

SRR UPDATE

Sustainable Rangelands Roundtable

Criteria and Indicators for Standardized Inventory, Monitoring, and Reporting

Conservation and sustainable management of our natural resource base is critical. Twelve governments, including the United States, agreed to the Santiago Declaration and are participating in the Working Group on Criteria and Indicators (C&I) for the Conservation and Sustainable Management of Temperate and Boreal Forests. A similar effort is underway for rangelands in the United States.

Rangelands/grasslands comprise approximately 70% of the earth's land surface. Without an effective way to accurately monitor social, ecological and economic aspects of rangeland sustainability, it is difficult to measure progress toward sustainability or movement in the opposite direction. Consistent standardized baseline information is needed to provide a common language for assessment and planning that will foster effective decision making.

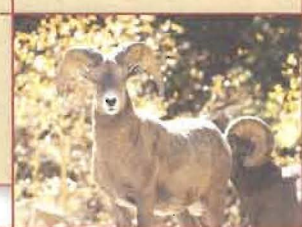
The Sustainable Rangelands Roundtable formally began work in 2001. Participants include rangeland scientists and managers, ecologists, sociologists, economists, policy and legal experts, environmental advocates, agency staff, and industry representatives. The Roundtable has had representatives from more than 75 organizations. The roundtable focuses on four main goals:

- Promote Paradigms and Practices for Sustainable Rangeland Assessment and Management.
- Facilitate the Development of a Multi-Agency Assessment of the Status and Trends of the Ecological, Social, and Economic Aspects of Rangeland Sustainability.
- Promote Integrated Ecological, Economic, and Social Research for Rangeland Sustainability.
- Effectively Communicate and Coordinate with Stakeholders and Others Interested and Involved in Sustainable Rangeland Management.

Funding has been provided by Colorado State University, Agricultural Research Service, Forest Service, Natural Resources Conservation Service, Bureau of Land Management, and US Geological Survey. Though funding is important, the volunteer time and effort of diverse participants has been the most valuable contribution to SRR. Through their efforts a suggested set of criteria and indicators was released as the group's First Approximation Report in 2003. This report identified 64 indicators categorized under 5 criteria. In 2005 a subset of these indicators was identified as core indicators, providing a more manageable starting point for coordinated national rangeland assessment efforts.

The 5 criteria are summarized as follows:

- 1.** Conservation and maintenance of soil and water resources on rangelands.
- 2.** Conservation and maintenance of plant and animal resources on rangelands.
- 3.** Maintenance of productive capacity on rangelands.
- 4.** Maintenance and enhancement of multiple social & economic benefits to present & future generations.
- 5.** Legal, institutional, and economic frameworks for rangeland conservation and sustainable management.



Conceptual Framework

A Tool for Selecting & Understanding Indicators

Evaluating the validity and application of indicators on rangelands is critical to the successful implementation of a comprehensive National program for rangeland sustainable management. The challenge faced is one not readily addressed: the integration of bio-physical indicators with socio-economic indicators. How do they affect one another? Are assumptions of interrelatedness valid and are the indicator sets developed by the Sustainable Rangelands Roundtable (SRR) consistent with those assumptions? These and other similar questions are the driving force behind the SRR's development of a conceptual framework to evaluate indicators selected for assessing sustainability on the Nation's rangelands.

Reasons for a Conceptual Framework

The Roundtable developed a conceptual framework with which to review the indicators it had selected. This approach was chosen to assure that the suite of indicators developed would adequately address the complexity of a rangeland resource system. The conceptual framework was also intended to provide a basis for understanding how the various conditions and processes interact with each other.

An important feature of the conceptual framework is to provide a basis from which an integrated "story" about the sustainability of our rangeland systems can be told using data from the selected indicators. It is essential to realize that the SRR Conceptual Framework is not a predictive or mathematical model; instead, it is a systems approach for evaluating the validity of the SRR indicator set and for explaining what the indicators mean.

In developing its conceptual framework the SRR faced the challenge of depicting how indicators for five quite different criteria can be combined to give an integrated understanding of the rangeland system. To meet this challenge, the SRR drew upon the knowledge of range ecologists, economists and sociologists. Each discipline contributed knowledge of its own system. The resulting conceptual framework shows the relationships among bio-physical and socio-economic indicators at increasing levels of detail.

