GRAZING MANAGEMENT 101

Carolyn L. Wong
State Grazing Land Management Specialist
NRCS Pacific Island Area

Forages

- Meristems / Growing points
- Growth phases
- Reproduction
- Forage Quality
- Factors that affect Plant Vigor
- Response to Disturbances

Grazing Animals

- Market goal
- Digestive system
- Nutrition
- Condition
- Physiological State
- Forage Intake
- Animal Units

2

What is grazing management?

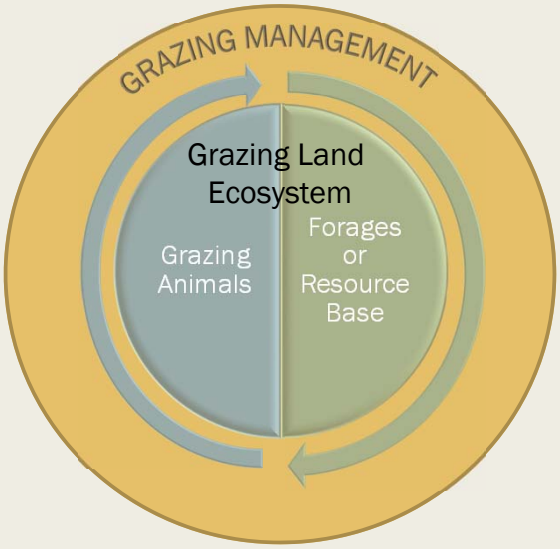
- "the manipulation of livestock grazing to accomplish a desired result"*
- "controlling the grazing habits of animals on pasture"**

*Univ of Florida IFAS Extension
**Susan Schoenian, Sheep 201

3

Grazing Management = Decisions

How many and what kind of animal. Where, how long and when they graze. When they come back. Performance goals



Pasture composition
Yield
Quality
Pasture/Ecosystem Health

4

Factors that influence forage

FORAGE

Pasture composition
Yield
Quality
Pasture/Ecosystem Health

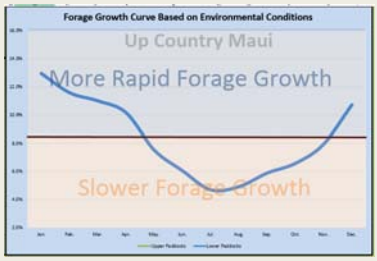
- Seasonal and spatial and physical factors
- Forage growth response to grazing
- Selective grazing

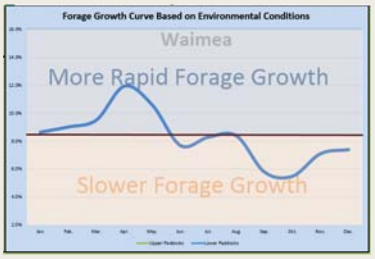
5

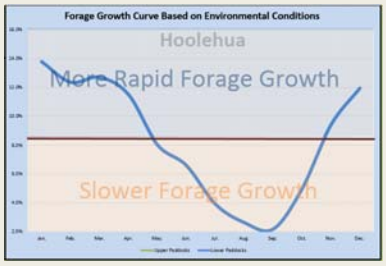
Seasonal & spatial factors

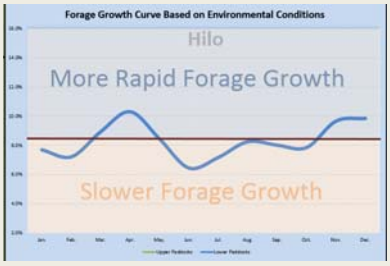
- Location
  - *Rainfall*
  - *Temperature*

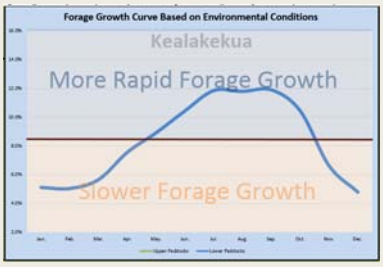
Affects species, growth, production and seasonal availability











Season

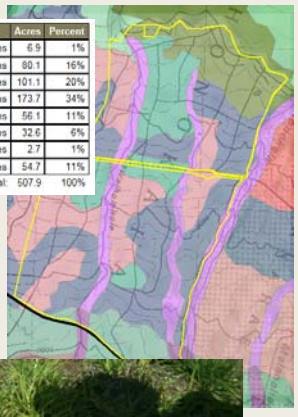
- Timing of grazing with the seasons in the tropics has a little different meaning than on the continent.
- Be aware of
  - *Growing season vs. non-growing season*
  - *Fast-growing vs. slow growing season*
  - *How the desirable forage reproduces and whether (annual?) seed production might be necessary for species increase or persistence.*

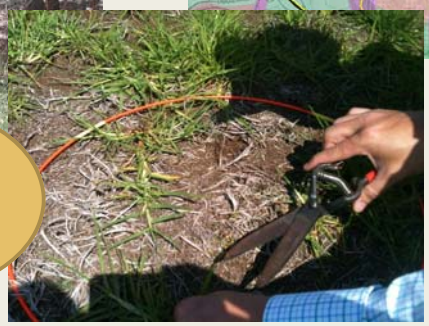
7

Physical factors

- Soil limitations
- Topography
- Shade
- Eroded areas
- Pasture condition

Map Unit Symbol	Map Unit Name	Acres	Percent
472	Paauhau- Rock outcrop complex, 35 to 70 percent slopes	6.9	1%
473	Kukaiau medial silty clay loam, 0 to 10 percent slopes	80.1	16%
474	Kukaiau medial silty clay loam, 10 to 20 percent slopes	101.1	20%
475	Kukaiau medial silty clay loam, 20 to 35 percent slopes	173.7	34%
478	Kukaiau-Rock outcrop complex, 35 to 70 percent slopes	56.1	11%
959	Paauhau medial silty clay loam, 10 to 20 percent slopes	32.6	6%
960	Honokaa hydrous silty clay loam, warm, 0 to 10 percent slopes	2.7	1%
961	Honokaa hydrous silty clay loam, warm, 10 to 20 percent slopes	54.7	11%
	Total:	507.9	100%





