

CHAPTER 6

Criterion V: Legal, Institutional, and Economic Framework for Rangeland Conservation and Sustainable Management

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Abstract: Laws, institutions, and economic policies play a large role in determining the sustainability of rangelands. They provide the basic framework from which many lasting decisions about rangeland management are made. The SRR has identified 10 primary indicators to assess how this framework influences the long-term health and productivity of rangeland in this country. The indicators within this criterion are broadly defined and examine the legal, institutional, and economic framework of rangeland conservation on a large scale. They can, therefore, be measured in multiple ways.

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Introduction

The legal, institutional, and economic framework for rangeland conservation and sustainable management in the United States can be assessed in many different ways. Indicators associated with this criterion can be numerous and detailed, such as were developed by the Montreal Process, or broadly defined and fewer in number, as is done in this report. The Montreal Process criterion entitled “Legal, Institutional, and Economic Framework for Forest Conservation and Sustainable Management” contains 20 of the 67 indicators of sustainable forest management, or 30 percent of the total (USDA Forest Service 2004).

The Sustainable Rangelands Roundtable (SRR) has divided the Legal, Institutional, and Economic Framework for Rangeland Conservation and Sustainable Management criterion into 10 broad indicators that constitute 16 percent of the 64 indicators of sustainable rangeland management, each of which is described in terms of primary data categories (Appendix 6-A). These indicators deal with land law and property rights, public participation in public land-use planning, involvement of institutions and organizations in rangeland sustainable management, economic policies, education and technical assistance, the nature of land management programs, land planning and assessments, protection of special values, monitoring rangelands and rangeland communities, and research and development.

None of the 10 legal-institutional-economic framework indicators are expressed in terms that routinely lend themselves well to specific measures that can be monitored. Normally, indicators use qualitative or quantitative methods to measure anthropogenic impacts over time on the environment, economy, and human well-being. Broadly defined indicators tend to be measurable in multiple ways, so employing them in a monitoring program first requires defining measures that provide specific details about the precise variable being inventoried (Wright et al. 2002). An alternative approach is to conduct research studies on the status and trends one or more of the components of an indicator, and use publications resulting from such studies to assess how they are or are not contributing to rangeland sustainability. A number of studies have reviewed how U.S. property rights have affected sustainable management, for example Anderson and Hill (1975) and Eaton et al. (2007).

Indicator 55. Land law and property rights.

This indicator describes the extent to which laws, regulations, and guidelines clarify property rights and land tenure arrangements on rangelands. It also evaluates how these laws recognize customary and traditional rights of indigenous people on rangelands, and whether these laws provide means of resolving property disputes by due process.

Underlying the elements of this indicator is a set of assumptions:

1. Stable property rights are essential for sustainable rangeland management.
2. Property rights reflect a society's values.
3. Property rights are evolutionary.
4. Property rights are determined by means of due process.

When the United States became a nation, the significance of protecting private property was prominent in the Founding Fathers' understanding of the rights of citizens versus the powers of government. The resulting principles that bolster the U.S. legal system rest largely on the value of individual liberties, limits on government power, and the right of people to property. The Fifth Amendment to the U.S. Constitution reinforces the balance between private and public

property rights by providing that no person shall be deprived of life, liberty, or property without due process of law; nor shall private property be taken for public use without just compensation. Recently, the concept of “public use” has been extended by the courts to a broader definition than was commonly used during the 300 years after the Fifth Amendment was ratified in 1791 (Lewis 2004).

The “police power” of the government to regulate private property is exercised in a manner consistent with the Constitution and applicable laws. Environmental and zoning regulations are two examples of police powers that limit the rights of landowners. Property owners also are not able to utilize property in a manner that endangers or damages the lives or property of others. As society’s values and norms slowly change over time, the balance of government power and private property rights is repeatedly subject to changing legal interpretation.

The variety of forms of property ownership, such as corporate ownership, property as collateral, intellectual property, liens, and easements, complicate the notion of property rights. Water is a special form of property on western U.S. rangelands. Western states follow the doctrine of appropriation in which water is appropriated for “beneficial” uses (Schorr 2005). During drought, when water is scarce, those who had earliest appropriated water from a particular source have superior rights over more recent (junior) right-holders. Although water cannot be “owned,” water rights can be bought and sold by separate deed, through stock transfers, or with the sale of land.

Property rights of American Indians are considered a critical component of this indicator. The United Nations Permanent Forum on Indigenous Issues has affirmed that indigenous peoples have the same rights as every other person in the world, and that respect for indigenous peoples’ knowledge and traditional practices contributes to the sustainable management of all countries (United Nations Economic and Social Council 2002).

Tribal sovereignty is more than an abstract legal concept; it is closely tied to the military, social, and economic development of the United States. Under the Constitution, Congress has power to regulate commerce with American Indian tribes, and it has used this means to recognize and limit tribal sovereignty. Presidential authority over tribal sovereignty rested in the ability of the United States to enter into treaties – at least until 1871, when Congress passed a law that prohibited the United States from entering any additional treaties with tribes. Until that time, 367 treaties between the federal government and American Indian tribes were ratified by the U.S. Senate. Since then, the primary mechanism for defining tribal sovereignty has been through the U.S. Supreme Court’s role of interpreting the actions of the Legislative and Executive branches of government to strike a balance between the rights of tribes and the decrees of the federal government. Earlier, in 1832, the John Marshall Court had established the principle that states cannot regulate or tax American Indian nations.

In the 19th century, the Supreme Court defined several principles related to American Indian sovereignty: 1) tribal nations possessed a limited form of sovereignty that did not allow them to interact with other nations outside the United States, 2) thus tribes were characterized as having a “trust relationship” with the United States, and 3) tribal sovereignty was subject to diminution by the United States. This trust relationship was used into the 20th century to justify federal involvement in the internal affairs of American Indian communities. For example, federal policy, as upheld by the courts, restricted the ability of tribes to control the development and use of natural resources located on tribal lands until latter parts of the 20th century.

Over the past 25 years, changes in federal legislation and case law have upheld the principle of tribal sovereignty and allowed tribes to exercise greater control over their natural resources (Cornell and Kalt 1987). The Indian Self-Determination and Education Assistance Act of 1975

gradually altered the role of the federal government, changing it from one of being a “guardian” to that of a “mentor.” As a result, primary decision-making authority over investment, marketing, pricing, and production has been taken from the Bureau of Indian Affairs and been given to individual tribes. There are approximately 300 American Indian reservations in the U.S., with lands comprising 225,000 km². A large proportion of these lands are located west of the 90th Meridian where public domain was available to provide to tribes (Sutton 1975). Thus, tribal governments collectively manage a substantial area of rangelands throughout the West, and the influence that they can have on rangeland sustainable management at local and regional scales is considerable (Appendix 6-B).

The property rights relevant to the sustainability of rangelands and other natural resources include the ability to exclude or control access to the land, and the rights to dispose, alienate, transfer, manage or manipulate, use, withdraw, consume, transform, and enjoy it.

While roughly the same concepts apply to land law and property rights governing federal, state and private lands, there are some important differences among them. First, the federal code of land and property rights law is far more complex and detailed than state codes, and state codes are usually far more complex than local codes. Second, legal mechanisms are less rigid in governing activities on state and private lands. Federal laws often speak directly to regulating grazing, oil and gas leasing, off-road vehicle use, mining, wildlife protection, or other similar activities on federal lands.

State laws governing the management of state lands are beginning to recognize the importance of sustainable management. Although Western states manage state endowment rangelands to maximize income for use by schools and other institutions, they now recognize that federal and state environmental laws apply to these lands, and thus can constrain the objective of income generation. Colorado and Arizona have changed their philosophy concerning the use of state lands so that maximizing income is no longer the only consideration. In 1996, Colorado voters amended the state constitution allowing a stewardship trust on 1/10th of the 3 million acres of state trust lands to protect “long-term productivity and sound stewardship” (Colorado Division of Wildlife 2005). The same year, Arizona established a preservation initiative whereby state lands can be reclassified for conservation and subsequently leased or sold at auction for that purpose. Municipalities can apply for state matching grants to make conservation purchases at the local level easier.

Decisions by agencies managing federal lands are strictly regulated, reviewed, and periodically revisited. On state and private lands, the laws governing rangelands tend to be less constrained and reviewed. Federal land managers cannot make a decision on how rangeland is to be managed without doing an environmental analysis under the National Environmental Policy Act (NEPA). That decision can usually be appealed to the federal courts. Federal grazing land permittees are subject to whatever management constraints are imposed by the responsible public land manager. State land manager decisions may be subject to requirements of “little NEPA” laws in some states but not in others. In general, state land managers have fewer constraints on management actions than federal land managers. The owners of private land have even fewer constraints on the management of deeded lands; these constraints usually come from federal and state water quality laws.

Until the mid-20th century, landowners historically allowed access to deeded rangelands for the local community good and for the benefit of friends and neighbors, e.g., for hunting and other recreational activities. Increasing populations, exurban development, and the changing nature of landowners have transformed the customs employed by ranchers, however, to one that generally

prohibits free rights of entry to private rangelands. This, in turn, has impacted efforts to implement cross-boundary conservation (Yung and Belsky 2007).

