Determining Range Site Potential on Annual Rangeland

Nora H. Monette and John W. Menke

The actual grazing resource in the 11 Western States is small in contrast to the rest of the United States, but public interest in the resource is great. The 11 Western States produce only 18% of the feed consumed by cattle and sheep in the United States, but grazing on public land constitutes a highly significant portion of this production (USDI and USDA 1977). Because of increased public interest in grazing on western rangeland and current requirements for grazing Environmental Statements, there is a need for more quantified resource information.

"Range sites" have been used as a planning tool in assessing the "potential" production of rangeland by the Soil Conservation Service and more recently, by the Bureau of Land Management (Site Inventory Method [SIM]). Stocking rates and management adjustments are recommended on the basis of potential plant cover, animal preferences, and range condition trends.

There are some unique problems that are encountered when the potential production of annual vegetation is estimated. The differences in germination times and in growth rates between plant species put limitations on the accuracy of vegetation sampling. In addition, the effect of light grazing on perennials in annual rangeland communities makes estimates of potential from relict vegetation difficult. These problems are important to the management of annual rangeland, especially in California, and perennial rangeland that has been invaded by annual species. Serious questions are being asked on how to evaluate annual plants and litter from annuals in the determination of range condition trend.

What is a Range Site?

A range site has its own combination of environmental factors that are expressed in a distinctive plant community: the natural plant community. This plant community represents an integration of factors, especially climate and soils (Passey and Hugie 1962). The "stable" or natural plant community of a range site is distinguished by the kind of species and amount of annual production of vegetation. In California, the highest annual production by species recorded represents the potential productivity of the site. Managers must continue to monitor highs and lows in annual production to keep their inventory guidelines current.

In the field, natural plant communities may be hard to find and identify. If current vegetation alone is surveyed, there are problems assessing the amount of disruption due to management. The species composition and production of sites tend to vary with disturbances such as heavy grazing, fire, tillage, and drought.

They also vary from year to year as a function of climatic variation. Where the original plant cover has been modified, range sites are recognized on the basis of permanent, mappable features. These features must be consistently associated with the original or potential plant cover and not change readily with time. Climate and soils are usually the mappable features used to distinguish range sites.

Aandahl and Heerwagen (1964) compared the mapping of range sites to soil mapping units. Like soil mapping units, range sites do not represent each individual plant community or cluster, but are described in terms of a predominant community that has an allowable proportion of inclusions of other plant communities. Range sites are set up to encompass a range in characteristics, like soil series. For a single range site, inclusions can make up to 15% of the mapping unit delineation (soil boundary). Mapping units can also be identified as geographic mixtures of soils or range sites. Such mapping units are less refined than one identified as a single soil or range site. A mapping unit identified as a single soil series, or a single range site, will provide more precise information than one that is identified as a mixture.

The number and kinds of range sites set up in a soil survey...
depend on practical considerations such as the proposed use for the resource information. Often, precise information on the resources of a small area is required, so a first or second order soil survey is made. When a broader perspective is all that is required, a third order soil survey is made. First order soil surveys are very detailed and are usually made for construction or research purposes. Second and third order level surveys are the type usually performed to obtain information on the natural resources of an area. The minimum size of mapping unit delineations in these surveys is a function of mapping scale and the level of mapping precision. The minimum acreage delineated in a second order survey ranges from 2 to 10 acres and usually is 5 to 10 acres in size. For a third order survey the minimum delineation ranges from 6 to 640 acres, with 20- to 40-acre delineations being common. In most second order surveys, range sites are determined from mapping units that consist of soil phases (e.g. Alpha sandy clay loam) and geographic mixtures known as associations, complexes, and undifferentiated groups.

At the third order level, precision of mapping does not permit the differentiation of soil phases, and range sites may be given as geographic mixtures of plant communities rather than a single range site. Presently, second order surveys are normally performed on private land by the Soil Conservation Service and third order surveys on Federal land by the U.S. Forest Service and Bureau of Land Management. On rangelands it may be worthwhile to gather more information that presently needed because of the increased amount of resource information required by the public for management, especially on Federal land.

How Is a Range Site Characterized?

The potential production of a range site is characterized by the annual production by species on an undisturbed site with climax vegetation. The concept of "increasers and decreasers" is not used when the natural plant community is characterized (USDA 1976). In some cases, the potential of a particular range site will have to be estimated from other climax vegetation by interpolation and extrapolation along environmental gradients (Passey and Hung 1962; Dyksterhuis 1958).

After the potential vegetation for a range site is characterized, comparisons can be made with areas that have similar soils and climate. On perennial rangelands range condition trend of a particular pasture or management unit is determined directly from the comparison of the vegetation on the site to the potential plant cover. On annual rangelands range condition trend is determined differently. Dominant plant species are rated in terms of quality and productivity. In California, the terms "preferred," "desirable," and "undesirable" are used to rate different plant species with respect to a particular grazing animal. Changes in the proportions of plants in these categories, plant litter accumulation, erosion, and total production are used to assess range condition trend. Range condition class ratings are not normally estimated on annual rangelands.

Problems with Annual Type Vegetation

Annual vegetation is an important component in grassland, oak woodland, and brushland communities in California and part of Oregon. Annuals also are abundant in many perennial grassland or shrubland communities as invaders. Because of the number of different vegetation types in which annual plants are found, it is difficult to make generalizations about the influence of environmental factors on production.

