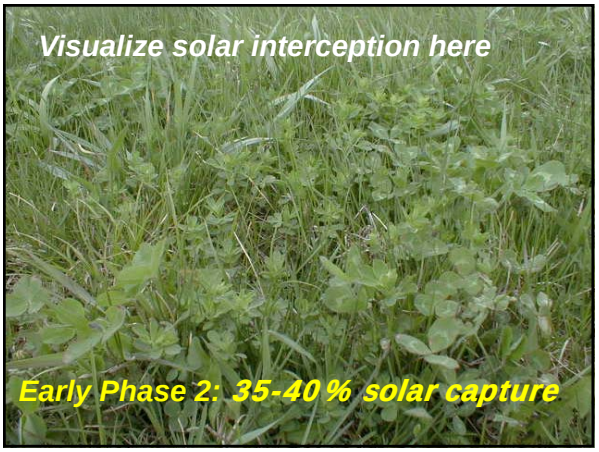


Example of LAI response

Different plant communities differ in typical leaf density

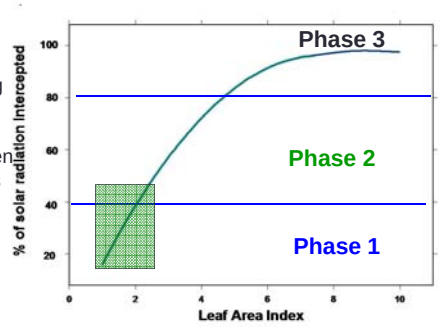


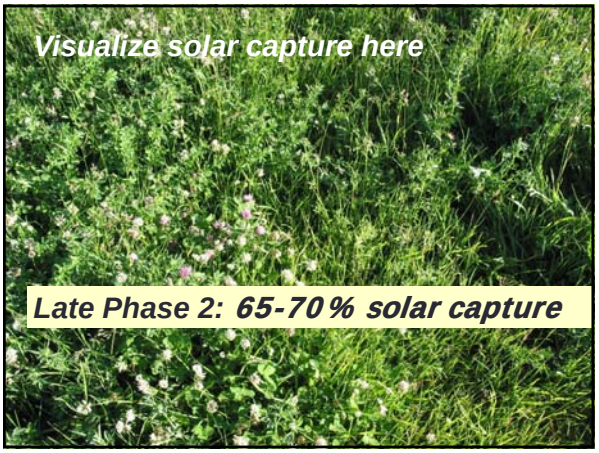




Where do you graze?

The factory is only operating at about 25-30% average efficiency when grazing in this zone.





Grazing in Phase 2

Greatest photosynthetic efficiency occurs in the phase 2 part of the growth cycle.

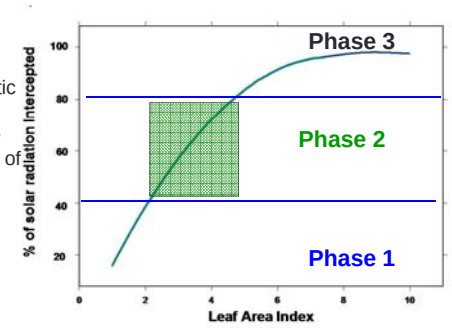
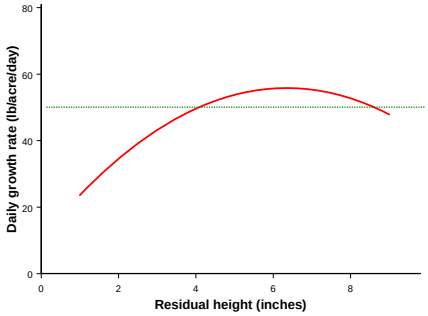
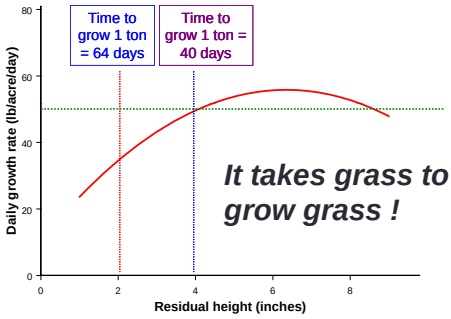


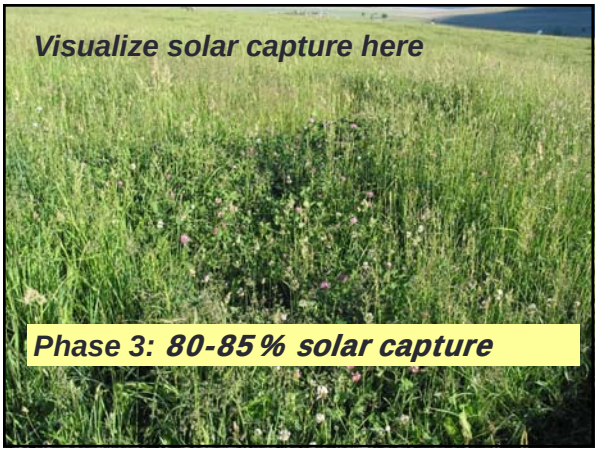
Figure 1. Effect of post-grazing residual on pasture daily growth rate (MU-FSRC)



Effect of post-grazing residual on pasture daily growth rate (MU-FSRC)

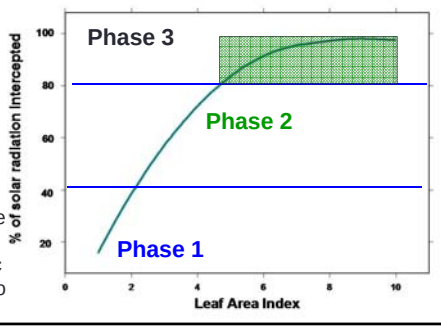


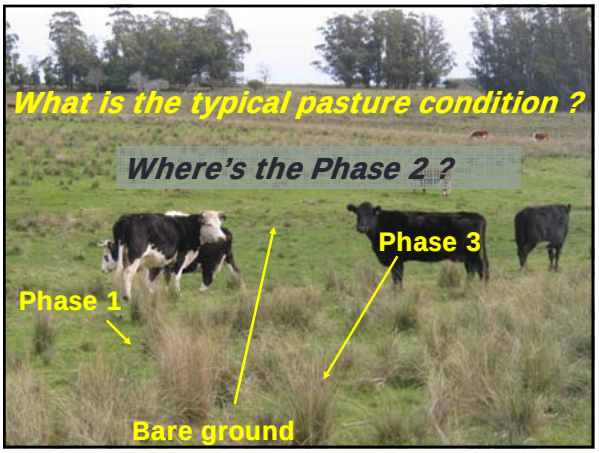
It takes grass to grow grass !

