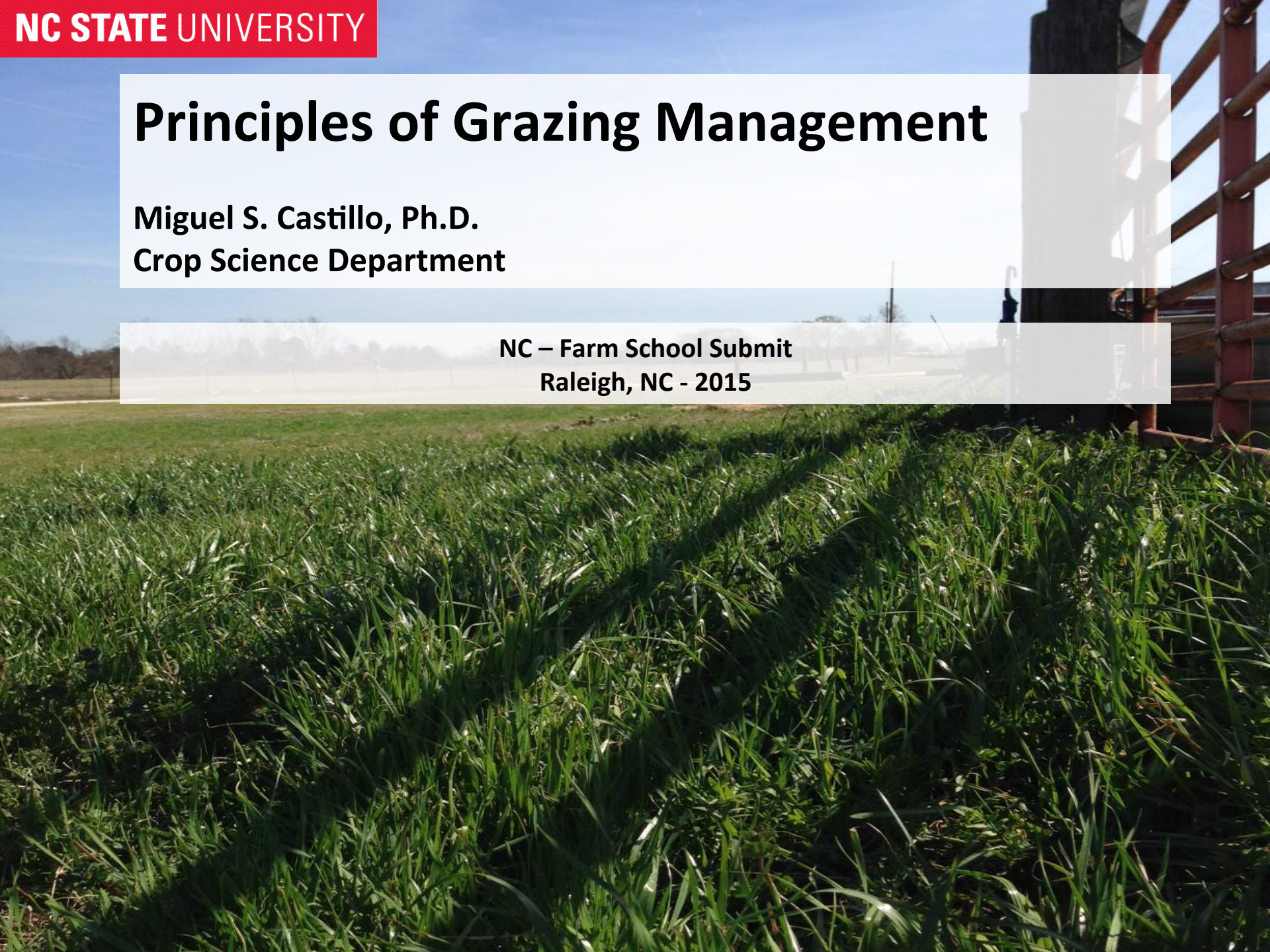


# **Principles of Grazing Management**

**Miguel S. Castillo, Ph.D.**  
**Crop Science Department**

**NC – Farm School Submit**  
**Raleigh, NC - 2015**







**Monoculture pasture**





**Mixed pasture (Grasses + Legumes)**






**Silvopastoril/Agroforestry**





**Compromise/Balance Requirements**

**Plant**  **Animal**



# Challenge....



... to recognize plant's need for "rest" to replenish energy, leaf area and root development



# Target post-graze stubble heights

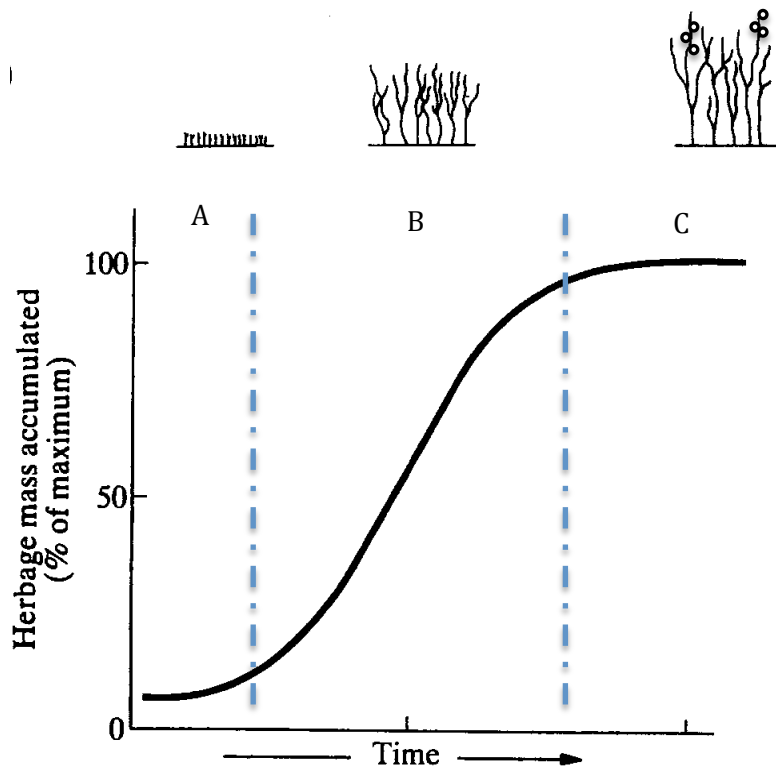
*Grazing to the target post-graze stubble height will:*

- *Ensure persistence of planted/ desirable forage species*
- *Maintain productivity*
- *Prevent weed infestation*

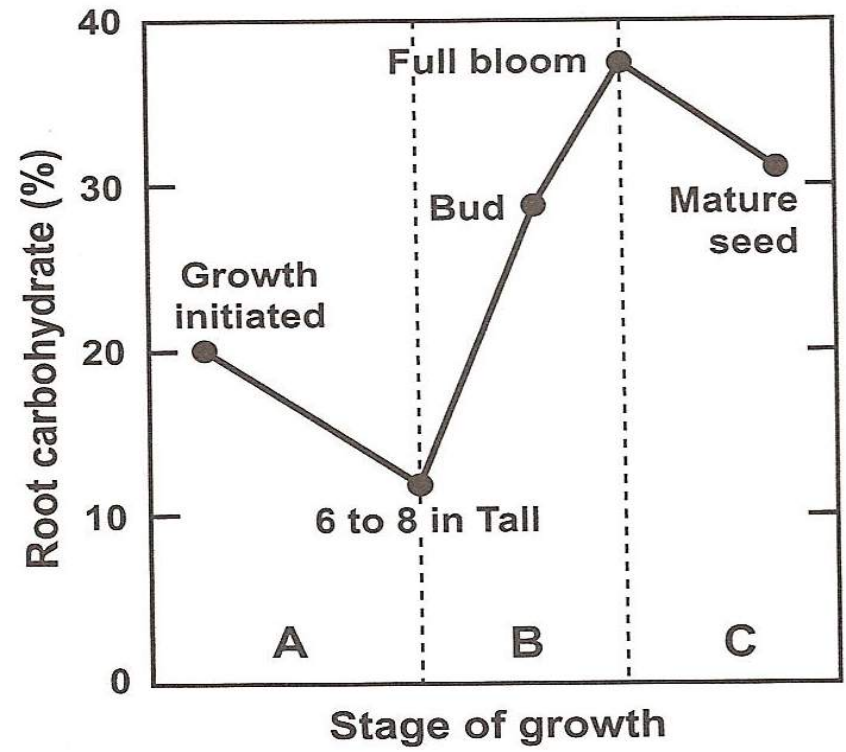
Forage	Target height (inches)		Digestibility	Crude Protein
	To Start	To Stop	--- % ---	
<b>Cool-season</b>				
Alfalfa	8 - 12	2 - 4	58 - 75	16 - 25
Orchardgrass	6 - 8	3 - 4	55 - 65	10 - 18
Ryegrass	8 - 10	2 - 3	55 - 65	10 - 18
Small grains (oats, barley, rye, triticale, wheat)	6 - 10	2 - 3	63 - 70	9 - 15
Tall fescue	6 - 8	3 - 4	55 - 65	10 - 18
<b>Warm-season</b>				
Annual lespedeza (Kobe and Korean)	4 - 6	2 - 3	55 - 60	10 - 14
Bahiagrass	4 - 8	2 - 3	50 - 62	11 - 14
Bermudagrass (common, hybrid and seeded varieties)	4 - 6	2 - 3	50 - 62	11 - 14
Big Bluestem	18 - 22	5 - 7	56 - 60	8 - 12
Caucasian Bluestem	8 - 12	3 - 4	60 - 69	9 - 12
Crabgrass	4 - 8	2 - 3	60 - 78	10 - 20
Dallisgrass	4 - 8	2 - 3	50 - 62	11 - 14
Eastern gamagrass	14 - 24	6 - 8	52 - 70	8 - 15
Indiangrass	18 - 22	5 - 7	56 - 60	8 - 12
Sorghum sudangrass	18 - 24	5 - 7	68 - 78	8 - 12
Switchgrass	18 - 22	5 - 7	56 - 60	8 - 12



# Plant regrowth



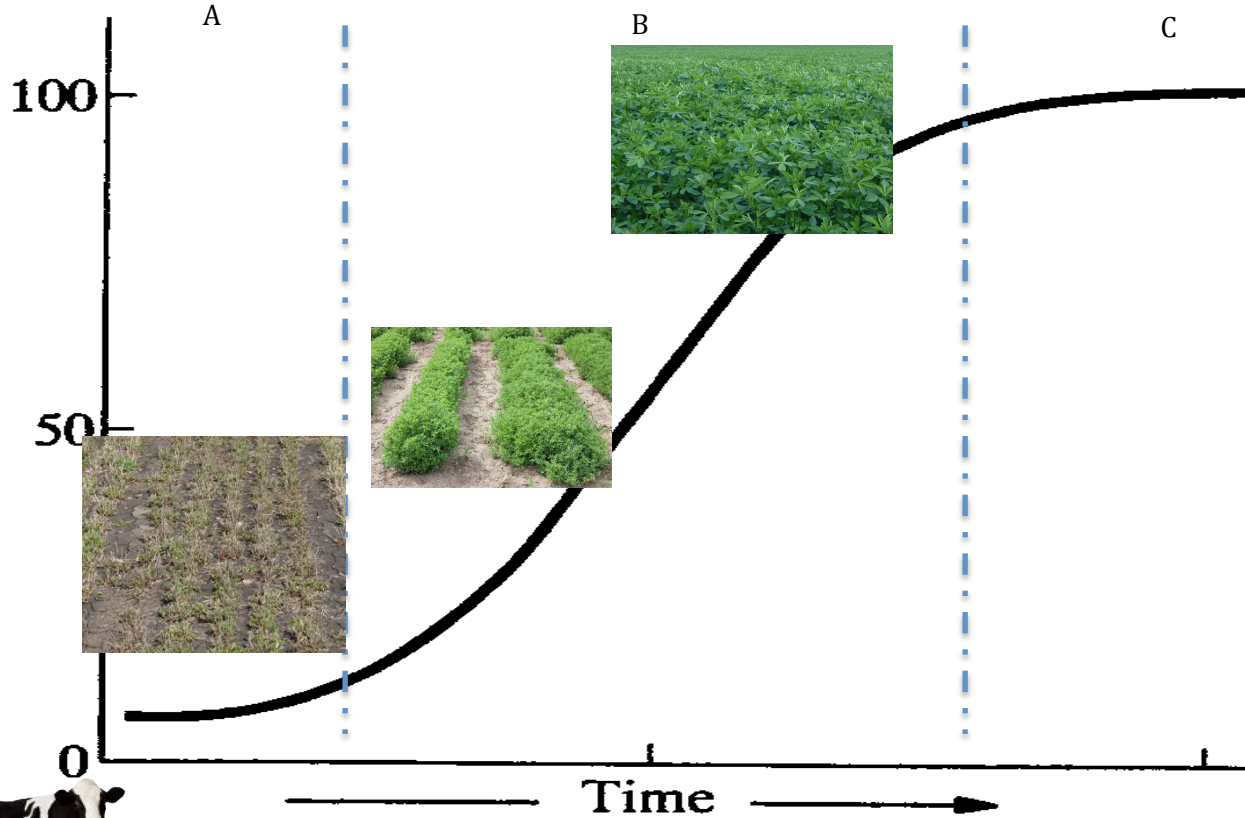
Herbage accumulation



Energy reserves



Herbage mass accumulated  
(% of maximum)