Is the “Land Law and Property Rights” indicator meaningful? Like most developed countries, the United States has highly developed property rights systems at federal, state, and local levels. Although the number of policies and regulations that affect the actions of property holders concerning their lands and natural resources have rapidly multiplied in recent years – leading to uncertainty about land-use restrictions, increased transaction costs, risk of civil and criminal penalties, and overlapping governmental jurisdictions – it is infeasible to consider any measure of land law and property rights as a significant indicator of sustainable rangeland management.

Legalities of land tenure and land use have historically reflected changing societal values. One might expect an indicator that monitors trends in land law and property rights to be more worthy of consideration in less developed countries. In particular, the ability to initiate land stewardship practices through conservation and land trust initiatives relies heavily upon a strong legal system of private property rights in balance with public land policy. An indicator that synthesizes laws that give landowners, including indigenous peoples, the right to use their lands for their long-term good and gives recognition to the value of ecosystem services resulting from such uses would be a valuable indicator in countries not having a strong land tenure system. It is argued that the structure of property rights governs the distribution of resources, and the distribution of resources is more important than the quantity of resources when it comes to promoting sustainable development (Sened 1997). A key element in the structure of property rights is individual property rights to land and land titling by government (Heltberg 2002).

What is the availability of datasets for the “Land Law and Property Rights” indicator?

Methods and procedures and dataset(s) of useable quality exist at the regional-national level. Most of the data are found in government documents, found in legal casebooks and databases, and from private sources. Although considerable data are available in raw form, analysis and synthesis of this information is infrequent.

Indicator 56. Public information and public participation.

This indicator measures the extent to which laws, regulations, guidelines, institutions, and organizations provide opportunities for public access to information and public participation in policy and decision-making processes relating to rangelands.

Public participation ensures that policy and programs are vetted by a cross section of the people who are affected. Public participation can foster political support for sustainable management. All steps in the management decision process – problem identification, data collection, analysis, alternative formulation, and choice – must be open to public participation. Public involvement is thus a complex, dynamic, interactive process of bargaining, negotiating, and mediation among and between constituents and managers. Engaging the public does not ensure sustainability in itself. It does, however, inform participants about the issues involved, conflicting laws, resource limitations, and what other people and groups want.

The challenge of promoting sustainable rangeland management in a way that harmonizes economics with social and environmental needs can only be met through active public participation in public issues. Goals of citizen participation include 1) furthering democratic values by recognizing the diversity of majority interests while also considering the needs of other groups, 2) educating the non-participating public by reaching out to them, 3) allowing for social change by providing for broad access to various ecosystem services emanating from rangelands, 4) obtaining citizen ownership and trust in agency goals and plans, and 5) obtaining better conditions that

reflect the objectives of sustainable rangelands.

Principle 10 of the Rio Declaration on Environment and Development states that environmental issues are best handled with the participation of all concerned citizens. “States shall facilitate and encourage public awareness and participation by making environmental information widely available” (United Nations 2000). To participate effectively, people must have access to decision-making, access to public information, and a legal standing providing access to justice. In democracies, all three components of public participation are provided through the legal system.

On private lands, the capacity for public participation is typically motivated by private self-interest because of the property rights issues discussed above. On federal lands, the legal framework for public participation is largely a result of congressional acts and rulemaking over the past 60 years. The Administrative Procedure Act of 1946 resulted from the rapid growth of federal agencies and programs during the New Deal, which had led to the increasing use of regulations. The act created a “Notice of Proposed Rulemaking” in the Federal Register and required agencies to give the public an opportunity to submit written comments about them. By the mid-1960s, seven federal legal mandates for public participation existed. By 1972, there were 81 mandates (Cortner 1995). Today, more than 20 chapters of the U.S. Code of Federal Regulations list public participation requirements for federal actions involving natural resource management (US GPO 2008). Among the acts are the Freedom of Information Act (FOIA) of 1966, NEPA (1969), the Federal Advisory Committee Act (FACA) of 1972, Forest and Rangeland Renewable Resources Planning Act (RPA) of 1974, Federal Land Policy and Management Act (FLPMA) of 1976, National Forest Management Act (NFMA) of 1976, and the Soil and Water Resources Conservation Act (RCA) of 1977.

The FOIA limits the ability of federal agencies to withhold information from the public. FOIA only applies to the executive branch, not to the judicial or legislative branches or to state and local governments. Interest in FOIA increased dramatically during the 1970s when public trust of governmental entities, such as the FBI, CIA, and the White House, declined following the Watergate scandal (Olmsted 1996). Subsequent amendments to FOIA have broadened access to federal files and, concomitantly, interest by a more extensive cross-section of American society. As a result, every federal department and agency, including all land management agencies, now has its own office and protocol for processing FOIA requests.

Virtually all states now have freedom of information acts equivalent to the federal legislation. However, each has its own requirements for requesting information, and each has its own rules and guidelines to follow. Each state legislature has also established its own categories of information that agencies may legally keep from the public. Local governmental agencies may or may not have freedom of information acts of their own; however, they are commonly subject to the same laws that apply to state agencies. Private owners of rangelands, individual or corporate, have limited obligations to provide any information about their operations on private land.

NEPA, the Forest and Rangeland Renewable Resources Planning Act, the Federal Land Policy and Management Act, and the National Forest Management Act are the principal laws mandating public participation in rangeland management. The Endangered Species Act (ESA) is also occasionally relevant. For example, when local and state jurisdictions write habitat conservation plans under ESA because landowners want to develop property, such activities provide for public participation and involvement.

The Federal Advisory Committee Act (FACA) provides another mechanism for rangeland stakeholders to make comments and recommendations about ongoing and proposed actions to federal agencies. The purpose of FACA is to ensure that expert advice rendered to executive

branch agencies by various advisory committees, task forces, boards, and commissions formed by Congress and the President be both objective and accessible to the public. FACA defines how federal advisory committees operate by addressing subjects such as open meetings, public involvement, and reporting upon their work. Resource Advisory Committees (RAC) are one form of advisory committee implemented under FACA. They exist to provide advice and recommendations to U.S. Department of the Interior (USDI) Bureau of Land Management (BLM) state offices on a wide variety of public land management issues, including grazing and energy and mineral development. Membership on RACs is meant to be balanced among commodity, environmental, tribal, local governmental, and academic interests. Members are generally appointed through an annual public nomination process and typically serve for three years. Other rangeland-related advisory committees and boards make recommendations about wild horse and burro management, land restoration and preservation, and invasive species issues, etc.

In general, legal interpretations and changing policy in recent years have pushed back limits to public access to federal information. A related factor is the interpretation of federally generated information and the public's ability to control it.

In 2000, Congress enacted the Data Quality Act (DQA) as an obscure two-paragraph provision in an appropriations bill, primarily in response to increasing agency use of the Internet to disseminate information. Under the DQA, federal agencies must specify quality standards for information in any medium or form, including textual, numerical, graphic, cartographic, narrative, or audiovisual. Standards in the act are not supposed to override privacy and intellectual property rights protections. However, the White House Office of Management and Budget guidelines allow presumptions of objectivity to be challenged (OMB 2000). Although the ramifications of the DQA have yet to be played out, the possibility exists for public participation in the public's information could actually change the nature of the information itself. One concern is that opponents of agency regulations will attack their data as a way to stop or change policy (Pielke 2002).

Is the “Public Information and Public Participation” indicator meaningful? Similar to the previous indicator on land law and property rights, the United States has achieved a broad and effective framework of laws and regulations ensuring public access to information and agency planning. Public participation is now a routine and integral part of land management and other agency activities. Increasingly, rangeland managers must understand the importance of public involvement in rangeland sustainability.

Numerous approaches exist to monitor trends in this indicator – some broad and inclusive and some more narrowly defined. Perhaps a measure of the number and kinds of legal actions taken by public organizations would show a trend in how successful agencies are in accommodating the public within the legal framework afforded them. Another approach, more difficult to measure objectively, might address the cumulative effects that public participation has under a given law or suite of laws.

What is the availability of datasets for the “Public Information and Public Participation” indicator? The availability of data will depend upon what measure(s) are selected to represent this indicator. Volumes of data exist describing the kinds and extent of public participation in federal activities. For example, the U.S. General Services Administration maintains a Federal Advisory Committee Act database of approximately 1,000 advisory committees government-wide. The database, used by federal agencies, Congress, and the public, contains a number of elements that could be monitored to show trends in this aspect of public involvement in agency planning and management (<http://www.facadatabase.gov/>. Accessed 17 February 2011).

Indicator 57. Institutions and organizations.

This indicator describes governmental agencies, educational institutions, and other for-profit and not-for-profit organizations that exist to promote the conservation and sustainable management of rangelands.

This indicator is extremely broad in scope. In the United States, the list of institutions and organizations with an interest in rangelands and rangeland stewardship is exceedingly long. Included in this list are federal, state, and local governmental agencies (broadly defined), as well as educational institutions and non-governmental organizations (NGOs). The cumulative number of such entities associated with the SRR comes to more than 100 (Appendix 6-C), and that list barely scratches the surface, particularly when it comes to the expanding number of environmental, commodity, and science-based NGOs with missions pertaining to rangelands and rangeland use. Even states, counties, and municipalities are starting to recognize the importance of sustaining rangelands for their citizens. The organizations, universities, and agencies that participated in SRR's criteria and indicator development are shown in Appendix 1-A.

