Indicators for Maintenance of Productive Capacity on Rangelands

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Abstract

This paper is a progress report outlining efforts of the Sustainable Rangeland Roundtable to develop standardized indicators for Maintenance of Productive Capacity for monitoring and assessing the sustainability of rangeland ecosystems. Conceptual challenges include identifying and defining indicators to include productive capacities for rangelands. To date, seven indicators have been identified to cover total acreage, livestock, wildlife, invasive plants, non-forage products, and biomass production. The current developmental status of these indicators is reviewed. Future work will concentrate on collaboration with other criteria groups to ensure all aspects are covered without duplication and assessing the viability of the indicator set.

Introduction

Sustainability has been broadly defined as providing goods and services for current and future generations. Rangeland has the capacity to provide the current generation with a wide variety of goods and services depending on the mix desired by society at any particular time. Maintenance of productive capacity then implies that future generations will also be able to obtain their desired mix of market and non-market goods from rangelands. Sustaining productive capacity requires that estimates of this criterion consider temporal and spatial scale issues for a wide variety of goods and services. It is important to understand that productive capacity includes more than forage based products such as livestock. It must include non-consumptive goods and services, for example, wildlife habitat and open space.

One of the difficulties that arises when evaluating the productive capacity of rangeland is the question, "Capacity for what?" One rangeland area can produce a wide variety of goods and services. Some of which are mutually exclusive while others are compatible to some degree. Seldom is there a linear exchange ratio between two different uses. Grazing of multiple species illustrates this concept.

The Productive Capacity Criterion Group has also discussed tradeoffs between non-productive and productive capacities. When the use of a given rangeland area changes in some permanent way, the question asked is, "Has the productive capacity changed as well?" For example, if the creation of a new wilderness area results in the elimination of domestic livestock grazing, has the productive capacity to produce livestock from that land changed? At the same time, has the productive capacity to provide recreational value increased? These are representative of the difficult questions being considered by the group.

This criterion group also raised and discussed the following questions:

- What are the important products, goods, and services that are being produced and which ones can be monitored?
- What products, goods, and services will potentially be desired and produced for future generations?
- How can issues of fragility and resiliency be considered?
- Is it important to assess the cost and benefits to society for producing these products?
- Should fire or other natural processes be monitored to account for change in productive capacity?

Indicators

Seven indicators have been identified to capture the diversity of the productive capacities of rangeland (Table 1). Some of these indicators will require close linkages with other criteria groups to prevent duplication. It will be especially important to coordinate with the Ecological Health and Diversity Criterion

Table 1. Indicators for productive capacity of rangelands.

Indicator	What it tells you
Total acres of rangeland within the context of physiographic regions.	Indicates major shifts in land use that disrupts the production of goods and services from rangeland.
Percent of available rangeland that Is grazed by livestock.	Provides information on land use patterns on rangeland that may shift production from one commodity to another use.
Number of domestic livestock on rangeland by physiographic region. (Cattle, sheep, goats, horses, bison, wild horses?? and burros??)	A direct measure of a consumptive use of rangeland forage.
Number of wildlife harvested by physiographic region. (Need number of hunters and success ratios)	An indirect measure of wildlife numbers that derive some proportion of their food and habitat requirements from rangeland.
Acres of invasive and noxious plants by physiographic region.	A measure of the extent to which rangeland productive capacity is altered through changes in the composition of plant species.
Annual removal of non-forage products by physiographic region.	An estimate of the wide variety of other consumptive uses of rangeland.
Annual above ground biomass production by physiographic region	A measure that integrates the biotic and abiotic factors that determine the annual production from rangeland.

Group and the Socio-Economic Criterion Group. A brief description of the seven indicators selected for the Maintenance of the Productive Capacity on Rangelands criterion follow.

Indicator 1. Total acres of rangeland within the context of physiographic regions

This indicator provides the base information of how much rangeland there is. It has also been identified by the Ecological Health and Diversity Criterion Group. Total acres of rangeland is shown as the first indicator because of the importance of this indicator to the development of indicators relating to productive capacity.