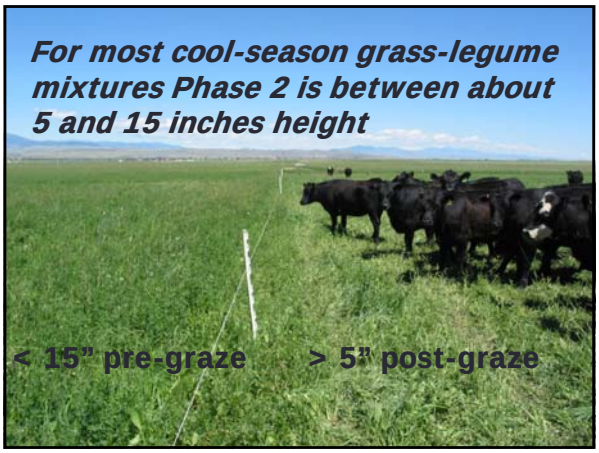


Why Phase 3 is less productive even though solar capture is high

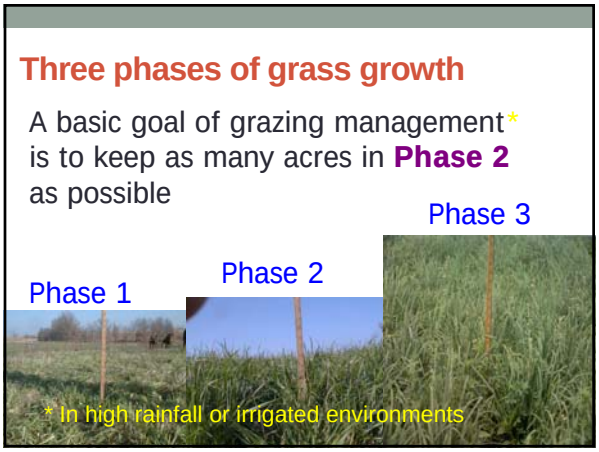
- Plants have maintenance requirements just like your livestock
- As the pasture grows towards Phase 3, more photosynthetic energy goes to maintenance

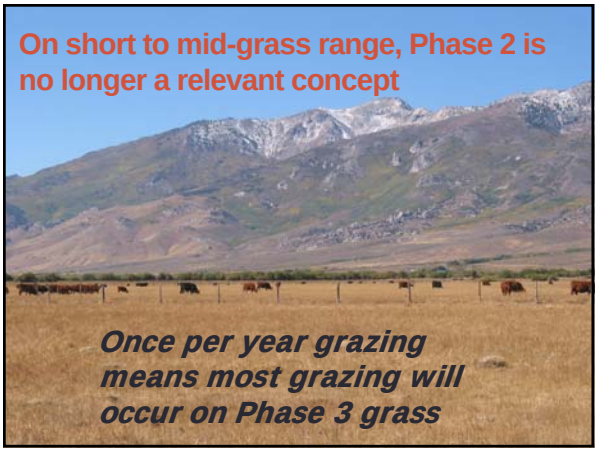


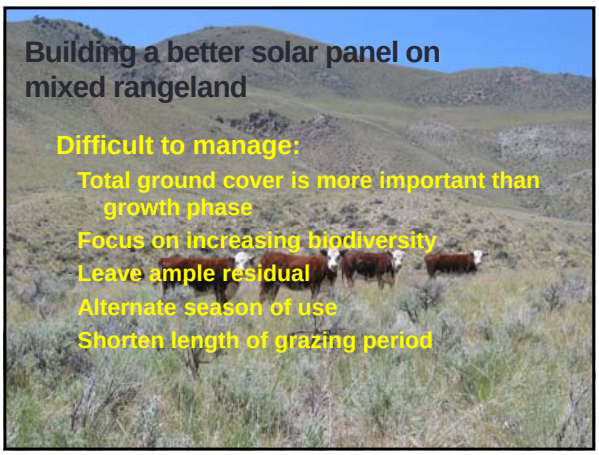



For most cool-season grass-legume mixtures Phase 2 is between about 5 and 15 inches height
< 15" pre-graze
> 5" post-graze


For tall warm season grasses Phase 2 may be between 12 to 30 inches


Three phases of grass growth
A basic goal of grazing management* is to keep as many acres in Phase 2 as possible
Phase 1
Phase 2
Phase 3
* In high rainfall or irrigated environments


On short to mid-grass range, Phase 2 is no longer a relevant concept
Once per year grazing means most grazing will occur on Phase 3 grass


Building a better solar panel on mixed rangeland
Difficult to manage:
Total ground cover is more important than growth phase
Focus on increasing biodiversity
Leave ample residual
Alternate season of use
Shorten length of grazing period


Range management is far more about time than numbers


Range management is far more about time than numbers
Virtually all negative aspects of cattle on range is due to too much time on the pasture, not too many numbers


Allowing ample recovery time is the key to maintaining range production and biodiversity