State/Status Boxes

Figure 1 depicts that basic layout of the SRR conceptual framework. Time (depicted on the left of the framework) is illustrated across "states," T⁰ representing the starting point of an assessment program, T¹ representing the next point in time that the

assessment takes place. The right side of the framework indicates the purpose of assessment and represents the desire to evaluate progress towards or away from a "sustainable" rangeland system.

SRR Conceptual Framework

It is important to keep in mind that "sustainability" is an abstract goal that is influenced by the values of stakeholders and society in general. The ability to classify a system as "sustainable" should not be the goal in using the criteria and indicators; instead, we should use them in a way that will build our understanding of the changes occurring in rangeland conditions and their causes so that we can change management practices as needed to sustain the values and outputs people desire.

Within the body of the framework, there are four "state" or "status" boxes at the top separated between the human and biophysical subsystems. The biophysical subsystem is divided into two states; Current Biophysical Conditions & Natural Resources Capital. Similarly, the human subsystem is divided into two states; Social Capacity & Economic Capital and Current Human Condition. These are described below:

Environmental and Human Subsystems

The environmental subsystem is divided into two categories; 1) current biophysical condition and 2) natural resource capital. The current biophysical condition state illustrates the full spectrum of biological and physical characteristics of rangeland systems including plants, animals, soil and water. Natural resource capital incorporates the "stock" of resources and the productive capacities within the biophysical environment that provide the goods and services used within the human subsystem.

The social capacity and economic capital state is comprised of the "traditional" economic notion of capital – all assets and liabilities present in the economy. Also included are the concepts of social capital or capacity representing the potential opportunities afforded by the way society exists. Current human condition encompasses the current status of people and society and human well-being.

Biophysical/Socio-Economic Processes Boxes

Between each time period of the framework, SRR recognized that many processes would be taking place in both the environmental and human subsystems. These processes are illustrated with the large arrows flowing through the time step to the following

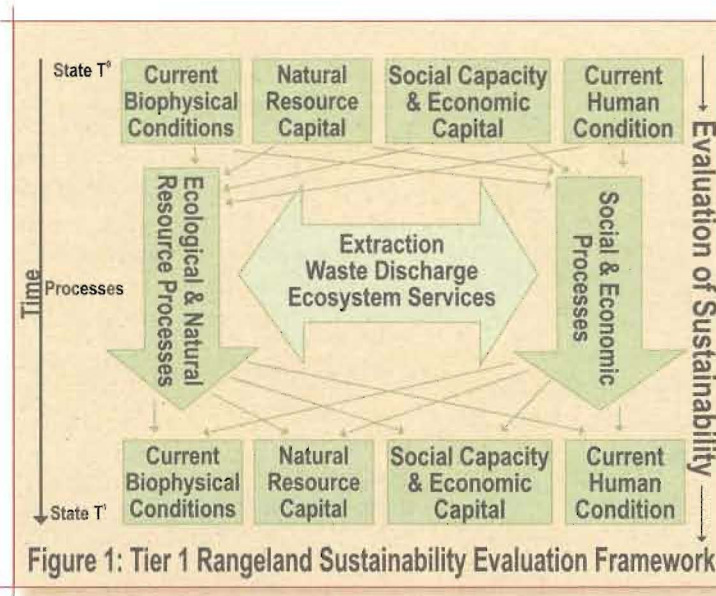


Figure 1: Tier 1 Rangeland Sustainability Evaluation Framework



assessment time. Members of the Conceptual Modeling Group (CMG) of the SRR further recognized that these processes do not take place independently and that there are important interactions between environmental and human subsystems, illustrated by the double arrow across the two subsystems. The actions and interactions of the processes between time steps lead to the following states/status of the major categories.

Refining the Conceptual Framework

For the evaluation and testing of validity of indicators, the SRR recognized the need to provide a refinement of the framework incorporating more detail into the processes component of the framework. Figure 2 illustrates the current status of Tier 2 of the SRR Conceptual Framework.

Within Tier 2, the CMG developed a more detailed view of both the environmental and human subsystem processes. In doing so, we have presented a format for validating the efficacy and potential integration of multiple processes that would be occurring between time steps. This representation is not intended to be an exhaustive list of all processes occurring; but, instead is to illustrate major processes identified by experts within each of the subsystems.

