Evaluating Rangeland Sustainability:  
The Evolving Technology  
The Task Group on Unity and Concepts in Terms

The Society for Range Management

The current condition and trend of American rangelands continues to be a topic of controversy and confusion. National reports on range condition have often provided different interpretations of the same data and are of limited utility for planning, budgeting or making policy decisions. The deficiency in these reports stems partly from lack of uniformity in the approaches used to measure range condition and the terminology used by the various land management agencies. A larger problem is that the attributes measured and their interpretation are not consistently related to the land management objectives. Further the concepts on which range condition have been based has not evolved along with the current theory about the nature of ecosystem changes.

Methods used in the inventory and evaluation of rangelands have not kept pace with the developing ecological theories of plant succession. While an understanding of how vegetation change occurs and likely pathways for change is vital for good rangeland management, Clementsian-based successional theory is an inappropriate model of vegetation change on many rangelands, particularly those of the arid West. Interpretations of successional status, or seral stage, are not adequate to assess whether or not rangelands are properly protected from site degradation, meeting management objectives or other characteristics related to biological diversity or nutrient cycling.

Protection and long-term sustainability of the natural resource base are major objectives in rangeland management. Currently, there is no consistent indicator of site pro-

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A more detailed technical presentation of this concept appears in the May *JRM* vol. 48:271-283.
Fig. 1. Concept of site conservation threshold for a particular ecological site. The measurable attribute influencing erosion may vary depending upon characteristics of the site. The response curve is hypothetical, but illustrates a threshold level (shaded area) of site protection below which allows for an increase in the rate of soil erosion.

Tection or soil stability. Further, little can be interpreted regarding site protection or soil stability from reports in which the many rangeland sites of a region are lumped together and millions of acres in excellent, good, fair and poor condition (or climax, high seral, etc. stages) are enumerated. This is further exacerbated by the inconsistent use of terminology throughout the profession.

Recognizing that these problems are hampering effective communication and decision making in the management of rangelands the Society for Range Management Board of Directors established the Task Group on Unity in Concepts and Terminology (Table 1). The principal task was to develop solutions to the problems related to the evaluation, interpretation and reporting of rangeland condition and trend information and seek, through the Society for Range Management, commonality and unity in terminology and methodology. The purpose of this article is to provide an update on the findings of this Task Group and report those items the SRM's Board of Directors has approved as standards and guidelines for the profession.

The deliberations of the Task Group were open discussions involving membership from throughout the SRM and with the input from private and public rangeland managers, researchers and administrators. The membership of SRM was kept abreast by notices in the Trail Boss, symposia at annual meetings and by keeping the SRM Board of Directors abreast of all discussions. The Task Group used the consensus approach to all decisions made and fostered input at every stage of the discussions.

The Basic Resource

The most important and most basic physical resource on rangelands is the soil. If excessive soil is lost, the potential of the site is changed. The site is no longer capable of supporting the same variety of plant communities it once produced. Avoidance of accelerated erosion due to land management should be the underlying goal. We define "accelerated erosion" as when the loss of soil is significantly greater than the "normal" or "geologic" erosion for the site. Erosion is, however, extremely difficult—some would argue impossible—to measure. Since the plant community is integral to protection of the soil, has characteristics that can be measured, and is the factor most readily managed and manipulated on a site, the Task Group agreed that it should be a primary focus for determinations of site protection.
Evaluation Approach
The Task Group developed an approach to the assessment of rangelands which concentrates on the dual objectives of land managers to meet management objectives while conserving long-term environmental options through site protection. The result of our efforts is a conceptual framework for evaluating the status of rangelands. It is just that, a framework, and not a finished product. We can, however, begin to use this framework with current knowledge, and continue to refine the system as our knowledge expands through research and experience. This approach has the following guidelines:

Guideline #1: Ecological Sites
Rangelands are to be classified into ecological sites as a basis for rangeland inventories, assessments, and extrapolation of research and management experience.

The capacity of rangeland to produce vegetation is determined primarily by climate and soil. Given a general climatic pattern, soil properties reflect the integrated effects of topography, geology, and geomorphic and land use history, thus determining the ability of the land to supply moisture and nutrients to plants. An ecological site is defined as a kind of land with specific physical characteristics which differs from other kinds of land in its ability to produce distinctive kinds and amounts of vegetation and in its response to management. This is an appropriate land classification regardless of the type of land being considered (e.g. grassland, woodland, forestland, even cropland) and it is not restricted to evaluation of rangeland for any particular use. All rangelands, both public and private, should be classified by ecological sites.