Principle # 2: Avoid grazing a pasture to Phase 1 !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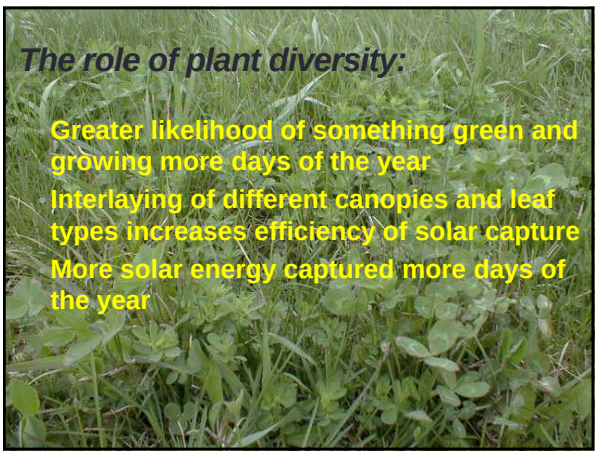
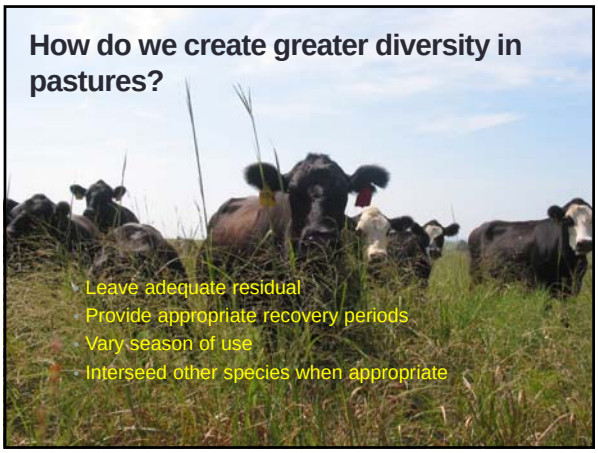

The role of plant diversity:
Greater likelihood of something green and growing more days of the year
Interlaying of different canopies and leaf types increases efficiency of solar capture
More solar energy captured more days of the year

How do we create greater diversity in pastures?



- Leave adequate residual
- Provide appropriate recovery periods
- Vary season of use
- Interseed other species when appropriate

Grazing and root growth

- Repeatedly grazing the plant top short produces shortened root growth

Plant Vigor-Leaves and Roots

Caring for the Green Zone, Riparian Areas and Grazing Management
Alberta Riparian Habitat Management Project, "Cows and Fish Project"

Plant Vigor-Leaves and Roots

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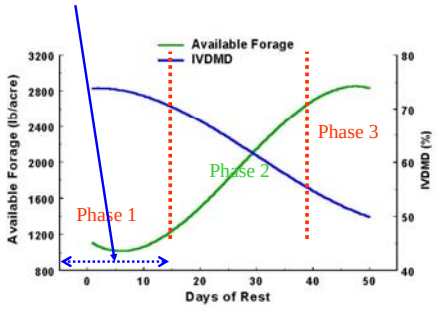
Grazing management & Utilization target

Figure 7. The more complete table of root growth stoppage (Crider, OSU-SCS, 1955)

Percent leaf removal	Rhodes grass (single clipping)	Rhodes grass	Smooth bromegrass	Kentucky bluegrass
		(repeated clipping)		
10	0	0	0	0
20	0	0	0	0
30	0	0	0	0
40	0	0	0	0
50	2	8	13	38
60	50	80	36	54
70	78	97	76	77
80	100	100	81	91
90	100	100	100	100

Grazing to Phase 1 residual may add 15 days to required rest



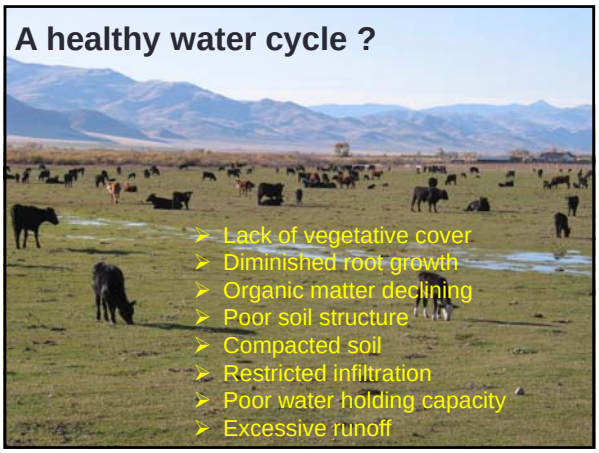
Residual and Rest

- In a 180 day growing season….
  - If grazing to Phase 2 residual requires 30 day rest period ….
  - Then there are 6 harvests annually
  - If 1000 lb forage grazed in each cycle, each acre yields 6000 lb of grazed forage

Residual and Rest

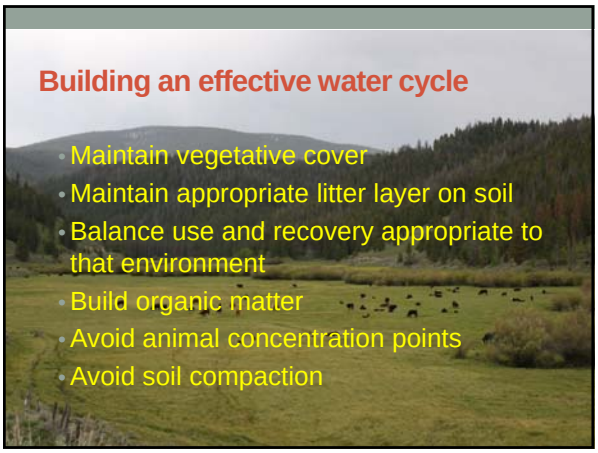
- In a 180 day growing season….
  - If grazing to Phase 1 residual requires 45 day rest period…..
    - Then there are only 4 harvests annually
    - If 1200 lb forage grazed in each cycle, each acre yields 4800 lb of grazed forage

A healthy water cycle ?