The Tier 2 framework also depicts the points where interactions between environmental and human subsystems occur. The process boxes including ecosystem services, extraction, waste discharge and use of ecosystem services provide a mechanism for understanding how the two subsystems interact and a means to illustrate the abilities of one subsystem to influence the processes of the other subsystem.

Illustrating the Concept of Changes from One Time Period to the Next

Reality dictates that constant, real-time assessment of rangeland systems is not practical. It is understood that the assessment of indicators and subsequent development of a National Report on Rangelands would take place within a set time frame (eg. every 10 years). This has been represented by the treatment of changes over time within the conceptual framework. Figure 3 illustrates this and defines what types of assessments might be made over a series of time steps using the indicators provided by the SRR.

Over time, the use of the proposed approach within the conceptual framework provided would result in a development of trends associated with individual indicators. Ultimately, by evaluation of suites of indicators depending on issues of interest, land managers and interested parties would be able to make determinations of the direction of the rangeland system towards or away from "sustainable" management.

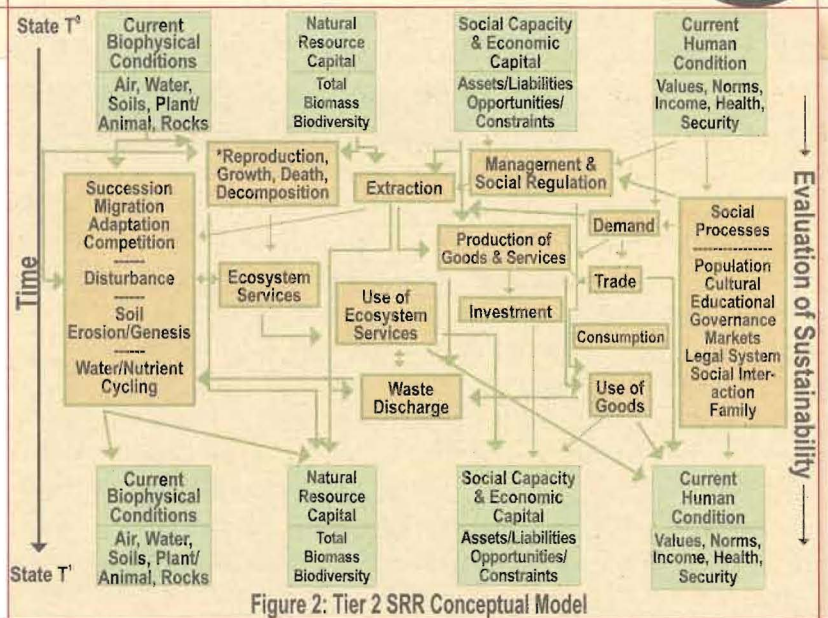


Figure 2: Tier 2 SRR Conceptual Model

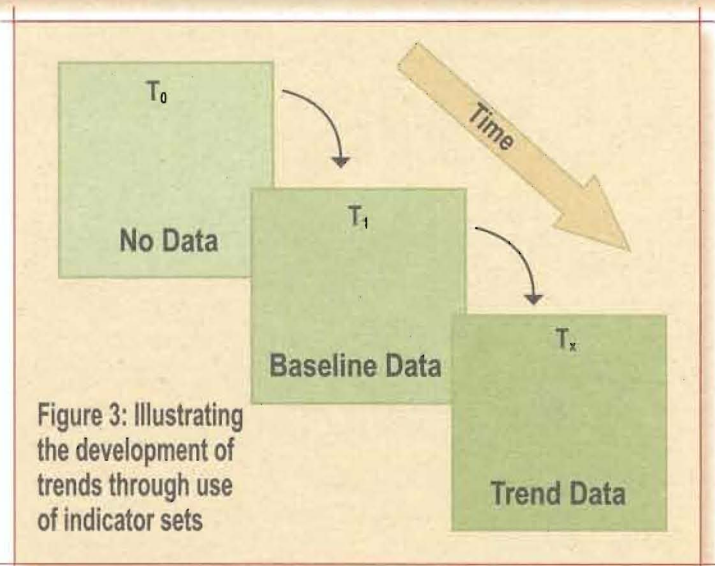


Figure 3: Illustrating the development of trends through use of indicator sets

Conclusions

The SRR is "testing" its set of indicators by identifying elements of the framework to which each indicator applies. SRR is also using the framework to develop stories regarding specific issues associated with rangelands such as the spread of an invasive species and impacts of fire and drought. To this point, the members of the CMG feel that we have a relevant set of indicators that are meeting the assumptions first identified in the development of criteria for assessing sustainability on rangelands. In essence, at this time, we feel that we have a "good" set of indicators.