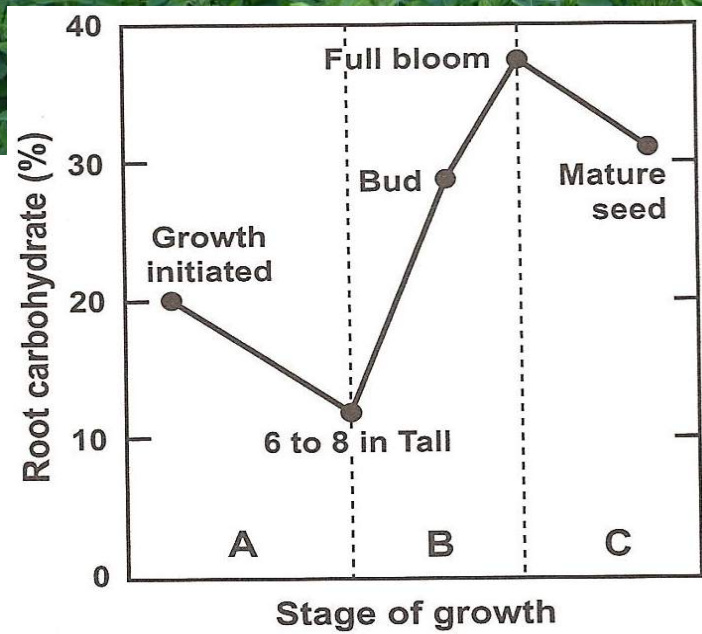
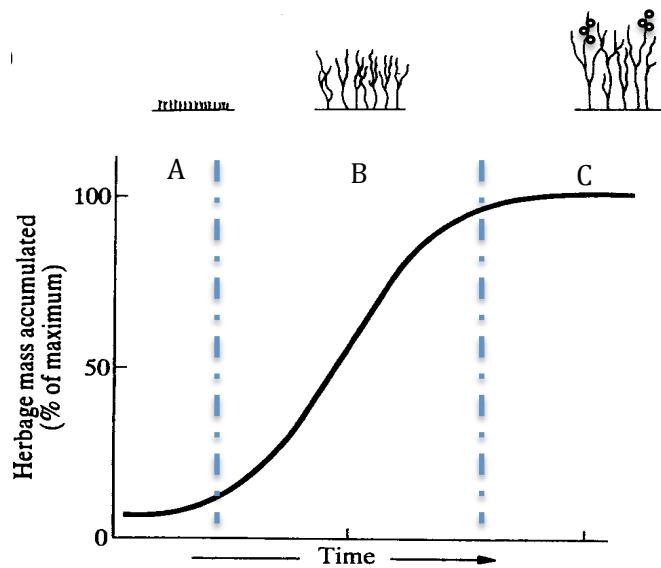