Federal agencies have a rich history of rangeland conservation, both in terms of management and research. The U.S. Department of Agriculture, Forest Service was formed in 1905 to manage the recently created Forest Reserves in order “to improve and protect the forest, secure favorable conditions of water flow, and to furnish a continuous supply of timber.” During the 100 years of its existence, USDA Forest Service (USFS) policy and management have reflected the shifting values American society holds toward stewardship and use of the nation's natural resources. As we enter the 21st century, the USDA Forest Service continues to evolve and develop new paradigms of management (Mitchell et al. 2005).

The BLM was created in 1946 when the Grazing Service and General Land Office were merged. Grazing was managed under the Taylor Grazing Act of 1934 (Carpenter 1981). In the year of the United States' bicentennial, Congress passed the BLM's Federal Land Policy and Management Act (FLPMA) of 1976, also known as BLM's Organic Act. This act recognized the value of the remaining public domain by stating that “public lands be retained in public ownership.” FLPMA thus provided a framework whereby the public lands “could be managed in perpetuity for the benefit of present and future generations” (<http://www.blm.gov/flpma/>. Accessed 15 November 2008). This has not been an easy task, given the increasing demands for minerals and energy on public lands – programs administered by the BLM.

The USDA Natural Resources Conservation Service (NRCS) – originally called the Soil Conservation Service – has provided technical assistance and leadership to private landowners since 1935, helping them to conserve soil, water, and other natural resources on their property. NRCS rangeland conservationists were among the first to recognize the importance of monitoring range condition (Dyksterhuis 1949). In recent years, the NRCS has promoted the incorporation of more sophisticated state and transition models of plant succession into rangeland classification and management (Briske et al. 2005). In addition to providing technical assistance to individual farmers and ranchers, the NRCS has a science and technology branch that conducts broad-scale monitoring of U.S. non-federal lands, allowing the agency to assess resource conditions and trends (Nusser and Goebel 1997).

The Agricultural Research Service (ARS) is the research arm of USDA. Although historically focused on forage and livestock production, ARS scientists are increasingly involved in advancing our knowledge about protecting rangeland ecosystems being managed for livestock and other commodities (Child and Frasier 1992). In 2003, as the agency celebrated its 50th anniversary, ARS leadership recognized the primary importance of research objectives that enhance rangeland

economic and environmental sustainability (ARS Information Staff 2004). An example of such work is the ARS rangeland carbon dioxide flux project, a cooperative research project to assess the role of rangelands in the global carbon cycle (Svejcar et al. 1997).

The land grant colleges also have considerable longevity, dating back to the mid-1800s (Appendix 6-D). Land grant colleges literally created the professional land management curriculums that are so important today. Similarly, the extension and technical assistance programs of the USDA and many state agriculture departments provide much needed assistance to the many ranchers and others who use rangelands. These institutions are addressed more directly in Indicator 59, “Professional Education and Technical Assistance.”

Other government agencies, education institutions, American Indian tribes, professional societies, and private organizations also play key roles in the development of expertise needed to manage rangelands, as well as their actual administration. Local government programs can slow the loss of rangelands, and thus promote sustainability, if they are successful in working together with both urban and ranching interests (Resnik et al. 2006).

Is the “Institutions and Organizations” indicator meaningful? The utility of this indicator greatly depends upon the precise measure selected to represent it. This indicator, as described, is so general that many different measures can be used to support it. Two factors make an actual measure of this indicator a complicated task. First, the idea of sustainability is broad and multifaceted, and various rangeland interests have different ideas about what constitutes sustainable management. As a result, activities to promote sustainability by federal, state, and local agencies will be perceived and valued differently by different stakeholders. Universities are sometimes considered to be more responsive than governmental agencies and NGOs because they are not tied to long-term goals or organizational mandates; however, universities can also become embroiled in differing perceptions concerning sustainability (Stokstad 2006).

Second, this indicator deals in part with federal agencies whose regulations are primarily dictated by Congress. Because Congress influences the policies of federal agencies nation-wide, there will likely be some overlap between this indicator and other indicators within this criterion that measure the actions of federal agencies.

If the conservation and sustainability of rangelands are to be guiding management principles in the future, institutions and organizations must commit to the concept of sustainability. Leadership at all levels of organizations must agree to instill sustainability concepts into the culture of the organization and vigorously seek out resources to implement programs that promote sustainability. This indicator should help in assessing the extent to which institutions and organizations are achieving this objective.

What is the availability of datasets for the “Institutions and Organizations” indicator? Like the previous indicator, availability of data will depend upon which measure(s) are selected to represent it. Possible data categories include 1) measures of programs and activities of governmental agencies, 2) majors, faculty, and curricula of university natural resource management schools, and 3) programs and activities of for-profit and not-for-profit organizations.

Indicator 58. Economic policies and practices.

This indicator describes the extent to which economic policies and practices affect the conservation and sustainable management of rangelands. The indicator explores the relationship between micro-economic and macro-economic processes and long-term sustainable management on rangelands.

This indicator can be measured in a myriad of ways.

Recent years have seen a transition from policies that primarily promote increased productive capacity on rangelands to a trend of encouraging ecosystem health and restoration. One example is the Conservation Reserve Program (CRP), which has been included in multiple farm bills over the past 20 years. The original Food Security Act, passed in 1985, created the CRP to help resolve two separate issues – decreasing net income to farmers and high levels of wind erosion caused by “plowouts” for small grain farming during the previous decade (Chapman 1988; Crosson 1991). Five years later, the Food, Agriculture, Conservation, and Trade Act of 1990 extended the CRP and broadened its objective to include improving water quality and other environmental goals. In 1996, the Federal Agriculture Improvement and Reform Act confirmed the new emphasis on environmental goals and provided more focus on water erosion (Mitchell 2000). One net result was to cause the distribution of enrolled lands to shift east toward the Midwest.

Historically, most efforts to monitor the economic effects of changing rangeland-use policies assumed that ranchers will employ production strategies that maximize ranch profit. However, extensive research has shown that important outputs of ranches are often not incorporated into conventional economic analyses (Torell et al. 2001). These outputs include things like family, tradition, and a rural way of life (Gentner and Tanaka 2002).

In addition to their management-unit level effects, economic policies influence rural communities and regions. NEPA contains a provision requiring economic analysis to assess how policy alternatives can affect local economies. As with outcomes of economic policies at the ranch level, analyses of regional economies can depend upon the model employed (Robison 1997).

Is the “Economic Policies and Practices” indicator meaningful? An economic policies and practices indicator contains no inherent measures. A myriad of ways to describe economic policies and practices exist, and the value of this indicator will greatly depend upon what precise measure is used to track the indicator at a broad scale over time.

An example of how an economic policy indicator might be useful in assessing sustainable management is embodied in the 2002 Farm Bill (Farm Security and Rural Investment Act). Prior to this act, conservation policy emphasized programs that retired erodible and marginal farmland from crop production, most notably the CRP. The 2002 act changed the focus to the conservation of working landscapes, including rangelands. Several programs, including the Environmental Quality Incentives Program (EQIP), the Wildlife Habitat Incentives Program, and the Conservation of Private Grazing Land Program, now provide technical and financial assistance to ranchers to conserve soil and water, improve wildlife habitat, and meet society’s increasing demands for recreation and open vistas (Claassen 2003). If a protocol was implemented that consistently monitored federal expenditures for conservation programs on private and tribal rangelands, it could have utility as an indicator of rangeland sustainability.

What is the availability of datasets for the “Economic Policies and Practices” indicator?

There is a lot of information concerning economic policies and practices that pertain to rangeland. However, identifying quantitative datasets is problematic for several reasons. First, it is difficult to separate rangeland-related data from larger datasets addressing agriculture in general. Second, policies are embodied at both micro- and macro-economic scales, making a true synthesis indicator difficult. In the same manner, the many major federal and state laws, court cases, regulations, and guidelines relating to economic processes affecting rangeland resources are not easy to describe.

Indicator 59. Professional education and technical assistance.

This indicator describes the extent to which institutions and organizations provide for professional education and technical information related to the conservation and sustainable management of rangelands.

This indicator cannot be considered independently from the “Institutions and Organizations” indicator, described above, because institutions and organizations are required to carry out teaching and extension activities. However, they can be separated in principle because the former focuses on structure while the latter concentrates upon process.

Professional education and training encompasses a broad range of categories, including formal academic degree programs, distance learning, accreditation of rangeland professionals, in-service training for agency employees, technical assistance by state and federal agencies and NGOs, and environmental education programs aimed at different parts of society.

Academic education. Rangeland education is in the midst of a transition, trying to respond to the changing values of society and students, as well as the changing missions of land management agencies (Nielsen and Decker, 1995). The interests of faculty, students, and agencies are shifting toward integrated subjects like conservation biology, restoration ecology, and ecosystem management. This transition is leaving some university administrators behind as they seek ways to keep up.

