MONTANA STATE UNIVERSITY
EXTENSION SERVICE
MONTGUIDE

MT198515 AG reviewed 6/2005

Montana Guide to Range Site, Condition and Initial Stocking Rates

by John Lacey and John E. Taylor*

This MontGuide discusses the need to balance available forage on your rangeland with the number of grazing animals for an optimal yield of livestock, wildlife and recreation. It provides an introduction to identifying range sites, classifying range condition and estimating stocking rates.

Rangeland is land that produces grasses, forbs and shrubs that can be harvested by grazing animals. Plants and animals on rangeland function as a unit, and any change in one factor (such as fire or grazing), changes the whole complex. For an optimal yield of livestock, wildlife and recreation, the number of grazing animals must be balanced with available forage. This publication explains how to identify range sites, classify range condition and estimate stocking rates.

This is a training guide to be used to learn the concepts and procedures. Actual range analysis should be based upon more complete information, such as that available from the appropriate state and federal agencies.

Range sites

The relationship between the plant community and the environment must be understood. A range site is a distinct kind of rangeland that has a certain potential to produce a distinct plant community (Fig. 1). The plant community that developed and matured under natural conditions is called the "climax" vegetation of the site. As long as the environment remains unchanged, range sites retain their capacity to reproduce the climax plant community following disturbances.

The kinds and amount of vegetation growing within plant communities are determined by topography, climate, exposure, level of water table and in the depth, texture, structure and salinity of the soil. Although all parts of the environment have the potential to influence the vegetation on a site, precipitation probably is the single, most important factor. Good range management can improve forage production, forage variability, seasonal distribution and water intake. Water intake is correlated with the amount of old and new vegetation that is left to protect the soil from erosion and crusting.

Different kinds of rangeland often are classified according to availability of soil moisture. "Normal" range sites allow vegetation to make a normal response to climate, and are not affected by soil or moisture-limiting factors. However, coulees and bottomlands often are designated as "run-in" sites because they have superior soil moisture availability and can produce more vegetation. In contrast, "run-off" sites have topographic features or characteristics that limit soil moisture availability and produce less vegetation than "normal" sites.

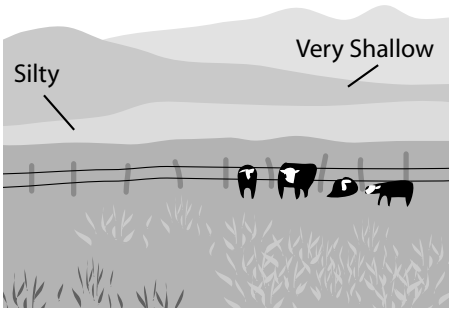

Figure 1. Each range site produces a different kind and/or amount of vegetation and often requires a unique management strategy.

Determining range sites

Plants often can be used as a clue to classify certain range sites. However, heavy grazing, drought, fire or tillage may change or destroy the vegetation. Thus, a site usually cannot be identified solely upon vegetation. The more the site has been disturbed, the greater the change in the climax vegetation. When the original vegetation is altered, the site must be identified on the basis of kind of soils, climate and topography.

The first step in identifying range sites is to select a representative location within each area, dig a small hole and examine the soil characteristics. The Range Site Key (Table 1) can be used to identify range sites.

*Former Extension range specialist and professor emeritus, respectively, Department of Animal and Range Sciences, Montana State University.

TABLE 1
Key to Common Montana Range Sites

To identify a range site, first determine which one of these three questions can be answered "yes."

1. Does the site receive additional moisture from overflow or sub-irrigation, or does it have a water table at least part of the growing season? If yes, go to GROUP 1; if no, go to the next sentence.
2. Is the soil depth at least 20 inches, with no sign of significant additional moisture? If yes, go to GROUP II; if no, go to next sentence.
3. Is the soil depth less than 20 inches to bedrock? If yes, go to GROUP III; if no, start over.

GROUP I - Range Sites That Receive Additional Moisture

SITE NAME	
1. Is the groundwater within 20 to 40 inches of the surface at least during part of the growing season?	
If YES, the range site is	SUBIRRIGATED (Sb)
If NO, go to the next sentence.	
2. Is there additional moisture from runoff of nearby slopes or stream overflow?	
If YES, the range site is :	OVERFLOW (Ov)
If NO, go back and see if you are in the right group, and try again.	