## **Stage A**





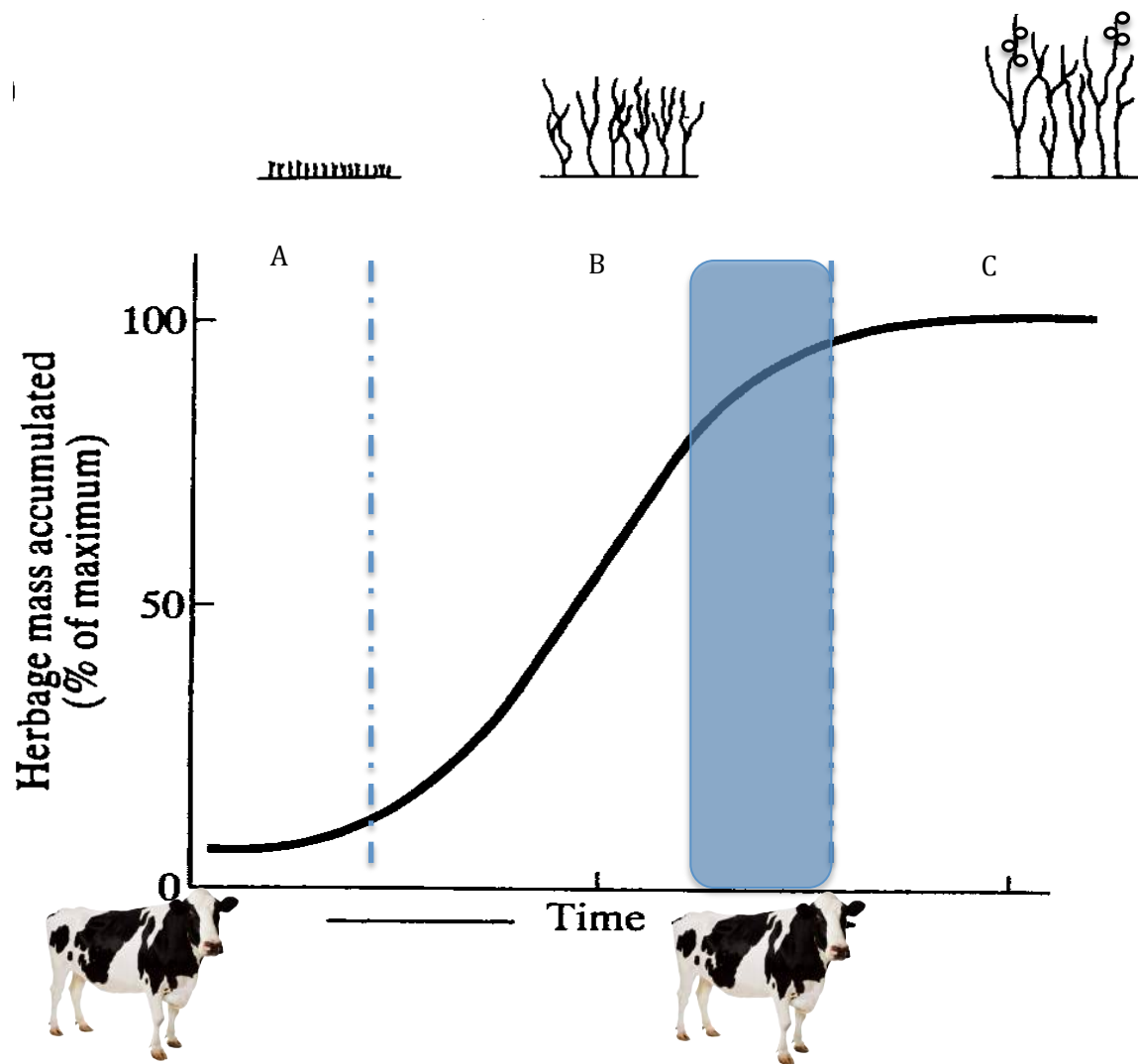




**Stage C**

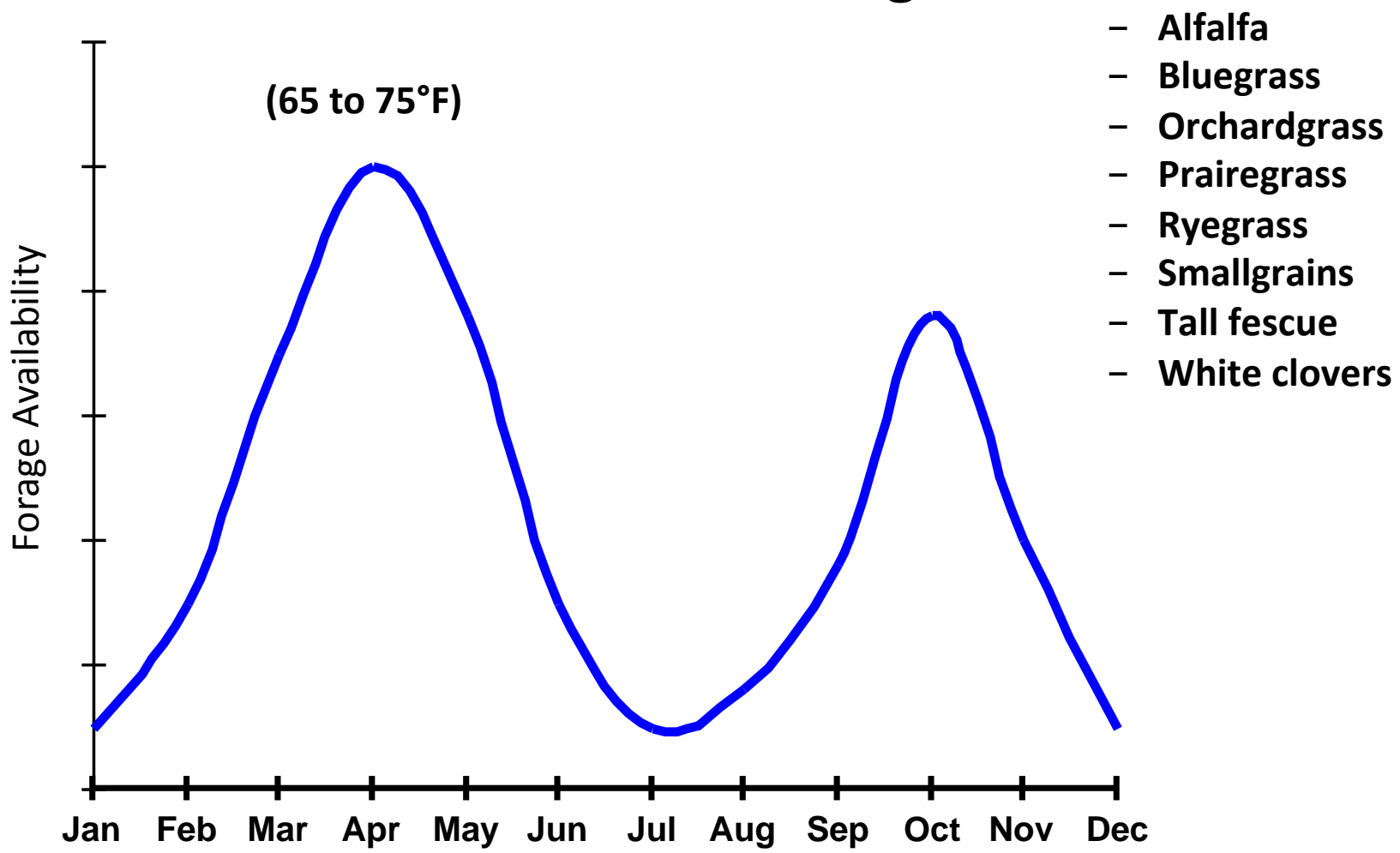






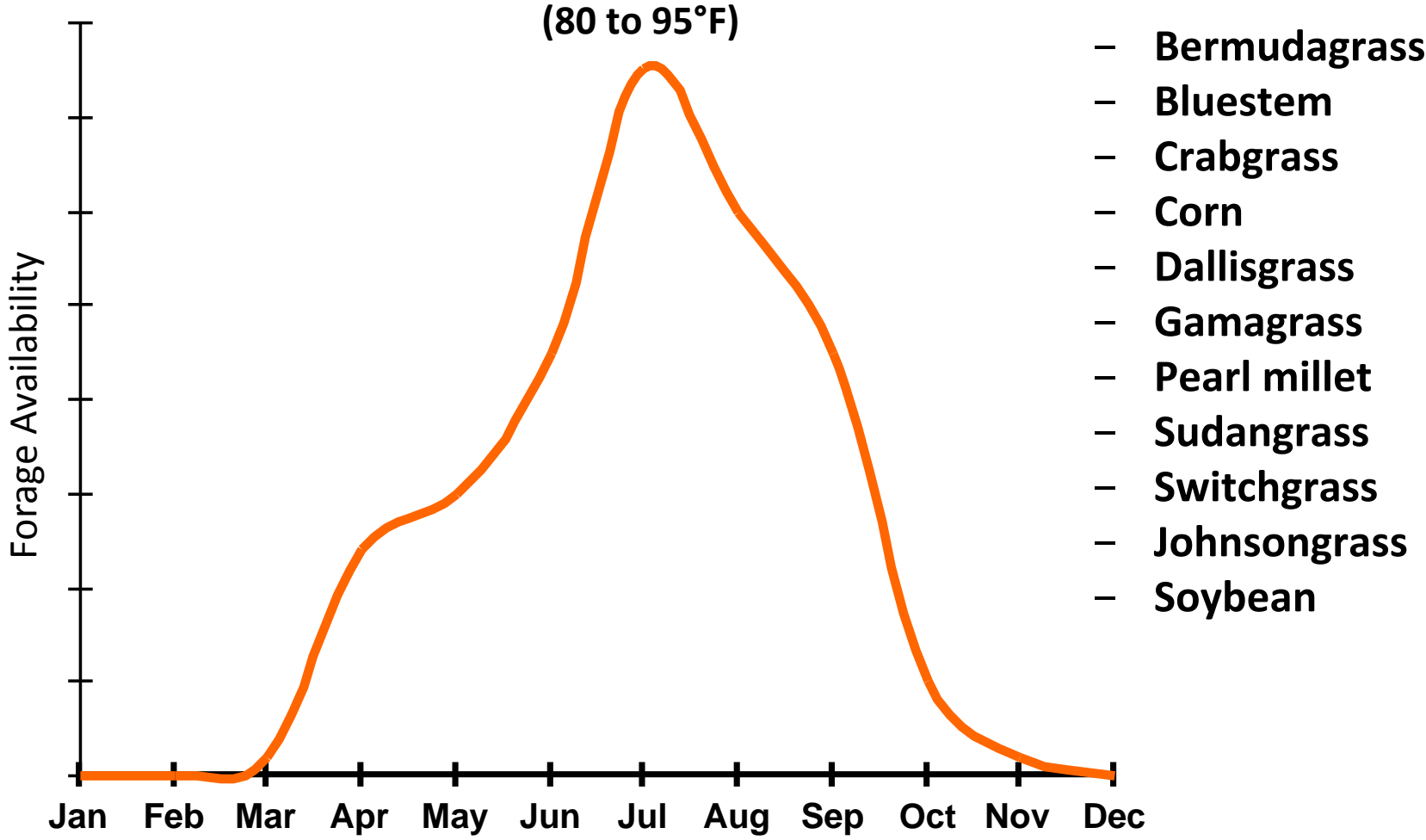


# Seasonal Distribution of Growth: Cool-season forages





Seasonal Distribution of Growth:  
Warm-season forages

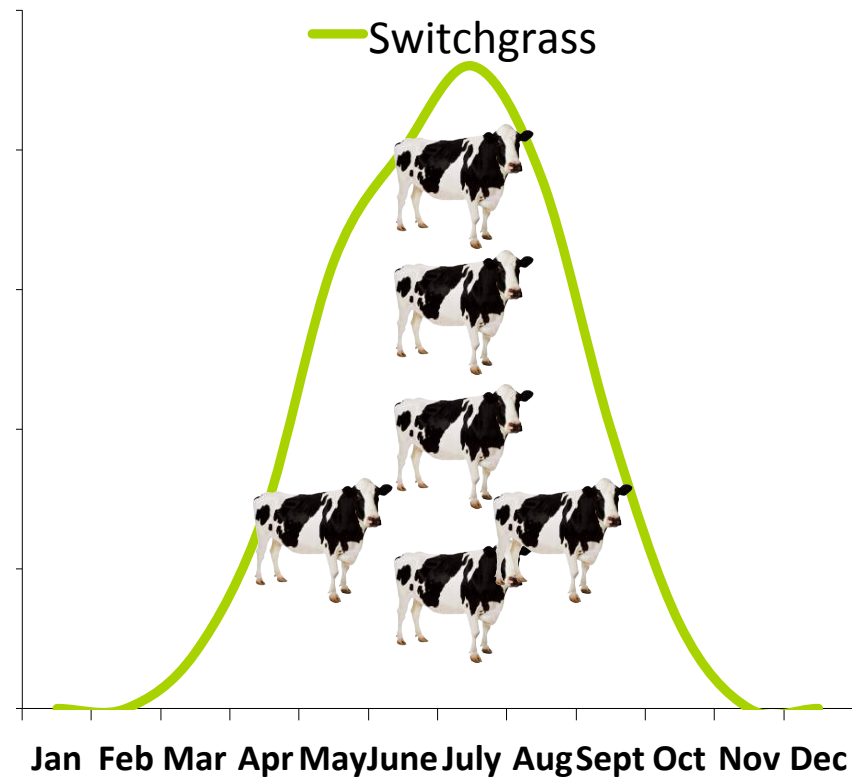
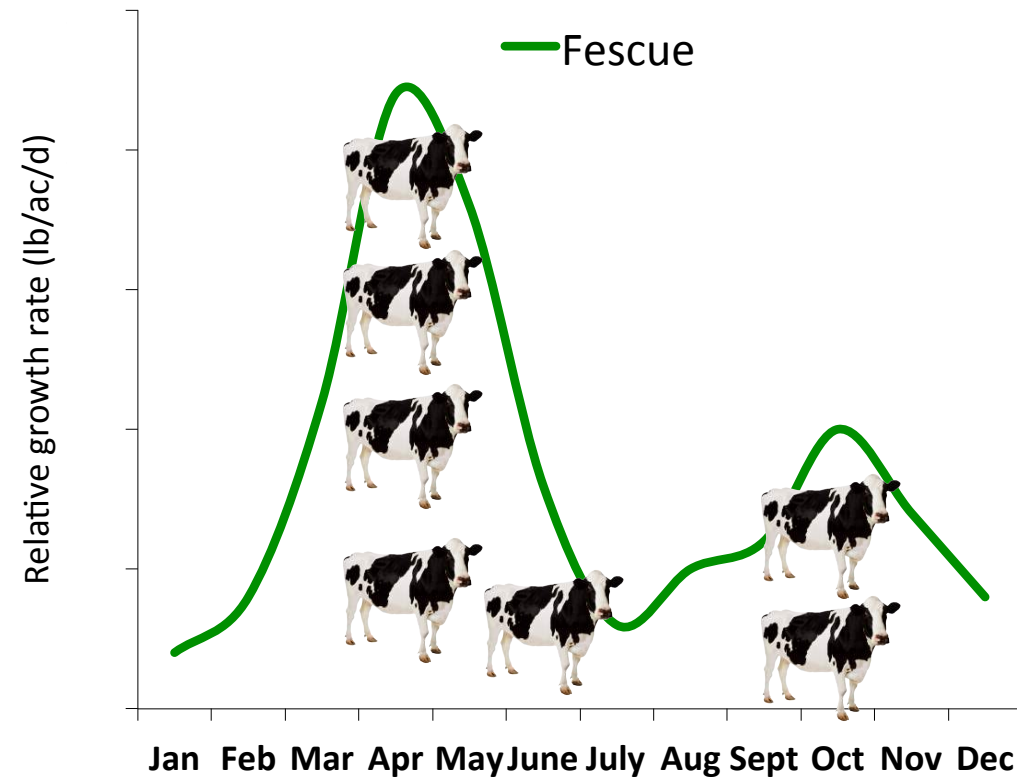




# Timing – NC example

Cool-season forage based

Warm-season forage based

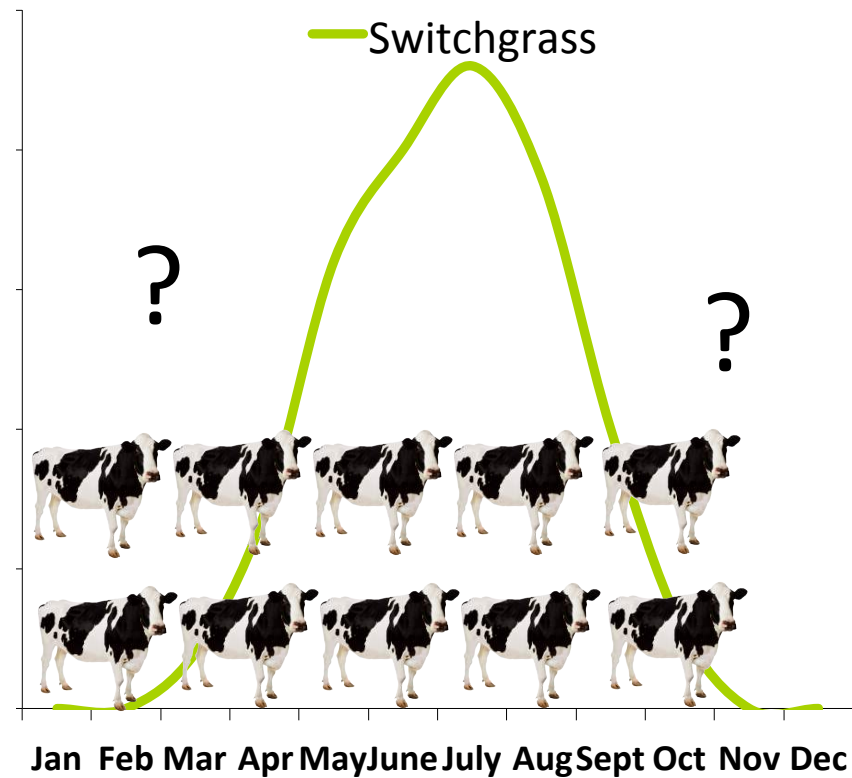
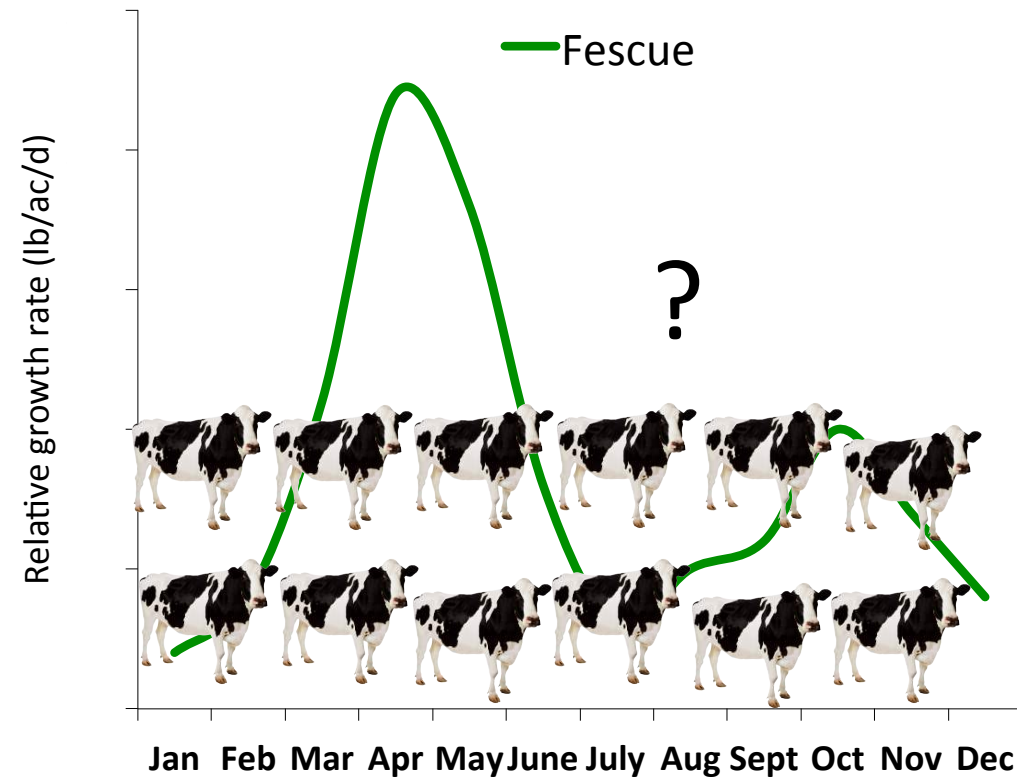




# Timing – NC example

## Cool-season forage based

## Warm-season forage based





# Timing

- Year-round forage productions in NC is possible using a combination of cool- and warm-season forages
- Forage production distribution curve determines **areas/times** of potential **excess/shortage** of forage supply
- Determine the number of animals that can be feed according to **forage production** and forage **management recommendations** to ensure persistence of the plant species

# How is grazing management characterized?

- **Intensity** (e.g. stocking rate, pasture height or mass)
- **Frequency** (e.g. rotational or continuous stocking)



# What is the importance of grazing management?

Grazing management determines whether a potentially good forage will actually be a good forage.

# Approach

- Provide definitions
- Discuss concepts
- Use examples from scientific literature to illustrate concepts

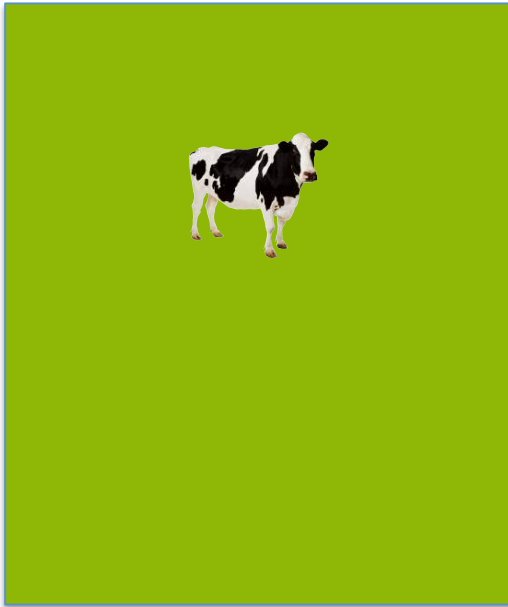


**Question 1.**

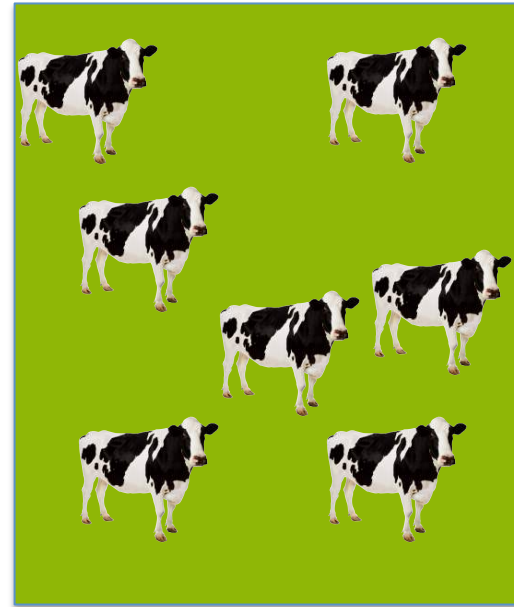
**What is the impact of stocking rate or pasture height on forage quality (animal responses)?**

