



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 well-being. 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.