- Lack of vegetative cover
- Diminished root growth
- Organic matter declining
- Poor soil structure
- Compacted soil
- Restricted infiltration
- Poor water holding capacity
- Excessive runoff

Building an effective water cycle



- Maintain vegetative cover
- Maintain appropriate litter layer on soil
- Balance use and recovery appropriate to that environment
- Build organic matter
- Avoid animal concentration points
- Avoid soil compaction

Controlling time spent in one area allows for pasture, water, and soil recovery on all other areas

Building of organic matter

Managed grazing leads to more photosynthetic energy capture resulting in more organic matter created in the soil

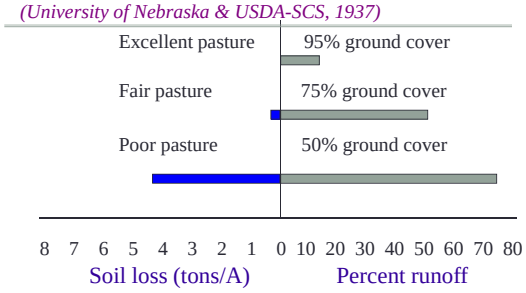
Plant Vigor-Leaves and Roots

Caring for the Green Zone, Riparian Areas and Grazing Management
Alberta Riparian Habitat Management Project, "Cows and Fish Project"
Grazing management & Utilization target

- Long term pasture growth builds soil structure and increases water infiltration rate and soil water holding capacity

Infiltration and Runoff

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



Grazing for Riparian Health

What are riparian areas?

What are riparian areas and why are they important?

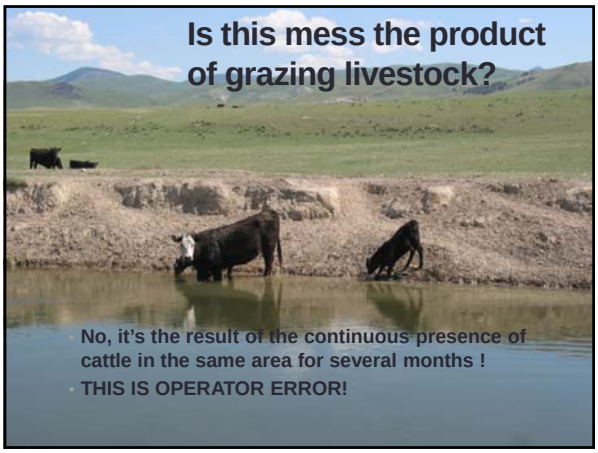
- Critical water source for humans, livestock, and wildlife
- Good indicator of overall environmental quality
- Valuable economic resource in many areas

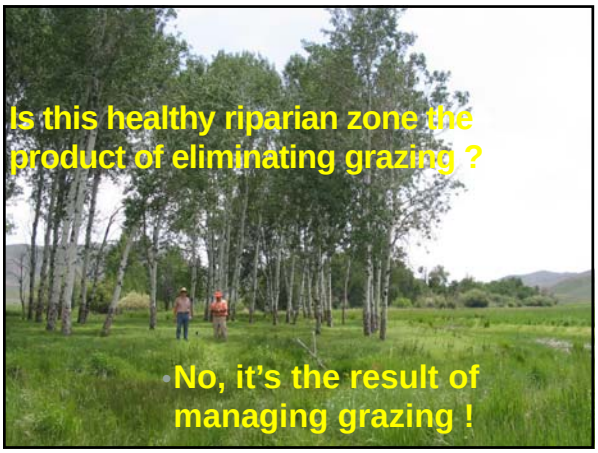
What defines riparian health?

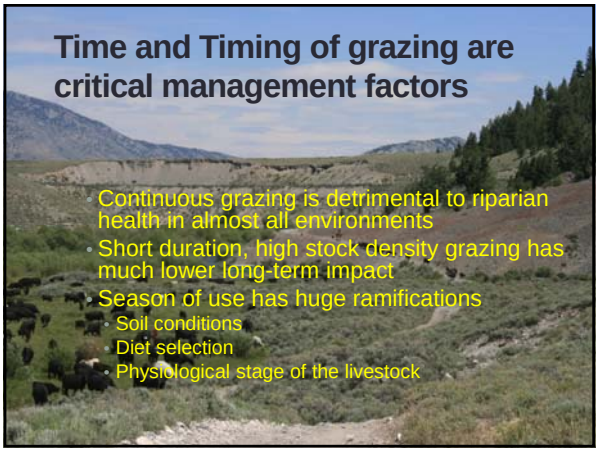
- Functional ecosystem processes
  - Solar energy flow
  - Effective water cycle
  - Dynamic nutrient cycle
  - Biodiversity at all trophic levels
- Clean water flowing to next reach

Poor riparian health

- No vegetation on stream bank
- Soil compaction & poor water infiltration
- Soil and manure runoff into water
- Minimal biodiversity

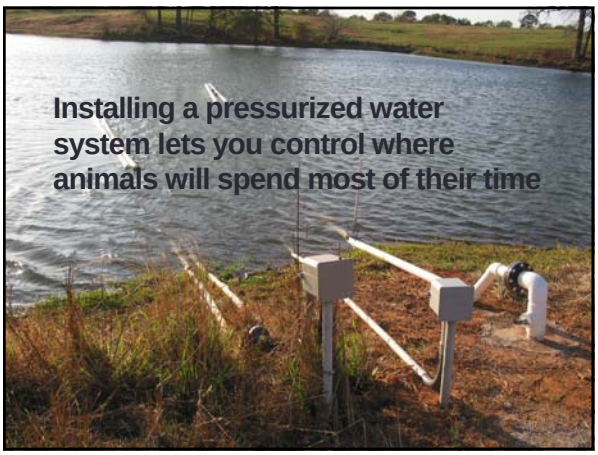

Is this mess the product of grazing livestock?
No, it's the result of the continuous presence of cattle in the same area for several months !
THIS IS OPERATOR ERROR!


Is this healthy riparian zone the product of eliminating grazing ?
No, it's the result of managing grazing !