# Intensity: Stocking rate, pasture height or mass

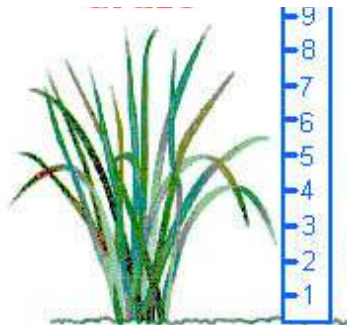
1 acre paddock



1 acre paddock



Pasture  
height

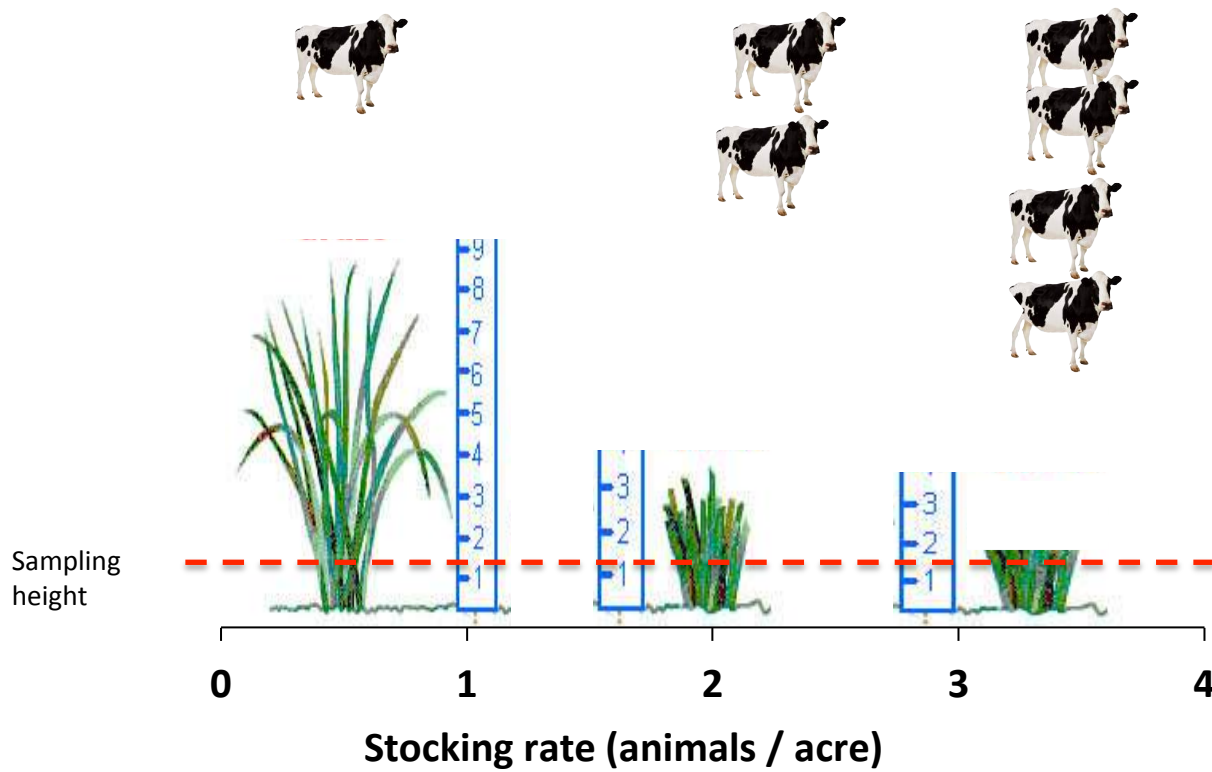




## **Nitrogen fertilization and stocking rate affect stargrass pasture and cattle performance.**

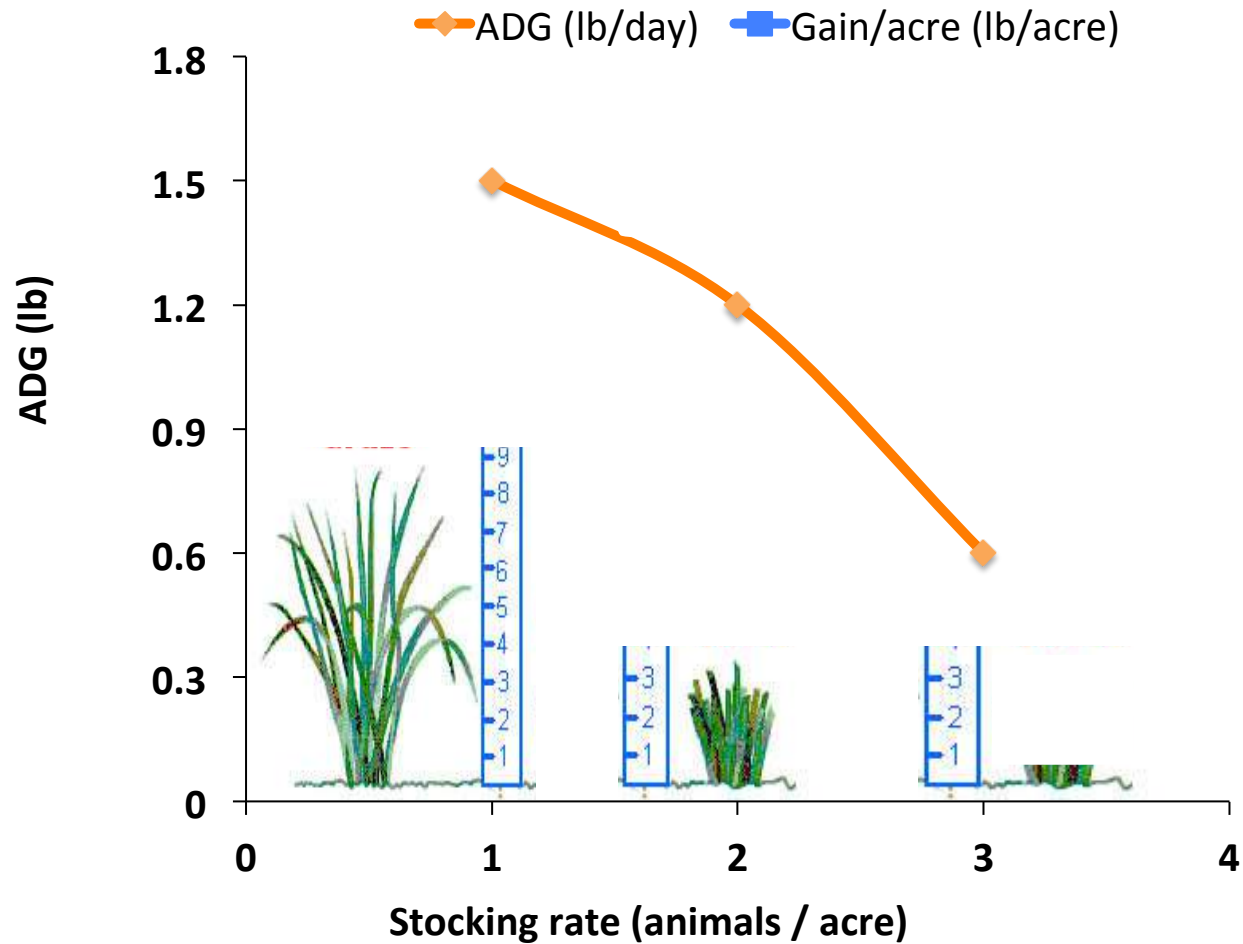
Hernandez Garay, A., L.E. Sollenberger, D.C. McDonald, G.J. Ruegsegger, and P. Mislevy.  
Crop Sci. 2004

- Stargrass grazed with 1, 2, and 3 yearling bulls per acre
- Grazing cycle 28 d (21-d resting period + 7-d grazing)
- 300 d grazing season for two years
- N rates: 100, 200, 300 lb/acre/yr

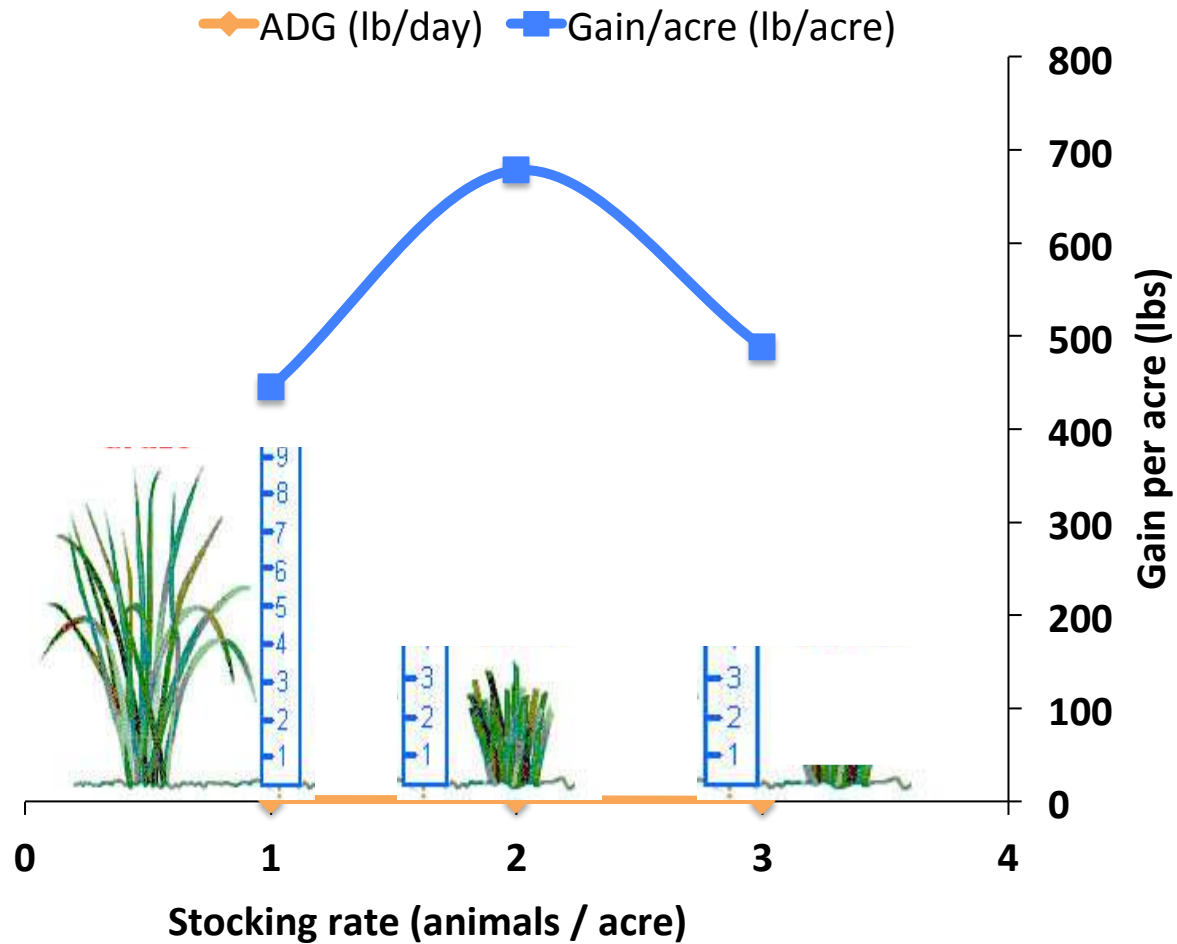




## Animal responses = quality of forage

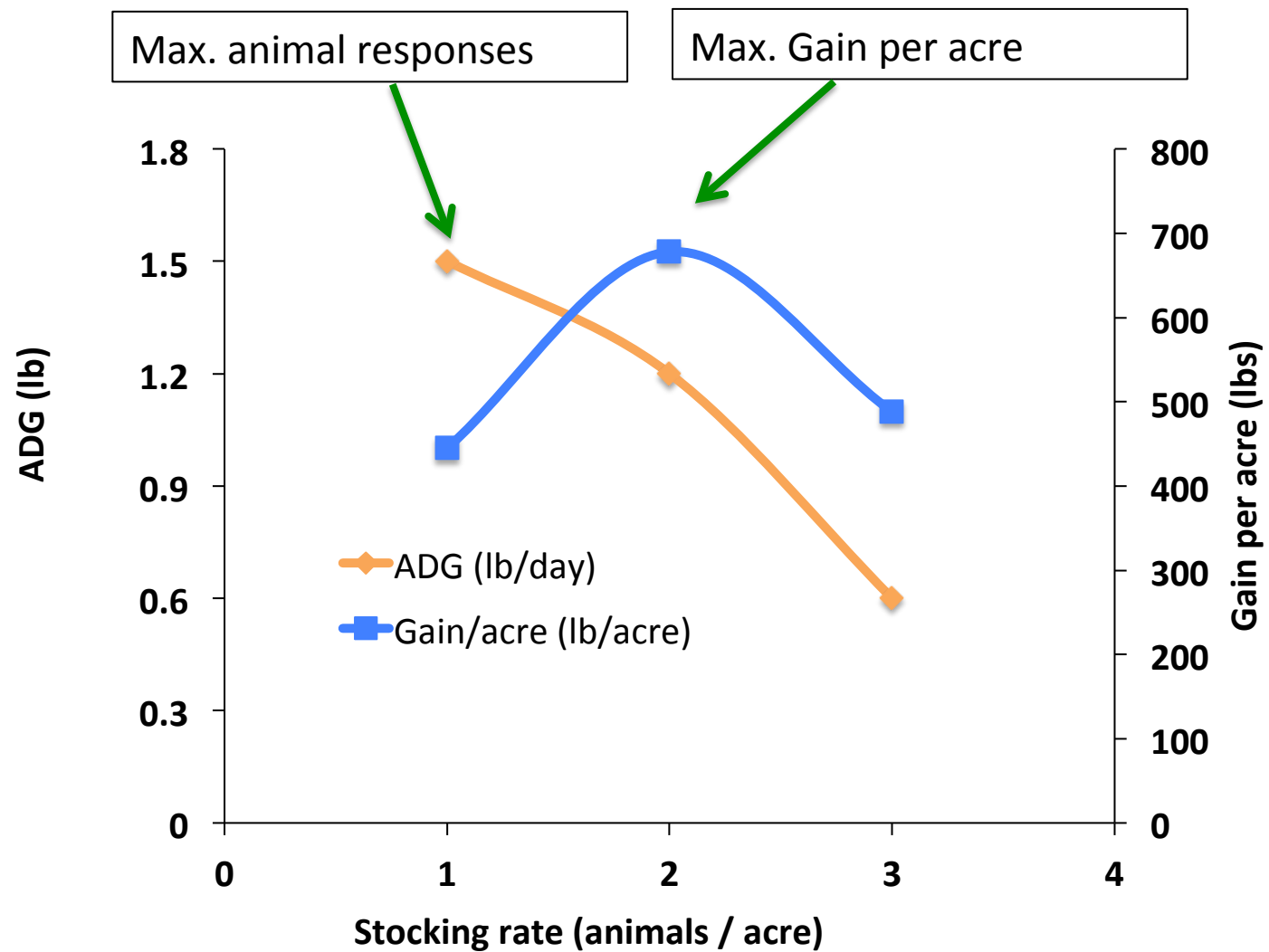


## Animal responses = quality of forage

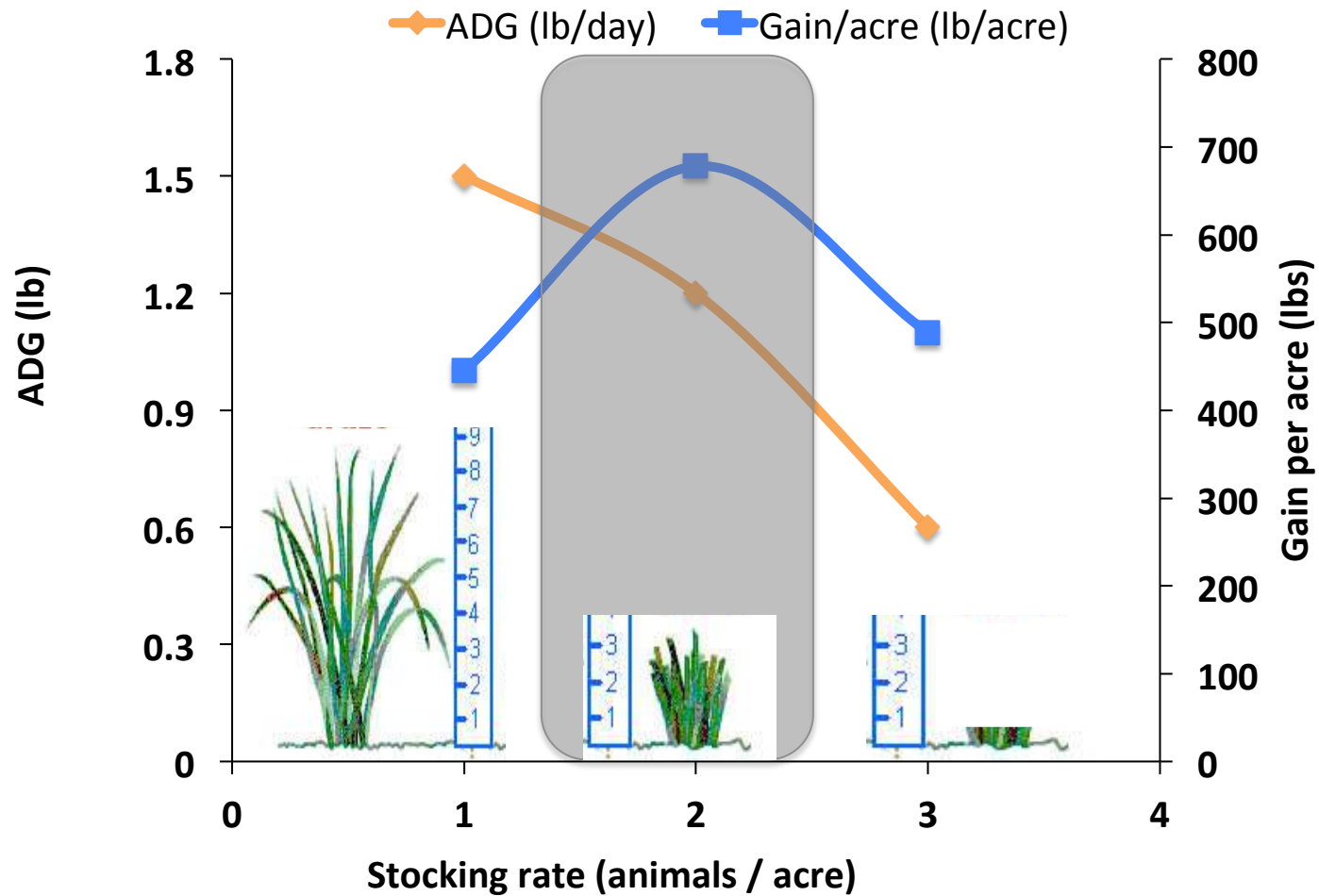




Which stocking rate is best?  
What are your goals?



