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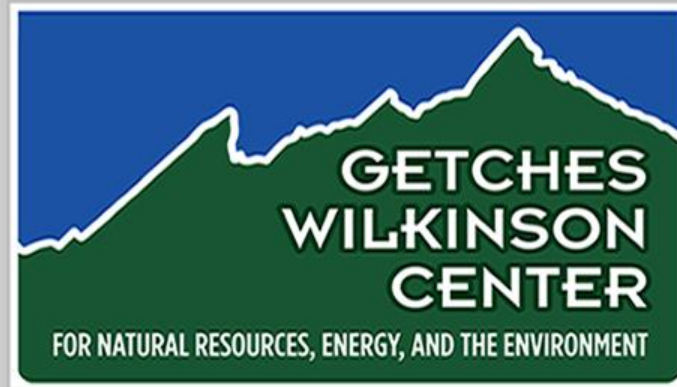
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VALUES OF THE FEDERAL PUBLIC LANDS

by

Douglas S. Kenney, Ph.D.
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Spring, 1998

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This report was prepared with funding from the Turner Foundation and the William and Flora Hewlett Foundation. All opinions expressed herein are those of the authors, and not the Natural Resources Law Center or the project sponsors.

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EXECUTIVE SUMMARY

All lands comprising the United States were previously owned by Indian tribes or foreign nations. Over the nation's history, over 2 billion acres of land have been acquired through treaty, purchase, or conquest. Ownership of most lands has since been transferred to states—which maintain their own public land systems—and private corporations (e.g., railroads) and individuals. Federal policies in favor of land disposition began to give way in the late 1800s to policies designed at land retention. Lands reserved in federal ownership through congressional or presidential action are found in several national land-use systems, including National Forests managed by the U.S. Forest Service, National Parks and Monuments managed by the National Park Service, Wildlife Refuges managed by the U.S. Fish and Wildlife Service, and a host of “leftover” lands, generally arid grasslands, managed by the U.S. Bureau of Land Management [hereinafter BLM]. Significant landholdings also are under the jurisdiction of the military and the two primary federal water agencies, the Bureau of Reclamation and U.S. Army Corps of Engineers. Today, approximately one-third of the original public domain—about three-quarters of a billion acres!—is retained in federal ownership. The overwhelming majority of these public lands lie in the western United States, including Alaska.

The value of the federal public lands is both vast and incalculable. While it is frequently possible to quantify public and private revenues associated with specific public land resources, activities, and programs, this information rarely paints a complete picture of resource valuation. Of particular concern is the observation that many qualities of the public lands are valued in ways that are not explicitly economic, thus impeding efforts to quantify all resource values using a singular, monetary valuation criterion. Additionally, many types of values with an economic component defy easy measurement. This can be particularly troublesome for resource goods and services that are not directly associated with human consumption or use, and for those which are not amenable to market transactions due to their public good orientation, their intergenerational nature, or to related qualities promoting market failures. The proliferation of natural resource subsidies can further hinder the use of economic statistics which, despite these shortcomings, still provide an essential empirical measure of value that is impossible to escape or ignore. For these reasons, the authors of this report have chosen to nest the review of economic statistics within discussions of the history, ideology, politics, and law of resource management, leading to a highly socioeconomic construct of value. This provides an appropriate perspective from which to value public land resources.

Although it is impossible to empirically describe the full value of the public lands, some relevant statistical data can be presented for most of the major uses and values, especially those of an explicitly economic nature. Two broad categories of statistical data are presented: (1) resource inventory, use, and prognosis; and (2) market values and revenue streams. This information is assembled for seven types of resource uses and values, organized into two categories:

A. Primarily Consumptive Uses and Values

- **(1) Minerals and Energy Resources.** This category include hardrock minerals, leasables (including most oil and gas resources), and salables. Both hardrock minerals and leasables generate huge financial outputs, although only the latter results in significant public revenues—approximately \$6.2 billion in 1997.
- **(2) Rangeland and Grazing.** The BLM manages approximately 165 million acres open to grazing, supporting about 4.4 million cattle, sheep, and horses; while the Forest Service manages approximately 105 million acres of public rangeland in the United States, almost exclusively located in the West, grazed by 2 million cattle, sheep, and horses. These activities typically generate over \$20 million in public revenues from grazing fees.
- **(3) Timber and Forest Products.** In 1996, approximately 3.7 billion board feet [hereinafter BBF] of timber was harvested from the National Forest system, generating about \$544 million in public receipts. Timber harvesting on BLM lands is not a major activity outside of the O&C (former Oregon and California Railroad) lands in Oregon, which generated \$75 million in public revenues in 1996.
- **(4) Water Resources.** Federal lands are the source of most surface water supplies nationally. Additionally, much of the nation's available water storage—especially in the arid and semi-arid West—is provided by federal water impoundments. Water withdrawals nationally totaled approximately 390 million acre feet [hereinafter MAF] in 1990, with the largest users being western agriculturists at 140 MAF. In addition to storing water, many of these facilities generate huge sums of hydroelectricity. Over 130 billion kilowatt hours were generated in 1996 from facilities managed by the Bureau of Reclamation and Army Corps of Engineers.

B. Primarily Non-Consumptive Uses and Values

- **(5) Recreation.** Most components of the public lands receive heavy recreational use. In 1995, the Forest Service and National Park Service recorded 345 million and 110 million visitor days, respectively. Recreational visits on BLM lands totaled almost 73 million visitor days in 1996. Recreation at federal water facilities is also extremely significant. Outdoor recreation in the United States is a \$350 billion industry (in terms of gross domestic product), with approximately \$140 billion attributable to public lands and \$40 billion to public waterways.
- **(6) Research and Knowledge.** The public lands contain a wealth of information in a variety of substantive areas, including biology, geology, archeology, and history. This knowledge is valued both by scholars and the general public, as evidenced by the approximately 60 million visits per year to historical, commemorative, and

archeological sites managed by the National Park Service. These resources are primarily valued for social, rather than economic, reasons.

- **(7) Biodiversity Preservation.** Over 3,000 plant and animal species are dependent upon the federal public lands for at least part of their habitat. Over 900 of these species are listed as either threatened or endangered. The value of these species, according to the Supreme Court's interpretation of the Endangered Species Act, is "incalculable." Congressional appropriations for recovery programs implemented by the U.S. Fish and Wildlife Service totaled \$29 million in 1994; the total national investment in species protection is considerably higher.

Potential reforms for improving public lands management come from all ends of the political and ideological spectrums. Proposals range from the "tweaking" of existing statutory regulations and administrative responsibilities to wholesale privatization of the public lands. This report does not attempt to survey the entire spectrum of potential innovations, but instead focuses on three major categories of reform proposals generally focusing on the location of decision-making authority and the nature in which market incentives and process are utilized to efficiently pursue objectives: *marketization*, *privatization*, and *localization*. The broad category of *marketization* includes those proposals calling for the application of market incentives and pricing structures to public land management, allowing free markets, rather than political processes, for example, to establish grazing, recreation, and royalty fees. A closely related—but more politically ambitious and controversial—concept is *privatization*, which involves formally transferring ownership or control of public land resources into private hands. Privatization is frequently discussed in the context of federal divestiture, which in the language of this report, also includes those reform proposals described as localization. *Localization* refers to the formal transfer of public land resources into the hands of state and local governments.

