Range Vegetation Classification

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It is well accepted that a rangeland manager should thoroughly understand plant and animal communities found on the rangeland. For effective management, he should know their species composition, structure, and function. Plant groupings as seen by a manager are formulated from his personal observations, which in turn will determine how he manages a given range site. It is not always easy to identify these plant groupings so that they form management units. Yet, most all management practices applied to sustain or increase forage relies entirely upon the perceived vegetation units to be managed.

It is clear to range managers that field boundaries simply do not exist between either natural or artificial groupings of vegetation. The absence of clearly defined boundaries, then, makes the classification and interpretation of vegetation groupings for management purposes difficult. Some modern-day managers even question whether classifying vegetation is actually necessary for good management, while others believe that such classification is appropriate as a matter of convenience in describing vegetation. Until some system other than the naming of vegetation groups is developed, management of rangelands will continue to be applied to vegetation as a group of species. In fact, good range management is based solely upon the application of ecological principles not only to individual species, but to groups of species. These principles should apply over all vegetation types and plant groupings found within these types. A general survey of the development of vegetation classification as it relates to range management is in order to understand the basis of such classification.

Two very different approaches have been used to classify range vegetation. One approach forms groups of plant species based upon certain classes of environmental habitats, while the other approach recognizes that plant species vary along with changes in the environment. Some range managers believe that this latter method is the best way to interpret range vegetation patterns and groupings (Dyksterhuis 1956).

By convention, there are four major vegetation divisions that are recognized: (1) *formation-type;* (2) *formation;* (3) *association;* and (4) *union.* The largest and most encompassing grouping is the vegetation *formation-type.* The formation-type is a group of geographically widespread plant communities of similar physiognomy. Examples of vegetation formation-types are grasslands, deserts, and forests. This broad category of vegetation is related primarily to major climatic and edaphic conditions that occur over large geographical regions. The *formation,* as distinguished from the formation-type, is an amalgamation of plant communities having similar physiognomic, climatic, and environmental features occurring in a specified region or on a single continent. The next major type is the plant *association* which is defined on the basis of floristic or species composition. Examples of this latter group are the shortgrass and mixedgrass associations of the North American or Midwestern grassland formation and the saltbush and sagebrush associations in the North American or Southwestern desert formation. The final major type of vegetation unit, the *union,* consists of those species of related growth form occurring in a specified canopy layer. An example of a vegetation union would be a community of shortgrasses such as buffalograss or blue grama occurring in almost pure stands.

In addition to these 4 major vegetation classifications, other vegetation divisions such as *landscape* and *habitat type* are also in popular use today. The term *landscape type* refers to an extensive area of land characterized by vegetation and its associated environment. This type of vegetation classification often overlaps several plant associations and is in wide use in environmental impact analysis. *Habitat type* is sometimes used to refer to a group of plant communities which resemble one another only through their habitat relationships. This latter designation is frequently used to describe vegetation for both rangeland and wildlife management purposes. The *range site* concept, often used to refer to plant communities and their corresponding edaphic setting, has probably found wider use in range management than all of the descriptive terms discussed above. This site concept is discussed later in the paper.

The basic approach to vegetation classification originally was that of making a general observation of the particular landscape and recognizing that a certain amount of pattern and repetition of the types of landscape was reflected largely through vegetational features. Landscapes with similar vegetation features were then mentally grouped together by the observer. It still holds true today that the recognition of differences occurring in vegetation groupings depends upon the knowledge that one has of plant species and communities. If a more or less distinct boundary of vegetation unit is observed, then a classification system is usually devised that recognizes several plant groups. Different hierarchies of social organization within the plant community and the ecosystem result in several classification levels which may be useful for range plant community descriptions. For the most part, each individual observer will view a vegetation classification problem in a different light and will subsequently tend to place greater emphasis upon a particular characteristic of the vegetation for use in describing it.