All affect production

8

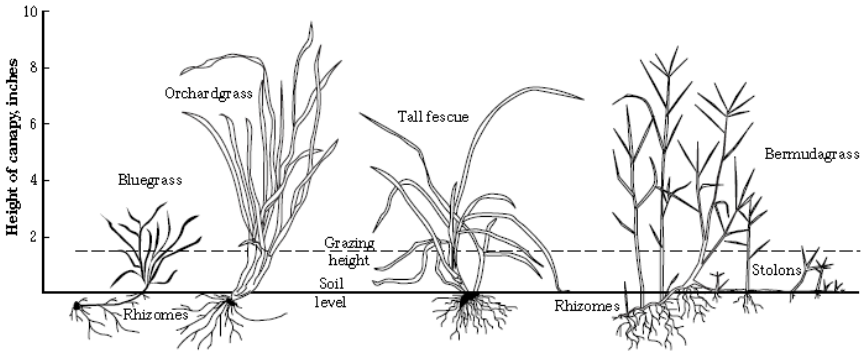
Forage growth response to grazing

- Intensity
  - *Grazing height*
  - *Removal of photosynthetic leaf area*
  - *Growing points*
  - *Below ground effects*
- Frequency and Duration
  - *Grazing period*
  - *Rest period*
  - *"Second bite"*
- Timing
  - *Fast vs. slow growth*
  - *Plant reproduction*

9

Intensity – growing points

Figure 5–21 Differences in forage plant morphology from one species to the next change their response to grazing height (from Blaser 1986) *



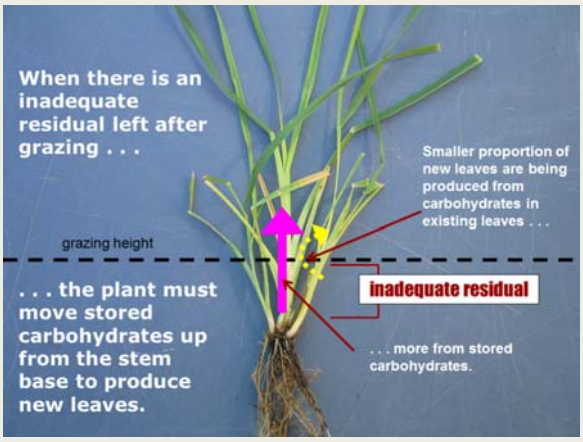
* Bermudagrass and Kentucky bluegrass can withstand close grazing since they hold some leaf area close to the ground and have food reserves stored in prostrate stems, rhizomes, or stolons. Orchardgrass and tall fescue have less leaf area after close grazing. They also contain most of their food reserves in the stem bases. If the stem bases are damaged, they are slow to recover.

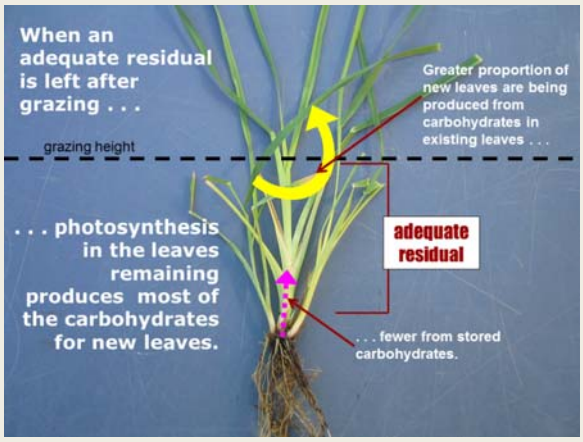
10

Intensity - residual

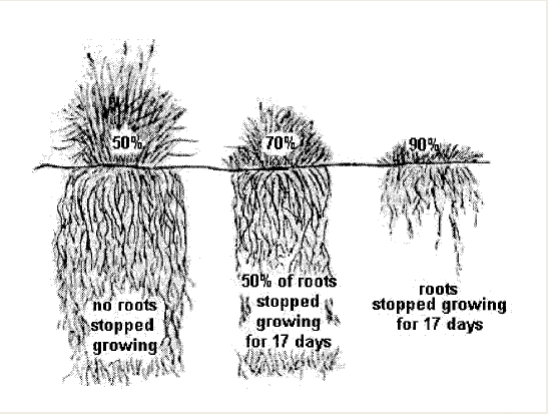
Grazing height and corresponding residual amount affect photosynthetic ability and energy reserves.

The plant's ability to photosynthesize and energy reserves affect its ability to REGROW.





Intensity - roots



Light grazing ⟷ Heavy grazing

- Grazing height or "biomass removal" also affects the plant's roots.
- "What you do to the plant above the ground affects the plant below the ground."
- Rule of thumb: Take ½ leave ½
  - *Leaves adequate residual*
  - *Little to no affect to roots*
  - *Usually no affect to growing points.*

12

Figure 5–1 Relationship between grazing and root growth (Crider 1955)

	Top reduction	Single clipping
	90%	No root growth for 17 days. 60 percent of root growth on 33rd day.
	80%	No root growth for 12 days. 96 percent of root growth on 33rd day.
	70%	Approximately 48 percent of root growth after 17 days. 159 percent root growth on 33rd day.
	60%	Approximately 55 percent of root growth after 5 days. 192 percent root growth on 33rd day.
	50%	Averaged a 3 percent root growth stoppage for 14 days. 223 percent root growth on 33rd day.
	30%	117 percent root growth on 3rd day. 250 percent root growth on 33rd day.
	0%	129 percent root growth on 3rd day. 338 percent root growth on 33rd day.

Frequency and Duration

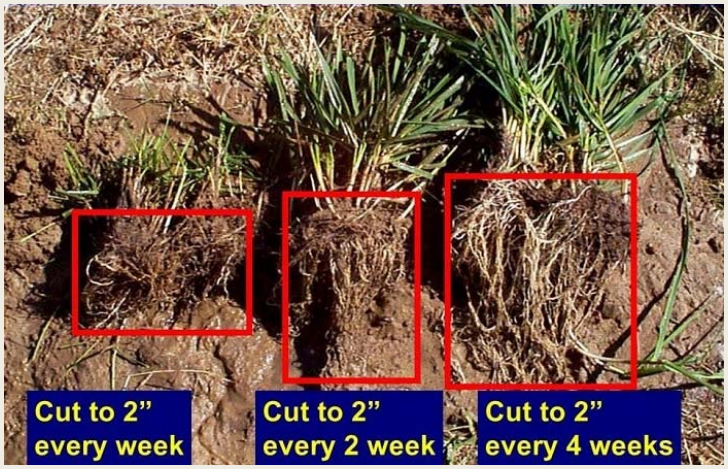
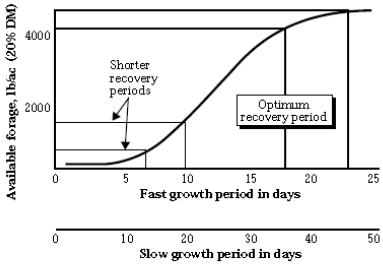