Time and Timing of grazing are critical management factors
Continuous grazing is detrimental to riparian health in almost all environments
Short duration, high stock density grazing has much lower long-term impact
Season of use has huge ramifications
Soil conditions
Diet selection
Physiological stage of the livestock


Location of water is the #1 factor determining where cattle will spend most of their time


Stock water developments
Moving stock water away from riparian areas shifts animal concentration away from sensitive areas

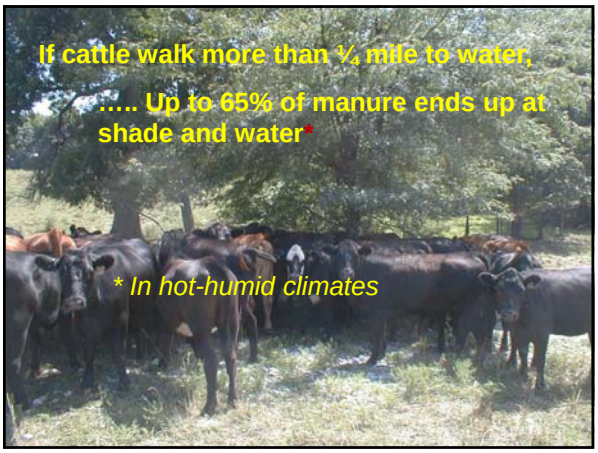

Installing a pressurized water system lets you control where animals will spend most of their time

Getting the most out of your pastures

- Step 1: Build a better solar panel
- Step 2: Manage for a healthy water cycle
- Step 3: Create a dynamic mineral cycle

If cattle walk more than ¼ mile to water,

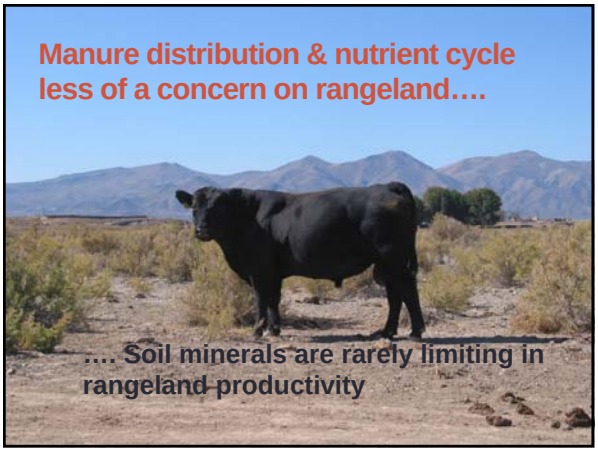
….. Up to 65% of manure ends up at shade and water*



** In hot-humid climates*

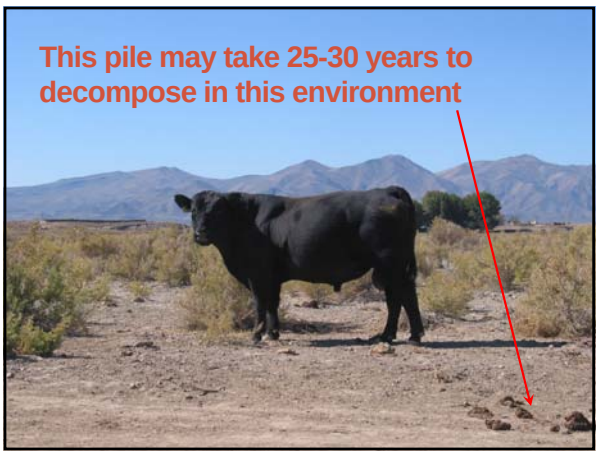
Short grazed pastures with animal concentration in riparian zone is recipe for contamination

Manure distribution & nutrient cycle less of a concern on rangeland….



…. Soil minerals are rarely limiting in rangeland productivity

This pile may take 25-30 years to decompose in this environment



Nutrient flow in grasslands

Inputs

- mineralization
- atmospheric
- fertilizer
- feed
- mineral
- manure
- legumes (N)

Nutrient Cycle

Exports

- hay
- animals
- loss pathways

Nutrient removal rates: Hay system

Inputs

- mineralization
- legumes (N)
- fertilizer
- atmospheric

Nutrient Cycle

Exports

- remove 80% of nutrients in hay

Each ton of hay removes:

- 40-60 lb. nitrogen
- 6 lb. P (13 lb. P_2O_5)
- 40-50 lb. K (48 lb. K_2O)

3 tons of hay removes:

- 150 lb. nitrogen
- 18 lb. P (40 lb. P_2O_5)
- 120 lb. K (145 lb. K_2O)

Nutrient removal rates: Pasture system

Inputs

- mineralization
- manure
- legumes
- (N) fertilizer
- atmospheric
- feed/mineral

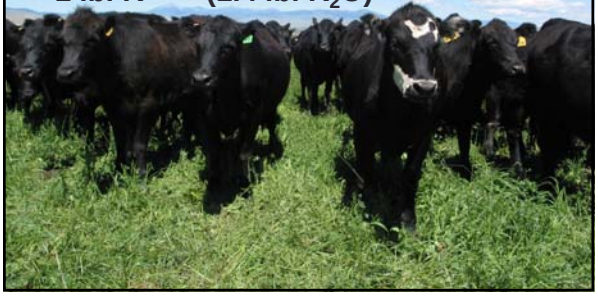
Nutrient Cycle

Exports

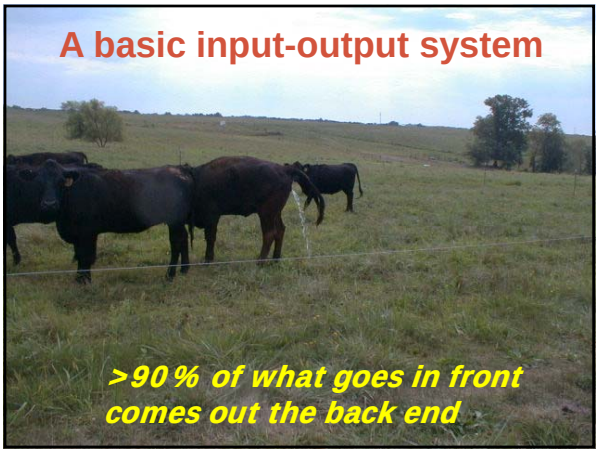
- calves
- beef
- loss pathways

500 lbs of beef per acre removes:

- 16 lb. nitrogen
- 5 lb. P (10 lb. P_2O_5)
- 1 lb. K (1.4 lb. K_2O)