Indicators of academic education have historically focused upon the number of students enrolled at various institutions offering rangeland management or science degrees. In recent years, such an indicator has assumed increased importance because federal natural resources’ agencies will be losing a significant proportion of their workforces to retirement (Gropp 2004). At the same time, the number of students in natural resources’ programs, including rangeland science, has been dramatically shrinking. In fact, most observers do not believe an adequate number of students exist to fulfill future agency needs (Renewable Natural Resources Foundation 2004).

Distance learning. Independent learning courses are primarily correspondence and telecourse distance credit courses offered through individual delivery methods or a combination of two media. Using study guides, textbooks, and additional reference materials, students have the opportunity to learn at their own pace without classroom attendance. Online learning allows students to access courses from anywhere in the world using computer-based instruction.

Online programs that grant undergraduate and graduate range management or science degrees are beginning to increase. In 2008, Colorado State University had a graduate curriculum with approximately 35 M.S. students enrolled (<http://www.learn.colostate.edu/distance/dd.asp>). The National Learning Center for Private Forest and Range Landowners, administered by a consortium of 24 universities, offers online courses in livestock management, wildlife-livestock interactions, mitigating wildfire effects, riparian area management, and rangeland monitoring (National Learning Center for Private Forest and Range Landowners 2008). However, it does not offer academic degrees. Nonetheless, as U.S. rural areas join urban communities in acquiring high-speed Internet access, prospects for online education are expected to increase dramatically (Gary R. Evans, Director (retired), Natural Resource Distance Learning Consortium, Northern Virginia Campus, Virginia Tech, Alexandria, VA, personal communication). If academic distance learning is to reach its full potential, however, faculty members will have to be given the flexibility, training, and reward structures needed for them to move into this field (He 2004).

Accreditation of rangeland professionals. State accreditation of professional foresters is an established practice for identifying those who meet defined standards for practicing forest

management (Block 2000). The roots of accrediting rangeland management professionals date back to the 1972 California Professional Foresters Licensing Act, which was legally interpreted to include all wildlands and thus required a “licensed professional forester” to supervise wildland management. After a series of compromises, the 1994 California Code of Regulations was amended to state licensing of Certified Rangeland Managers under the certification auspices of a professional society. The California Section of the Society for Range Management (SRM) began certifying professional rangeland managers in 1995.

In 2000, SRM initiated a national-level Certified Professional in Rangeland Management program, opened to all who meet specified education, experience, and ethical conduct standards (Jolley and Burwell 2004). The SRM program is designed to certify individuals who possess the professional credentials required to plan and implement sound rangeland management practices. Certification must be renewed through participation in approved continuing education opportunities.

In-service agency training. In-service technical training of federal employees includes both introductory instruction for new employees and continuing education for experienced employees. An example of the former is the “boot camp” carried out by NRCS (<http://www.nedc.nrcs.usda.gov/catalog/bootcamp.html>. Accessed 15 November 2008). Initial training has become increasingly important as agency hire employees from diverse, urban backgrounds who lack basic skills in map reading, construction, handling livestock, etc. Continuing education rises and falls with agency budgets, but advances in online learning has the potential for creating new opportunities in this area. Within the USDA, an online program called AgLearn has integrated administrative, technical, and career development training (<http://www.aglearn.usda.gov/>. Accessed 15 November 2008). The BLM provides similar kinds of in-service training through its National Training Center (USDI BLM 2008a).

One advantage of online training from a sustainability indicator perspective is that excellent records are kept about numbers and characteristics of students enrolled in various programs.

Technical assistance. If farmers and ranchers are to sustain healthy and productive lands that not only provide food and fiber for the nation, but also protect soils, watersheds, and ecosystems, mechanisms must be in place to educate them about evolving tools and resources available to them. Management and monitoring tools for private landowners are effective when they can be easily understood, appreciated, and shown to be cost-effective. Skills for providing technical assistance, on the other hand, are often complex, often not appreciated, and sometimes costly.

At the federal level, the NRCS has the primary mission for providing conservation assistance to private rangeland owners and managers. Over the years, NRCS has been very successful in accomplishing this goal. For example, in recent years NRCS has developed or applied conservation systems that improve the health and productivity of approximately a half million acres of grazing land per year (USDA NRCS 2006).

State and local extension activities have taken place under Cooperative Extension Services of state land grant universities since they were authorized in the Smith-Lever Act of 1914. Historically, extension activities dealing with rangeland management concentrated on livestock production practices. More recently, an emphasis has been placed on teaching people about sustainable practices. However, these programs have included subjects equally applicable to urban and rural households (e.g., composting and recycling). Another recent innovation has been collaboration between state Extension and federal agencies to produce a range management school for ranchers that covers multiple subjects from plant identification to land management planning (Kennedy and Brunson 2007). Research has shown that most ranchers who utilize extension

services make positive changes in their operations such as implementing new management practices or adjusting business tactics to increase ranching profits (Richards and George 1996).

In recent years, NGOs and professional societies have become more involved in on-the-ground education. The famous King Ranch in Texas formed the King Ranch Institute for Ranch Management at Texas A&M University-Kingsville, which, among other things, holds an annual symposium for ranchers and rangeland managers on subjects such as integrated resource management and the balanced scorecard (Shadbolt 2007).

Environmental education programs. Nearly every Western state has a “range camp,” open to youths, primarily of high school age, who want to learn about rangelands and natural resource management. These camps are co-sponsored by sections of the SRM, NRCS, state conservation districts, NGOs, and others. Participants learn plant identification and study interactions between soils, water, vegetation, wildlife, and livestock.

A number of general environmental programs sponsored by non-profit organizations exist for the benefit of students and K-12 teachers. Among the most notable of these programs are Project Learning Tree, Project WILD, and Project WET. All three programs are designed to be concept-oriented and balanced with regard to value-sensitive issues. Unfortunately, the reach of these programs extends to less than 3 percent of the United States teacher population. Funding is the major constraint for most programs.

Is the “Professional Education and Technical Assistance” indicator meaningful? As with all the Legal-Institutional indicators, the professional education and technical assistance indicator, as written, is overly broad and requires a specific measure. Some observers believe the most logical measure would be the number of students enrolled in rangeland management and science degree programs. Recording the number of students enrolled in rangeland-related disciplines is not easy, however. Over the past decade, academic departments have consolidated as student enrollments declined, and opportunities for students to enroll in generalized majors like natural resources management and environmental studies have increased. Consequently, a common definition of what constitutes a rangeland management or science degree program would be necessary. One approach would be to only count students enrolled in academic programs accredited by SRM. As of 2010, nine universities have accredited rangeland management education programs.

This indicator might also monitor the number of faculty positions dedicated to teaching courses concentrating on rangeland management or science. As is the case with student numbers, however, defining a consistent protocol for identifying relevant disciplines can be problematic.

A coarser measure of academic education might be the number of departments teaching rangeland science in the United States. In addition to these nine universities with accredited rangeland management education programs, 13 more U.S. colleges and universities offered degrees in rangeland ecology, science, or range management. Another 17 colleges and universities have been identified as offering rangeland science and management courses as part of various agriculture or natural resource degree programs (http://www.rangelands.org/links_universities.shtml . Accessed 15 November 2008).

What is the availability of datasets for the “Education and Technical Assistance” indicator? No systematic procedures are in place for monitoring the number of students enrolled in various rangeland management disciplines or the number of faculty members employed to teach them. Most such data are kept by various universities, often in incompatible formats, instead of a central data repository. Data on extension services provided by federal, state, and NGOs are also difficult to obtain. Detailed NRCS records are protected by the Privacy Act and by agreement with

individual landowners, and they have only been summarized in national reports. However, state and regional data summaries may be useful for monitoring trends at regional and national levels.

Indicator 60. Land management.

This indicator describes the extent to which land management programs and practices support the conservation and sustainable management of rangelands. Like other indicators pertaining to this criterion, a land management indicator can reflect legal, institutional, and economic factors.

Federal land management programs. Federal agencies within the departments of Interior, Agriculture, Defense, and Energy manage more than 275 million acres of rangeland in the United States. Federal statutes require management for a wide range of environmental, cultural, social, and/or scientific values on rangelands. Some of the important pieces of federal legislation for managing rangeland resources are:

1. Taylor Grazing Act of 1938
2. Multiple-Use Sustained-Yield Act of 1960
3. National Environmental Policy Act of 1969 (NEPA)
4. Federal Advisory Committee Act of 1972 (FACA)
5. Endangered Species Act of 1973. P.L. 93-205. 87 Stat. 884.
6. Forest and Rangeland Renewable Resources Planning Act of 1974 (RPA)
7. National Forest Management Act of 1976 (NFMA)
8. Federal Land Policy and Management Act of 1976 (Organic Act)
9. Archaeological Resources Protection Act of 1979. P.L. 96-95. 93 Stat. 721
10. Federal Land Policy and Management Act of 1994. P.L. 94-579.

With notable exceptions (Clean Water Act, Endangered Species Act), the Federal government does not directly regulate activities on state and private land. However, federal agencies often participate in resource management decisions at all levels and, in some cases, provide incentives through technical and financial assistance to encourage and facilitate better management practices.