Indicator 2. Percent rangeland used to produce livestock

This indicator tracks the ratio of net area of rangeland that is used to produce forage for livestock to the total area that is classified as rangeland within the context of physiographic regions (Indicator 1). Our group initially thought that ecological state or condition would be important as well, but the data required to do this was thought to be too difficult to obtain at the regional and national scale. Using this indicator for market and non-market goods other than domestic livestock was also considered and thought to not be feasible at this time. A concern was that the distribution of commodities and their extraction/use is not equally distributed; therefore, we must account for potential trends in disproportionate use.

Indicator 3. Number of domestic livestock (i.e., cattle, sheep, goat, horses) on rangeland by physiographic region

It is recognized that livestock do not spend their entire life in one area and that this indicator would require careful evaluation and use with other indicators. The number of head was used rather than using AUM's because the total number of head would be more easily understood by the general public. Conversion to AUM's could be accomplished for other analyses if required. After considerable discussion, it was decided that the number of feral horses and burros would not be included as livestock because their importance tends to be localized and not appropriate for use as a national indicator.

Indicator 4. Number of wildlife harvested by physiographic region

Similarly to issues faced with livestock in Indicator 3, most wildlife species do not spend their entire life cycle on rangeland and determining the actual time spent on rangeland would be an impossible task. A complete inventory of major wildlife species (e.g., elk, deer, pronghorn antelope, sage grouse) would be desirable. However, the availability of this information is highly variable from state to state. Most states collect data on the number of wildlife harvested, hunter success ratios, and the number of permits/licenses issued. These numbers might be used as an indicator of the long-term trends in wildlife numbers on rangeland.

Indicator 5. Acres of invasive and noxious plants by physiographic region

Changes in vegetation can impact the productive capacity of rangeland. This is especially true when very large areas are invaded and dominated by invasive and noxious plants. Their dominance can change the capacity for some uses of these rangelands. Most states inventory and track invasive plants at the county level. This indicator may overlap

with the Ecosystem Health and Diversity Criteria Group.

Indicator 6. Annual removal of non-forage products by physiographic type

Traditional non-forage products from rangelands include seeds, medicinal plants, and firewood. More recently, landscape materials have been harvested from arid and semi-arid rangelands. Individual products are often important locally but the net effect of their removal may not be important regionally and nationally. One of the strongest messages that has come from our discussions thus far has been that productive capacity should consider the entire mix of market and non-market goods from rangelands. Details on how this will be done still remain to be worked out.

Indicator 7. Annual aboveground biomass production by physiographic type

Standing crop has traditionally been a measure of productivity. This indicator seems to be understood by the general public and has the potential to be monitored remotely. The working group is exploring options to develop this indicator.

Correlation with the Roundtable on Sustainable Forests Criteria and Indicators

Criterion number two, developed by the Roundtable on Sustainable Forests (RSF), *maintenance of productive capacity of forest ecosystems*, is the counterpart to this criterion. Five indicators were developed for forestlands as follows:

- Area of forestland and net area of forestland available for timber production.
- Total growing stock of both merchantable and non-merchantable tree species on forestland available for timber production.
- The area and growing stock of plantations of native and exotic species.
- Annual removal of wood products compared to the volume determined to be sustainable.
- Annual removal of non-timber forest products (e.g., fur bearers, berries, mushrooms, game), compared to the level determined to be sustainable.

The SRR Productive Capacity Criteria Group evaluated these RSF criteria and retained and developed relevant aspects into the seven indicators.

Challenges And Opportunities

There are two significant challenges and opportunities confronting the criterion group. The first challenge will be to maintain the momentum gained in the most recent SRR meeting held in January 2002. Work in this group began with a fury of ideas and enthusiasm during the first two meetings (April and June, 2001). However, progress slowed at the August and November 2001 meetings as the group recycled a myriad of new ideas and surfaced some new ideas. In the latest meeting, significant progress was made.

The second challenge and/or opportunity will be to link the work of this criterion group with the other groups. Essentially all of the proposed indicators have a significant linkage with other criteria or draw upon information that will be obtained from indicators developed to address other criteria. Developing clear and smooth connections between groups without duplicating efforts will require careful collaboration and an overall perspective of the criterion as a body.

Conclusions and Future Work

Seven indicators have been developed thus far. By comparing the current list of indicators with minutes taken at all five SRR meetings and with indicators developed in the RSF, the Productive Capacity Criterion Group found that these seven indicators address all issues raised to date. The next tasks will be to develop linkages with other criterion groups and to assess the feasibility of using these indicators.