A basic input-output system



>90% of what goes in front comes out the back end

Mobile vs. Immobile nutrients

- Mobile
  - Nitrogen
  - Sulfur
  - Boron
  - Chlorine
- Immobile
  - Phosphorus
  - Calcium
  - Magnesium
  - Iron
  - Zinc
  - Copper

** Potassium is mobile in sandy soils but immobile in clay*

N fixation in mixed stands

Species	N fixed 1st year	(lb/acre) old stand	N from fixation
Alfalfa	70-80	120-230	60 - 94 %
Red Clover	10-90	130-250	40 - 96 %
Birdsfoot Trefoil	30-60	80-150	40 - 94 %
White Clover	10-100	20-240	35 - 100%

West & Mallorino, 1996

Effect of protein level on daily N excretion rate

Protein content	10%	15%	20%	
Cow weight	1200	1200	1200	lb
Intake rate	2.6%	2.6%	2.6%	% of liveweight
Daily consumption	31.2	31.2	31.2	lb/hd/day
Daily protein consumption	3.12	4.68	6.24	lb/hd/day
Daily nitrogen consumption	0.50	0.75	1.00	lb/hd/day
Daily nitrogen excretion	0.47	0.71	0.95	lb/hd/day

* Fecal N level remains near constant, excess N is excreted as urine

Effect of protein level on daily N excretion rate

Protein content	10%	15%	20%	
Cow weight	1200	1200	1200	lb
Intake rate	2.6%	2.6%	2.6%	% of liveweight
Daily consumption	31.2	31.2	31.2	lb/hd/day
Daily protein consumption	3.12	4.68	6.24	lb/hd/day
Daily nitrogen consumption	0.50	0.75	1.00	lb/hd/day
Daily nitrogen excretion	0.47	0.71	0.95	lb/hd/day
Daily fecal N output	0.24	0.24	0.24	lb/hd/day
Daily urine N output	0.24	0.47	0.71	lb/hd/day

* Urine N is nearly all readily available on a daily basis

Effect of stock density on daily available N return to the soil

Stock density	600	1200	4800	24000	48000	96000
Protein content	*lb of available N applied daily*					
10%	0.1	0.2	0.9	4.7	9.5	19.0
15%	0.2	0.5	1.9	9.5	19.0	37.9
20%	0.4	0.7	2.8	14.2	28.5	56.9

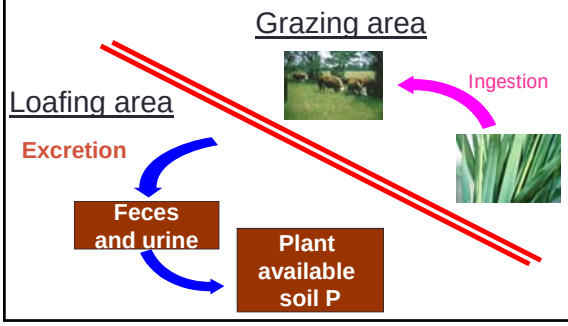
Effect of stock density on daily available N return to the soil

Stock density	600	1200	4800	24000	48000	96000
Protein content	*lb of available N applied daily*					
10%	0.1	0.2	0.9	4.7	9.5	19.0
15%	0.2	0.5	1.9	9.5	19.0	37.9
20%	0.4	0.7	2.8	14.2	28.5	56.9

Management requirements for these stock densities:

- 600 lb/A = continuous graze 2 acre/cow
- 1200 lb/A = continuous graze 1 acre/cow
- 4800 lb/A = rotational graze 10 day grazing period
- 24000 lb/A=rotational graze 3 day graze period
- 48000 lb/A=rotational graze 1 day graze period

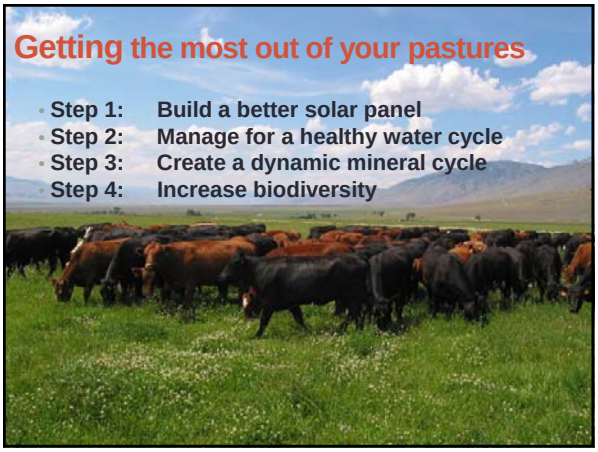
Manure Distribution: Continuous grazing

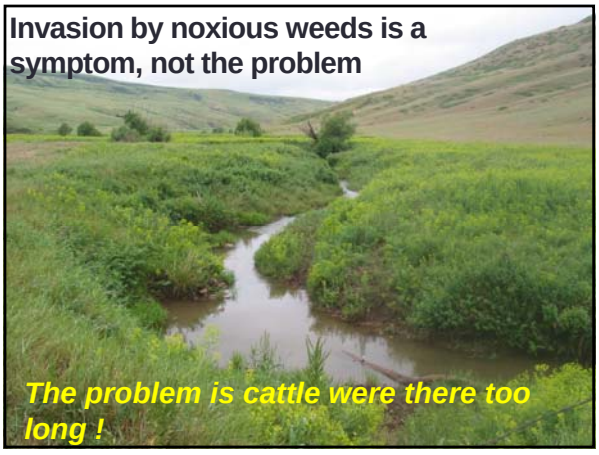


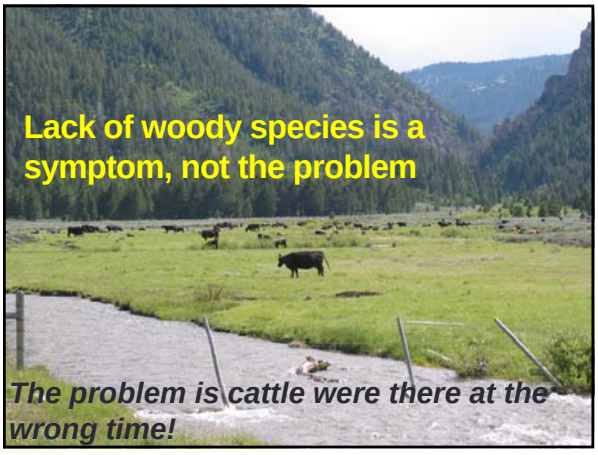
Manure Distribution

Rotation Frequency	Years to get 1 pile / sq. yard
Continuous	27
14 day	7-8
4 day	4-5
1 day	1-2