Federal law enforcement. Federal laws that regulate natural resource management generally belong to one of the following categories: 1) environmental protection (air quality, water quality, species preservation, and soil conservation), 2) public property protection, and 3) special features protection (i.e., protection of sensitive or fragile areas containing unique environmental attributes or resources). Limitations on natural resource management activities can also come in the form of guidelines and regulations. All federal laws, regulations, and guidelines have varied applicability and are enforced within a complex jurisdictional structure. (Jurisdiction describes the enforceable reach of a law and who has the responsibility of enforcing that law.)

State land management programs. State land management agencies, particularly in the Western states, collectively manage more than 100 million acres of rangeland – primarily for livestock grazing. Until recently, state agencies spent little time or money evaluating the impacts of grazing on the land. Most of the law relating to the management of state-owned rangelands was directed toward the procedures for issuing leases for grazing and other uses. There was little concern about the manner in which grazing lands were used or the intensity of grazing practices.

However, legal changes are gradually taking place. Federal statutes now allow states to implement regulations equal to or even stricter than those adopted by the U.S. Environmental

Protection Agency (EPA). At least 41 states now have some requirement for federal agencies to evaluate the environmental impacts of proposed management actions (e.g., issuing or renewing leases). Fourteen of these states have “little NEPA” laws modeled on federal NEPA laws (Sive and Chertok 2005). The other 27 states have informal or scattered requirements for environmental impact assessments.

Increasingly, state land management agencies are requiring their lessees to manage state-owned lands in accordance with written management plans. The development of these plans requires the land management agencies to undertake assessments of the condition of the lands to be leased.

NGOs are active in promoting a broad range of environmental regulations at federal, state, and local levels. Nationally, the Natural Resources Defense Council, Environmental Defense Fund, and Earthjustice (formerly Sierra Club Legal Defense Fund) have interests in actions affecting ecosystem management, including environmental impact statements.

State law enforcement. The role of state and local governments include regulating property rights for privately owned lands and administering federal laws that affect private property rights. State laws that govern land management practices on private lands in various manners include “little NEPA acts,” coastal zone management acts, clean air acts, hazardous waste removal laws, pesticide and insecticide laws, worker safety laws, and endangered species laws. These laws may apply directly or indirectly to state, federal, or other government lands.

Private land management programs. Ownership of the nation’s privately owned rangelands is distributed among several hundred thousand individuals. The most effective results in managing these lands have been achieved through voluntary programs where private landowners are encouraged, advised, and assisted in developing stewardship programs. These technical and financial assistance programs are typically managed by federal and state agencies, as well as various for-profit and not-for-profit associations.

Voluntary and/or required land management practices. Specific recommended management practices for agriculture, including rangelands, have been developed in almost every state in the United States. Some of these management practices for rangeland management activities (notably practices that affect non-point source water quality) are required under various local, state, or federal laws. Other management practices are implemented through various voluntary or quasi-voluntary programs. Other methods of encouraging specific management practices include 1) cost-share payments under a variety of state and federal programs, 2) preferential property or income tax treatment, 3) technical assistance and extension education programs, 4) environmental education programs, and 5) conservation easements.

Is the “Land Management” indicator meaningful? The Land Management indicator provides another approach for assessing how well our nation’s rangelands are being managed for long-term biodiversity, productive capacity, social value, and other goals. Indicators in other criteria measure the direct response of rangeland ecosystems and social systems to human activities. This indicator, alternatively, monitors the manner in which federal, state, and local governments, as well as NGOs, provide legal and institutional direction to land management practices on the ground.

On private lands, the “Economic Policies and Practices” indicator may provide an adequate measure of trends in rangeland management by monitoring incentive programs like EQIP. On public lands, however, an indicator that tracks federal, state, and local laws and regulations promoting sustainable rangeland management may be more useful. However, this indicator will only have meaning when a specific variable is selected that can be measured consistently over time.

What is the availability of datasets for the “Land Management” indicator? Presently, no regional or national datasets exist to support a land management indicator. In fact, no common measure for the indicator has yet been accepted. Data supporting a land management indicator are not now required to be collected by federal or state agencies or NGOs. The lack of protocols for how and when to monitor changes in a land management indicator will make it difficult to implement, regardless of its perceived importance.

Indicator 61. Land planning, assessment, and policy review.

This indicator describes the nature and extent of periodic rangeland-related planning, assessment, and policy review activities, including planning and coordination between institutions and organizations.

All federal land management agencies have proceeded according to some general strategy since their earliest beginnings. Now, however, federal law mandates and governs federal land-use planning at multiple scales. Formal planning is now more comprehensive, both procedurally and substantively. Managers have less discretion in deciding whether and how to plan. Planning is a central component of all land management. Each statute and administrative strategy governing land management incorporates planning. Planning guides individual discretionary decisions through explicit plan goals.

Land management policies, as well as planning and assessments, are governed in part by statutes and case law. As the regulatory situation changes over time, planning and assessment activities undertaken by agencies have to be flexible enough to keep up.

Federal planning, assessment, and policy review. Periodic planning, assessment, and policy review are a major component of the work federal land management agencies perform. The main drivers of federal planning, assessment and policy review are the Taylor Grazing Act, Federal Land Policy and Management Act (FLPMA), Forest and Rangeland Renewable Resources Planning Act (RPA), National Forest Management Act (NFMA), Soil and Water Resources Conservation Act (RCA), and a variety of legislation dealing with mining and mineral leasing of federal lands. Assessments and planning documents are to be issued at specified intervals, although there is often a delay in complying with these schedules and sometimes the schedules have no legal obligation.

The Government Performance and Results Act of 1993 (GPRA) provided for the establishment of strategic planning and performance measurements by all federal agencies. Section 3 of the act requires agencies to prepare strategic plans every three years (with a five-year window) that include comprehensive mission statements, general goals and objectives, and plans to meet the goals and objectives. Section 4 mandates annual performance assessments and reports that show how well each agency is attaining its general goals in a measurable and verifiable manner.

Even though all land management agencies must adhere to the requirements of GPRA, they also must follow individual statutes. Planning direction for the BLM is contained in FLPMA, described earlier. The USFS follows the mandates in RPA and NFMA. Congress ordered that management decisions must be “consistent” or “in accordance” with formal plans for both agencies. However, the USFS is required to comply with a relatively specific set of procedures in its planning while the BLM has only very general provisions guiding its work.

Moreover, the planning documents of federal agencies operate on several different scales. There may be nation-wide guidance (such as the BLM’s riparian policy), regional assessments and plans (such as BLM resource area management plans), and local plans (such as allotment management

plans). Under federal law, when assessments, plans, and policies are issued or revised, extensive coordination opportunities are required, including “consultation and coordination” with state and local governments, tribes, and the public. All of these parties have the right to review drafts of policies, plans, rulemakings, and assessments.

At the management unit level, the USDI National Park Service (NPS) has a partial statutory planning requirement, and the U.S. Fish and Wildlife Service (FWS) has none. Both agencies do prepare land-use plans for a variety of uses. These plans are similar to discretionary regulations, in that they guide officials but rarely dictate the specified result. They do, however, provide reviewing courts with standards against which to judge subsequent management actions for arbitrariness or capriciousness. The Department of Defense also has a statutory requirement to prepare integrated natural resources management plans for military lands. This is spelled out in the Sikes Act (16 USC 670).

Federal land management agencies must make assessments of how well they are achieving strategic management goals as part of the GPRA. In addition, the agencies are required by the acts listed above (e.g., RPA, NFMA, GPRA, RCA) to make assessments of lands and resources (USDA NRCS 1996). Since 1975, the USFS has presented a decadal assessment that includes an analysis of present and anticipated uses, as well as the demand for and supply of renewable resources on all U.S. forest, range, and other associated lands (USDA Forest Service 2001).

Because agencies cannot develop comprehensive assessments of lands under their jurisdiction without considering the status and dynamics of surrounding lands, both public and private, they are beginning to recognize the need for collaboration and sharing of data in the assessment process.

Regional planning, assessment, and policy review. Recently, comprehensive assessments have been undertaken in California (Fire and Resource Assessment Program 2003), the interior Columbia River Basin (Everett et al. 1994), and other areas. There are many different and often conflicting reasons for undertaking such regional assessments, but they do evaluate the current condition of all lands, including rangelands. One approach has been to compare current condition to an earlier condition as obtained from historical records. The current condition is then compared to some “desired future condition,” and a management plan is developed to move to the desired future condition.

Problems in accomplishing large-scale regional plans include the difficulty in eliciting adequate public participation and vague requirements for different institutions to collaborate. However, the Unified Federal Policy for a Watershed Approach to Federal Land and Resource Management (Federal Register, Vol. 65, No. 202, p.62566-62572) does direct the departments of Interior, Agriculture, Commerce, and Defense, the EPA, and the Tennessee Valley Authority to collaborate.

Local planning, assessment, and policy review. In recent years, some Western states have begun to develop and implement management plans for state-owned trust rangelands under their jurisdictions. These rangeland resource plans are intended to be a principal guiding document, providing long-range direction, operation objectives or targets, and a budget framework that will assure coordinated and balanced implementation of state-owned rangelands.

Since the early 1970s, nine states have adopted programs to assert state control over land development policies to provide consistency and direction among counties (or other local jurisdictions) where zoning decisions traditionally lie (Zinn 2004). These programs attempt to reconcile

the goal of environmental protection with that of economic development.