In many cases, these reform efforts are fueled by a growing national concern over natural resource subsidies, as many uses of the public lands are not financially self-supporting or do not generate revenues commensurate with similar activities on private or state lands. Public land subsidies often suggest an outdated or otherwise inappropriate allocation of federal funds and priorities. However, in other cases, these policies reflect a desire to protect ecological or social values and land uses that defy a simple monetary accounting. Determining which policies are inappropriate and which reforms are justified, therefore, is a difficult undertaking, requiring a careful balancing of resource values of both an economic and non-economic nature. This is usually best accomplished through a non-quantitative approach that utilizes the available economic data, but also considers factors such as environmental objectives, social mores, and community responsibilities. This is an extremely difficult mandate, but is central to the challenge of public lands valuation.

I. INTRODUCTION

The Issue of Perspective

The public lands of the United States are a great national treasure. These vast tracts of land, largely located in the western U.S., encompass a staggering array of natural diversity, and correspondingly, a tremendous diversity of attendant human uses and values. Determining appropriate uses, and non-uses, of these lands is a complex and evolving policy challenge. To do this correctly—and we must do this correctly—requires, at a minimum, some common understanding of the value of these lands. At first glance, this appears to be a conceptually simple, albeit practically arduous, matter of compiling statistics on resource availability and use. While information of this nature is certainly relevant and useful, and is a featured component of this report, these statistics can provide only an *approximation of public value*, as *value* is not a fixed or easily defined parameter. In most human endeavors, value is determined through a comparison of costs of similar goods or services, or if no comparable substitutes exist, through some estimate of willingness to pay.¹ While tools such as these can be of some use, ultimately they can provide only crude approximations of many types of values.

One particularly troubling challenge in estimating public land values is the simple observation that what is valuable is shaped by a variety of forces over time, as cultural, economic, political, technological, ideological, legal, and social trends, among others, work to modify the perspective through which we view our public lands. There is an awkward, historically-based dichotomy in the public lands. Whereas many public lands are regions of such beauty and significance that they have been retained in federal ownership as national treasures, many others are quite literally lands the government could not give away during the homesteading era. Long thought to be valueless, many of these semi-arid and arid lands are now highly coveted, as changing social mores, economic conditions, and technological opportunities have revealed many new values in these lands, including oil and mineral resources, recreation opportunities, and a variety of other commodity and amenity values. If this consideration were not sufficiently complex, consider the further situation of lands now utilized to satisfy specific management purposes, for example, the preservation of endangered species. For those that value endangered species, including those that feel a moral responsibility to protect species from human-induced extinction, what is the value of these lands? For those that depend economically upon the production of timber or other commodities from those same lands, activities now restricted in favor of endangered species protection, what is the value of these lands? How, if at all, were these values truly different before the endangered species was recognized and accorded legal protection? These are not economic questions, nor are they questions for which any credible economic valuation statistic can be provided.

¹ Detailed discussions of valuation techniques are provided by Freeman (1993), Hausman (1993), Smith (1996), and Pethig (1994), among others. Section III provides a very brief overview of some of the major concepts covered in these texts.

Accurately cataloging and measuring the full range of public land values, consequently, is an inherently imprecise undertaking. The aforementioned methodological constraints, however, do not invalidate the need to provide policy-makers with accurate information about public land values. As is true for all policy areas, the quality of decisions made is, at least in part, dependent upon the quality of information available to the decision-makers. How, then, can a meaningful and practically useful estimate of public land values be compiled? The approach taken in this report is to recognize that several types of statistics, if placed within a relevant historical and ideological context, can help to develop an *appropriate perspective* through which to evaluate public land values. An appropriate perspective is one which recognizes that human beings ascribe value to external objects in a multifaceted manner, attaching monetary, spiritual, aesthetic, or simply indefinable impulses of significance to the public lands and to the array of natural qualities and human communities which, in some way, are associated with these lands. If this perspective is cultivated, then traditional economic statistics—such as revenues generated from timber sales—can be utilized responsibly in public policy debates, and not used as a political tool to subjugate parties concerned with the less economically tangible and quantifiable values of the same lands, such as environmental activists promoting the preservation of old growth forests to serve ecological and aesthetic objectives. This is the approach taken in this report.

Organization and Content of the Report

This report presents a variety of statistics and supporting material dealing with the public lands. Public lands are defined broadly to encompass all lands retained and managed by the federal government due to their natural resource properties. This definition includes familiar public land components such as National Forests, National Wildlife Refuges, federal rangelands, and National Parks and Monuments, as well as less familiar elements like sub-surface mineral resources—including offshore deposits—wildlife habitat, and environmental amenities. A few other resources, such as wildlife and water, are discussed briefly due to their close association and interrelationship with public lands management. Indian lands are not covered in this report due to their quasi-independent status. Similarly, federal lands retained for military purposes are also excluded in this report, in part because the management decisions for these lands are not driven by traditional natural resource management considerations, and in part because relevant natural resource statistical information for these lands is often not publicly available.² The availability—and more importantly, the unavailability—of statistical information unavoidably shapes the type of data provided in the report. Most of the quantitative information presented focuses upon the two major public lands management agencies, the BLM and the U.S. Forest Service, as these agencies keep solid records of their activities. Most nongovernmental sources of information derive their statistics from the data and records of these two agencies, thus

² Rubenson et al. (1996) provide one of the few useful overviews of the 25 million acres of land managed by the Department of Defense.

privately compiled records are typically not appreciably different or more credible than the official statistics.

The report begins in Section II with a description of the historical genesis of the public lands and the gradual shift in federal land policy from a focus on aggressive disposition of the “public domain” to increasingly strict land retention and management by the federal government.³ This discussion is needed to describe the major categories of federal public lands, and to introduce the primary agencies and statutes responsible for the management of these resources. Section III features a review of philosophical and methodological issues associated with public lands valuation. This discussion is part of the effort to nurture an appropriate perspective from which to consider valuation statistics. Section IV features a partial summary of use and valuation statistics for many types of public land resources, including the primarily consumptive use values associated with energy and mineral resources, rangeland, forests, and water resources, as well as the primarily non-consumptive values associated with outdoor recreation, research and knowledge, and biodiversity preservation. Section V examines emerging trends and proposed policy reforms that are reshaping public lands policy. Specifically, this section investigates innovations expanding the role of market processes and local entities, both public and private, in the management of the federal public lands. Finally, in Section VI, a few concluding observations are offered, focusing in part on the modern concern over natural resource subsidies. Additional statistics and literature citations are provided in Sections VII and VIII, respectively.

³ Although the phrase “public domain” today is used synonymously with the term “public lands,” traditionally the term “public domain” referred to lands open to homesteading which had not yet been “reserved” to federal ownership. There are no public domain lands today in the sense of public lands which are not explicitly reserved.