GROUP II - Soil at Least 20 Inches Deep—No Additional Moisture

1. Is the surface layer a gritty, course texture, not sticky when moist, and does water drain through the soil fairly fast?	
If YES, the range site is	SANDY (Sy)
If NO, go to the next sentence.	
2. Is the surface layer a medium (silty) texture that feels smooth or slightly gritty and slightly sticky and is the surface layer limy and strongly effervescent? Are the soils on a moderately steep or steep bench edge or slopes of hills?	
If YES, the range site is	THIN SILTY (TSi)
If NO, go to the next sentence.	
3. Is the surface layer a medium (silty) texture that feels smooth or slightly gritty and slightly sticky? (The soils are on nearly level to moderately steep slopes.)	
If YES, the range site is	SILTY (Si)
If NO, go to the next sentence.	
4. Is the surface layer a fine (clayey) texture that is sticky and plastic? (The soil ribbons when moist.)	
If YES, the range site is	CLAYEY (Cy)
If NO, go back and see if you are in the right group, and try again.	

GROUP III - Soil Less than 20 Inches Deep

1. Is the soil depth between 10 and 20 inches, over granite, sandstone, siltstone or shale?	
If YES, the range site is	SHALLOW (Sw)
If NO, go to the next sentence.	
2. Is the soil depth less than 10 inches to hard bedrock (except for crack in rock)?	
If YES, the range site is	VERY SHALLOW (Vs)
If NO, go back and see if you are in the right group, and try again.	

Range condition

Range condition or range health is the present state of the vegetation, compared to the kind and amount of native vegetation the range site is capable of producing. Vegetation comparisons are based on the relative weight of species, not on plant density, vigor or erosion. Estimates should be made to the nearest 5 percent for each species or group. The total always is 100 percent. While a major departure from climax indicates poor range condition, a minor departure may indicate good condition.

Plant Response to Cattle Grazing

To assist in determining the range condition class for a range site, plant species are grouped as decreasers, increasers or invaders, based primarily on the response to grazing pressure. Decreasers are high producing, palatable plants that grow in the original climax community. These plants decrease in relative abundance under continued heavy use. In calculating range condition, count the total of each decreaser species, up to the amount shown in the guide, which represents the amount that was present in climax condition.

Increasers are lower producing, less palatable plants that also grow in the original climax community. They tend to "increase" and take the place of decreasers that weaken or die due to heavy grazing, drought or other range disturbances. The increasers will also be weakened by continued close grazing and decline in abundance. In calculating range condition, the amount of increaser plants counted must not exceed the maximum level shown on the range condition guide.

Invaders are introduced plants or native plants that are rare in the climax plant community. They invade a site as the decreasers and increasers are reduced by grazing or other disturbances. In calculating range condition class, invaders are not counted for range condition.

The relationship between decreasers, increasers and invaders in range condition classes is shown in Fig. 2.

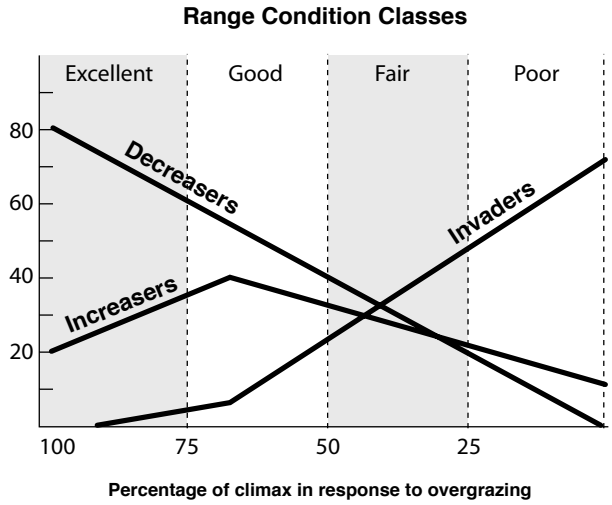

Figure 2. Relationship between decreasers, increasers and invaders.

The deviation from climax is divided into excellent (76 to 100 percent of climax), good (51 to 75 percent of climax), fair (26 to 50 percent of climax) and poor (0 to 25 percent of climax) range condition classes. The total decreasers, increasers and invaders always is 100 percent, and is based upon air-dry weight of the current growth.