CMG members are continuing to refine Tier 2 of the model and test various rangeland "issues" within the model. Next steps include the development of a Tier 3 model that will further the ability to examine how indicators are functioning and how they integrate across the environmental and human subsystems.

Integrate Social and Economic Indicators with Ecological Indicators for Rangeland Monitoring?

Who would want to do that?

Ecological systems (such as watersheds, prairies, and forests) and processes (such as reproduction, growth, death, decomposition, succession, migration, adaptation, water cycles, nutrient cycles, carbon cycles, etc.) provide the biological interactions underlying ecosystem health and viability. Social and economic infrastructures and processes (such as demand, investment, depreciation, management, social regulation, production, consumption, social interaction, institutional processes, etc.) provide the framework or context in which rangeland use and management occurs, and in which rangeland health improves or deteriorates. All these systems and processes interact and feed back on each other to change stocks of natural and human capital and conditions over time.

An integrated conceptual framework has been developed to explicitly recognize and highlight that ecological and natural resource processes affect and are affected by social and economic processes, capacities, and capitals. An example of such effects is extractions from rangelands that provide goods, ultimately for human use. Forage is extracted by livestock and wildlife. Various plants are extracted from rangeland ecosystems for herbal and medicinal uses, among others. Water is extracted from rangeland ecosystems for irrigation and human consumption. Such extracted products are demanded by people and enter into the production of goods and services, supporting jobs and lifestyles among other things. They are used, consumed or traded, and contribute to social capacity, economic capital, and to human well-being (both of individuals and of communities that depend on rangelands). As part of the extraction process, biomass is removed affecting the stock of natural resource capital. Byproducts of extraction, extraction processes, and the resulting production processes affect biophysical conditions through such mechanisms as generation of waste products, soil erosion, succession of species, etc. These effects are driven largely by economic demands for goods and services, fueled by

underlying preferences and social norms and expectations.

Beyond those relatively straightforward extractions from rangeland ecosystems are extractions of habitat and rangeland itself. Increasing and migrating human populations encroach on rangeland. Use changes from grazing and open space to residential development and subdivision resulting in fragmentation of habitat. Basic changes occur in the composition of species as development takes place and landscaping replaces many of the native plants, exotic and invasive species might be introduced and spread, and native wildlife species might become pests and nuisances leading to their removal from parts of the ecosystem, among other effects. These effects are largely driven by population processes and by social norms and preferences for lifestyles, balanced by management and social regulation.

Likewise, social and economic processes affect and are affected by biophysical conditions and natural resource capital, and by ecological and natural resource processes. Ecosystem services refer to a wide range of conditions and processes through which natural ecosystems, and the species that are part of them, help sustain and fulfill human life. These ecosystem services are used by humans, whether they recognize it or not, and contribute to human wellbeing. Human use of rangelands and rangeland ecosystems can profoundly affect the extent and quality of ecosystem services produced by rangelands. Human population processes can affect the amount and integrity of rangelands available to produce ecosystem services, which over time affects human well-being.

Indicators are intended to provide measures of key variables that will inform and facilitate monitoring and periodic assessment of the condition and functioning of rangeland ecosystems over time. Because human actions and influences can affect the extent and condition of rangelands, it is important to monitor human use of rangelands and the human influences on rangeland condition. Such uses and influences are, in turn, driven by underlying social and economic conditions and processes. Monitoring those driving conditions and processes will allow decision makers insight into how and why impacts on rangelands occur, and allow the possibility of proactive management to prevent or mitigate rangeland degradation or to enhance rangeland health and sustainability. It is also important to understand how changes in rangeland ecosystems affect the well-being of communities that depend on them.

Picture credits: USDA-NRCS, USDI-NPS, USDA-ARS, D. Child, K. Obele, J. Garrett