Historical Development of Range Classification

Early range management theory was greatly influenced by the concepts of F.E. Clements. The development and use of vegetation classification systems, as applied to range condi-

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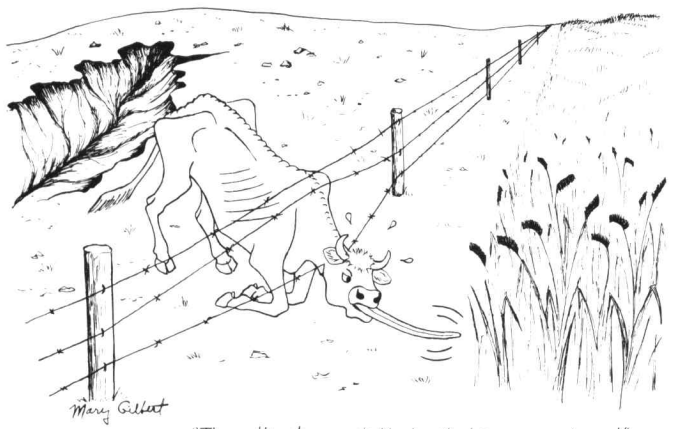
tion, can be traced back as far as Sampson's work reported in 1919 (Dyksterhuis 1956). Since these classification systems were derived from Clements, they had common denominators with the Clemensian theory of classifying groups of plants into well-defined vegetation types. This approach to a classification system for determining range condition was based entirely upon vegetation characteristics as expressed in various successional stages.

The primary concern of early efforts in range management classification was the use of plant species composition as indicators of range condition. The plant species composition was compared to the climax stage of species combinations. Continued use of this concept led to the *range site* classification which was based upon differences in floristic composition compared to hypothetical climax vegetation. These differences in vegetation composition were further divided into range condition classes based upon the percentage of plant categorical groups such as decreasers, increasers and invaders occurring on the site (Dyksterhuis 1949). Intermittent reclassifications of the vegetation of a given range site recognized successional patterns with respect to changes in range condition toward or away from the climax. This process of change in vegetation, called *trend in range condition,* was mediated largely by grazing-imposed stresses on plants in the community.

To develop a classification system for range vegetation based on trend in range condition, native rangelands which



"The ultimate vegetation's not doing me much good."

have been protected from grazing and which have fairly stable species composition are required for determining practical subdivisions and successional patterns toward this climax (Dyksterhuis 1956). Thus, the use of a vegetation classification scheme with regard to past grazing history occurred when the need arose to classify rangelands based upon the successional pattern of the vegetation.

Dyksterhuis (1949) stated that any classification of rangeland vegetation to describe range conditions must be based upon quantitative ecology. Prior to that time (and even today), livestock operators commonly associated the term "range condition" with a favorable climatic season. That is, good range condition simply meant that the area had recently received sufficient precipitation for rapid growth of forage (Dyksterhuis 1949). In contrast to this early idea, current concepts of range condition indicate more than just the current season's growth of forage.

Clements (1935) considered natural plant communities the best integrator of the effects of climate and soil in terms of plant production. Today, the range manager does define range condition in such a way that the climate, soil, and vegetation are all considered in the final analyses. Thus, a given range condition is indicated by the vegetation characteristics which are currently present relative to vegetation characteristics at or near climax. It follows then that the range manager should have a thorough ecological knowledge of the potential vegetation which could exist on a given site before he applies any range improvement practices.

Prior to 1949, range condition, as referred to by range conservationists, was based primarily upon a description of the species composition of the vegetation. Sampson (1919) concluded that the most rational and reliable way of detecting overgrazing was to recognize the replacement of one type of plant cover by another as grazing continued. He further recognized that the grazing value of a vegetation type was essentially determined by the stage of vegetation succession and that the carrying capacity as well as the forage value increased as the vegetation on a site approached climax. In effect, what Sampson had done was to make an application of the Clemensian concept of plant succession and climax in a way that would relate to range condition. So, the idea of an ecological classification of range condition was generally accepted and put to extensive use. A short time later the vegetation successional stage concept of range degeneration as described by Sampson (1919) had been transformed into range condition classes.

Classification Modification

Concepts of range condition are then closely associated with vegetation classification since condition is determined from vegetation characteristics. Range condition classes have more recently been developed which are based upon abundance and vigor of desirable forage species rather than upon the successional status of a site. Some of these later classification systems for range condition do not depend at all upon the successional stage of vegetation but rather are determined by identifying range condition directly in terms of relative forage production. However, basic plant ecological research has shown that forage production is generally a reflection of the successional status of the vegetation.

Dyksterhuis (1949) proposed that a description of range condition include the percentage of the present plant species which was in the original vegetation or climax for a particular site. He also cautioned that this definition had little meaning without an application of ecological principles in practical field test on rangelands. Moreover, he recognized that many kinds of vegetation may occur on the same site, depending upon the historical use of the vegetation by livestock. This concept is, of course, vividly pointed out by the many fence-line contrasts that range managers routinely encounter.