Photo credit: http://onpasture.com/2013/04/30/collect-more-sunshine-to-grow-more-grass/

Figure 5–25 Variable recovery period* (from Murphy 1988)



* During fast growth periods, days for recovery are half that of slow recovery period in this example. During prolonged periods of moisture stress, recovery periods can be much longer before available forage target is reached for class of livestock being pastured. Note shorter recovery periods fail to make much use of fast accumulation rate portion of growth curve (typical of continuously over-stocked pasture).

ORCHARD GRASS GRAZING RESPONSE

University of Kentucky Study
Dr. Ray Smith
Laura Schwer
Tom Keene

Methods

- Two similar orchard grass plants were chosen from greenhouse.
- Both were managed the same for 6 months:
  - *Clipped ~once per month*
  - *Supplied with good fertility (N,P, K) and water*

Methods

- Left plant simulates continuous grazing.
  - *Initially clipped to a 1 inch height*
  - *Then clipped weekly for the next 4 weeks at a 1 inch height*
- Right plant simulates rotational grazing.
  - *Initially clipped to a 3.5 inch height*
  - *Then clipped again at 3.5 inches four weeks later*
- Time lapse photography started at the beginning of the fifth week (day 29) for both plants.

Day 1

(24 hours after clipping)

1” Continuous 3.5” Rotational

Day 2

1” Continuous 3.5” Rotational

Day 3

1” Continuous 3.5” Rotational

Day 4

1” Continuous 3.5” Rotational

Day 5

1” Continuous 3.5” Rotational

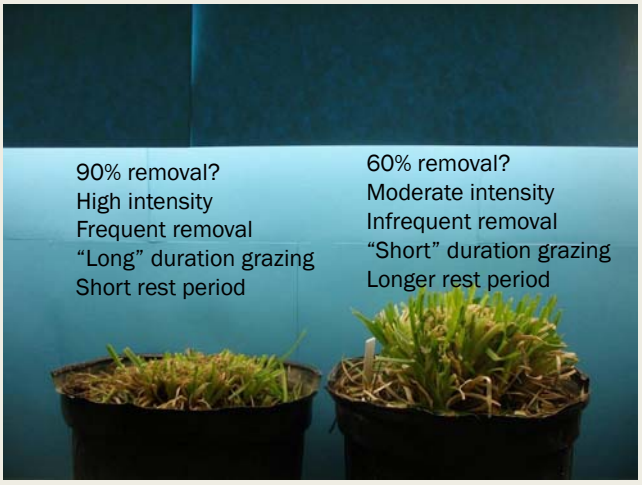
Day 6

1” Continuous 3.5” Rotational

Day 1

(24 hours after clipping)

1” Continuous 3.5” Rotational

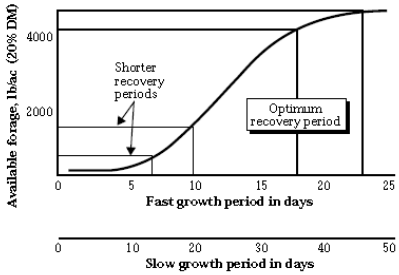


Day 6

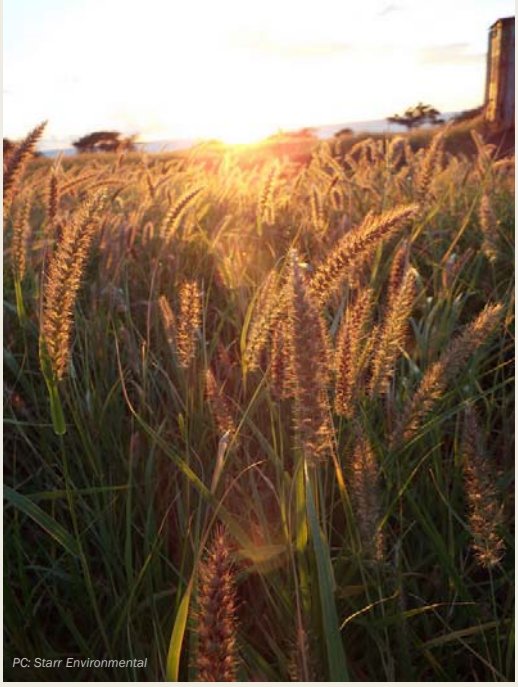
1” Continuous 3.5” Rotational

Timing

Figure 5–25 Variable recovery period* (from Murphy 1988)



* During fast growth periods, days for recovery are half that of slow recovery period in this example. During prolonged periods of moisture stress, recovery periods can be much longer before available forage target is reached for class of livestock being pastured. Note shorter recovery periods fail to make much use of fast accumulation rate portion of growth curve (typical of continuously over-stocked pasture).



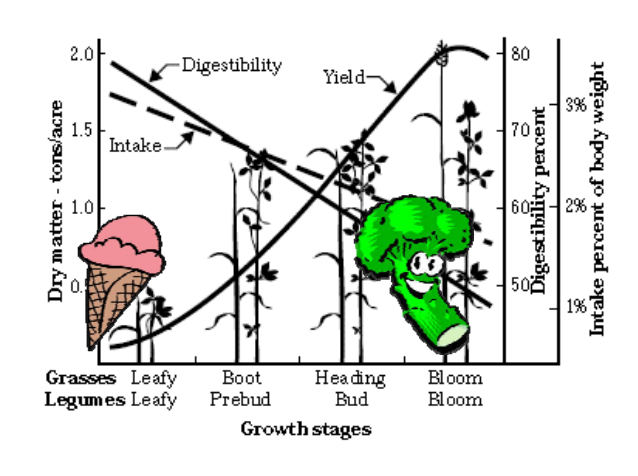
Selective grazing

- Selective grazing or “spot grazing” can impact the “intensity”, “frequency” and “duration” of grazing on particular plants within a paddock within a grazing period.
- Selective grazing is correlated with plant palatability.
- Plant palatability directly linked to forage quality
  - *Low fiber, higher protein, no toxins = Higher palatability.*

27

Selective grazing – within a species

- Animals are kind of like kids, given the choice, they will only eat the tastiest, best things!
  - *Ice cream and candy!*
  - *Never the broccoli!*
- Plants are most palatable when they are young or freshly regrown.