Getting the most out of your pastures

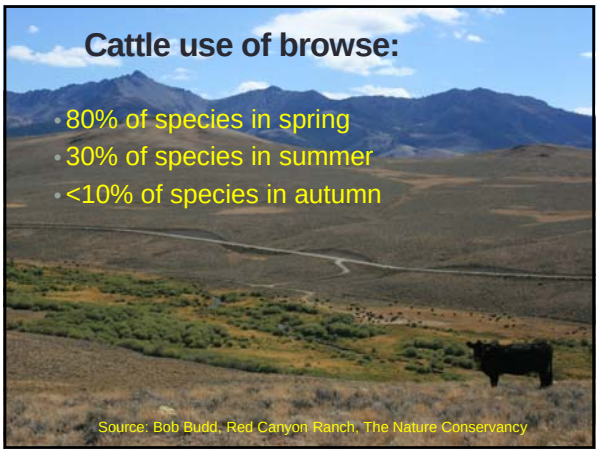






Cattle use of browse:

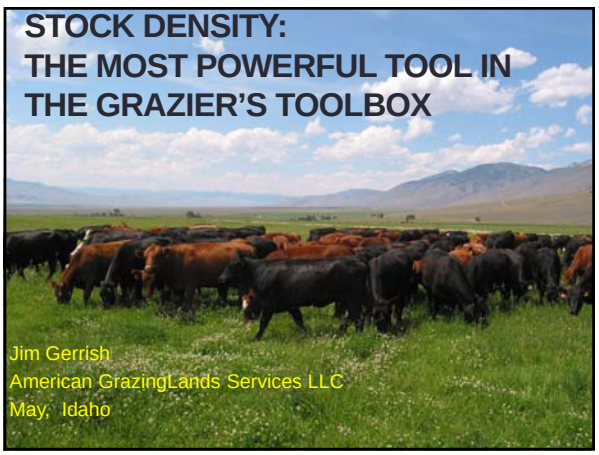
- 80% of species in spring
- 30% of species in summer
- <10% of species in autumn



Source: Bob Budd, Red Canyon Ranch, The Nature Conservancy

Winter use can help improve range and riparian conditions as long as cattle have adequate forage available

STOCK DENSITY: THE MOST POWERFUL TOOL IN THE GRAZIER'S TOOLBOX



Jim Gerrish
American GrazingLands Services LLC
May, Idaho

Some useful definitions

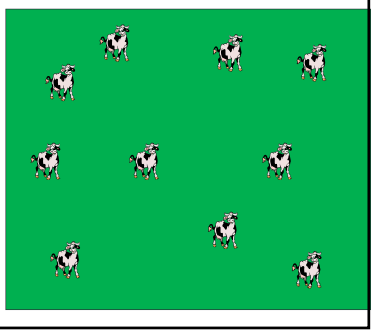
- **Stocking rate**: The number of animals or animal liveweight assigned to a grazing unit on a seasonal basis.

Stocking rate affects all these factors:

- Forage production
- Forage quality
- Species composition
- Animal performance
- Soil compaction
- Profitability

Stocking rate illustration

- Ten head on ten acres
- Stocking rate = 1 hd/acre
- If cows weigh 1200 lb… stocking rate is 1200 lb/acre

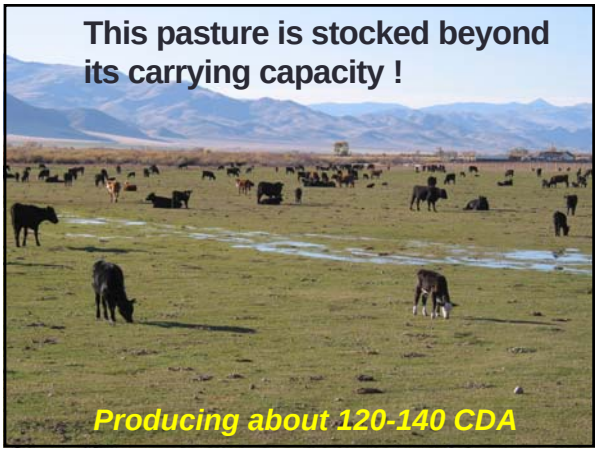


Some useful definitions

- **Stocking rate**: The number of animals or animal live weight assigned to a grazing unit on a seasonal basis.
- **Carrying capacity**: The stocking rate that provides a target level of performance while maintaining the integrity of the resource base.

Carrying capacity of pasture is determined by four factors

$$\text{Carrying Capacity} = \frac{\text{Forage Production} \times \text{Seasonal Utilization Rate}}{\text{Daily Intake} \times \text{Length of the Grazing Season}}$$

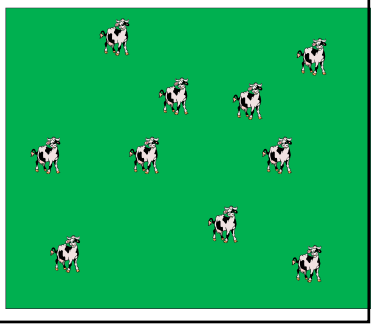


Some useful definitions

- **Stocking rate**: The number of animals or animal live weight assigned to a grazing unit on a seasonal basis.
- **Stock density**: The number of animals or animal live weight assigned to a *specific pasture area* at a *specific point in time*