The Mediterranean annual rangelands of California are very diverse in character. This diversity is a function of complex geology, topography, vegetation character, and the climatic gradation of coastal influence. The complexity of environmental gradients and the vegetation on annual rangeland makes interpretations of range site information more difficult than in other areas.

There are several problems associated with sampling vegetation in the California annual type. The short-lived vegetation germinates in the fall, actively grows from February to June, dies, and dries. Because of this succession of changes, it is hard to make adjustments for phenology when sampling the vegetation during the growing season. Problems also arise because different species grow actively at different times. Ratliff and Heady (1962) observed that filaree (Erodium spp.) and burclover (Medicago polymorpha) grow early in the season, followed by wild oats (Avena fatua) and rip-gut (Bromus diandrus), then by soft cress (Bromus molis), and finally by annual ryegrass (Lolium multiflorum). They also found that weight changes in the vegetation associated with drying and plant shattering occurred at different times for each of the species. The rapid weight changes that occurred at the end of the growing season also varied in magnitude among the plant species.

There are additional sampling problems because of complex responses of annual vegetation to rainfall. The timing and amount of rainfall often influences total production and species composition in the annual type but these effects vary between regions. At the Hopland Field Station in north coastal California, a significant correlation between the amount of autumn rainfall and forage production was found (Murphy 1970). At the San Joaquin Experimental Range in the central California Sierra foothills, no correlation between production and rainfall could be found (Duncan and Woodmansee 1975). These differing results point to the need for a regional approach to determine the climatic factors that affect production. The Soil Conservation Service currently uses "Land Resource Areas" to divide regions on the basis of climatic and physiographic features. These Land Resource Areas could be used as the basis for studying the

Open annual grassland and blue oak (Quercus douglasii) savanna grassland in central Tehama County, northern edge of Sacramento Valley, northern California. April 18, 1978
influence of climatic factors on annual forage production.

In some cases, climate adjustments for different soil phases may also need to be determined as rainfall distribution will have a different effect on a shallow sandy soil that a deep clay loam soil. These adjustments are needed not only when characterizing the natural plant community of a range site, but also when the range condition trend of a management unit is being determined.

It has been observed on the Hopland Field Station that perennials make up a greater proportion of the vegetation in exclosures than on pastures with only light grazing pressure. The perennial species come back in the plant community more in exclosures protected from sheep and deer than in exclosures protected from sheep only. This raises the question of whether natural plant communities in the annual type should be characterized on totally protected sites or areas with light grazing pressure.

It is very difficult to manage for perennial grasses once annuals have become established since annual grass seedlings are generally better competitors than perennial grass seedlings. Without complete exclusion of grazing, the reestablishment of perennials on California annual rangeland is unlikely. Thus, range site characterization and interpretation should include considerations on the management of annual vegetation in both California and on perennial rangelands where annuals have become established.

Conclusion

Range sites are a planning tool that must be considered along with animal preferences and site condition in determining range condition trend on annual rangelands. The concept of range sites has been seen used successfully in a broad sense, but we still need to quantify more relationships regarding phenology, response to weather, and the response of vegetation to management. In this quantification, it may be best to take a regional approach to determine the most important factors influencing vegetation in any one season or sampling time, perhaps with the use of the Soil Conservation Service Land Resource Areas. Correct site identification and sampling adjustments are not only important in determining the potential productivity of a site, but in determining proper use factors.

A greater understanding of the factors affecting the growth of annual range plants is not only important for the Mediterranean annual grassland communities, but also for perennial communities where annual grasses and forbs have become established. The annual plants' contribution to forage production and erosion control needs to be characterized and some assessment of these contributions included in the determination of range condition trend.

Literature Cited


Ratliff, Raymond D., and Harold F. Heady. 1962. Seasonal changes in herbage weight in an annual grass community. J. Range Manage. 15:146-149.


Notes from Denver

A FAREWELL NOTE

For the past four plus years it has been my great pleasure to serve as your Executive Secretary. Those years have not been without their usual problems and challenges, yet they have been years of great personal rewards for me and my family. It would, therefore, be my desire at this time to express my deepest appreciation to the Society membership who have worked hard to support our organization and to insure its growth during these past four years. I am quick to realize that the success of our efforts has centered around membership activity and we here in Denver have only been involved in the process of suggestion and implementation. The reward to someone who sits in my position is to see the growth and success of people involved in Society programs. To have seen this success makes leaving seem a bit easier.

Appreciation must be expressed to our dedicated staff here in Denver and the six great people working on our Old West Project. I send a very personal thank you to Janna Poll, Dorothy Rasmussen, Michelle Conger, Pat Smith, and Pat Willems here in the Denver office and to our field team of Bob Gartner, J.C. Shaver, Dan Bose, Rod Baumberger, Tom Sparks, and John Shrader for their excellence of work and for their great friendship.

Many great people have served in leadership capacities and on the committees of the Society these past four years and I extend my personal thanks to them for their service. In addition, many of the stalwart, silent members have been very generous with their time, talent, and funds in helping us to realize some of our most hoped for goals. They, too, deserve my thanks.

Now as to the future, you should all know that all is well with me and mine. We have some exciting plans ahead for us in two business ventures here in Denver. I will also continue my association with the Society as an active member with a willingness to serve as may be requested.

Our door is always open to our special SRM friends and we would be very disappointed if you did not call upon us whenever your busy schedules may bring you to Denver.

Best wishes to all. —David A. Smith, Executive Secretary, SRM