Recognition of land types which differ significantly in their ability to produce vegetation, either kind or amount, is fundamental for predicting response of vegetation to nature's forces or to management practices and for extrapolating research and management experience to the landscape. Differences in any of the physical or cultural factors significant to management would constitute the basis for recognizing a different ecological site.

Guideline #2: Site Conservation Threshold (SCT) and Site Conservation Rating (SCR)
Vegetation communities should be evaluated as to their

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**Fig. 2.** Multiple plant communities identified for a hypothetical, ecological site are illustrated both above (1-V) and below (A and B) the site conservation threshold. Arrows indicate possible transitions among plant communities due to natural processes or management.
effectiveness in protecting a site from accelerated erosion. The point at which erosion appreciably accelerates due to management influences would be called the Site Conservation Threshold (SCT) (Figure 1). For example, as ground cover decreases on an ecological site (Figure 1), erosion increases. At some cover value the rate of erosion accelerates. This point is the SCT. There will be some uncertainty in the estimation of SCT for an ecological site, thus the gray zone around SCT (Figure 1). The SCT may be estimated using one or more parameters of the vegetation (for example, canopy cover, basal area, density, lifeform, species, biomass) as well as soil surface characteristics. The SCT, and the parameters used to measure it, would be very specific to the ecological site.

Vegetation occurring on a particular site would be evaluated in relation to the criteria for the Site Conservation Threshold for that site. Those situations where the community meets the criteria for protection of the site would be assigned a Site Conservation Rating (SCR) of “sustainable”; all others would be “unsustainable.” Ecological sites having an SCR of unsustainable may not have necessarily suffered a significant loss in site potential. This potential will be lost eventually, however, if the kind, amount or pattern of vegetation is not altered. If continued long enough, the site potential will be changed permanently and sufficiently to require the description of a new ecological site.

**Guideline #3: Desired Plant Communities (DPC)**

An ecological site may support several different plant community types at different locations or times (Figure 2). These plant communities may differ in species composition, life forms, or other attributes. Vegetation communities which have a Site Conservation Rating (SCR) exceeding the Site Conservation Threshold (SCT) (Figure 2) are considered to adequately protect the site from accelerated erosion, even though the rates of erosion may differ. Plant communities with an SCR of sustainable may be selected as the management goal Desired Plant Community (DPC) for that site based solely on management objectives, not on erosion rate. Characteristics of the community are determined by the nature of the site, the land use history, “natural” factors such as fire, drought, flood, wildlife, etc., and their interactions. Community structure may remain fairly stable over time or it may change in the direction of another community type due to management or natural processes.

Communities capable of occurring on a site which have site protection above the threshold Site Conservation Threshold (SCT) are acceptable management goals because any of these communities will provide sufficient site protection from accelerated erosion to maintain future management options. The choice of community type as a management goal on any particular site, i.e. the “desired plant community,” depends on the goals of the landowner or manager. The SRM defines Desired Plant Community (DPC) as “the plant community, of the several that may occupy a site, that has been identified through a management plan to best meet the plan’s objectives for the site.”

Any plant community which provides site protection in excess of the site conservation threshold Site Conservation Threshold (SCT) could be chosen as the Desired Plant Community (DPC) and management would aim to alter current vegetation in that direction (Figure 2). Desired Plant Communities should be based on actual vegetation which has been observed to exist on particular ecological sites.

Plant communities which provide site protection below the (SCT) should not be selected as (DPCs). By definition, these plant communities are undesirable since they will not protect the site from accelerated erosion. Through management these plant communities may be converted to a plant community above the (SCT), but if soil loss is sufficient the former potential may be unattainable.

Management objectives should be defined in terms of a Desired Plant Community for each ecological site, and the Vegetation Management Status be reported in terms of similarity to and trend toward or away from the selected DPC. Management has basically two objectives, to conserve to the extent practicable the long-term potential of the site to produce vegetation, and to produce in the shorter term those combinations of goods and services desired from the land. The desired plant community should meet both of these objectives.

The following series of photographs further demonstrate these concepts.

These photographs illustrate a series of plant communities providing various levels of soil protection. Plant communities photographed are on the same ecological (range) sites within each set. The sites are located in Arizona (AZ1–8) and Oklahoma (OK1–8).