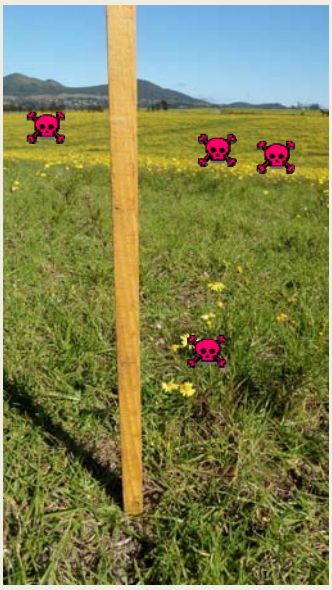
28

Selective grazing – between species

- Palatability between species based on
  - *Morphological differences – leaf coarseness, leaf:stem ratio*
  - *Chemical differences – secondary compounds that impart odors, flavors or are toxic; quality differences – fiber, crude protein, etc.*

29

Selective grazing – between species



- Palatability between species based on
  - *Chemical differences – secondary compounds that impart odors, flavors or **are toxic**; quality differences – fiber, crude protein, etc.*

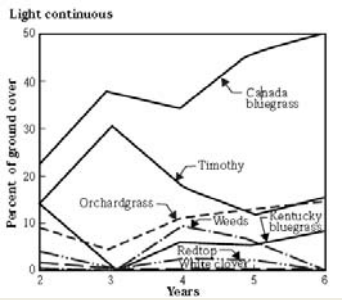
30

Day 6

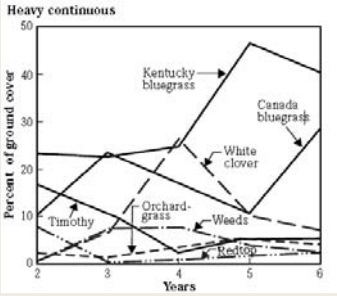
1” Continuous 3.5” Rotational

Second Bite

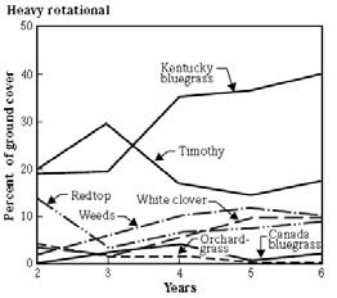
Effects of grazing on plant composition



Lots of selective grazing.
Less palatable grasses proliferated.
High stubble shaded out clovers



Heavy grazing pressure.
(Intense, frequent, perpetual)
Pasture dominated by stoloniferous grasses.
Timothy (bunch grass) heavily utilized and being grazed out.
White clover more abundant



Grazing pressure still heavy.
Intense, less frequent, shorter duration
Pasture dominated by stoloniferous grasses.
Timothy (bunch grass) allowed to rest and seed so it persists.
White clover more abundant.

32

TYPES OF SYSTEMS

33

Types of systems
- 3 classes of methods

- Allocation stocking methods
- Nutritional optimization stocking methods
- Seasonal stocking methods

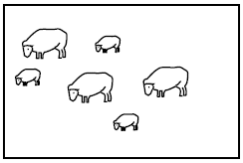
"Stocking" vs "grazing"
Herbivores "graze"
but livestock producers
"stock" them

Reference: NRPH Chapter 5

34

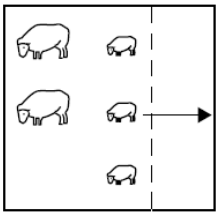
Allocation stocking methods

Continuous set stocking



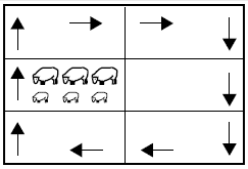
- Seasonal or year long
- More selective grazing
- Usually inefficient
- Usually lighter stocked to avoid damage
- In tropics, most appropriate if used seasonally with short-term herds (ie stockers).

Continuous variable stocking



- Same as set stock but adds an additional area used seasonally (ie hay or crop field)
- Can also vary stocking number based on forage availability ("put and take")

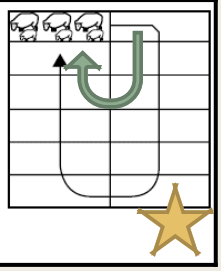
Set Rotational stocking



Example: 6 day grazing period and 30 day recovery period.

- "set" grazing and recovery period.
- Best if grazing period is < 7 days to avoid 2nd bite
- Can be inflexible to varying growing conditions.

Variable rotational stocking



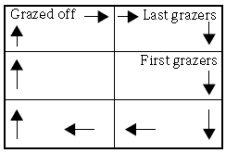
- Highly flexible
- Paddocks are grazed based on forage growth rates
- Less paddocks in fast growing season
- More paddocks in slower growing season

Reference: NRPH Chapter 5

35

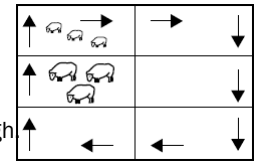
Nutritional optimization methods

First-last grazing



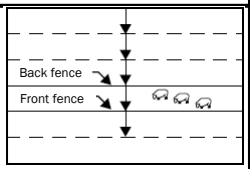
- High performers graze first, low performers graze last.
- Combined grazing period should not exceed 7 days when there is potential for regrowth.

Creep grazing



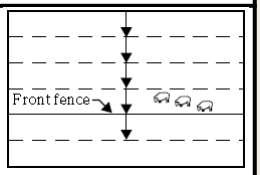
- Offspring graze ahead under electric fence or via special gates that just allow calves through
- In rotational systems, mothers follow young after young have had first choice of higher quality forage.