## Animal responses = quality of forage





Question 2.

At the correct stocking density, how do animal responses compare when grazing bermudagrass and native warm-season grasses?

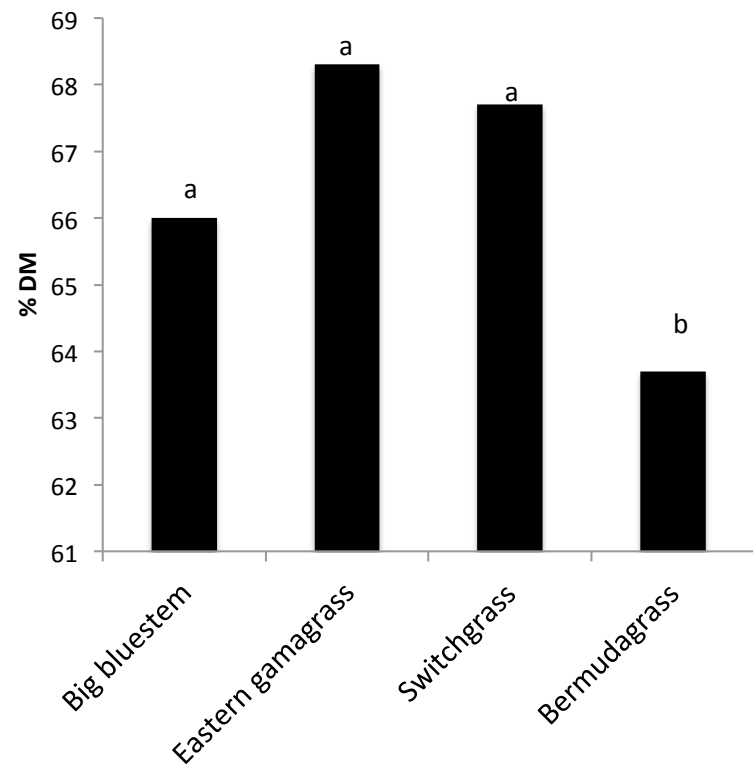
## **Steer performance and pasture productivity among five perennial warm-season grasses**

Burns, J.C, and D.S. Fisher. Agron. J. 105:113-123 (2013)

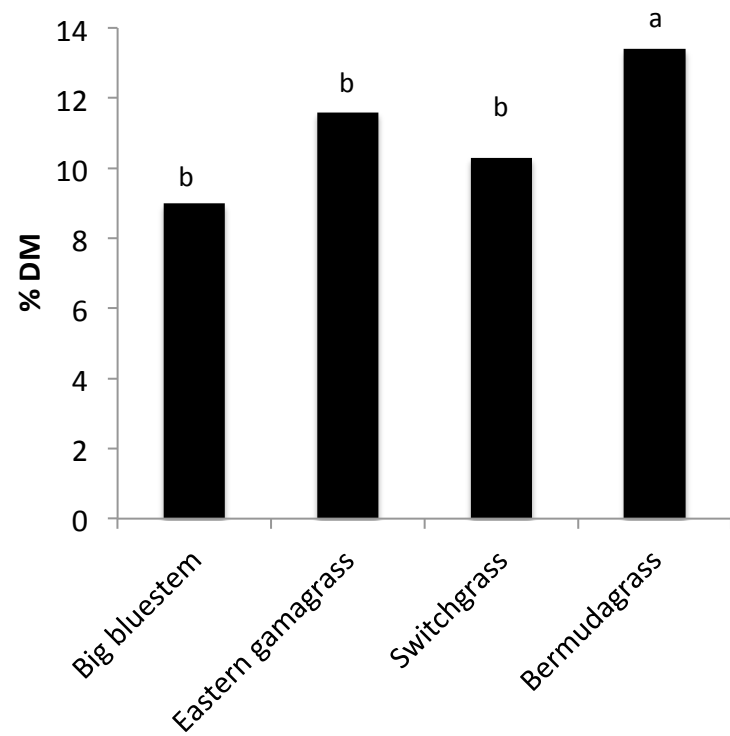
- Grasses:
  - Gamagrass, big bluestem, switchgrass, bermudagrass
- Stocking method: continuous stocking (put and take)
- Pasture management:
  - 3 – 5 in bermudagrass
  - 8 - 12 in for gamagrass, switchgrass, big bluestem
- N rates: 200 lb / acre

Plant responses

Digestibility

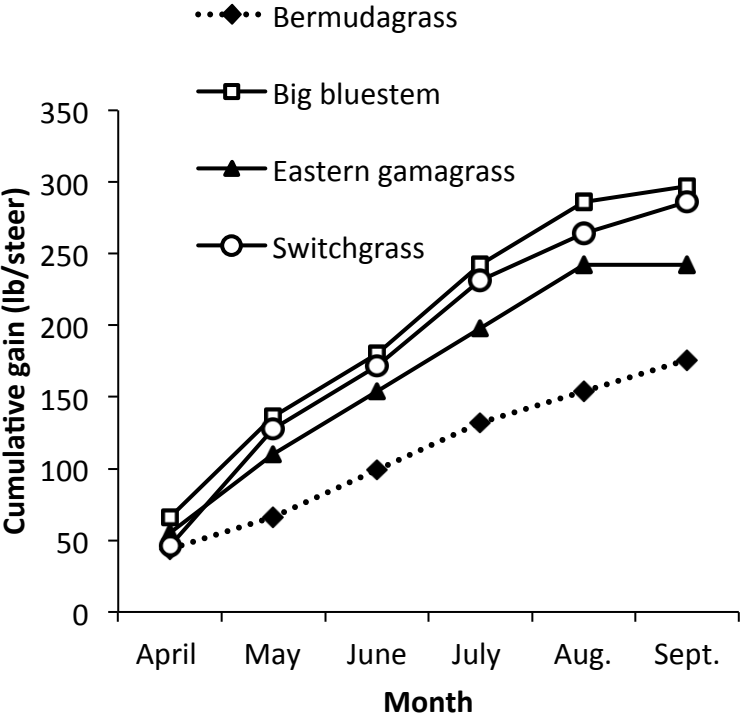


Crude Protein

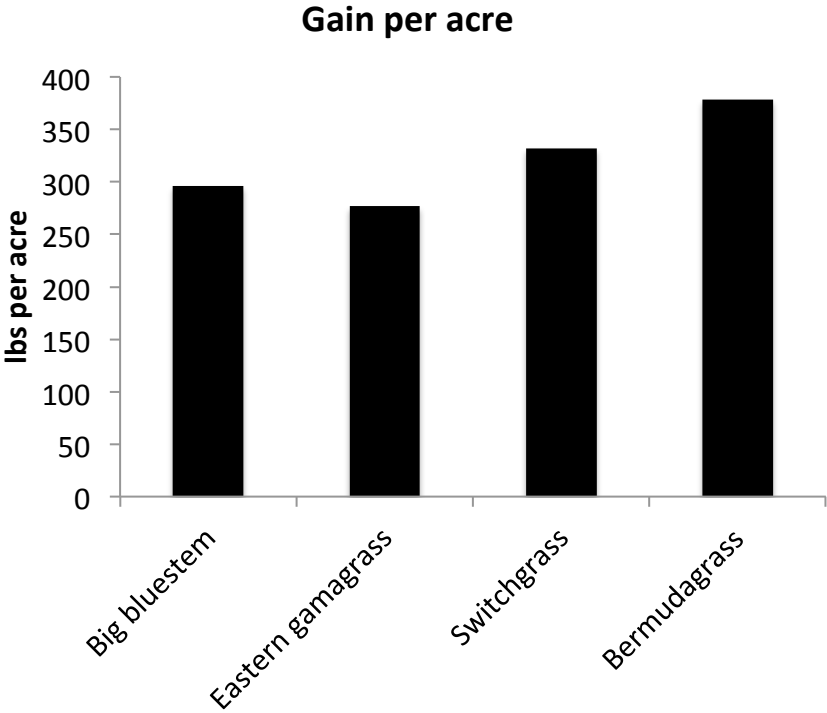
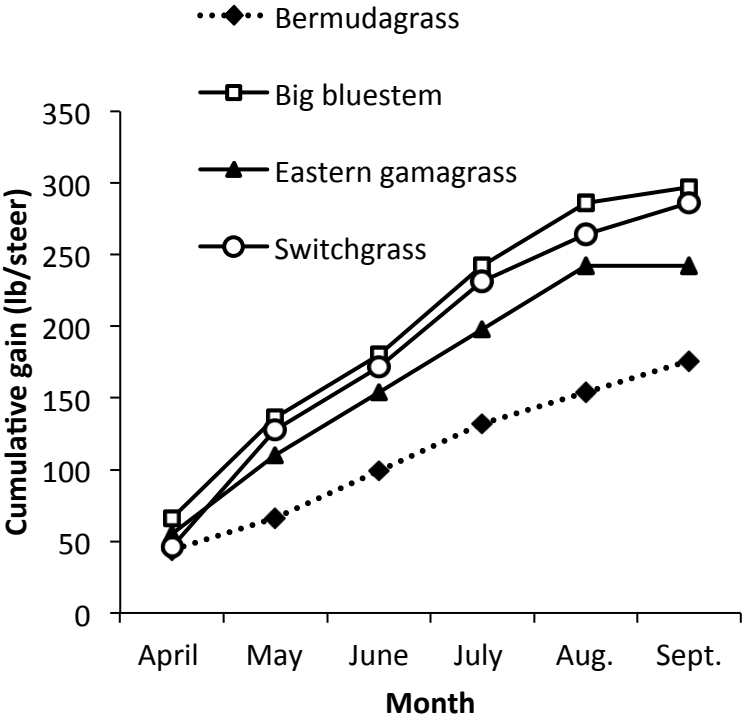




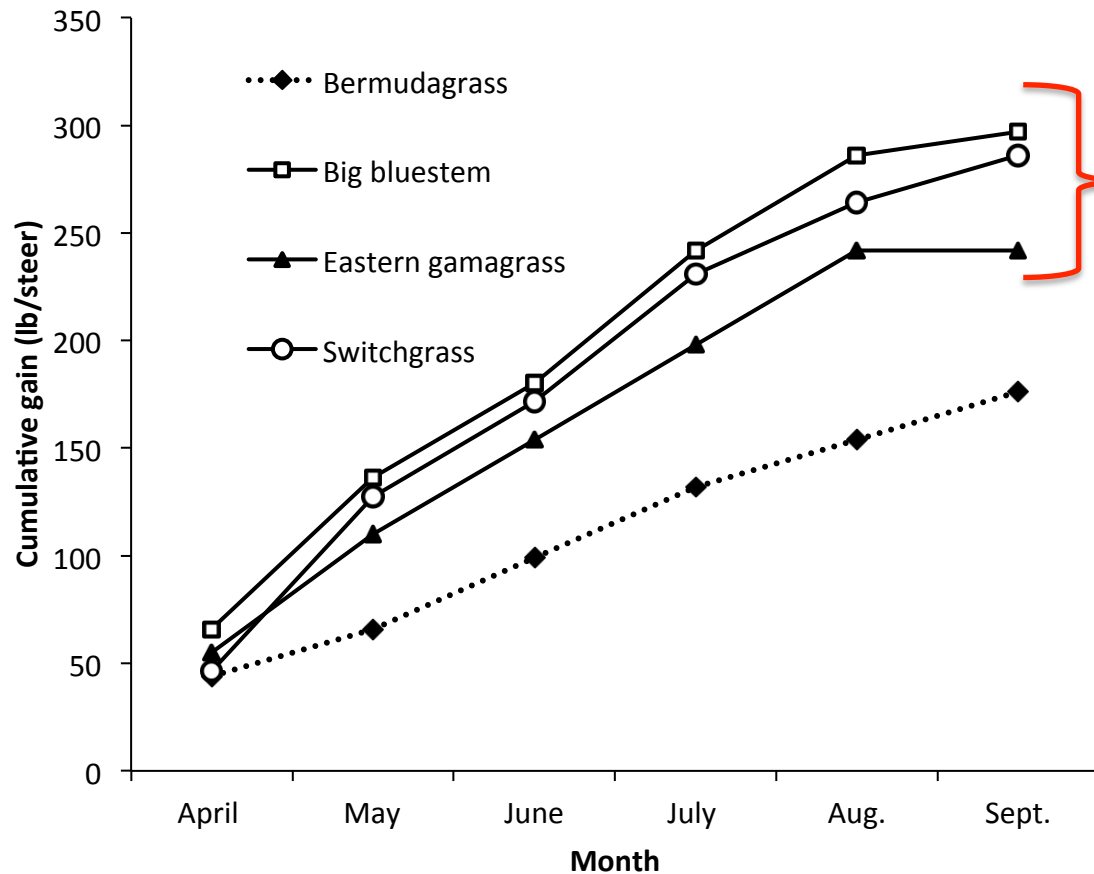
Animal responses



Animal responses



# Animal responses



steer/acre

4.0

2.0

2.5

2.5



# How is grazing management characterized?

- In terms of :
  - **Timing**
  - **Intensity** (e.g. stocking rate, pasture height or mass)
  - **Frequency** (e.g. rotational or continuous stocking)

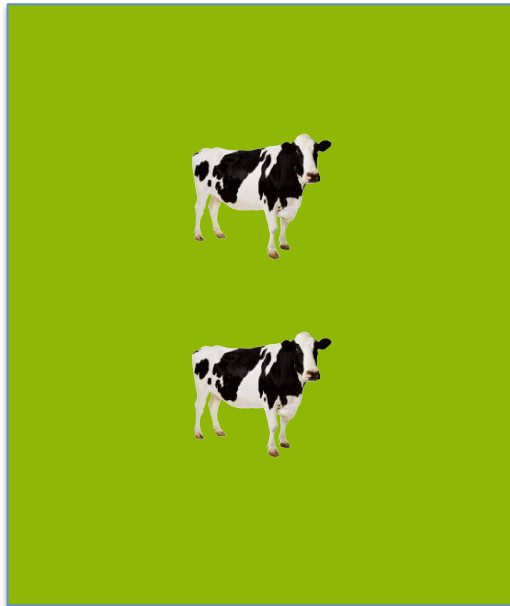
# Stocking method

- *Def.:* a defined procedure or technique to manipulate animals in space and time to **achieve a specific objective**
- Most common methods are various forms of continuous and rotational stocking.