II. HISTORICAL BACKGROUND

Acquisition of the Public Lands

All lands comprising the United States were previously owned by Indian tribes or foreign nations. Over the nation's history, over 2 billion acres of land have been acquired through treaty, purchase, or conquest. Ownership of most lands has since been transferred to states—which maintain their own public land systems—and private corporations and individuals. However, approximately one-third of the original public domain remains in federal ownership. The majority of these public lands lie in the western United States, including Alaska.

The nation's formal acquisition of territory began with the American Revolution and the ratification of the Constitution, which effectively gave the original thirteen states underlying fee title to the lands of the former English colonies located along the Atlantic coast.⁴ These original states, as well as Vermont, Maine, Tennessee, Kentucky, Texas, and Hawaii, are generally not considered "public land states," because the federal government never retained appreciable ownership of lands within their borders, instead ceding most of these lands directly to the states. In addition to land acquisitions from the English Empire, significant landholdings were also acquired from France, Spain, Mexico, and Russia. Of particular historical significance was the Louisiana Purchase of 1803, when 523 million acres of the Mississippi River Basin were acquired from France. This acquisition was soon followed by Spain's surrender of Florida in 1817, and by an agreement with the British in 1818 to extend the 49th parallel—the northern border of the continental United States—westward into the Red River Valley. Remaining English territories in Maine and Oregon were acquired in 1842 and 1846, respectively. Most of the remaining western territories, excluding Alaska and Hawaii, were acquired through conflicts with Mexico in the 1840's. Of particular note was the statehood granted to Texas in 1846 after achieving independence from Mexico, and acquisition of many additional territories originally claimed by Mexico—including California and much of the Southwest—in the 1848 Treaty of Guadeloupe Hidalgo. Extreme southern Arizona and New Mexico were later acquired from Mexico in the Gadsden Purchase of 1853. Alaska and Hawaii did not join the Union until 1959, the Alaska territories having been acquired earlier through purchase from Russia in 1867, while Hawaii joined the United States as an independent nation.⁵

Caught in the middle of the colonial conflict for land between the emerging new nation of the United States and European nations struggling to retain significant footholds

⁴ A fascinating narrative of this history is provided by DeVoto (1952).

⁵ Although it is difficult to measure the cost of territories acquired by war, those acquired by purchase are easy to evaluate. The total price tag of the Louisiana Purchase, after required interest payments and other terms, totaled over \$27 million dollars. The 1853 Gadsden Purchase, involving much smaller and dramatically less fertile lands, cost \$10 million. The purchase of the Alaskan territories in 1867 cost \$7.2 million. Of these transactions, the Alaska purchase was the most controversial, even though the per acre cost of about two cents per acre was nearly identical to the cost of the highly acclaimed Louisiana Purchase. Available in Encyclopedia Britannica Online, <<http://www.cb.com>>.

in North America were the Native Americans, thought to have occupied the continent for at least 20,000 years. The legal basis for federal acquisition and control of Indian lands was first articulated by the Supreme Court in 1823 in the landmark case of Johnson v. McIntosh.⁶ Although many elements of the decision authored by Chief Justice Marshall positively influenced federal Indian law by recognizing some tribal rights of occupancy and sovereignty on aboriginal lands, the decision's articulation of a "doctrine of discovery" provided the legal justification for dispossessing the Indians of their lands.⁷ After several decades of warfare, disease, and treaty-making, most surviving Indian Nations by the 1880's had been concentrated on reservations in the western United States, primarily in what is now Oklahoma, South Dakota, Montana, and Arizona. These reservations, totaling approximately 138 million acres of mostly desolate lands, represented only a small fraction of original Indian territories. Moreover, within 50 years, well over sixty percent of these lands were removed from Indian possession, as the new American nation completed its torrid and frequently reprehensible accumulation of land and natural resource wealth. One of the primary mechanisms by which Indians were dispossessed of reservation land was the General Allotment Act (or Dawes Act) of 1887⁸ which called for Indian reservations to be allotted, or parceled out, to individual members of the tribe rather than remaining in collective ownership. Once these lands were converted to private individual ownership, transfer to non-Indian interests was greatly simplified (McDonnell, 1991).

Early Policy: Disposition of the Public Lands

Almost as quickly as the public domain was acquired did Congress turn its attention to land disposition and settlement, recognizing that nations cannot easily retain lands that are poorly populated. The Property Clause of the U.S. Constitution provides Congress with broad authority over the use and disposal of the public lands: "Congress shall have Power to dispose of and make all needful Rules and Regulations respecting the Territory or other Property belonging to the United States."⁹ Up until the turn of the 20th century, Congress used this exclusive plenary power in a series of legislative initiatives designed to dispose of the public lands. These initiatives included land grants to states, railroads, and settlers, as well as mineral and timber grants.

Grants to States

In addition to large land grants made upon statehood to the "non-public lands states" located primarily in the East, newly created states in the Midwest and West also

⁶ *Johnson v. McIntosh*, 21 U.S. (8 Wheat) 543 (1823).

⁷ Essentially, the doctrine of discovery, borrowed from the international "law of civilized nations," asserts the right of European nations to assume valid title to land either by conquest or purchase.

⁸ Act of February 8, 1887, ch 119, §1, 24 Stat. 388, now codified at 25 U.S.C. § 331 (1995).

⁹ Article IV, section 3, paragraph 2.

often received sizable land grants upon gaining statehood.¹⁰ These grants were allocated in accordance with the Land Ordinance of 1785, which created a rectangular survey system in which federal lands were divided into square townships of 36 identically-numbered sections each containing 640 acres (Coggins et al., 1992).¹¹ Initially, states were allocated two sections per township—numbers 16 and 36—typically to support state education expenses.¹² In some circumstances, “in lieu” selections were granted to the states when necessary to compensate for the fact that the legislatively specified township sections were sometimes already claimed by other private interests, usually homesteaders or miners. In lieu selections entitled a state to another township section of land of comparable quality or rough equivalency. Originally, states making in lieu land selections were prohibited from systematically selecting valuable lands of known mineral character or value, however, this policy was eventually revised to allow in lieu mineral selections provided that the unavailable school trust lands were also mineral in character.¹³ Land grants to states either gave full fee simple ownership to states, or were sometimes limited to a particular public purpose like recreational activity.¹⁴

Overall, 77 million acres were given for state school trust lands and 21 million acres were disposed of as sites for institutions of higher education (Coggins et al., 1992). The vast majority of these educational land grants are located in the West, in accordance with changing federal policies over time regarding the admission of new states. A few western states—namely Arizona, New Mexico, and Utah—were particularly fortunate, receiving four school sections, twice the normal allotment, in every township.¹⁵ Another special case was that of Alaska, which under the Alaska Enabling Act was granted the right to select 104 million acres of federal land, the largest of all state land grants.¹⁶

Grants to Railroads

Another major strategy of land disposal was grants to railroads, which provided powerful economic incentives to accomplish the twin goals of western infrastructure

¹⁰ In accordance with the Submerged Lands Act of 1953 (43 U.S.C.A. §§1301-1315), states have also been granted the right to regulate lands located beneath navigable rivers within their borders—although regulation of the river itself is frequently retained by the federal government through exercise of the Commerce Clause.