Strip Grazing



- Flexible areas offered
- Can be used very intensively
- Can increase intake
- Very efficient
- Labor intensive
- Best for high performing classes of livestock

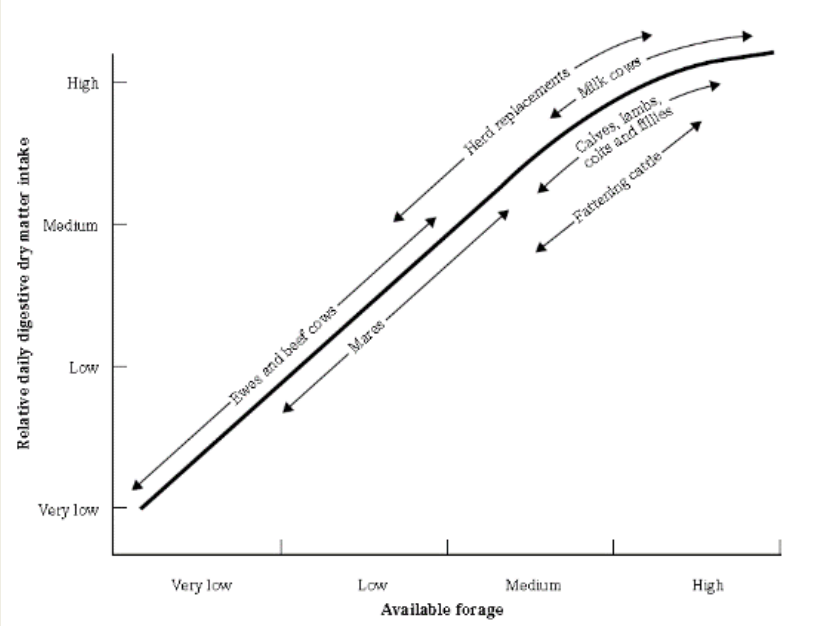
Frontal Grazing



- Same as strip but with no back fence.
- Reduces losses to trampling
- Best in low/slow growth season when little to no regrowth potential

Reference: NRPH Chapter 5

36



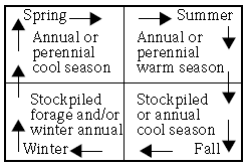
Reference: NRPH Chapter 5

37

Seasonal stocking methods

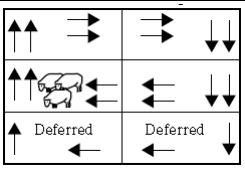
Sequence stocking

- Grazing is planned across sections with different seasonal availability of forages.
- Not common in PIA



Deferred stocking

- Areas are deferred to allow forage to stockpile
- Or areas are deferred until conditions are better for grazing, ie when an area is too wet.



Reference: NRPH Chapter 5

38

KEY TOOLS IN GRAZING MANAGEMENT

39

Key "Tools"

- *Stocking Rate vs. Stock Density*
- *Carrying Capacity*
- *Seasonal Distribution*
- *Intensity of grazing*
- *Frequency of grazing*
- *Timing of grazing*
- *Duration of grazing*

- How many and what kind of animal.
- Where, how long and when they graze.
- When they come back.
- Performance goals

40

Stocking Rate vs. Stock Density

- Stocking rate: Units of animal per unit area per season or year.

Stocking rate = 6 cows : 60 acres or

1 cow : 10 acres

If 1 cow = 1,000 lbs, 1 AU:10 acres

- Stock Density: Units of animal per unit area per unit time (grazing period)

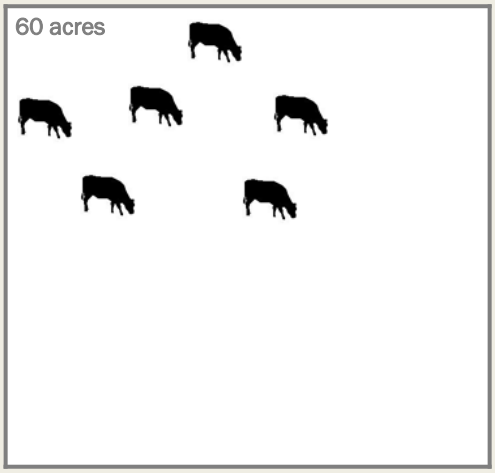
Stock density = 6 cows : 60 acres or

1 cow : 10 acres

If 1 cow = 1,000 lbs, 1 AU:10 acres OR

6 x 1000 lb = 6000 lb/60 ac = 100 lb/ac

Year-round grazing, 1 60-ac paddock



Pasture is grazed 100% of the time, resting 0%

41

Stocking Rate vs. Stock Density

- Stocking rate: Units of animal per unit area per season or year.

Stocking rate = 1 AU : 10 acres

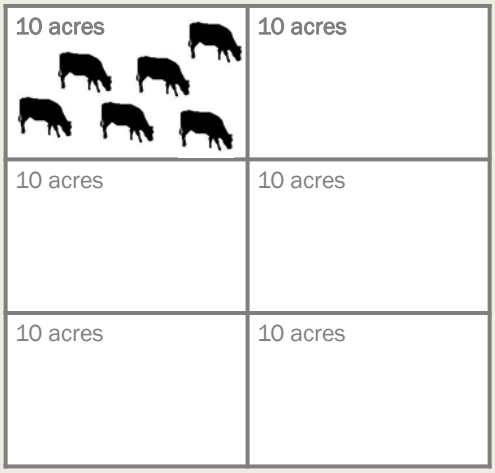
- Stock Density: Units of animal per unit area per unit time (grazing period)

Stock Density = 6 AU : 10 ac or

1 AU : 1.67 ac OR

6,000 lb/10 ac = 600 lb / ac

Year-round grazing, 6 10-ac paddocks



Pasture is grazed 16% of the time, resting 84%

42

Stocking Rate vs. Stock Density

- Stocking rate: Units of animal per unit area per season or year.