# Stocking method

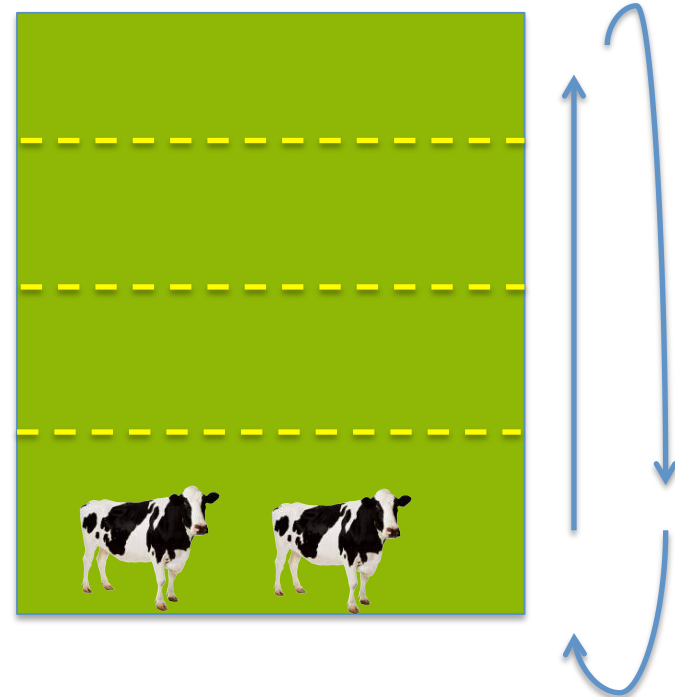
## Continuous stocking

1 acre paddock



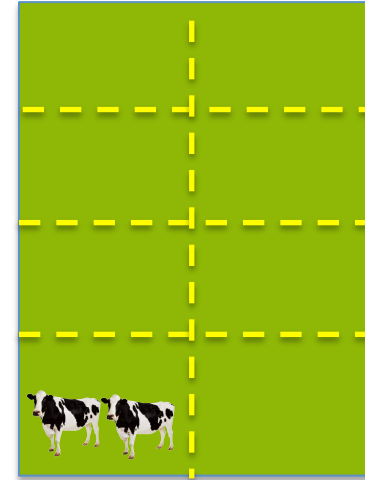
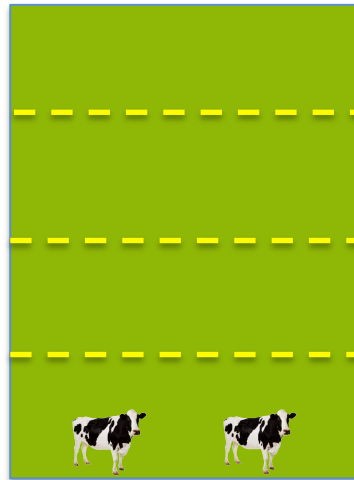
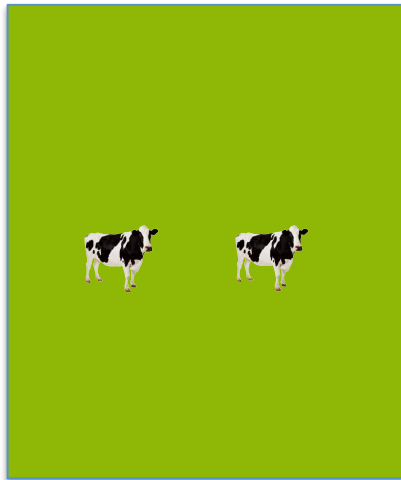
## Rotational Stocking

1 acre paddock



# Example

- Two rotational stocking treatments differing in # of paddocks (length of grazing period). Rest period is 21 days.

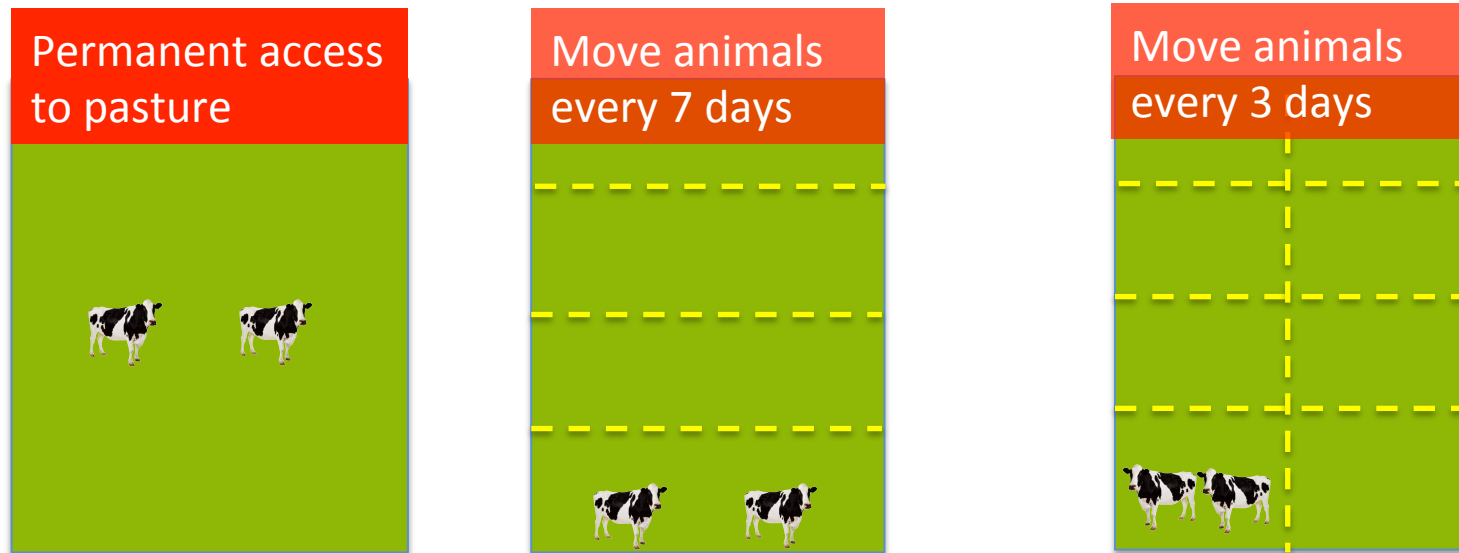


# Paddocks	4	8
Grazing period (d)	7	3



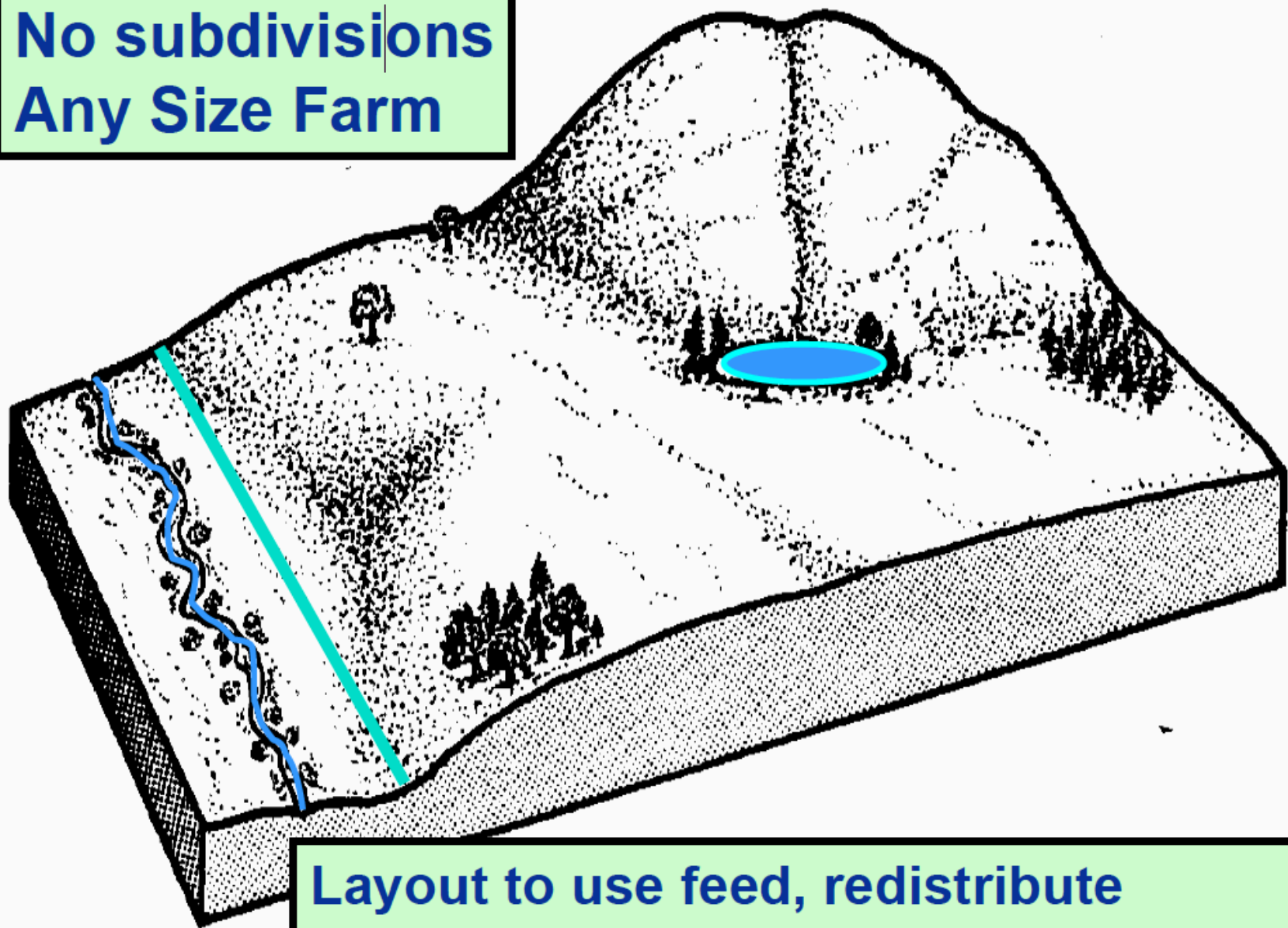
# Example

- Two rotational stocking treatments differing in # of paddocks (length of grazing period). Rest period is 21 days.