¹¹ A Township is a square plot of land 6 miles to a side, consisting of 36 sections of one square mile each. Each section contains 640 acres.

¹² See 43 U.S.C.A. §§ 851-73.

¹³ The Supreme Court upheld the Secretary of Interior’s administrative policy of disallowing in lieu selections when there was “grossly disparate value” between the original school trust lands and those selected for substitution, in *Andrus v. Utah*, 448 U.S. 907 (1980).

¹⁴ See 43 U.S.C.A. § 869.

¹⁵ In fact, a significant controversy surrounding President Clinton’s recent declaration of the 1.7 million acre Grand Staircase-Escalante National Monument in southern Utah is the fact that the State of Utah has some school trust lands located within the monument which are believed to be of significant mineral value, and is consequently demanding comparably valuable federal lands outside of the monument boundaries in compensation.

¹⁶ 72 Stat. 339 (P.L. 85-508), Act of July 7, 1958; 48 U.S.C. §§ 21, ch. 2-27.

development and settlement (Coggins et al., 1992). As early as 1835, Congress was granting railroads rights-of-way across the public lands up to 100 feet wide, adopting a general law to that effect in 1852, which also included the free use of earth, stone, and timber from adjacent public lands.¹⁷ To create an additional incentive for rapid railroad construction, Congress in 1850 began granting railroad companies "checkerboard" rights-of-way through the public lands, giving railroad companies the alternate odd-numbered township sections within six miles of the railroad line. Later, these checkerboard grants increased to twenty odd-numbered sections within a forty-mile radius. This checkerboard pattern of land disposal was designed to increase the value of the federal plots adjacent to newly privatized railroad lands by making it more appealing for settlement due to its proximity to a rail line and burgeoning commercial enterprises. The checkerboard policy was also designed to prevent the already powerful railroad companies from monopolizing the public lands—a goal only partially accomplished. Railroads were given immense parcels of land, drying up a significant amount of the public lands still available for homesteading and leading some modern observers to conclude that the "railroad enterprise effectively ended the frontier" (Coggins et al., 1992:98). Approximately 90 million acres were eventually given directly to the railroads by Congress, as well as 35 to 40 million acres granted to the states for use by the railroads.

These generous land grants to railroads were often abused, occasionally leading to forfeiture of lands back to the federal government for failure to comply with the conditions of the original grants. The most notable example is provided by the timber-rich "O&C" lands of the Pacific Northwest, so named due to their original conveyance to the Oregon and California Railroad which had agreed to construct a line from Portland to Sacramento. However, after numerous delays in construction, the land eventually reverted back to the federal government and is today managed by the BLM (Coggins et al., 1992). The O&C lands contain some of the finest old growth forests left in the United States, and have consequently emerged as lands of high concern to many parties in the Pacific Northwest, as well as national timber interests and the greater environmental community.¹⁸

Land Grants to Settlers

Several legislative initiatives were also designed to privatize or directly transfer public lands into the hands of individual western settlers, particularly farmers. The underlying federal philosophy during the homesteading era was derived from the idealistic Jeffersonian vision of a vast society of independent, productive "yeoman" farmers. Individuals of this nature were typically characterized as being more desirable Americans than the capitalistic and industry-minded entrepreneurs that were becoming an increasingly powerful economic force in 19th century America. Initial federal support for homesteaders

¹⁷ Act of August 4, 1852, ch. 200, §§ 1-2, 10 Stat. 28.

¹⁸ Most of these lands are now under the protective veil of President Clinton's Northwest Forest Plan, in effect since 1993, which has severely restricted timber cut-levels in old growth forests of the Pacific Northwest primarily to protect the dwindling population of endangered spotted owls (Record of Decision, 1994; Carroll, 1995).

came in the General Preemption Act of 1841, which formally recognized the previously unofficial practice of preemption: i.e., granting settler-squatters the preferential right to buy their claims at modest prices without competitive bidding.¹⁹ Further assistance to western homesteaders was provided by the 1862 Homestead Act,²⁰ designed to achieve widely dispersed individual ownership of land and provide a means of encouraging rapid westward expansion into the Frontier. Under the Act, an individual U.S. citizen was permitted to enter a parcel of public domain land in good faith and receive a federal patent—i.e., a deed granting fee simple title—to 160 acres of territory for settling the land, residing on it for five years, and putting it to beneficial agricultural use.

The Homestead Act and similar policies were frequently abused. For example, many unscrupulous “settlers” would enter a parcel in alleged good faith, only to strip the land of its timber or minerals, sell the commodities, and then move on to exploit other parcels of the public domain. More sophisticated schemes involved hiring a straw purchaser to pose as a farmer-settler and patent a tract, whereupon the phony homesteader would turn around and sell the patent to timber speculators for a nominal fee (Wilkinson, 1992). Still other recalcitrant individuals would claim lands they did not legitimately settle—in the sense of cultivating the land agriculturally—or fence in more land than was allowed by the statute, thereby excluding other settlers. Ultimately, the Homestead Act was partially revoked with the passage of the 1934 Taylor Grazing Act,²¹ and was expressly repealed in 1976 with the passage of the Federal Land Policy and Management Act (FLPMA).²²

Corruption was not the only major deficiency in federal homesteading policy. Of equal concern was the tremendous failure rate of homesteads, especially during prolonged midwestern droughts beginning in the late 1880's (Stegner, 1953). To more effectively pursue Jefferson's agrarian ideal, it was soon evident that landholdings of 160 acres were insufficient to support a pioneer family in semi-arid and arid regions that were better suited to ranching economies. One response to this realization was found in the Stock-Raising Homestead Act of 1916, which increased the amount of land that could be homesteaded to 640 acres of land designated as chiefly valuable for grazing.²³ A different approach to the aridity problem was taken earlier in the 1877 Desert Lands Act,²⁴ which awarded land to settlers in arid regions for twenty-five cents per acre, with patents being conveyed upon

¹⁹ Act of September 4, 1841, ch. 16, § 11; 5 Stat. 433, 456 (repealed 1891). Up until the passage of this Act, preemption was understood to be a preferential right of settlers to squat on a parcel of public lands and later purchase the land from the federal government for a modest fee and without the competition of a bidding system. In contrast to all prior preemption-based statutes which had only the effect of ratifying prior squatting claims, the General Preemption Act sanctioned prospective squatting by granting the right of eligible settler-squatters to receive up to 160 acres at \$1.25 per acre (Coggins et al., 1992).

²⁰ See 43 U.S.C.A. §§ 161-284, (repealed 1976).

²¹ 43 U.S.C.A. §§ 315-315r.

²² 43 U.S.C.A. §§ 1701-84.

²³ See 43 U.S.C.A. §§ 291-302. The Stock-Raising Homestead Act followed largely in the footsteps of the Kinkaid Act, passed in 1904, to successfully settle Nebraska. In response to the abuses of the Homestead Act, patents issued under the Stock-Raising Homestead Act limited the use of the land to grazing and foraging crops, explicitly reserving the coal and mineral rights to the government. As a result of this, lands patented under the Stock-Raising Homestead Act comprise a split-estate: the surface ownership is private, while the subsurface, mineral estate is federally owned.