Stocking rate = 1 AU : 10 acres

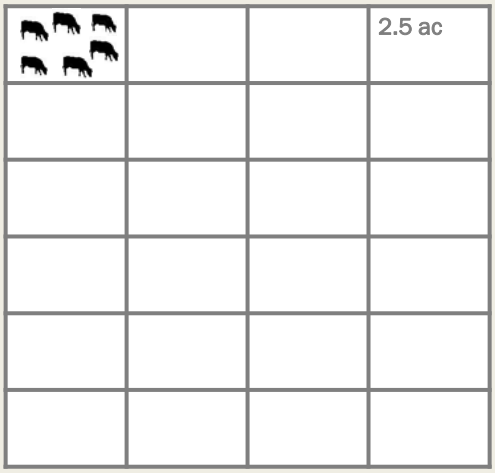
- Stock Density: Units of animal per unit area per unit time (grazing period)

Stock Density = 6 AU : 2.5 ac or

1 AU : 0.42 ac OR

2400 lb / ac

Year-round grazing, 24 2.5-ac paddocks



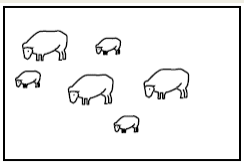
Pasture is grazed 4% of the time, resting 96%

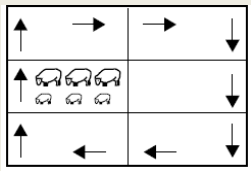
43

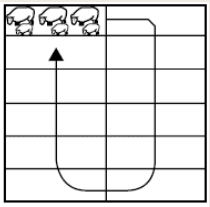
Stocking Rate vs. Stock Density

- Different systems might use same stocking rate, but the type of system used will affect the density.
- The stocking rate together with the system determine the intensity, frequency and duration of grazing….

Which can affect plant composition







Ref. slide 32

44

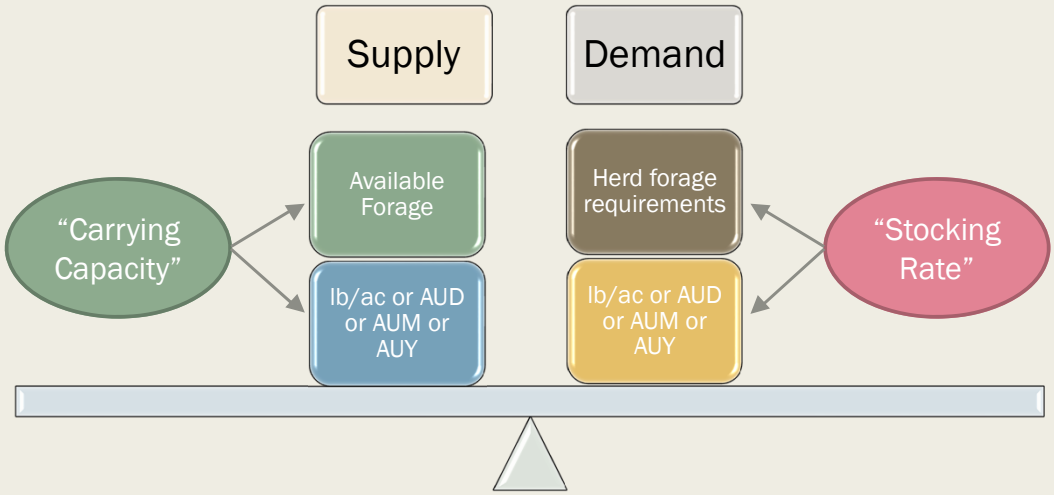
Carrying Capacity

- Carrying capacity is the number or "capacity" of animals a pasture can "carry" without damaging the resource base.
- Stocking rates can vary in the short-term, depending on the operation.
- Carrying capacity represents the average level of sustainable production over the long-term.
- Very useful towards sustainable management
- Difficult to calculate due to spatial and temporal variation
  - *Veg Species composition, forage utilization patterns, livestock nutrition demand, time of sampling, site selection, landscape variation, weather fluctuations*

"An evaluation of carrying capacity should be treated as a preliminary gauge to animal numbers for the management unit that will be revised in the light of monitoring information and immediate forage conditions." - Global Rangelands

45

Forage-Animal Balance



46

Forage-Animal Balance - Demand

- Expressed as lbs of forage needed or AUD or AUM or AUY
- For Benchmark: What kind and how many animals are grazed (Animal Units – AU)? Are they all together? When do they graze? All year? Part of the year? What are they used for? What's their intake rate?

AU × Intake rate × Time = Demand (lbs or AUD/ AUM/AUY)

47

Forage-Animal Balance - Supply

- Expressed as lbs of forage available or AUD or AUM or AUY
- How many acres are grazed? Are all the acres the same? How many lbs/ac?

Forage Produced (Lbs/ac) × Grazable area (acres) × Grazing Efficiency = Supply (lbs or AUD/ AUM/AUY)

Where do we get these numbers???