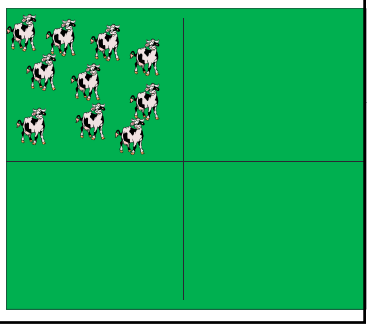
Stocking rate and stock density with continuous grazing

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



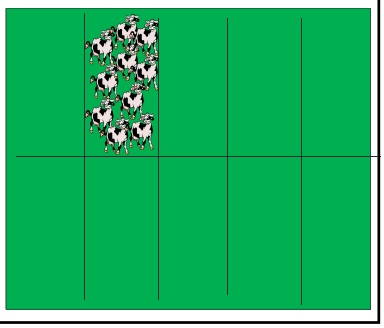
Pasture subdivision and stock density

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



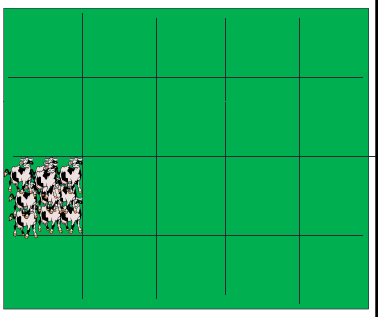
Pasture subdivision and stock density

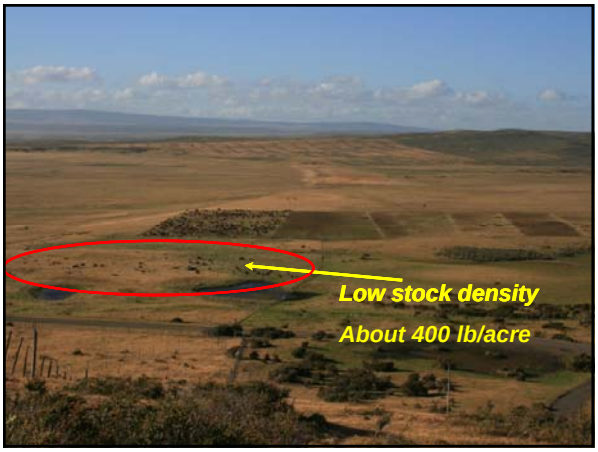
- Each level of subdivision results in higher stock density
- Stock density is now 12,000 lb/acre

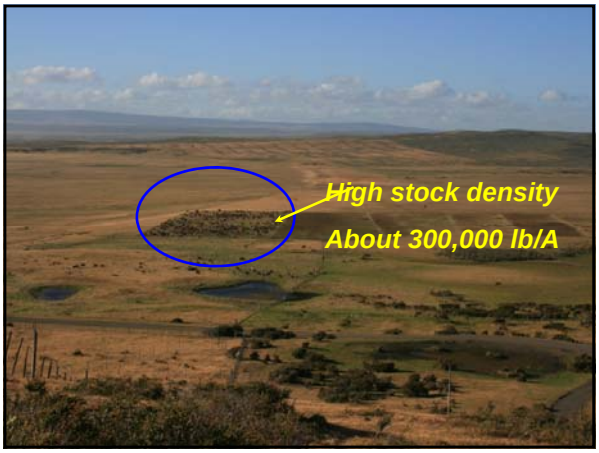


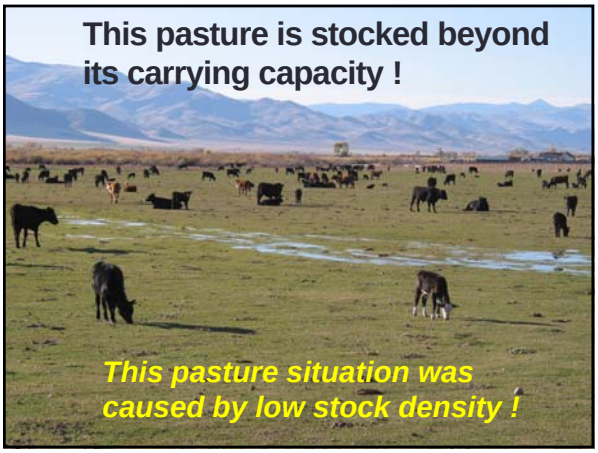
Pasture subdivision and stock density

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









So, what's the 'right' stock density?

Grazier's Arithmetic

$$\text{Stock Density} = \frac{\text{Forage Availability} \times \text{Temporal Utilization Rate}}{\text{Daily Intake} \times \text{Length of the Grazing Period}}$$

What is the appropriate stock density?

Intake target	2.5%
Utilization target	50%
Length of grazing period	1.00

Available Forage	Potential Stock Density
forage/acre)	*(lb liveweight/acre*
1000	20000
1500	30000
2000	40000
2500	50000
3000	60000
3500	70000
4000	80000
4500	90000
5000	100000
5500	110000
6000	120000

What is the appropriate stock density?

Intake target	2.5%
Utilization target	80%
Length of grazing period	1.00

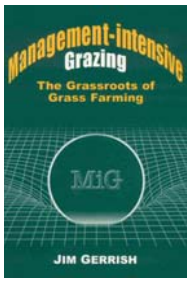
Available Forage	Potential Stock Density
forage/acre)	*(lb liveweight/acre*
1000	32000
1500	48000
2000	64000
2500	80000
3000	96000
3500	112000
4000	128000
4500	144000
5000	160000
5500	176000
6000	192000

What is the appropriate stock density?

Intake target	2.2%
Utilization target	80%
Length of grazing period	1.00

Available Forage	Potential Stock Density
forage/acre)	*(lb liveweight/acre*
1000	36364
1500	54545
2000	72727
2500	90909
3000	109091
3500	127273
4000	145455
4500	163636
5000	181818
5500	200000
6000	218182

Books by Jim Gerrish



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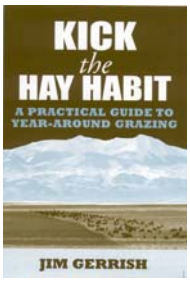

$27

Both for $55

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