²⁴ See 43 U.S.C.A. §§ 321-329.

proof of successful irrigation. In many regions, however, relatively few individuals or privately-funded cooperatives could successfully satisfy the financial and technical demands of constructing irrigation projects, prompting congressional passage of the Reclamation Act of 1902²⁵ and the subsequent establishment of the U.S. Reclamation Service, later to become the Bureau of Reclamation (Pisani, 1992). Some \$22 billion later, the Bureau of Reclamation has provided well over 100 million acre-feet of water storage capacity in over 130 major projects, radically changing the western landscape forever (WWPRAC, 1997).

Sizable land grants were also offered as payment to individuals who served in the armed forces during war, especially the Civil War. Not only did these "bounty warrants" eliminate a burden on the federal treasury, they also satisfied the twin goals of "rewarding the aggressive conquerors while removing them from the civilized vicinity" (Coggins et al., 1992:85). Although a precise estimate of the total acreage awarded through this program is difficult to accurately determine, over 60 million acres were disposed of in this manner between 1847 and 1906.

Mineral and Timber Grants to Settlers

Land was not the only incentive provided by the federal government to settle the West. The potential to "strike it rich" through mineral development provided one of the most significant inducements to western settlement, beginning in earnest with the gold and silver rushes of the 1840's and 1850's (Coggins et al., 1992). The 1872 General Mining Law (also known as the "Hardrock Act") was designed to encourage additional western mineral exploration, proclaiming "all valuable mineral deposits in lands belonging to the United States . . . shall be free and open to exploration and purchase, and the lands in which they are found to occupation and purchase."²⁶ Still in effect today, the law gives individuals the opportunity to "locate" or stake a mining claim on federally owned public lands, entitling the individual to the exclusive rights to occupy and diligently explore the land for "discovery" of a valuable mineral deposit.²⁷ Upon proof of discovery of a commercially valuable mineral deposit and payment of a nominal fee, the individual can patent the land and thereby receive a full estate in property: i.e., fee title to both the land (surface estate) and the mineral resources (subsurface estate). With such a liberal standard for mineral exploration, it is not surprising to find a long and sordid history of exploitation under the General Mining Law. These abuses have led over time to increasingly strict management of minerals in the public interest and a gradual removal of commercially valuable minerals initially covered by the Hardrock Act, with those resources placed instead under closely managed leasing or competitive bidding systems.

²⁵ See 43 U.S.C.A. §§ 371-431.

²⁶ 30 U.S.C.A. § 22.

²⁷ This right is known as "pedis possessio," under which the prospecting individual has an exclusive right to work the located land, a right which is good against all third parties except the United States. Upon discovery of a commercially valuable mineral deposit, however, the individual may "patent" the land and thereby receive full fee title, good against all parties, including the United States.

The incentive of federal timber resources in the Frontier—and their resulting exploitation—also provided a strong stimulus for western expansion. Responding to the nearly insatiable commercial demand for timber in the budding young nation, claims to western timber resources were often based on fraudulent assertions of preemption by settler-squatters with dishonest motives. In many other cases, less sophisticated criminal operations entailed illegally entering the lands of absentee owners and clearcutting the available timber (Coggins et al., 1992). Several legislative initiatives also promised significant timber rewards, thereby further fueling timber speculation. For example, the Timber Culture Act of 1872 supplemented the Homestead Act by granting settlers the right to aggregate an additional 160 acres to a homesteading claim by simply agreeing to leave 40 acres of the additional land as uncut forest. Later, in 1878, the Timber and Stone Act authorized some western citizens to purchase up to 160 acres of public timberlands which were identified as “chiefly valuable for timber or stone” for a modest fee of \$2.50 an acre. Although these timberlands were to be used only for personal, non-speculative use, commercial interests again predominated. Additional congressional support for timber exploitation in the West was provided later that year in passage of the Timber Cutting Act, which gave residents of other states the right to cut on mining lands that had not been entered (Coggins et al., 1992).

Modern Era of Retention and Preservation

Beginning late in the 19th century, Congress and the Executive started to fundamentally redirect the focus of the nation’s public lands policies, concluding that the remainder of the public domain and its associated natural resources should be conserved and managed for long-term public benefit. In large part, this change in focus was prompted by the widespread abuse of liberal federal land disposition policies by unscrupulous railroad companies, homesteaders, prospectors, and other entrepreneurs over-zealously extracting the wealth of the public domain. This change in focus is perhaps best illustrated by revisiting the case of the O&C lands, which after being repossessed by the federal government, were not returned to the public domain and to the policies of disposition. Instead, the 1937 O&C Act asserts that these lands “shall be managed for permanent forest production, and the timber thereon shall be sold, cut, and removed in conformity with the principal [sic] of sustained yield for the purpose of providing a permanent source of timber supply, protecting watersheds, regulating stream flow, and contributing to the economic stability of local communities and industries, and providing recreational facil[i]ties.”²⁸

Both Congress and the Executive have played prominent roles in reserving federal lands for specific purposes, with early congressional reservations primarily focusing on lands of scenic value, and initial presidential reservations focusing on the retention of timber lands and lands of special ecological significance. Over time, land reservations have been made for an extremely wide variety of public purposes, as directed by an evolving body of federal law and policy. While Congress possesses plenary power over the public lands, the

²⁸ 43 U.S.C.A. §1181(a).

presidential authority to reserve lands continues to be an area of some confusion and controversy.²⁹ The Executive does possess some independent authority to reserve public lands, however, most presidential land reservations have been based on authority delegated from Congress. One of the earliest of these delegations was found in the General Revision Act of 1891, which authorized the President to "set apart and reserve . . . any part of the public lands wholly or in part covered with timber or undergrowth, whether of commercial value or not, as public reservations."³⁰ Also significant has been the Antiquities Act of 1906, which authorizes the President to set aside from the public domain national monuments, defined as "historic landmarks, historic and prehistoric structures, and other objects of historic or scientific interest."³¹ Even more sweeping was the Pickett Act of 1910³² which gave the President discretionary authority to "temporarily withdraw from settlement, location, sale, or entry any of the public lands of the United States, including Alaska . . . and such reservations shall remain in force until revoked by him or by an Act of Congress."³³ The language in these and similar statutes not only provides a legal mechanism for the preservation of federal public lands, but also serves to articulate some of the values that Congress and the President, on behalf of the American people, ascribes to these lands.

Forest Management: The Forest Service

The General Revision Act of 1891, prompted in large part by widespread abuses of public forestlands under the General Preemption and Timber Culture Acts, created the vehicle for the establishment of the modern system of National Forests. By 1894, almost 18 million acres of forestlands had been withdrawn from the public domain. Three years later, with just ten days left in office, President Cleveland more than doubled these reservations by withdrawing an additional 21 million acres of forest reserves (Clarke and McCool, 1985). This rapid reduction of the public domain outraged many western leaders, in part because existing law suggested these forest reserves were to be off-limits to all private use, perhaps even illegal to enter (Pinchot, 1947). The intended use of these reserves began to take shape with passage of the Organic Act of 1897 and the subsequent establishment in 1905 of the Forest Service, within the Department of Agriculture,³⁴ under a mandate "to regulate . . . occupancy and use" of the forest reserves, including the managed sale of timber.³⁵ This already formidable management mandate grew significantly in the agency's first couple

²⁹ "Plenary power" in this case refers to broad congressional exercises of authority, actions that have the effect of preempting state action.