Determining Range Condition

The first step in estimating range condition is to select locations within the range sites and estimate species composition by weight. These estimates should not be made in "sacrifice areas" adjacent to livestock waters nor in areas that receive little livestock use. The locations should have a plant community that is "representative" for the site.

List the species growing on the site, and estimate the percentage each contributes to total weight. Your estimates can be checked by clipping and weighing the herbage of each species within selected plots.

Determine the precipitation zone that describes the site (10-14 or 15-19 inch) and list the estimated allowable percentages of each species from Table 2. Compare these values to your estimates. The lesser amount of each decreaser and increaser species is used in calculating range condition. Do not include invaders in calculations. The sum of the decreaser and increaser species determines if the range condition is classed as excellent (76-100), good (51-75), fair (26-50) or poor (0-25).

The following example shows how to calculate range condition percentages on a shallow range site in the 10-14 inch precipitation zone (Fig. 3). First, list the on-site vegetation and estimate how much each contributes to total current-year production. Assume that the species or types make up the percentages shown as on-site estimates in the following table. To estimate condition, we compare the present plant production to the maximum allowable percentage listed on the condition guide.

Plant	On-site Estimate	Condition guide (Shallow site, 10-14 pz)	Count
Bluebunch wheatgrass	40	60	40
Green needlegrass	15	20	15
Forb decreasers	5	15	5
Needle-and-thread	15	20	15
Western wheatgrass	5	20	5
Other shrub increasers	15	10	10
Invaders	5	0	0
	100%		90

So range condition percentage is 90 percent, or excellent condition.

Figure 3. Example of range condition calculation.

Stocking Rates

Recommended stocking rates are based upon results from grazing research, local experience and clipped-plot yields. Recommended range site stocking rates are summarized at the bottom of the range condition guide (Table 2, last page).

Initial stocking rates also are influenced by season of use, kind and class of livestock, amount of wildlife use, prolonged drought, series of wet years and other factors. Physical limitations (such as steep slopes and distance from water) that cause certain portions of the range to be under-used also affect them. Under adverse conditions, the stocking rate must be reduced to avoid overuse of the more accessible parts of the range. In addition to proper stocking, good grazing management requires a systematic plan that includes such factors as good livestock distribution, correct season of use and control of the grazing period.

Animal Unit Equivalents

In planning the use of rangelands, the standard livestock unit is the *animal unit* defined as one mature (1,000 lb.) cow, with or without an unweaned calf. Stocking rates are often expressed in animal unit months (AUMs) per acre, which is one animal unit grazing for one month on the specified number of acres. Animal unit equivalents for cattle and horses are shown below:

Cattle

Weaned calves 0.50
Yearling.....0.67
Mature cow
(with or without calf) 1.00
Bulls (2 + years of age) 1.30

Horses

Yearlings.....0.75
Two-year-olds.....1.00
Three + years 1.25

It often is necessary to adjust the animal unit equivalents to fit local conditions. For example, forage available may not be equally usable by different kinds of animals. Different animals also use different areas or forage species within a pasture. Thus

AUM equivalents for sheep and wildlife have been omitted, because their food and habits differ from cattle.

Conclusion

Range condition and stocking rates for Montana can be estimated if the relationships between climate, soil, plants and animals are understood. The process of balancing the number of grazing animals with available forage involves the following steps:

1. Use the "range site key" to identify range sites.
2. Select locations within each range site to estimate species composition by weight.
3. List decreaser, increaser and invader species, and estimate the percentage each contributes to the total yield.
4. Compare the percentages of each decreaser and increaser species with the estimated maximum allowable percentages, and take the lesser of the two values for each species. In most cases, all the decreaser species will be counted. The sum of these "counted" values is the percentage range condition for the site.
5. Determine the stocking rate for each range site by referring to the initial stocking rate for the proper range condition class within the respective site. By summing up the available AUMs for each site within a pasture, an initial stocking rate for the entire pasture is obtained.