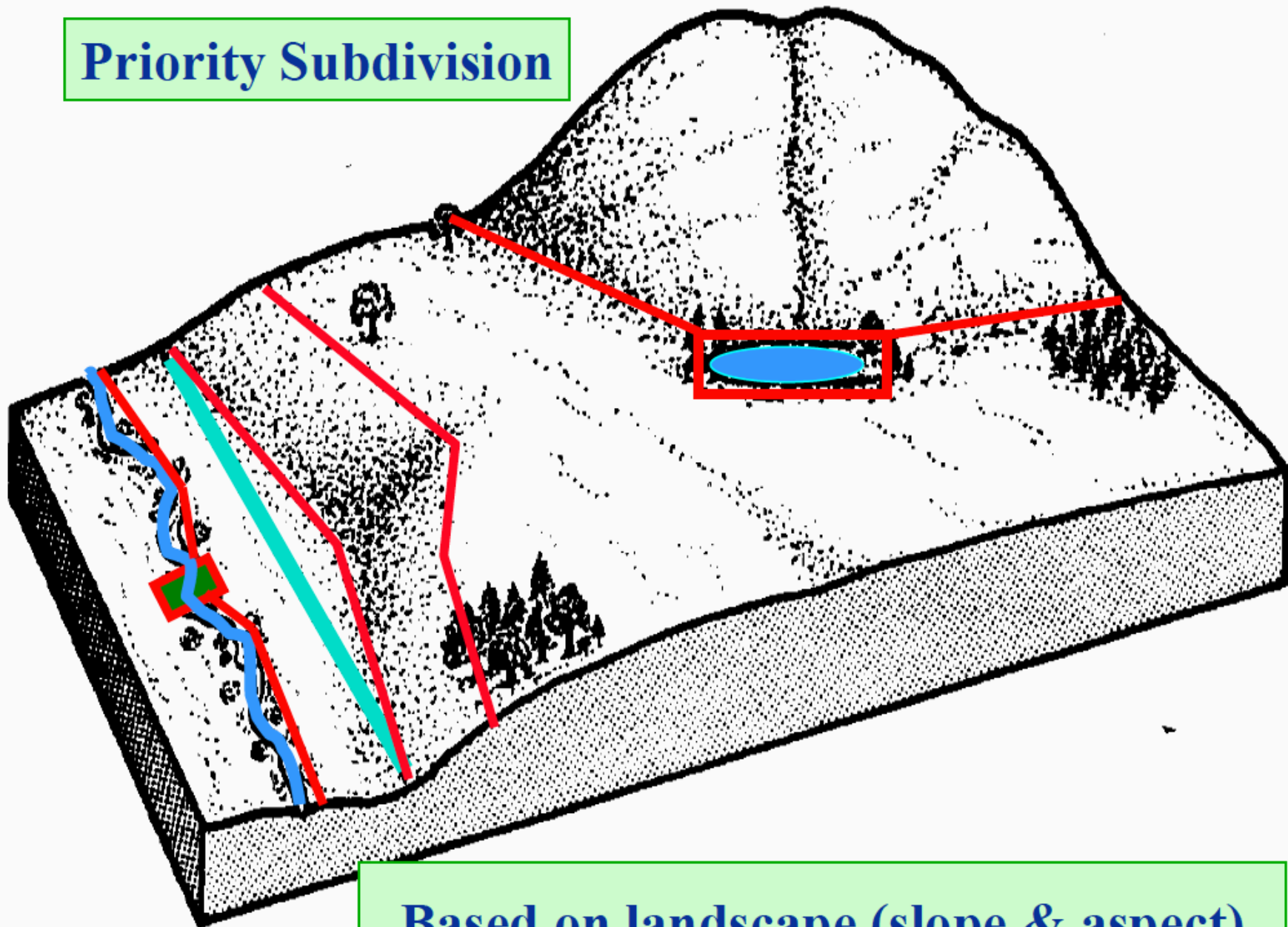
# Paddocks	4	8
Grazing period (d)	7	3

**No subdivisions  
Any Size Farm**



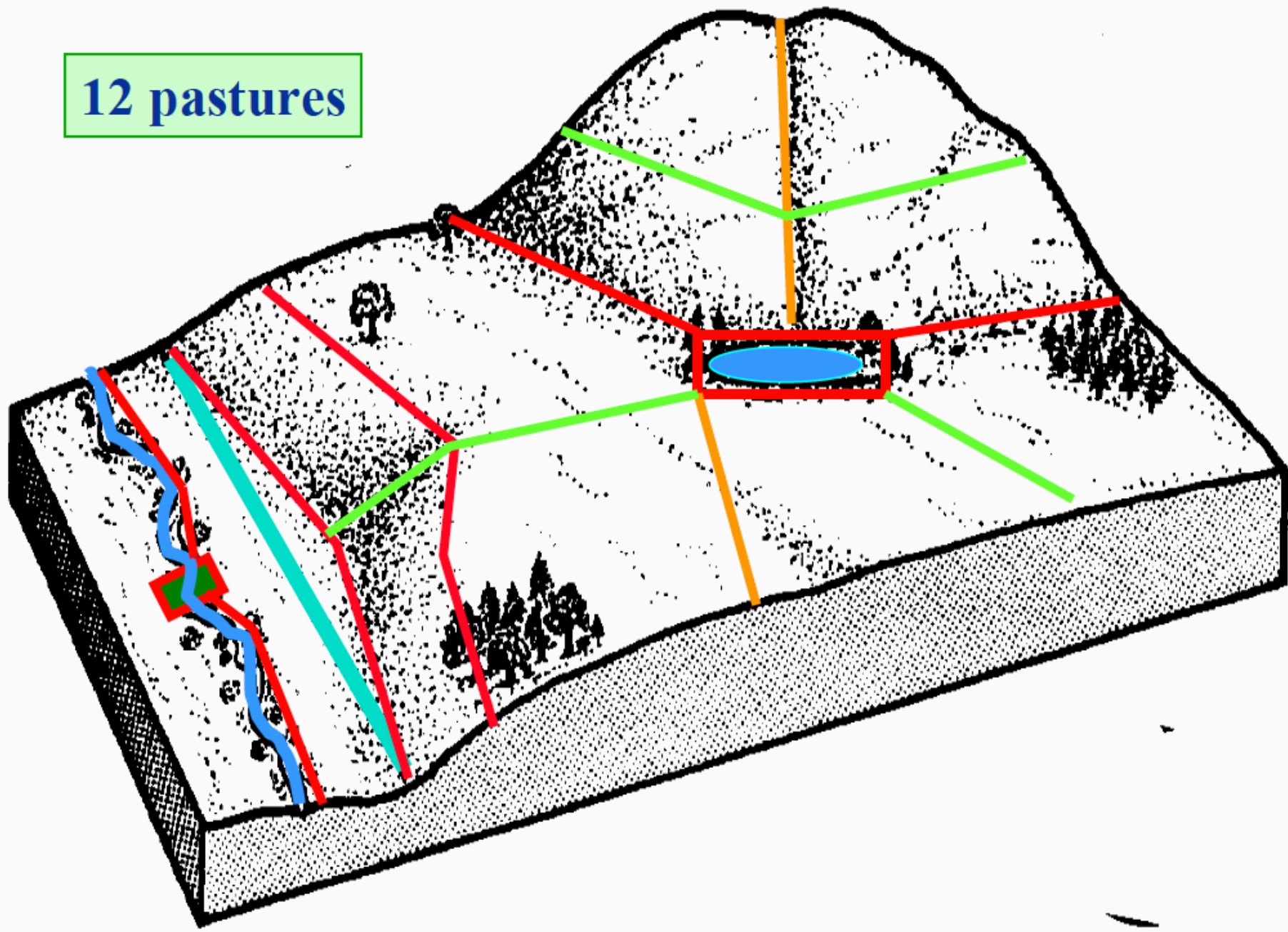
**Layout to use feed, redistribute  
nutrients, & minimize animal stress.**

## Priority Subdivision



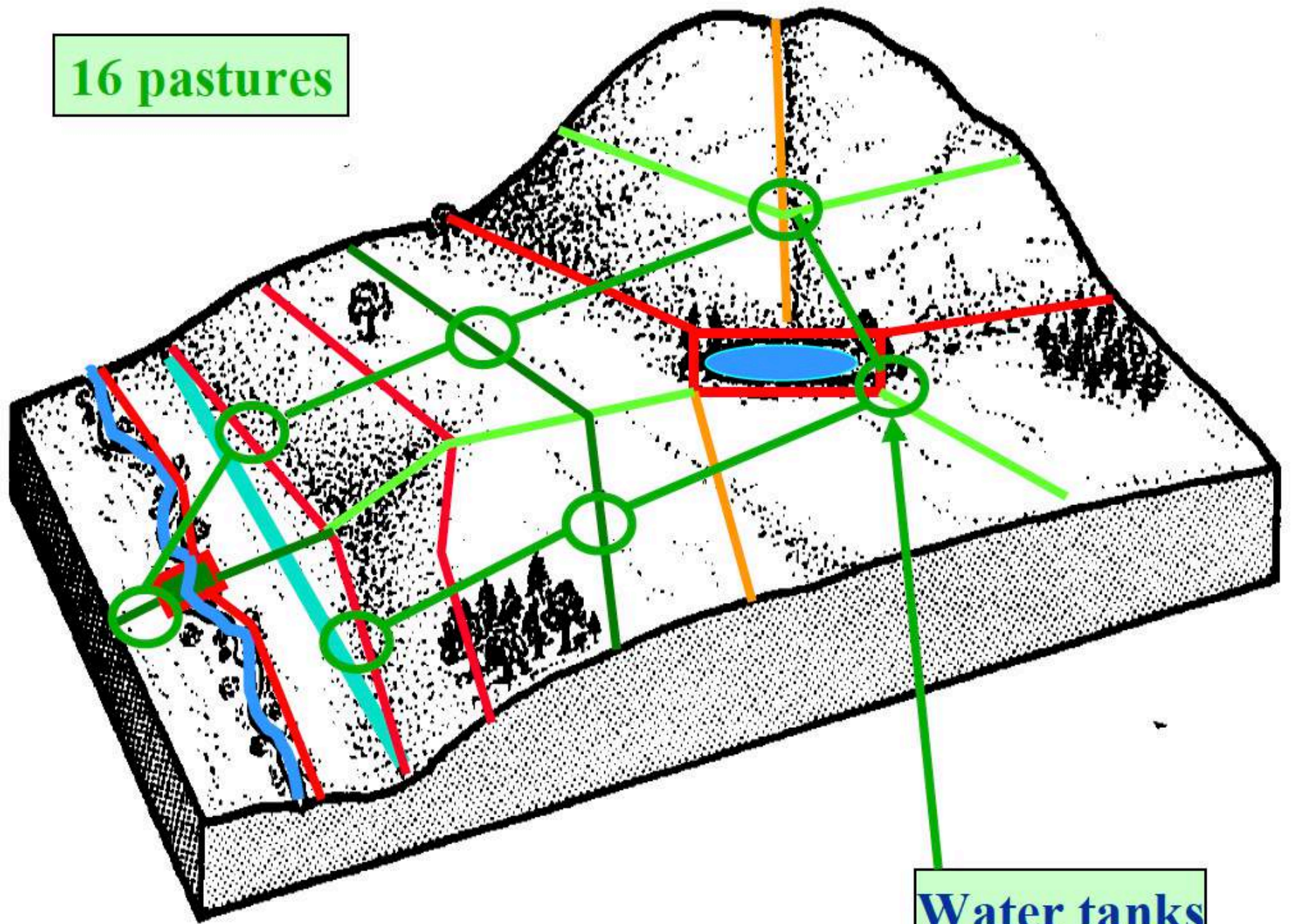
Based on landscape (slope & aspect)

12 pastures





16 pastures



Water tanks

What is the impact of stocking method on forage nutritive value?

## NUTRITIVE VALUE

Rotational (R) vs. Continuous stocking (C)...?

=, >, <

- $R > C$
- $R = C$
- $C > R$



## NUTRITIVE VALUE

Rotational (R) vs. Continuous stocking (C)...?

=, >, <

- $R > C - 21\%$
- $R = C - 71\%$
- $C > R - 8\%$



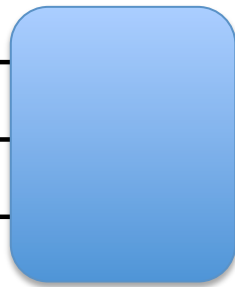
What is the impact of stocking method on quantity of forage?

## CARRYING CAPACITY

Rotational (R) vs. Continuous stocking (C)...?

=, >, <

- $R > C$  -
- $R = C$  -
- $C > R$  -



## CARRYING CAPACITY

Rotational (R) vs. Continuous stocking (C)...?

=, >, <

- $R > C - 81\%$
- $R = C - 19\%$
- $C > R - 0\%$

**How large an advantage?  
(Rotational > Continuous stocking)**

Range:

Average:



**How large an advantage?  
(Rotational > Continuous stocking)**

Range: 9 – 68%

Average: 29%

**Why does the difference occur?**

Pasture more productive?

Pasture grazed more efficiently?

## **Why does the difference occur?**

Pasture more productive? Yes

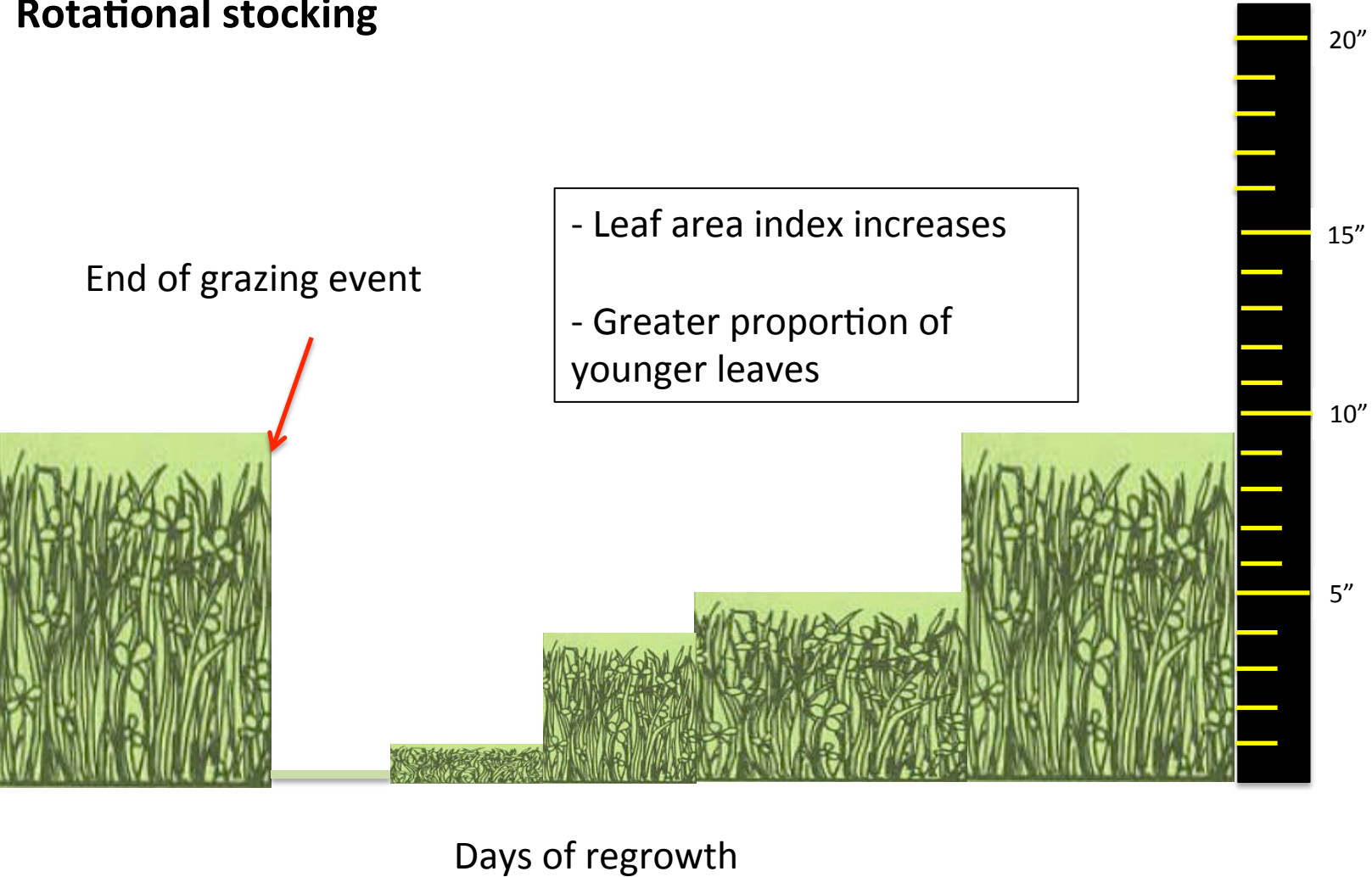
Pasture grazed more efficiently? Yes

**If pasture is more productive then why?  
(Rotational > Continuous)**

Greater average LAI and more favorable leaf-age profile  
for rotational – increases photosynthesis