³⁰ 16 U.S.C.A. § 471 (repealed 1976).

³¹ 16 U.S.C.A. § 431.

³² See 43 U.S.C.A. §§ 141-142 (repealed 1976).

³³ 43 U.S.C.A. § 141.

³⁴ Until 1905, the federal forest reserves were under the jurisdiction of the Department of Interior, while all of the government's foresters—all two of them—were employed in the Department of Agriculture. The 1905 legislation finally connected the federal forests and professional foresters (Clarke and McCool, 1985; Pinchot, 1947).

³⁵ 16 U.S.C. §§ 476, 551.

years, as the national forest system swelled to almost 150 million acres (Wilkinson, 1992; Coggins et al., 1992). Today's system of National Forests contains approximately 191 million acres (Forest Service, 1996).

In language designed to retain but limit presidential authority to reserve national forests, the Organic Act provided an initial determination of forest management objectives: "No national forests shall be established, except to improve and protect the forest within the boundaries, or for the purpose of securing favorable conditions of water flows, and to furnish a continuous supply of timber for the use and necessities of citizens of the United States."³⁶ Providing this "continuous supply" of timber to the rapidly growing nation, especially in the post World War II housing boom, required dramatic increases in harvest levels, which created escalating conflicts with parties seeking to utilize these lands for other purposes, such as recreation.³⁷ These growing sectoral conflicts were addressed in part in the Multiple-Use, Sustained-Yield Act (MUSY) of 1960, which codified the heretofore implicit Forest Service policy of multiple-use management by listing five uses of the national forests to be pursued on a sustained-yield basis: "outdoor recreation, range, timber, watershed, and wildlife and fish purposes."³⁸

Although the management purposes specified in MUSY remain as the modern basis of National Forest management, implementing multiple-use, sustained-yield management has proven to be highly difficult, especially as concerns over clearcutting, the loss of old-growth forests, endangered species, and related environmental issues have become more featured elements of the public policy dialogue. These and other concerns regarding the difficulty of managing forests to serve "multiple" values were addressed in part in the National Forest Management Act of 1976 (NFMA),³⁹ which requires the Forest Service to utilize public input in preparation of comprehensive multiple-use land management plans for each administrative unit of the national forest system every 15 to 20 years—a procedural requirement that has proven extremely difficult to implement.⁴⁰ Also problematic in

³⁶ 16 U.S.C.A. § 475.

³⁷ Annual timber harvests in the national forests first exceeded 1 BBF in 1923, 2 BBF in 1940, 4 BBF in 1951, and an amazing 12 BBF in 1966 (Coggins et al., 1992). Coincident with this post-war logging boom was a parallel increase in recreation on the national forests. For example, from 1948 to 1976, visits to the national forests increased twentyfold, from 10 million to 190 million annual visits (Wilkinson, 1992).

³⁸ 16 U.S.C. § 528. This legislation is discussed further in Section III.

³⁹ See 16 U.S.C.A. §§ 1600-1614.

⁴⁰ The passage of NFMA was largely fueled by the so-called *Monongahela* decision of 1975, in which the Fourth Circuit Court of Appeals held that the Forest Service had exceeded its authority by selling economically, but not biologically, mature trees, and by failing to practice selective cutting, as required by the Organic Act, in favor of the more efficient harvest method of clearcutting. (See *West Virginia Division of the Izaak Walton League of America, Inc. v. Butz*, 522 F.2d 945, 4th Cir. (1975).) NFMA supports the court's decision that trees must be biologically mature prior to sale, as it prohibits the cutting of trees which have not reached the "culmination of mean annual increment" (CMAI) of growth—that is, to be eligible for sale, trees must have reached a point of maturity where annual growth rates have tapered significantly (16 U.S.C.A. § 1604 (m)). This has the effect of imposing a longer rotation age upon Forest Service timber harvesting, requiring the Service to wait until trees are physically mature before turning over a stand. In addition, NFMA imposes a number of stringent conditions which must be met before the Forest Service may authorize a clearcut sale, and requires that the Forest Service engage in genuine multiple-use planning by classifying lands physically and economically unsuitable for timber production to "provide for a diversity of

practice is implementation of the act's reliance on "nondeclining even-flow" (NDEF) management,⁴¹ essentially a conservative version of sustained-yield management which discourages wholesale removal of old growth forests by requiring that the same level of timber harvest be "maintained annually in perpetuity" (Coggins et al., 1992).

National Parks: Creation and Management

Running counter to the utilitarian motives of the Forest Service and its first leader, Gifford Pinchot, was the preservationist school of thought articulated by men such as John Muir, best remembered as the founding father of the Sierra Club.⁴² The preservationists primarily fought for the reservation of federal lands of unique scenic and historical significance. Early congressional land reservations at the Hot Springs region in Arkansas in the 1830's⁴³ and California's Yosemite Valley in 1864⁴⁴ paved the way for the eventual designation of the nation's first National Park: Yellowstone, reserved as a national "pleasuring ground" in 1872.⁴⁵ There are now 50 such parks covering over 80 million acres of land, with Congress approving 340 land additions to existing Parks to date (Coggins et al., 1992; Miniclier, 1997).

Very similar to the situation seen for National Forests, the American system of National Parks evolved well before an administrative body emerged to manage these lands. The deficiencies of this approach were perhaps best illustrated at Yellowstone, where the early days of the Park saw rampant squatting by hunters, loggers, and miners. It was only after the eventual dispatch of the U.S. Cavalry to Yellowstone that these squatters were ejected (Miniclier, 1997). These forces remained at Yellowstone until the U.S. National Park Service was established and equipped to take over enforcement responsibilities. The Park Service was established as part of the National Park Service Organic Act of 1916, which provided the agency with a mandate to "to conserve the scenery and the natural and historic objects and the wildlife therein, and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired in future generations."⁴⁶ The management of most National Monuments, National Battlefields, and many other areas of physical or cultural significance are additional responsibilities of the Park Service.

plant and animal communities based on the suitability and capability of the specific land area in order to meet overall multiple-use objectives" (16 U.S.C. §§ 1604(g)(3)(E), 1604(k), and 1604(g)(3)(B)).

⁴¹ "The Secretary of Agriculture shall limit the sale of timber from each national forest to a quantity equal to or less than a quantity which can be removed from such forest annually in perpetuity on a sustained-yield basis." 16 U.S.C.A. § 1611(a).

⁴² For a discussion of philosophical differences between the Pinchotian and Muirian approaches to public lands preservation, see Section III.

⁴³ The Hot Springs region was acquired as part of the Louisiana Purchase in 1803 and reserved from the public domain on April 20, 1832 (4 Stat. 505). The site was not designated as a National Park until March 4, 1921 (41 Stat. 1407).

⁴⁴ Yosemite Park Act, 13 Stat. 325.