**Arizona Set — Arizona Loamy Upland Ecological Site (12-16-inch precipitation)**

AZ-1. Native short grass. This plant community is characterized by a continuous cover of short gramas, in this case blue grama. Black grama, sprucetop, curley lewiss and low shrubs like false mesquite and range ratany may also be present. Soil protection is adequate to maintain the site. However, if basal cover falls below 5 or 6 percent on 2 to 3 percent slopes this ecological site is no longer stable and accelerated erosion may occur. Drought, fire or heavy grazing can push basal cover below the stable levels when short-grass communities exist on these sites.
AZ-2. Mesquite.-Lehmann lovegrass. These communities generally developed from mesquite-native grasslands either through natural invasion or brush clearing and seeding. Soil protection is above the SCT.

AZ-3. Mesquite-halfshrub/cacti. In this photograph, mesquite canopy is less than 10 percent and the understory is primarily burroweed with an occasional native midgrass or Lehmann lovegrass plant. The site is not stable; soil protection is below the SCT.

AZ-4. Native mid-grass. This is a mixed stand of native perennial grasses including sideoats grama, plains lovegrass, cane beardgrass and blue grama. Scattered mesquites occur in the background. Soil protection is above the SCT.

AZ-5. Invading mesquite with very little groundcover in interspaces. Soil protection is below the SCT but the potential productivity of the site remains good. However, improved grazing management may not be enough to bring this location above the SCT.
Oklahoma Set — Oklahoma Loamy Prairie Ecological Site

AZ-6. Grass stand composed primarily of black grama with overstory of mesquite. Soil protection is above the SCT.

AZ-7. Heavy infestation of mesquite with very little cover in the interspaces. Rate of soil loss is high, well below the SCT.

AZ-8. A nearly pure stand of Lehmann lovegrass. There is a good stand of false mesquite obscured by the grass. The area was not cleared of brush or seed; the lovegrass invaded naturally. Soil protection is above the SCT.

OK-1. This "tall grass" plant community is dominated by tall and mid grasses. Little bluestem, sand bluestem, switchgrass and Indian grass are the dominant species. A mixture of legumes and forbs, catclaw sensitivebrier, Illinois bundleflower, Engleman daisy, Missouri goldenrod and black sampson are present in this community. There is an understory of blue grama, sideoats grama, and buffalograss. This site is stable, the soil is protected and it is above the SCT.
OK-2. The "little bluestem" plant community is dominated primarily by little bluestem and sideoats grama. Blue grama and buffalograss comprise a significant portion of the understory. Forb population includes scarlet globemallow, heath aster and wild alfalfa, among others. The soil is protected by adequate ground cover and this community is above the SCT.

OK-3. The "little bluestem-cedar" plant community is similar to that described in Figure OK-2. The significant differences is that eastern red cedar has invaded this community and now covers approximately 10 to 15% of the site. Small cedar seedlings indicate that this infestation will increase rapidly. This site is stable, the soil is protected, and it remains above the SCT.

OK-4. This is a "reestablished native rangeland" plant community on previously farmed Woodward soil. Codominates are little bluestem and sideoats grama. Sand bluestem, Indian grass and switchgrass are also present as well as an understory of blue grama. Principle forbs are western ragweed, heath aster, and scarlet globe mallow. The Woodward soil is somewhat shallow because of past erosion. Presently the site is stable, the soil is protected, and it is above the SCT.

OK-5. This "blue grama" plant community is similar to Figure OK-4. Blue grama dominates the community with sideoats, silver bluestem and annual brome as a smaller component of the vegetation. Western ragweed and common broomweed are common forbs present. Ground cover remains adequate to prevent erosion and the community is above the SCT.
OK-6. The monoculture on this "introduced grass" site is an Old World bluestem (Bothriochloa ischaemum). This Woodward soil suffered some erosion while farmed, but remains identifiable as such. The stand of improved grass, however, adequately protects the soil and this "community" is above the SCT.

OK-7. This loamy prairie ecological site has a St. Paul soil. The "blue grama-forb" plant community is dominated by blue grama and western ragweed. Sideoats grama dominates the down slope area. Other grasses found include buffalograss, hairy grama and annual brome. Typical forbs are heath aster, groundcherry, and wild alfalfa. This site is not stable and accelerated erosion occurs. The blue grama on the upslopes protects the soil to some degree, but rapid movement of water across this "slick" upper portion brings excess water to the lower slopes causing sloughing of the soil and accelerated erosion where sideoats grama dominates. Consequently, this community is below the SCT.

OK-8. This field, planted to annual wheat, consists of a Woodward soil. If conservation compliance measures are fully met, this soil is protected and it could be replanted to a plant community similar to the original. At present, the wheat plant is heavily grazed and if this were to continue, both wind and water erosion could be significant. Depending on management, this may or may not be protected.

The Oklahoma photographs were taken by James H. Shearhart and the Arizona slides were taken by George Ruyle, Lamar Smith and Susan Watters.