Virtually all planning and assessment programs for private lands are voluntary. Even the states that have land development policies tend to tread lightly with limitations on the use and development of private rangelands.

Is the “Land Planning, Assessment, and Policy Review” indicator meaningful? An indicator addressing planning, assessment, and policy review has meaning within both a legal and an institutional framework. At the federal level, laws on land management planning at local and national scales are firmly established, as described above. However, the legal and institutional basis for planning at state and regional levels is more of a patchwork. A measure that monitored the spatial degree and extent of planning and/or monitoring could be useful.

This indicator examines how a society plans for the use of rangeland resources and is based on the specific value assigned to particular uses. Without planning and assessment, sustainable management is less feasible.

What is the availability of datasets for the “Land Planning, Assessment, and Policy Review” indicator? The history of national rangeland assessments and concomitant availability of data was reviewed in the 2000 RPA rangeland assessment document (Mitchell 2000). In contrast to U.S. forests, comprehensive national plot-based biophysical data are not available to support national rangeland assessments. The sampling land base of the two national monitoring systems, the National Resources Inventory (NRI), administered by NRCS, and Forest Inventory and Analysis (FIA), administered by the USFS, are individually or collectively exhaustive when it comes to rangelands (Frayer and Furnival 1999). NRI sample points can be found on all U.S. lands. However, actual data are only collected from non-federal lands. FIA sample points are presently located on forested lands of all ownerships, so no data are collected from non-forested lands, including rangelands.

Datasets supporting land management planning have greatly improved in recent years. Executive Order 12906 of 11 April 1994 (The White House 1994) required geospatial data used by federal agencies to be accompanied by metadata in the format set by the Federal Geographic Data Committee. This data was also required to be accessible to all interested parties. Agency guidance on data used in land-use planning requires that corporate data be able to withstand scientific and legal scrutiny and be readily available to both agency personnel and interested publics (<http://www.blm.gov/nhp/efoia/wo/fy03/im2003-238.htm>). Advances in Geographic Information System (GIS) technology now allow agencies to store and display digital geospatial data in map layers in ways that facilitate the requirements in Executive Order 12906.

The availability and quality of data supporting planning and assessments can be used as a measure of a planning, assessment, and policy review indicator because when accurate and reliable data are available, they are always used in these processes.

Indicator 62. Protection of special values.

This indicator assesses the extent to which laws, regulations, institutions, and organizations conserve rangeland for special environmental, cultural, historic, social, and/or scientific values.

Federal, state, and local governments have the authority to conserve special areas for these values. In addition, there are a number of NGOs that do the same thing through purchasing land or conservation easements. The variety of governmental and organizational efforts to preserve

special values makes monitoring or defining this indicator difficult. In addition, the levels of protection assigned to lands for different values is often controversial, causing decision makers to try and balance the differing ideals of various rangeland stakeholders. A good example of this is the Grand Staircase-Escalante National Monument, which was set aside primarily for scenic and wilderness values but is valued for grazing and motorized recreation uses as well (USDI BLM 2008b).

More than 250 federal laws protect special values pertaining to forests and rangelands. In the same manner, numerous records exist for identifying and cataloging these laws (Coggins et al. 2002). Some are spatially explicit; others focus on the kinds of values to be protected; yet others deal with specific resources, like water or wildlife. Beyond the laws themselves, management of special values is affected by agency regulations. A 1995 General Accounting Office (renamed to Government Accountability Office in 2004) study estimated that 43 percent of the land area administered by the USFS, BLM, FWS, and NPS are regulated by laws limiting land use or management (GAO 1995).

Relatively few state government programs exist to conserve special rangeland values. As described in the “Land Law and Property Rights” indicator section above, Colorado and Arizona now call for conservation goals on some state trust lands to protect productivity and sound stewardship. Other states have laws on wetlands conservation, surface mining restoration, and farm and rangeland preservation. For example, state governments can designate rangeland of “statewide importance” so it may come under the Farmland Protection Policy Act (FPPA) of 1981. The FPPA requires collaboration between federal programs and state and local efforts to prevent the conversion of private farm and rangeland to nonagricultural uses. The FPPA does not authorize the federal government to regulate the use of private or non-federal land and does not in any way affect the property rights of landowners. The FPPA categorizes farmland as prime farmland, unique farmland, and land of statewide or local importance.

Conservation of special values on private lands relies upon voluntary legal options, such as conservation easements, land retirement programs, mutual covenants, deed restrictions, and leases for conservation use. Unfortunately, no inclusive analyses of private land initiatives for conserving special values on rangeland have been attempted.

A number of national NGOs work toward conserving lands for special values. The Conservation Fund has helped protect nearly 5 million acres in the Western states since it was founded in 1985 (<http://www.conservationfund.org/>. Accessed 15 November 2008). The Nature Conservancy, the Land Trust Alliance, and the Trust for Public Land are other major players in promoting special values on public and private rangelands. In 2007, New Mexico expanded its state tax credit for land conservation, in part because of support by environmental organizations.

Is the “Protection of Special Values” indicator meaningful? An indicator pertaining to special values will integrate well with other indicators within this criterion, some of which are more narrowly focused. These indicators include 1) “Threat or Pressure on the Integrity of Cultural and Spiritual Resource Values,” 2) “Area of Rangelands Under Conservation Ownership or Control by Conservation Organizations,” and 3) “Public Beliefs, Attitudes, and Behavioral Intentions Towards Natural Resources.” The indicator also provides a more legal perspective of the way the United States sets aside and otherwise protects environmental, cultural, historic, social, educational, and scientific values on rangelands.

What is the availability of datasets for the “Protection of Special Values” indicator? Given the extensive and complex nature of laws and rules restricting rangeland use and management to promote special values, numerous measures are possible to monitor this indicator. Information

dealing with areas set-aside by major laws, such as the National Park System and the National Wilderness Preservation System, is widely available, but data describing the status of more obscure actions, such as heritage areas and restoration acts, are not yet available.

Indicator 63. Measuring and monitoring.

This indicator measures the extent to which agencies, institutions, and organizations devote human and financial resources to measuring and monitoring various rangeland conditions.

Monitoring of rangeland ecosystems and rangeland-dependent social systems have become critical elements of rangeland management and planning on public and private lands in the United States. Detecting and documenting changes in rangeland conditions provide reliable information for evaluating various management activities and programs. These evaluations are necessary precursors for conducting assessments. Assessments, in turn, allow managers and policymakers to make decisions using the best information available.

The Government Performance and Results Act (GPRA), discussed earlier under the “Land Planning, Assessment, and Policy Review” indicator – directs agencies to provide up-to-date reports of strategic planning and performance. The GPRA has significantly increased the amount of coordination within agencies. According to the U.S. House Appropriations Committee Report for the Department of Interior and Related Agencies Appropriations Bill for FY 2002, “Prior to the passage of the Government Performance and Results Act, it is likely that any consistency of information disseminated by U.S. government agencies was coincidental.”

Historically, rangeland monitoring systems have concentrated upon describing ecological sites using plot-derived data. As described above in the discussion on the availability of datasets for the “Land Planning, Assessment, and Policy Review” indicator, the only national monitoring framework that samples rangelands, the NRI, does not include the roughly 275 million acres of federal rangelands in its sampling population. As a result, attempts to monitor and measure U.S. rangelands are increasingly relying upon remote sensing technology (Washington-Allen et al. 2006).

The data within this criterion can be found and monitored in the periodic work done by the USFS in its RPA Assessments, the BLM’s Public Land Statistics, and the NRCS’s NRI and RCA appraisal work. This capability is diminished at the state and local levels and dependent upon the level of detail and scope of questioning. There is not an equivalent GPRA for state governments or one that could be consistent across the country. Information relating to private rangelands is addressed by the NRCS and is only available to the Major Land Resource Areas level, in many cases a fairly large amount of acreage.

Strategic planning undertaken by state boards and agencies varies greatly from state to state. Nonetheless, information on whether planning occurs, and something about its extent, should be available from the Internet and other public information sources.

Another recent law, which may have an impact on federal agencies, is the Data Quality Act (DQA). The impact of the DQA has yet to be determined. However, it has the potential to have a significant impact on how the federal government collects, handles, and disseminates data, including that from monitoring efforts.

Is the “Measuring and Monitoring” indicator meaningful? This indicator measures the extent to which government agencies and NGOs expend resources to monitor indicators of sustainable management on rangelands. The United States has a large, but mostly fragmented, capacity

to monitor changes in rangeland systems, both biophysical and socio-economic. About one-third of the nation's rangelands fall under the stewardship of the federal government and are managed by various agencies, primarily within the departments of Agriculture and Interior. These agencies have the ability to monitor land under their jurisdictions but currently do not measure the same variables, nor do they use consistent protocols to ensure consistent, reproducible results. States, tribes, and private landowners holding the majority of U.S. rangelands do little formal monitoring. The very problems that preclude monitoring systems from providing information at regional and national scales for all U.S. rangelands provide the evidence showing how meaningful an indicator that tracks measuring and monitoring would be, however.