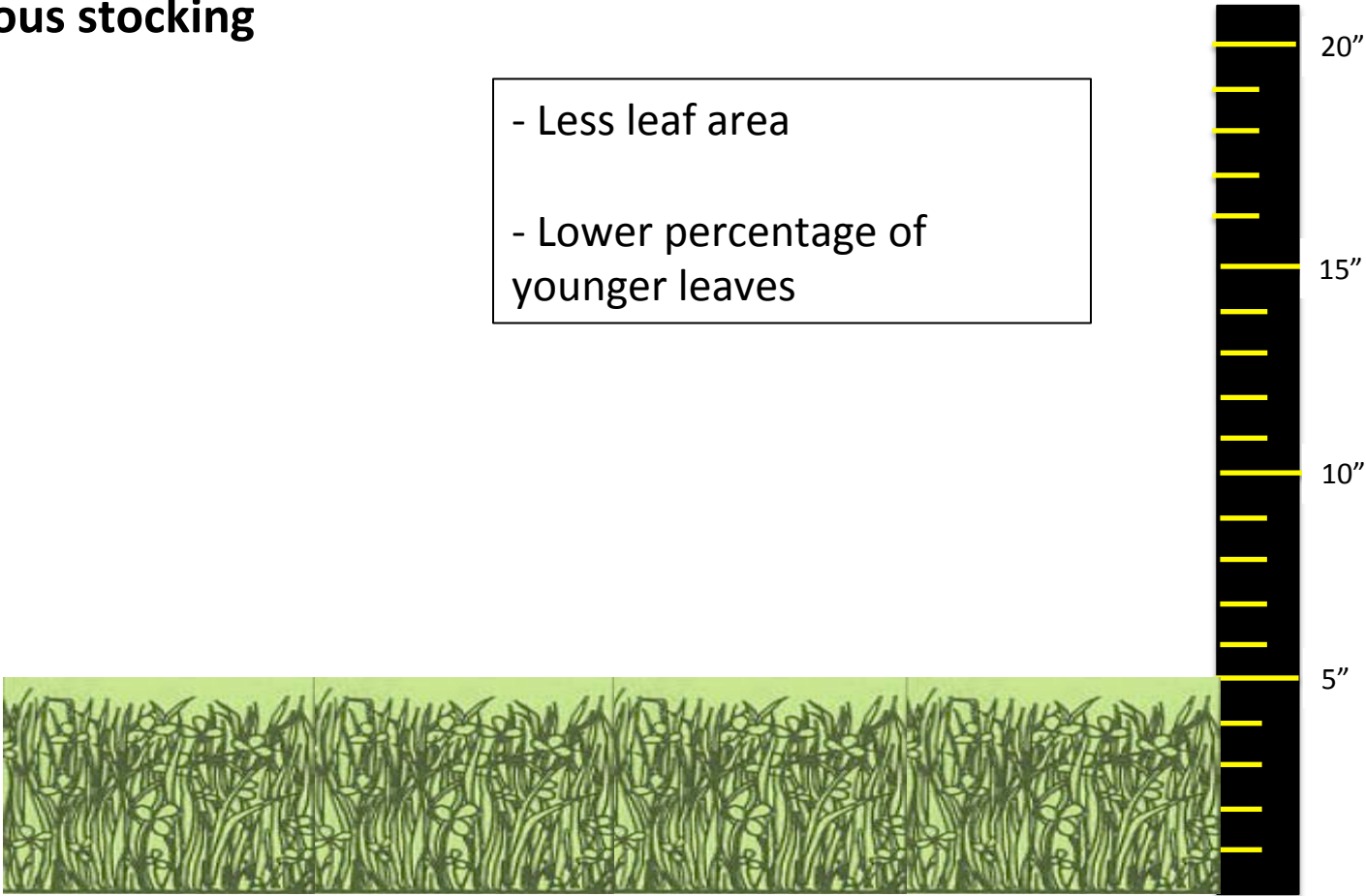


Rotational stocking



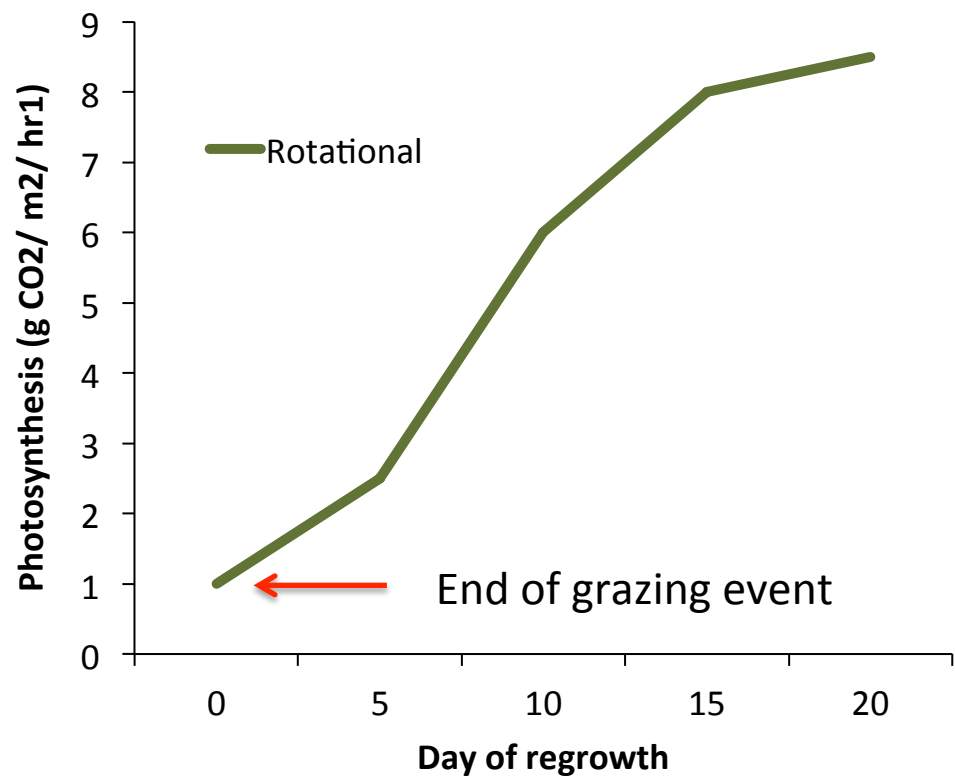
Continuous stocking

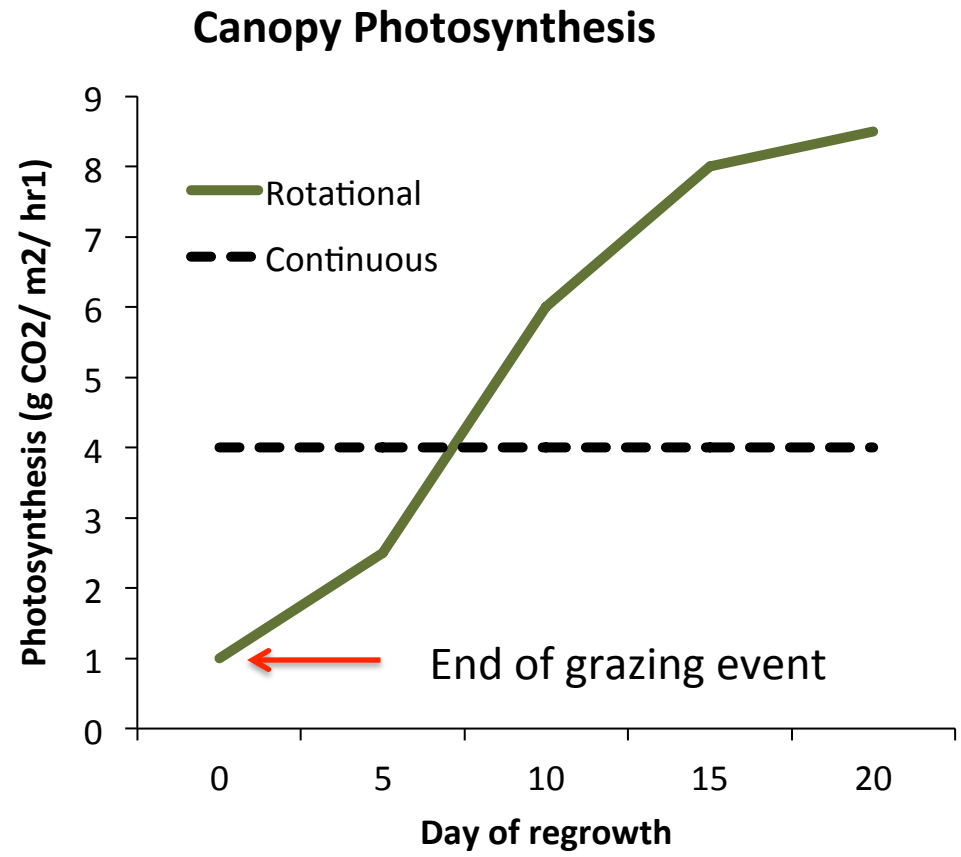
- Less leaf area
- Lower percentage of younger leaves



Days of regrowth

Canopy Photosynthesis







### **Credible reasons:**

- Greater average LAI and more favorable leaf-age profile for rotational – increases photosynthesis
- Greater uniformity of pasture utilization – increases efficiency of grazing and provides more desirable pasture conditions for regrowth

## **Other impacts of stocking method:**

- Persistence
- Nutrient cycling
- Animal behavior

What is the impact of **stocking method** on **plant communities** (composition and vigor)?

# Treatments

- Three mixtures

**1. Orchardgrass  
+ alfalfa**



**2. Orchardgrass  
+ white clover**



**3. Kentucky bluegrass,  
white clover, b. trefoil**



# Treatments

- Two Stocking methods (equal stocking rate, # animals per acre):
  1. Continuous
  2. Rotational Stocking

**Mixture 1:** grazed at bud stage of alfalfa to 3 in. stubble height

**Mixture 2:** grazed from ~9 in. tall to 2 in. stubble height

**Mixture 3:** grazed from ~5 in. tall to  $\frac{3}{4}$  in. stubble height



# RESULTS

	Continuous	Rotational
Herbage harvested (lb/ac)		

# RESULTS

	Continuous	Rotational
Herbage harvested (lb/ac)	403	619

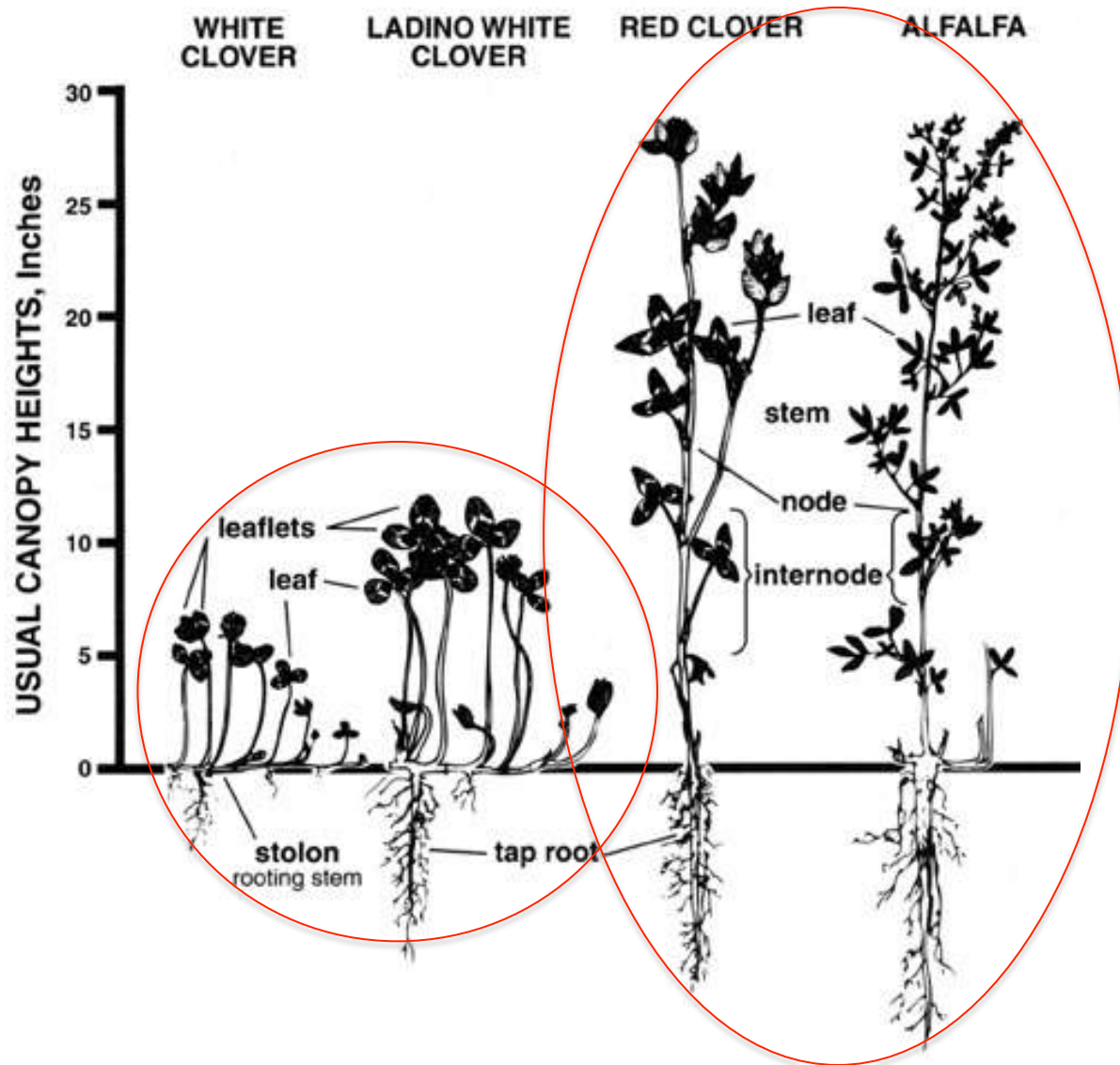
# RESULTS

	Continuous	Rotational
Herbage harvested (lb/ac)	403	619
% PRESENCE IN THE PASTURE		
Alfalfa	17%	48%
White clover	13%	19%
Birdsfoot trefoil	<0.5%	12%

# RESULTS

	Continuous	Rotational
Herbage harvested (lb/ac)	403	619
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White clover	13%	19%
Birdsfoot trefoil	<0.5%	12%

# Differences in plant growth habit





# RESULTS

	Continuous	Rotational
Herbage harvested (lb/ac)	403	619
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Birdsfoot treefoil	<0.5%	12%
WEEED INFESTATION		

# RESULTS

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Herbage harvested (lb/ac)	403	619
% PRESENCE IN THE PASTURE		
Alfalfa	17%	48%
White clover	13%	19%
Birdsfoot treefoil	<0.5%	12%
WEEED INFESTATION		
MIXTURE 1 (alfalfa +orchardgrass)	30%	9%

## Take-home message – grazing intensity

- Priority NUMBER ONE in any grazing system is **to GET THE GRAZING INTENSITY RIGHT** (i.e. stocking rate, pasture height)
- No other grazing management tool can overcome a failure to select the proper grazing intensity

# Take home message – Stocking method

- **Rotational stocking:**
  - Can increase carrying capacity ~ 30% over continuous
  - Not expected to increase individual animal gain if forage is not limiting
  - Improves persistence of less grazing tolerant plants

**Thank you...!!!**

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