RANGE SITE: Ov-Overflow; Sb-Subirrigated; Sy-Sandy; Si-Silty; Cy-Clayey; TSi-Thin Silty; Sw-shallow; Vs=Very shallow

TABLE 2 - Range Condition Guide: Maximum Percent Allowable in Climax by Range Site

		10—14" pz								15—19" pz							
		Group I		Group II			Group III			Group I		Group II			Group III		
GRASS DECREASERS		Sb	Ov	Sy	Si	TSi	Cy	Sw	Vs	Sb	Ov	Sy	Si	TSi	Cy	Sw	Vs
Basin wildrye		20	40								40						
Bearded wheatgrass		10	20														
Big bluestem		10	45	10	10		15										
Bluebuch wheatgrass			10	25	50	40	40	60	60			20	70	70	50	70	80
Columbia needlegrass											15	5	15		5		
Cordgrasses		40	40														
Green needlegrass		10	25	30	40	25	55	20	15								
Little bluestem				30		30		30	30								
Mountain brome												10	10	10	10	10	
Prairie sandreed			10	55				15	10								
Rough fescue											20	25	75	40	40	70	
Nebraska sedge		30	10	15	10	10	15	10	5								
Slender wheatgrass		20	20														
Tufted hairgrass		15	10							10	10						
Other decreaser grasses		10	10	10	15	15	15	10	15	10	10	10	15	15	15	10	15
FORB DECREASERS		10	10	10	15	10	15	15	10	10	10	15	15	15	15	15	30
SHRUB DECREASERS		10	10	10	5	5	5	5	5	15	15	15	15	15	15	15	30
GRASS INCREASERS																	
Blue grama			5	5	5	5	5	5	5								
Idaho fescue					10		5		5	15		20	20	20	20	15	15
Needleandthread				25	20	15		20	20			5				5	10
Prairie junegrass				5	5	5	5	5	5								
Sandberg bluegrass				5	5	5	5	5	5								
Sedge increasers				5	5	5		5	5								
Thickspike and Western wheatgrass		15	50	10	40	20	50	20	30		15				20	10	5
Other increaser grasses		10	10	10	15	15	15	10	15	10	10	10	15	15	15	10	15
FORB INCREASERS		10	10	10	5	5	5	5	5	10	10	10	15	15	15	10	15
SHRUB INCREASERS																	
Big sagebrush			5	x	5	x	5	5					10	10	10	5	
Silver sagebrush		5	5	5	5	5	5	5	5								
Rabbitbrushes		5	5	5	5	5	5	5	5								
Broom snakeweed		5	5	5	5	5	5	5	5		Responds as invader in foothills and mtns.						
Other shrub increasers		5	10	10	10	10	10	10	15	15	15	15	15	15	15	15	15
INVADERS																	
Any annuals or biennials																	
Any introduced plant																	
Red threeawn																	
Other invaders																	
Initial Stocking	E	1.6	.6	.4	.4	.4	.3	.3	.08	1.6	.8	.6	.6	.65	.5	.5	.2
Rate: AUMs/Acre	G	1.2	.45	.3	.3	.3	.22	.22	.06	1.2	.6	.45	.45	.45	.37	.37	.15
By Range Condition	F	.8	.3	.2	.2	.2	.15	.15	.04	.8	.4	.3	.3	.3	.25	.25	.1
	P	.4	.15	.1	.1	.1	.07	.07	.02	.4	.2	.15	.15	.15	.12	.12	.05
Initial Stocking	E	.6	1.6	2.5	2.5	2.5	3.3	3.3	12.5	.6	1.3	1.7	1.7	1.6	2.0	2.0	5.0
Rate: Acres/AUM	G	.8	2.2	3.3	3.3	3.3	4.5	4.5	16.7	.8	1.7	2.2	2.2	2.2	2.7	2.7	6.7
By Range Condition	F	1.2	3.3	5.0	5.0	5.0	6.7	6.7	25	1.2	2.5	3.3	3.3	3.3	4.0	4.0	10
	P	2.5	6.7	10	10	10	14.3	14.3	50	2.5	5.0	6.7	6.7	6.7	8.3	8.3	20

MONTANA STATE UNIVERSITY EXTENSION SERVICE

The U.S. Department of Agriculture (USDA), Montana State University and the Montana State University Extension Service prohibit discrimination in all of their programs and activities on the basis of race, color, national origin, gender, religion, age, disability, political beliefs, sexual orientation, and marital and family status. Issued in furtherance of cooperative extension work in agriculture and home economics, acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture, Douglas L. Steele, Vice Provost and Director, Extension Service, Montana State University, Bozeman, MT 59717.

DOWNLOAD ME FREE ON THE WEB

File under: Range
A-1 (Range Management)
Reviewed June 2005
500 605 KMM

http://www.montana.edu/wwwpb/pubs/mt8515.html