What is the availability of datasets for the “Measuring and Monitoring” indicator? Data addressing a measuring and monitoring indicator do not actually measure biophysical or socio-economic attributes. Rather, datasets supporting this indicator would address the spatial and temporal extent, grain, accuracy, precision, and repeatability of monitoring protocols, considered collectively. SRR scientists utilized a data matrix for evaluating individual indicators during the development of criteria and indicators (Appendix 1-D). Thus, some groundwork has been accomplished for a measuring and monitoring indicator, but, like most indicators in the legal/institutional criterion, work still needs to be done in order to realize a quantitative measure of the indicator.

Indicator 64. Research and development.

This indicator measures the nature and extent of research and development (R&D) programs that promote the conservation and sustainable management of rangelands. Essentially, this indicator looks at the extent to which government agencies, universities, and NGOs spend human and financial capital to find new and innovative uses of rangeland and associated resources.

The relevance of R&D to innovation and success is well documented for businesses and private industry (Mansfield et al. 1977). However, a similar rationale for government R&D is not so widely understood. The mid-20th century Soil Bank, authorized in the Agricultural Act of 1956, provides an example of what happens when a large rangeland conservation program is not supported by a research and monitoring program. The Soil Bank program paid \$2.6 billion (nearly \$10 billion in today's dollars) to subsidize farmers for converting cropland to permanent grass or tree cover. In part, because of a lack of concomitant R&D, mistakes were repeated 30 years later when the CRP was initiated for generally the same purposes (Mitchell and Evans 1988).

Regardless of any shortcomings, the United States has made significant investments in the development of scientific understanding of rangeland ecosystem characteristics and functions. Research on rangeland ecosystem characteristics, functions, and processes has been carried out in universities and federal agencies for years, although some have argued that the scope of rangeland research has probably never been commensurate with their biological complexity and geographic extent (Olberding et al. 2005). Research addressing rangeland communities, natural and human capital, rangeland-linked cultures, and other social sciences lag far behind R&D in the biophysical sciences (Vavra 1995). Even further back is research that links rangeland ecosystem management with human well-being (Gunderson and Holling 2002).

New technologies. Technology in agriculture has historically been associated with increasing productive capacity. The “green revolution” of the mid-20th century saw the introduction of high-yield cultivars, a process that maximized crop yields and overlooked system stability (Daily et al. 1998). On rangelands, science for developing new technology emphasized rehabilitation equipment and strategies, which at the time was also related to increasing production (Rangeland

Technology & Equipment Council et al. 2007). In more recent years, technological advances have also focused upon sustainability issues, in particular the restoration of degraded ecosystems (Lodge et al. 2006). Natural ecological restoration is a slow process, often measured in centuries, so artificial interventions resulting from technology provide an important management alternative (Dobson et al. 1997).

Predicting impacts of human disturbances. There is research underway to predict impacts of human disturbances on rangelands. Some of these are discussed above in the “Measuring and Monitoring” indicator section. At a global scale, one of the most significant forms of human disturbance, the introduction of greenhouse gases into the atmosphere, is the subject of intense scientific research (Botkin et al. 2007). In 2001, the President launched a National Climate Change Technology Initiative that directed the Secretaries of Energy and Commerce to lead a multi-agency review of federal R&D efforts regarding climate change. From that Initiative, a multi-agency coordination activity, the U.S. Climate Change Technology Program, was organized ([http:// www.climatechange.gov](http://www.climatechange.gov) . Accessed 15 November 2008).

Is the “Research and Development” indicator meaningful? An R&D indicator can measure the different capacities of governments, universities, and NGOs to undertake research and disseminate its results. The number of full-time equivalent scientists working on the three legs of the sustainability “stool” (Newport et al. 2003) is one possible measure. Other measures of R&D on rangelands could be tied to federal agency research budgets, grant dollars received for research addressing hypotheses dealing with rangeland sustainable management, or the number of scientific papers published on this subject. Any of these measures would be meaningful to all rangeland interest groups, including Congress and other policymakers.

What is the availability of datasets for the “Research and Development” indicator?

Numerous kinds and amounts of data exist that support different measures of an R&D indicator. For example, the National Institute of Food and Agriculture (formerly called the Cooperative State Research, Education, and Extension Service) maintains current and archived records of various R&D activities, including rangeland research, on its website (<http://www.nifa.usda.gov/fo/rangelandresearchprogram.cfm>. Accessed 10 June 2011).

One problem with these data, also common to other indicators within the “Legal, Institutional, and Economic Framework...” criterion, is the lack of consistency across datasets and the need for common repositories of data. For example, the Range Science Education Council, an informal organization of some 27 colleges and universities that offer courses and degrees in rangeland ecology and management, occasionally publishes information about numbers of graduate faculty, funding for research assistantships, etc. (Engle and Waller 1993). However, consistent monitoring and reporting of these variables does not take place.

Summary and Conclusions

We recommend placing increased emphasis on using scientific studies to evaluate the status and trends in the Legal, Institutional, and Economic Framework for Rangeland Conservation and Sustainable Management criterion. Many of the indicators are responsive to changing laws, regulations, and policies, none of which lend themselves to rigid monitoring systems, arranged a priori. For example, multiple reviewers evaluated the status of various forms of property rights in relation to legal institutions and other factors (Yandle and Morriss 2001). During the 20th century, recurring national assessments of U.S. rangelands took place that did not rely upon

long-term data for specified indicators (U.S. Secretary of Agriculture 1936; Public Land Law Review Commission 1970; Committee on Rangeland Classification 1994).

Regardless of which mechanism is employed to monitor how well our country's legal, institutional, and economic structures support the sustainable management of U.S. rangelands, we are obligated to maintain the momentum to monitor and report upon a joint suite of environmental and social conditions, including those described above, in an integrated manner (Kates et al. 2001). The path toward understanding sustainable management, and how rangelands fit into the larger picture of sustainability, depends upon how well we can capture the dynamic interactions between nature and society.

On the surface, the legal, institutional, and economic framework for promoting sustainable rangeland management is well-developed in the United States. Land laws and property rights in rangeland states have arisen from an agricultural foundation (Ingersent and Rayner 1999). Numerous, organizations and institutions exist that promote sustainable management of rangelands from various perspectives, including commodity use, preservation, restoration, conservation, recreation, etc. Although fewer university departments are dedicated to rangeland science, alone, and larger universities are facing declining enrollments (Thurrow et al. 2007), opportunities for students to study rangeland ecology and management still exist. The key element in rangeland education will be to use this diversity to create dynamics that can provide for changes in the discipline as concepts in sustainable management evolve (Scarnecchia 2003).

As a rule, rangeland economic practices are driven by broader environmental and agricultural policies, such as are found in farm bills. The mechanism for economic practices is often through support for technical assistance (Gordon 2008).

Opportunities for professional education and technical assistance are changing and becoming more diverse in the United States. At the same time that state Extension budgets are decreasing (Anderson and Feder 2007), other opportunities have become available (Tanaka et al. 2009).

Land management planning on public lands is driven by a suite of laws, many of which were enacted during the 1970s (Table 1.1). During the intervening quarter century, these and other laws have been tempered and made more specific by court cases and agency regulations, resulting in shifting public values that promote ecosystem health and amenity uses (Brunson 2003). This includes protection of special values (Kochan 2003).

Advances continue to be made in rangeland monitoring, a factor engrained in the SRR vision statement, "Criteria and indicators for monitoring and assessing the economic, social, and ecological sustainability of rangelands are widely accepted and used." Monitoring and assessing the benefits and costs of providing ecosystem services is attracting increased scientific and public interest (Meyerson et al. 2005). The geospatial aspects of rangeland monitoring continue to rapidly advance (Weber 2006).

Thus, laws, institutions, and economic policies are playing a large, and increasing, role in determining the long-term sustainability of our rangelands. As social scientists, economists, and ecologists continue to study the 10 broad indicators described above, and reporting about them begins to take place, rangeland stakeholders will be able to include this added dimension into assessments of rangeland sustainability, both in the United States and throughout the world.

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Appendix 6-A. Summary table of legal, institutional, and economic framework for rangeland conservation and sustainable management data categories.

1. Land Law and Property Rights Extent to which laws, regulations, and guidelines clarify property rights and land tenure arrangements, recognize customary and traditional rights of indigenous people, and provide means of resolving property disputes by due process.	<u>Data Category 1:</u> Major federal and state legislation relating to land law, property rights, and land tenure arrangements associated with rangelands. <u>Data Category 2:</u> Major governmental and state agency regulations and policies relating to land law, property rights, and land tenure arrangements associated with rangelands. <u>Data Category 3:</u> Major federal and state court cases relating to land law, property rights, and land tenure arrangements associated with rangelands. <u>Data Category 4:</u> Sales and transfers of rangeland titles and the right to take forage. • Private, state, and federal rangeland acres sold annually, by type of transfer, e.g., private treaty, auction, inheritance, or other device. • Private, state, and federal AUMs (or equivalent) sold or transferred annually, by type of transfer, e.g., private treaty, auction, inheritance, or other device.
2. Institutions and Organizations Extent to which governmental agencies, educational institutions, and other for-profit and not-for-profit organizations affect the conservation and sustainable management of rangelands.	<u>Data Category 1:</u> Programs and activities of governmental agencies that affect the conservation and sustainable management of rangelands. <u>Data Category 2:</u> Programs and activities of colleges and universities that affect the conservation and sustainable management of rangelands. <u>Data Category 3:</u> Programs and activities of for-profit and not-for-profit organizations that affect the conservation and sustainable management of rangelands.
3. Economic Policies and Practices Extent to which economic policies and practices affect the conservation and sustainable management of rangelands.	<u>Data Category 1:</u> Macro-economic policies and practices that affect rangeland sustainability including economic growth, interest rates, and international trade practices. <u>Data Category 2:</u> Federal and state legislation, regulations, and guidelines and court cases that affect economic processes related to rangeland resources. <u>Data Category 3:</u> University, public agency, and NGO studies on incidence and impacts of investment, trade, and taxation.
4. Public Information and Public Participation Extent to which laws, regulations, guidelines, institutions, and organizations provide opportunities for public access to information, and public participation in the public policy and decision-making process.	<u>Data Category 1:</u> Federal, state, and local laws, regulations and guidelines that affect public access to information that affect public access to information relating to rangelands. <u>Data Category 2:</u> Federal, state, and local laws, regulations, and guidelines that affect public participation and involvement in decision-making processes relating to rangelands.