⁴⁵ Under the Yellowstone Park Act, public domain lands were "reserved and withdrawn from settlement, occupancy, or sale under the laws of the United States, and dedicated and set apart as a public park or pleasuring-ground for the benefit and enjoyment of the people" (30 U.S.C.A. §§21-22).

⁴⁶ 16 U.S.C.A. § 1.

The dual mandate of the Park Service to preserve the natural quality of designated sites while providing for tourism and recreation has been a constant source of conflict within the agency. Traffic congestion and facility overcrowding are increasingly severe problems in many components of the Park system, as agency officials and subcontractors struggle to upgrade and maintain visitor services and concessions while protecting those natural qualities that merited the original reservations of these lands. Managing negative transboundary impacts among these lands and neighboring communities is also an increasingly complex challenge for the Park Service. For example, while supporters of Yellowstone worry about potential negative impacts on the Park from outside developments, such as the proposed New World Mine, some neighboring ranching interests fear the export of predators such as wolves and diseases such as brucellosis, which some parties fear may be carried by bison.⁴⁷

Rangeland and the Bureau of Land Management

Rangelands constitute another major component of the federal public lands. Unlike the highly valued lands reserved for National Forests and National Parks, the federal rangelands are, in large part, comprised of lands the government could not give away during the homesteading era. Much of these lands are highly arid and generally unsuitable for agriculture, but are instead more appropriate for ranching economies. The initial homesteaders who established private ranches in these arid and semi-arid regions typically monopolized the water sources in valleys, leaving in the public domain higher altitude lands upon which further settlement was not readily feasible. As these ranching operations grew, the lands remaining in public ownership became increasingly utilized as summer grazing lands. In a manner typical of common resources, these public grasslands soon began to show the negative effects of overuse, as each rancher sought to maximize their own use of the unregulated resource.⁴⁸ Rampant overgrazing, in turn, led to widespread erosion, flooding, and vegetative community changes on the public lands (Bates, 1992).

The Taylor Grazing Act of 1934⁴⁹ was designed, at least in part, to curb this overuse problem occurring on the federal rangelands—a goal that essentially resulted in the closing of the public domain. The Taylor Grazing Act created “grazing districts” within which Interior Department land managers award grazing permits to participating ranchers, thereby regulating the number of animals grazing on a given portion of the public lands.⁵⁰ This management scheme was initially more impressive on paper than in practice, however, as

⁴⁷ Many of these issues are discussed in depth in the *High Country News*, September 15, 1997 (Volume 29, Number 17).

⁴⁸ Situations of this nature are frequently referred to as a “tragedy of the commons,” a phrase made famous by Garret Hardin (1968). Problems of this type are typically resolved by limiting access, either by transferring the common resources to private control, or by instituting a governmental program of regulated access. Elements of both strategies can be found in existing leasing programs.

⁴⁹ See 43 U.S.C.A. §§ 315-315(r).

⁵⁰ Grazing leases are based on the number of AUM's, animal unit months, that the federal land manager believes the land can support.

“district boards” with the power to set grazing levels and fees within the districts were effectively controlled by ranching interests (Foss, 1960).

To address this and other administrative deficiencies in the new grazing program, the BLM was established in 1946 in a merger of the Grazing Service and the General Land Office. As of 1996, slightly more than half of the 264 million acres under BLM management are located within grazing districts,⁵¹ firmly establishing the agency as the nation’s premier manager of grazing lands.⁵² The establishment of the BLM, however, has proved to be only a partial remedy to the management problems on the federal rangelands, as the new agency did not acquire an official mandate to implement rangeland conservation or protect other public land values until the passage of the Multiple-Use-Sustained Yield Act of 1960,⁵³ soon followed by the Federal Lands Policy and Management Act of 1976 (FLPMA).⁵⁴ Clearly codifying what had been implicit since the Taylor Grazing Act, FLPMA articulated the modern policy preference in favor of federal land retention, stating that “the public lands be retained in Federal ownership, unless . . . it is determined that disposal of a particular parcel will serve the national interest”⁵⁵

FLPMA is the primary land management statute governing the lands managed by the BLM.⁵⁶ Similar in many ways to NFMA, FLPMA is management and planning oriented, requiring the Interior Secretary “to establish comprehensive rules and regulations after considering the views of the general public,” including the promulgation by BLM of long-term resource management plans based on the multiple-use, sustained-yield philosophy.⁵⁷ Implement of this philosophy is complicated by its inherent contradictions between resource development and preservation. On the one hand, FLPMA specifies that the “public lands be managed in a manner that will protect the quality of scientific, scenic, historical, ecological, environmental, air and atmospheric, water resource, and archeological values; that, where appropriate, will preserve and protect certain public lands in their natural condition; that will provide food and habitat for fish and wildlife and domestic animals; and that will provide for outdoor recreation and human occupancy and use.”⁵⁸ On the other hand, FLPMA specifies that the rangeland be managed “in a manner which recognizes the Nation’s need for domestic sources of minerals, food, timber, and fiber from the public lands”(footnote for quote)

⁵¹ Statistics taken from Table 1-4 of *Public Land Statistics* 1996 (BLM, 1996a), available on the world wide web at <<http://www.blm.gov/nhp/landfacts/pls96.html>>.

⁵² The Department of Agriculture, primarily acting through the Forest Service, also manages some federal grazing areas within National Forests, and in areas designated as “National Grasslands” by the Secretary of Agriculture. National Grasslands include lands purchased by the Federal Government from bankrupt dirt farmers in drought-ridden depression years under the Submarginal Lands Retirement Program (Coggins et al., 1992). Through the “land acquisition and utilization program,” or LU program, a series of reforms were undertaken in 1933 to shift the use of lands ill-suited to crop production to livestock grazing. This program evolved into the Bankhead-Jones Farm Tenant Act in 1937 (U.S.C. §§ 1001-40).

⁵³ 16 U.S.C.A. § 528-531.

⁵⁴ 43 U.S.C.A. § 1701-84.

⁵⁵ 43 U.S.C.A. § 1701(a)(1).

⁵⁶ This legislation is discussed in greater depth in Section III.

⁵⁷ § 1701(a)(5).

⁵⁸ 43 U.S.C.A. § 1701(a)(8), § 1701(a)(12).

No doubt inspired by the failure of the “district boards” system under the Taylor Grazing Act to noticeably improve range conditions on the public lands, FLPMA was augmented in 1978 by the Public Rangelands Improvement Act (PRIA), which establishes a modified system of grazing advisory boards as well as a formula for setting grazing fees.⁵⁹ More recently in the 1990’s, an experimental system of “resource advisory councils” or RACs has been employed to seek bottom-up, consensus-based solutions to rangeland management controversies. Nevertheless, critics maintain that grazing fees remain significantly below market prices and problems of overgrazing, while regionally variable, are still prevalent (Wilkinson, 1992; Coggins et al., 1992; Davis, 1997).