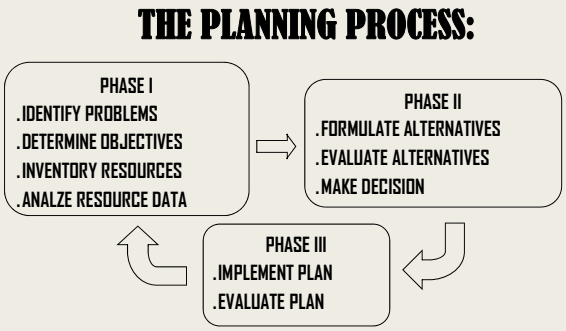
48

GRAZING LAND INVENTORY

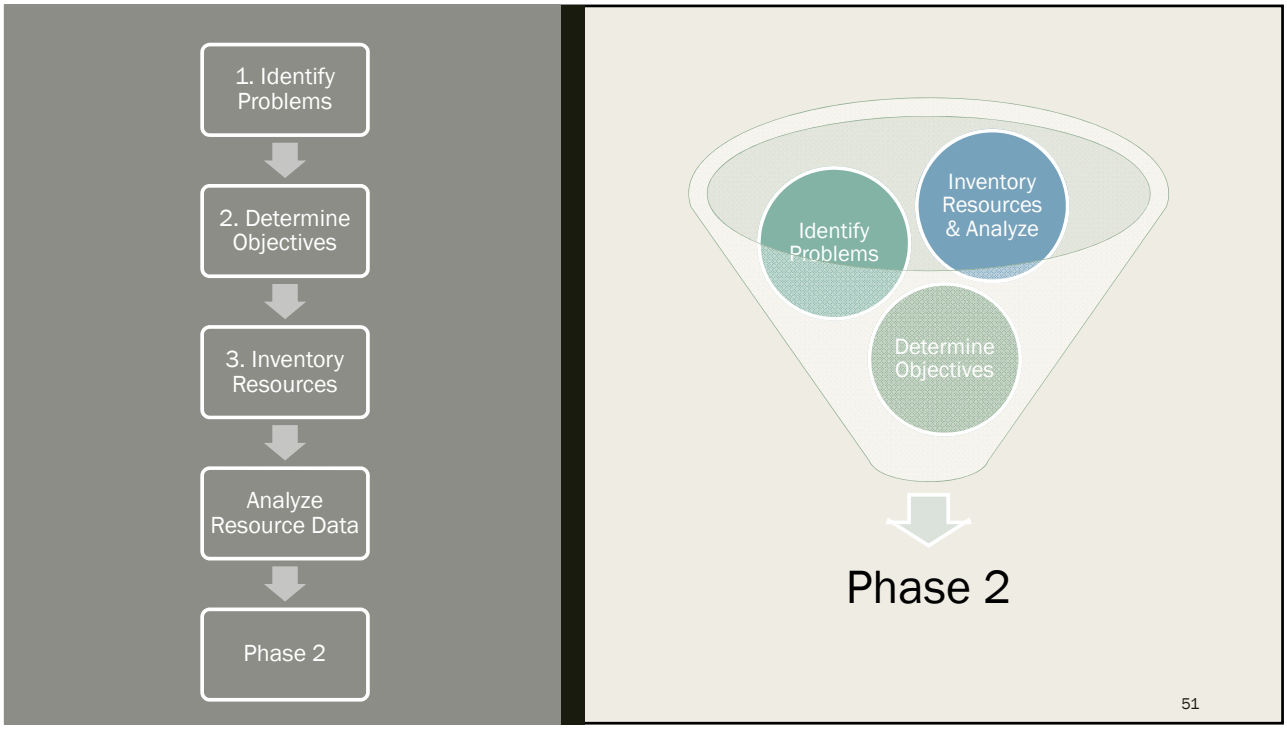
For Conservation Planning

49

9 steps of Conservation Planning



50



Conservation Planning on Grazing Lands

Steps What…	How…

• Identify problems
"Clients identify perceived problems"
 	
"Clients develop understanding of grazing land ecosystems"
 	
"Clients recognize the real problems and the causes of the problems"
	• *"…ensure managers understand grazing land ecosystems…"*
	NRCS personnel assists land managers to…
	• Inventory the resources in the grazing lands ecosystem.
	  • Soils
	  • Precipitation
	  • Area
	  • Slopes (Topographic maps)
	• Identify symptoms of problems (SWAPA) and causes of each

• Determine Objectives *"Client expresses management objectives"* *"…that are ecologically, economically and socially sound."*	• Ensure clients understands grazing land ecosystem • Assist managers in inventorying their grazing lands resources. • Assist managers in recognizing resource problems and causes. • Assist clients to establish objectives that are ecologically, economically, and socially sound.

Reference: NRPH Chapter 11

52

Conservation Planning on Grazing Lands

Steps What…	How…
• Inventory Resources *"Secure needed materials for inventory"* *"Conduct the inventory"*	• Identify vegetation types/zones • Record fences, watering facilities, pipelines, roads, corrals • Determine grazing distribution, key grazing sites and species. • Determine soil erosion • Evaluate water sources, quality and yield or capacity • Develop forage inventory • Develop livestock & wildlife inventory • Develop benchmark forage-animal balance sheet • Determine animal husbandry practices and livestock performance • Identify cultural resources • Identify endangered species and habitat

Reference: NRPH Chapter 11

53

Conservation Planning on Grazing Lands

Steps What…	How…
• Analyze Resource Data *"Evaluate the current grazing lands ecosystem in relation to site potentials."*	NRCS assists land managers to determine… • Vigor of desired plant species • Grazing distribution uniformity • Desirability/compatibility of existing plant species • Is current grazing management achieving desired level of forage quality and quantity. • Forage production in relation to potential for the site • Balance between forage production and forage requirements.

Reference: NRPH Chapter 11

54

What does that look like today?

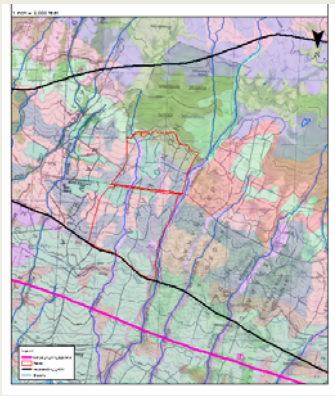
- Maps – soils, topo, precip, T&E, aerial images. Others? Old cane maps? Geology?
- Shapefiles – fences, pipelines, tanks, troughs, reservoirs, water meters, corrals, roads, gates, vegetation zones, graz-able areas, brush and/or herbaceous weed problem areas, eroding areas, etc
  - *Get as much as you can from the producer. Some of them have GIS and will share data.*
  - *Digitize as much as possible off producer-provided maps and imagery.*
  - *Attribute data wherever possible – fence types, pipe/tank/trough size and material*
  - *GPS whatever cannot be identified*
  - *Important to get the BIG picture*
- Livestock inventory (What, when, where, how many)
- Stock water Inventory Worksheet
- Vegetation Inventories and Analyses
  - *CPTN 7*
  - *Grazing Land Condition Score Sheet*
  - *Grazing Land Trend Worksheet*
  - *Prescribed Grazing Worksheets and Planning Tool*

This will take time. How much depends on the complexity of the situation.

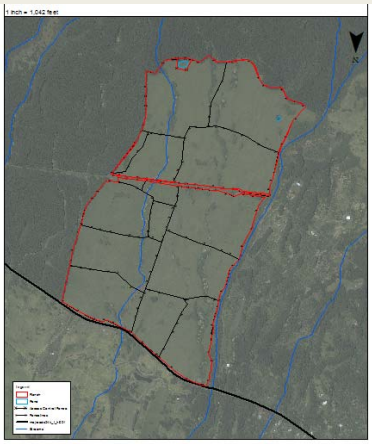
55

Inventory - Maps

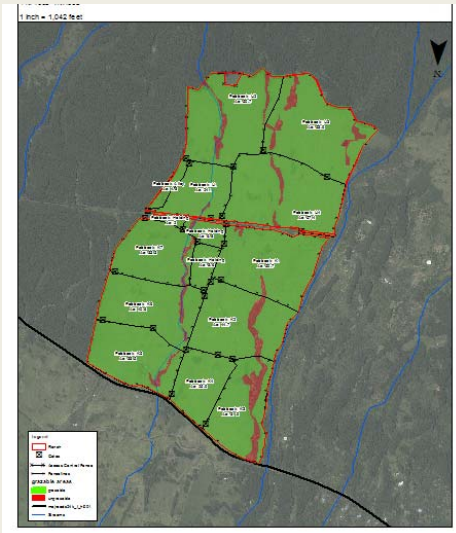
Soils, topo, precip



Fences....