5. Professional Education and Technical Assistance Extent to which laws, regulations, guidelines, institutions, and organizations provide for professional education and the distribution of technical information and financial assistance related to the conservation and sustainable management of rangelands.	<u>Data Category 1:</u> Federal and state agency and NGO public information, technical assistance, and other outreach programs that affect rangeland sustainability. <u>Data Category 2:</u> College and university education and training programs that affect rangeland sustainability. <u>Data Category 3:</u> Federal, state, and NGO agency internal training programs that affect rangeland sustainability.
6. Land Management Extent to which land management programs and practices support the conservation and sustainable management of rangelands.	<u>Data Category 1:</u> Legislation relating to management, use, and protection of rangelands, e.g., Federal Land Policy and Management Act, National Forest Management Act, Government Performance and Results Act. <u>Data Category 2:</u> Governmental agency regulations and policies relating to management, use, and protection of rangelands. <u>Data Category 3:</u> Court cases relating to management, use, and protection of rangelands. <u>Data Category 4:</u> Resources spent to enforce laws that affect rangelands. <u>Data Category 5:</u> Resources spent to develop and maintain infrastructure on rangelands, including facilities and improvements such as roads, fences, structures, and water systems.
7. Land Planning, Assessment, and Policy Review Nature and extent of periodic range-related planning, assessment, and policy review activities, including planning and coordination between institutions and organizations.	<u>Data Category 1:</u> FLPMA, Forest and Rangeland Renewable Resources Planning Act (RPA), Soil and Water Resources Conservation Act (RCA), and other plans and reports for public lands, and National Resources Inventory (NRI) reports for non-federal lands. <u>Data Category 2:</u> USDA Forest Service RPA assessments, NRCS appraisals made under RCA, BLM, USF&WS assessments, NRCS reports resulting from NRI, USDA Economic Research Service, and World Outlook Board projections and forecasts. <u>Data Category 3:</u> Monies spent on land and natural resource assessments (Interior Appropriations Act, etc.). <u>Data Category 4:</u> Programs and expenditures for financial assistance to owners and users of rangelands.

8. Protection of Special Values

Extent to which laws, regulations, guidelines, institutions, and organizations conserve special environmental, cultural, social, and/or scientific values.

Data Category 1: Federal legislative and executive actions that set aside national parks and monuments that include rangelands, and identify the extent to which such acts affect conservation and sustainable management of rangelands.

Data Category 2: Presidential executive orders that set aside rangelands for conservation of special resources, and identify the extent to which such acts affect conservation and sustainable management of rangelands.

Data Category 3: Programs and activities of for-profit and not-for-profit organizations designed to protect tracts of rangelands for special values, and identify the extent to which such acts affect conservation and sustainable management of rangelands.

Data Category 4: GIS tabular and visual displays of size, location, and special values protected, and nature of rangeland uses within the set-aside areas.

9. Measuring and Monitoring

Extent to which agencies, institutions, and organizations devote human and financial resources to measuring and monitoring changes in the extent and condition of rangelands.

Data Category 1: Scope and reliability of rangeland-related information in existing databases.

Data Category 2: Resources used to monitor and measure rangeland-related datasets by federal and state agencies and NGOs.

Data Category 3: Extent to which the various agency databases may be combined and used effectively.

Data Category 4: Additional resources needed to monitor and measure information deemed necessary but not being monitored.

10. Research and Development

Nature and extent of research and development programs that affect the conservation and sustainable management of rangelands.

Category 1: Resources allocated to agency, university, and NGO research programs related to rangeland ecosystem state and function.

Data Category 2: Resources allocated to agency, university, and NGO research programs related to integrating environmental and social costs and benefits into markets and public policies.

Data Category 3: Resources allocated to agency, university, and NGO research programs related to new technologies and the capacity to assess the socioeconomic consequences associated with new technologies.

Data Category 4: Resources allocated to agency, university, and NGO research programs related to predicting impacts of human intervention on rangelands, including restoration.

Data Category 5: Resources allocated to agency, university, and NGO research programs related to the impacts of climate change on rangeland ecology and associated rangeland activities and uses.

Appendix 6-B. Partial List of American Indian reservations containing considerable rangeland.

Reservation Name (Tribe, if not in name) – State	Land Area (km²)
Blackfeet – MT	7,800
Cheyenne River (Cheyenne River Sioux) – SD	11,051
Colville – WA	5,483
Crow – MT	9,341
Duck Valley (Shoshoni, Paiute) – ID, NV	1,167
Flathead – MT	5,020
Fort Apache (White Mountain Apache) – AZ	6,805
Fort Belnap (Atsina, Assiniboine) – MT	2,626
Fort Berthold (Mandan) – ND	4,000
Fort Hall (Shoshoni, Bannock) – ID	2,111
Fort Peck (Assiniboine, Sioux) – MT	8,520
Hopi (AZ)	6,557
Mescalero (Apache) – NM	1,862
Navajo Nation – AZ	67,000
Nez Perce – ID	3,095
Northern Cheyenne – MT	1,831
Osage – OK	5,900
Pine Ridge (Oglala Sioux) – SD	8,984
Rosebud (Lakota) – SD	5,103
San Carlos (Apache) – AZ	7,539
Southern Ute – CO	2,742
Standing Rock (Dakota, Lakota) – ND, SD	9,251
Tohono O'odham – AZ	11,534
Uintah and Ouray (Northern Ute) – UT	17,532
Warm Springs (Wasco, Paiute) – OR	2,640
Wind River (Shoshoni, Northern Arapaho) – WY	9,148
Yakima – WA	5,662

Appendix 6-C. Partial list of non-governmental, non-profit organizations involved in the conservation and sustainable management of rangelands.

- Allan Savory Center for Holistic Management
- Arizona Common Ground Roundtable
- Audubon Society
- CABI
- Center for Biological Diversity
- Collaborative Planning Organizations on the Colorado Plateau
- Diablo Trust
- EcoResults
- Idaho Conservation League
- King Ranch Institute of Ranch Management
- Malpai Borderlands Group
- National Wildlife Federation
- Natural Resources Defense Council
- Overseas Development Institute
- Public Lands Information Center
- Rocky Mountain Elk Foundation
- Sierra Club
- Sonoita Valley Planning Partnership
- Southern Arizona Grasslands Trust, Inc.
- The Nature Conservancy
- The Quivira Coalition
- U.S. Institute for Environmental Conflict Resolution
- Udall Center for Studies in Public Policy
- Western Gamebird Alliance
- Western Watersheds Project
- World Conservation Monitoring Centre

Appendix 6-D. Partial List of Colleges and universities with programs or courses in rangeland sciences.

- Angelo State University, San Angelo, TX
- Arizona State University, Tempe, AZ
- Brigham Young University, Provo, UT
- California Polytechnic State University (Cal Poly), San Luis Obispo, CA
- Colorado State University, Fort Collins, CO
- Fort Hays State University, Hays, KS
- Humboldt State University, Arcata, CA
- Iowa State University, Ames, IA
- Kansas State University, Manhattan, KS
- Montana State University, Bozeman, MT
- New Mexico State University, Las Cruces, NM
- North Dakota State University, Fargo, ND
- Oklahoma State University, Stillwater, OK
- Oregon State University, Corvallis, OR
- Sheridan College, Sheridan, WY
- South Dakota State University, Brookings, SD
- Sul Ross State University, Alpine, TX
- Tarleton State University, Stephenville, TX
- Texas A&M University, College Station, TX
- Texas Christian University, Fort Worth, TX
- Texas Tech University, Lubbock, TX
- University of Alberta, Edmonton, Alberta, CANADA
- University of Arizona, Tucson, AZ
- University of California, Berkeley, Berkeley, CA
- University of California, Davis, Davis, CA
- University of Florida, Gainesville, FL
- University of Idaho, Moscow, ID
- University of Montana, Missoula, MT
- University of Nebraska-Lincoln, Lincoln, NE
- University of Nevada, Reno, Reno, NV
- University of Wyoming, Laramie, WY
- Utah State University, Logan, UT
- Washington State University, Pullman, WA