There are several important factors known to be important in a range condition classification system. For instance, there is often as much difference in forage production on one site from year to year as there is between sites in the same year. Secondly, relative plant composition fluctuates less from year to year than does forage production. Thirdly, vegetation climaxes that are different floristically may produce essentially the same amount of forage per unit of surface area. And, lastly, in field operations, a range manager cannot classify a range with respect to potential production except as judged from the current species that occur on the site (Dyksterhuis 1956). With this in mind, pioneering efforts were undertaken to describe local range condition classes and the assumption was made that a disappearance of the

original vegetation under grazing pressure would result in an inferior combination of plants. Yet, it was found that a range condition below climax vegetation may produce more herbage but less forage than the climax, especially where different plant life forms such as forbs prevail because of heavy grazing.

Other Considerations

Woodbury (1954) listed criteria that are closely associated with the range site and condition concept. He suggested use of the following in description of plant communities: (1) the most conspicuous, dominant plants should be recognized and acknowledged in the classification system; (2) specific plants must be consistent in their occurrence throughout the community; (3) the potential climax vegetation of the site should be considered whether climax species are actually present or not; and (4) the environmental setting in which the plant occur must be recognized. All 4 of these principles were used in determining the nature and number of range sites to be described by range managers (Dyksterhuis 1956).

Range classification systems also reflect the principle that clumping of species is characteristic of the structure of vegetation populations. Such clumping of plant species is known to be a response to differences in local habitats, reproduction or dispersal processes, or grazing pressures. Certain plant species or groups of species may stand out in a dominant manner only because of their numbers or the mere size of the individual plants. On rangelands, the dominant lifeforms are grasses, forbs and shrubs, and it follows that they would reflect the classification of range communities by vegetation types. Based upon the fact that some species are indicators of certain environmental conditions, Cain (1947) suggested that natural and stable vegetation types provide the logical basis for any classification method for range management. This suggestion was integrated into the range site description process in spite of the difficulties encountered in interpreting associated environmental complexities of range condition.

Another useful concept of classifying vegetation for detecting initial successional changes in range condition is by means of plant vigor. This particular addition to range vegetation classification has been somewhat controversial although there is no reason why range vegetation cannot be classified according to the forage vigor or individual species' state of health. The jsutification for this approach is that vigor does provide an indication of relative health or capacity of the plant to convert solar energy to chemical energy and biomass. Thus, it is not uncommon for range managers to recognize that a trend or a change in range condition will first be expressed by a change in individual species vigor. This is so since plants must either gain in vigor or be replaced by other, more vigorous plants. Plant vigor is usually estimated in terms of high, medium, or low vigor. Reduced vigor of plants is indicated by shorter and fewer seedstalks, shorter current growth, more dead crown, and less herbage yield. These relative species characteristics have led to different species groupings in order to identify changes in range condition, whereas ecological criteria is used to identify the condition at or below full ecological development or full potential.

Conclusions

It is often assumed that a range manager has developed an understanding of the different plant and animal communities found on the rangeland specifically under his management. Sometimes this understanding has not been gained simply because the manager has not had the opportunity for a long-term experience in field observations. Most ranchers are certainly exceptions to this. On the other hand, public land management agencies, through transfer of their personnel, often short-cut the opportunity for a range manager to develop a good understanding of the vegetation communities with which he is involved.

It is important that a vegetation manager obtain enough experience to develop plant groupings through personal observations which will in turn determine how he manages a given range site. While the identification of various plant groupings will differ among managers, any range plant classification system will be useful in the management of the rangeland. Differences among managers are not important since the individual classification will be based upon field experience and technical training of the manager. Much work has been accomplished on classifying vegetation for range management purposes and there is always room for any new approach that will enhance management of the range.

Literature Cited

Cain, S.A. 1947. Characteristics of natural areas and factors in their development. Ecol. Monogr. 17:185-200.

Clements, F.E. 1935. Experimental ecology in the public service. Ecology 16:342-363.

Dyksterhuis, E.J. 1949. Condition and management of rangeland based on quantitative ecology. J. Range Manage. 2:104-115.

Dyksterhuis, E.J. 1956. Ecological principles in range evaluation. Expanded from an address for the Ecol. Soc. of America on the theme "Grasslands in our National Life" at the meeting of the Amer. Assoc. Advance. Sci., New York, December, 1956.

Sampson, A.W. 1919. Plant succession in relation to range management. USDA Dep. Agr. Bull. No. 791.

Woodbury, A.M. 1954. Principles of general ecology. Blakiston, N.Y.