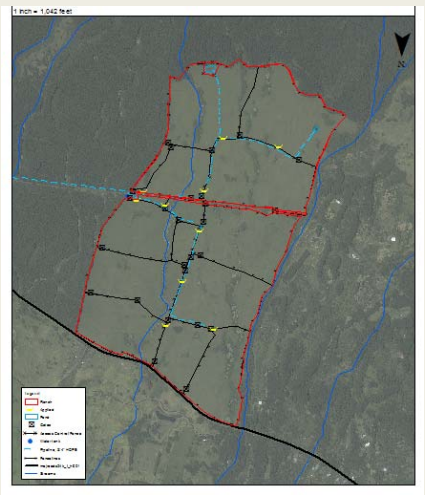
Grazable areas and acreages

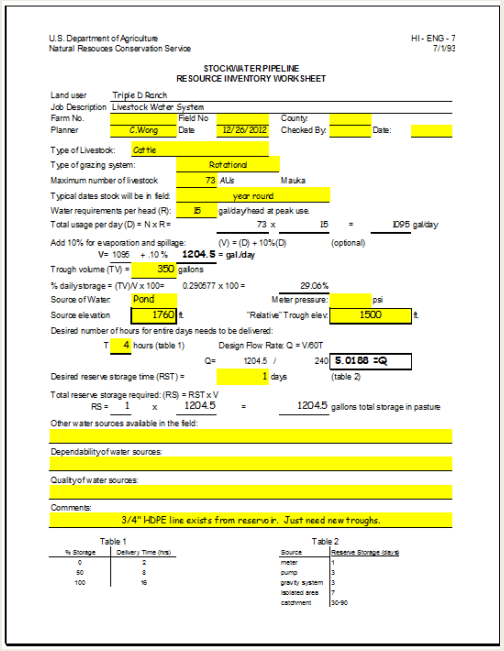


56

Inventory - Maps

Water system





U.S. Department of Agriculture
Natural Resouces Conservation Service

HI - ENG - 7
7/1/93

STOCKWATER PIPELINE
RESOURCE INVENTORY WORKSHEET

Land user: Triple D Ranch
Job Description: Livestock Water System
Farm No.: | Field No.: | County:
Planner: C.Wong | Date: 12/26/2012 | Checked By: | Date:

Type of Livestock: Cattle
Type of grazing system: Rotational
Maximum number of livestock: 73 AUs Mauka
Typical dates stock will be in field: year round
Water requirements per head (R): 15 gal/day/head at peak use.
Total usage per day (D) = N x R = 73 x 15 = 1095 gal/day
Add 10% for evaporation and spillage: (V) = (D) + 10%(D) (optional)
V= 1095 + 10 % 1204.5 = gal./day
Trough volume (TV) = 350 gallons
% daily storage = (TV)/V x 100= 0.290577 x 100 = 29.06%
Source of Water: Pond Meter pressure: psi
Source elevation: 1760 ft. "Relative" Trough elev: 1500 ft.
Desired number of hours for entire days needs to be delivered:
T 4 hours (table 1) Design Flow Rate: Q = V/60T
Q= 1204.5 / 240 5.0188 =Q
Desired reserve storage time (RST) = 1 days (table 2)
Total reserve storage required: (RS) = RST x V
RS = 1 x 1204.5 = 1204.5 gallons total storage in pasture
Other water sources available in the field:
Dependability of water sources:
Quality of water sources:
Comments:
3/4" HDPE line exists from reservoir. Just need new troughs.

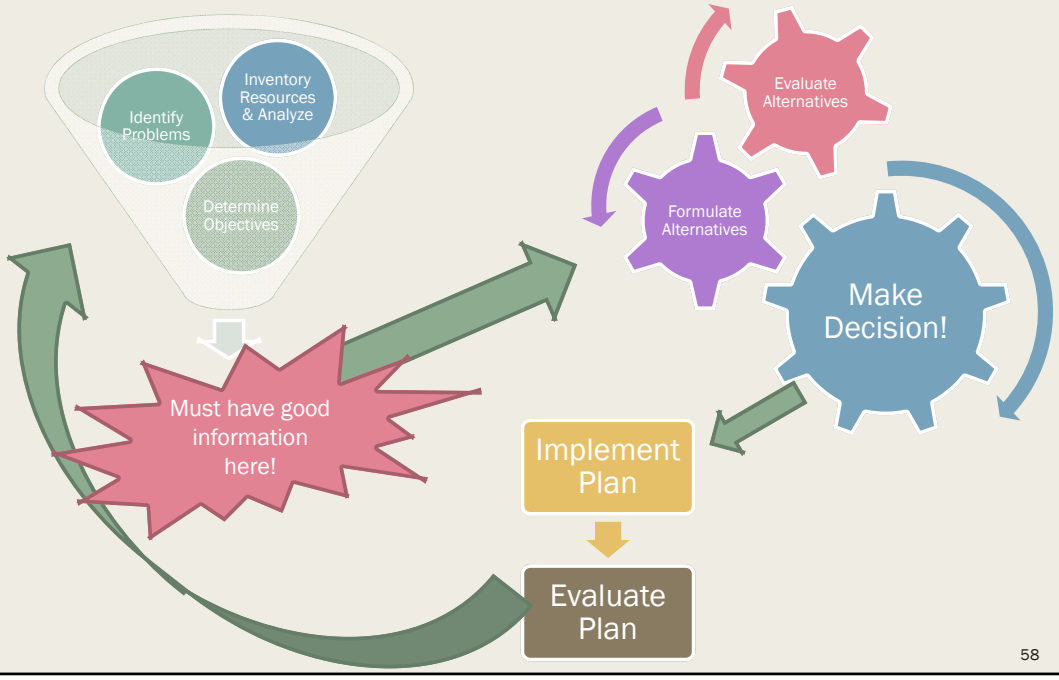
Table 1

% Storage	Delivery Time (hrs)
0	2
50	8
100	16

Table 2

Source	Reserve Storage (days)
meter	1
pump	3
gravity system	3
isolated area	7
catchment	30-90

57



58