Further Experiments in Preservation: Protecting the Wild Places

While the most visible articulation of the preservationist philosophy is our National Park system, several additional efforts have been made to ensure that settlement and “civilization” of the nation, especially the West, does not bring an end to all things wild. These efforts have had a significant influence in determining the magnitude and management of the public lands. Of particular significance has been the recognized value of protecting wildlife and wildlife habitat, for both “intrinsic” preservationist values and, in a more utilitarian vein, to maintain future hunting opportunities. Since passage of the Fish and Wildlife Coordination Act of 1934,⁶⁰ federal agencies have been required to explicitly consider the wildlife impacts of various federal projects, including water development and water pollution control activities. Habitat protection for wildlife was further solidified by the creation of the U.S. Fish and Wildlife Service within the Department of the Interior in 1939⁶¹ with a mandate to conserve and manage migratory birds, to control predator populations, to conduct ongoing wildlife research, and to manage lands set aside for these purposes (Clarke and McCool, 1985; Bates, 1992).

Establishing a tradition of federal land reservations for wildlife purposes was a major accomplishment of the presidency of Theodore Roosevelt—often regarded as the nation’s premier conservationist president—who established the first national wildlife refuge at Florida’s Pelican Island in 1903, eventually establishing an additional 50 wildlife refuges over the next 6 years (Wilkinson, 1992; Hays, 1959). It was not until the National Wildlife Refuge Administration Act of 1966,⁶² however, that these and similarly reserved lands were consolidated into the modern system of National Wildlife Refuges and placed under the express jurisdiction of the Fish and Wildlife Service. Today, the National Refuge System covers almost 93 million acres organized into 752 administrative units: 509 National

⁵⁹ 43 U.S.C.A. §§ 1702, 1753, 1901-08.

⁶⁰ See, 16 U.S.C.A. §§ 661-667.

⁶¹ 16 U.S.C.A. § 742(b).

⁶² This legislation proclaims “all lands, waters, and interests therein administered by the Secretary [of the Interior] as wildlife refuges, areas for the protection and conversation of fish and wildlife that are threatened with extinction, wildlife ranges, game ranges, wildlife management areas, or waterfowl production areas are hereby [collectively] designated as the ‘national Wildlife Refuge System,’ . . . which shall be administered by the Secretary through the United States Fish and Wildlife Service” (16 U.S.C.A. §§ 668dd-668ee).

Wildlife Refuges, 193 Waterfowl Protection Areas, and 50 Coordination Areas (FWS, 1996).

A more explicitly preservationist motive underlies the Wilderness Act of 1964,⁶³ which created a National Wilderness Preservation System to preserve wild areas by initially designating 9.1 million acres of existing public lands as wilderness preserves, much of which had been protected previously as designated "primitive" areas under National Forest, National Park, or Wildlife Refuge classifications. By recognizing the special attributes of wild areas, the congressional definition of wilderness illustrates a growing realization that the public lands contain many values that extend beyond traditional human land-uses:

Wilderness, in contrast with those areas where man and his own works dominate the landscape, is . . . an area where the earth and its community of life are untrammelled by man, where man himself is a visitor who does not remain. An area of wilderness is further defined to mean . . . an area of undeveloped Federal land retaining its primeval character and influence, without permanent improvements or human habitation, which is protected and managed so as to preserve its natural conditions and which (1) generally appears to have been affected by the forces of nature, with the imprint of man's work substantially unnoticeable; (2) has outstanding opportunities for solitude or a primitive and unconfined type of recreation; (3) has at least five thousand acres of land or is of sufficient size as to make practical its preservation and use in an unimpaired condition; and (4) may also contain ecological, geological, or other features of scientific, educational, scenic, or historical value.⁶⁴

Unlike many other types of federal land reservations, the authority to designate wilderness areas is a power retained exclusively by Congress (Bates, 1992). The designation of wilderness is an ongoing and often highly controversial political process. Most wilderness designations follow an extensive period of agency study, as both the BLM and the Forest Service are required to conduct wilderness studies of primitive, roadless areas under FLPMA and the Wilderness Act, respectively.⁶⁵ Many activities are expressly prohibited in such designated study areas, including road-building, commodity production, the use of motorized equipment, and the erection of structures; however, several annual appropriation riders have passed Congress authorizing exceptions, such as allowing limited mineral development within study areas (Bates, 1992). Additionally, the Wilderness Act itself allows many pre-existing uses to continue within the wilderness system.⁶⁶ Several

⁶³ 16 U.S.C.A. §§ 1131-36.

⁶⁴ 16 U.S.C.A. § 1131(c).

⁶⁵ Among the better-known, and highly controversial, studies have been the RARE I and II studies. The purpose of these "Roadless Area Review and Evaluations" was to identify undeveloped areas within the National Forest system with the potential for inclusion in the Wilderness system. RARE I (1967 to 1973) identified 12.3 million acres for study as wilderness areas. Later in the 1970's, RARE II identified over 62 million acres (Coggins et al., 1992). Similar reviews on BLM lands are required by FLPMA (43 U.S.C.A. § 1872 (603)(a)).

⁶⁶ 16 U.S.C.A. § 1133(d).

administrative components of the federal public lands have been formally designated by Congress as wilderness, including approximately 35 million acres of Forest Service lands, 39 million acres within the National Park system, 21 million acres managed by the Fish and Wildlife Service, and 1.4 million acres managed by the BLM.⁶⁷

Similar in philosophy to the wilderness system have been efforts to protect other special types of wild environments. One prominent example of these efforts is the National Wild and Scenic Rivers Act of 1968.⁶⁸ This Act proclaims that "certain selected rivers of the Nation which, with their immediate environments, possess outstandingly remarkable scenic, recreational, geologic, fish and wildlife, historic, cultural, or other similar values, shall be preserved in free-flowing condition, and that they and their immediate environments shall be protected for the benefit and enjoyment of present and future generations."⁶⁹ The system currently contains over 10,000 river miles along more than 200 rivers, concentrated primarily in northern California, Oregon, Alaska, and Michigan's Upper Peninsula.⁷⁰

Statutory protection has also been extended to the preservation of biodiversity, most directly through a program designed to prohibit activities that imperil the survival of threatened and endangered species. The Endangered Species Act of 1973⁷¹ provides a process for recognizing (i.e., "listing") those plant and animal species that are in danger of extinction, and requires the development of long-term management plans to protect these threatened and endangered species from further decline and to provide for the recovery of such populations. Under the Endangered Species Act, it is a federal offense to kill, injure, trap, harass, or otherwise "take" any animal species listed as threatened or endangered.⁷² The legislation further instructs all federal agencies to insure their actions do not "jeopardize" threatened or endangered species or their habitats, a requirement that has significant ramifications on how the public lands are managed.⁷³ Nowhere is this more evident than in the Pacific Northwest, where federal management of timber-rich public lands has been significantly influenced by the recovery programs in place for the northern spotted owl, and where water management programs have been radically transformed to address the needs of endangered salmon (Carroll, 1995; Volkman, 1997). The impact of the program

⁶⁷ Forest Service statistic taken from Table 9 of *Land Areas of the National Forest System*, available on the "world wide web" at <<http://www.fs.fed.us/database/lar/>>. Park Service statistic is from Coggins et al. (1992). Fish and Wildlife Service statistic is from FWS (1996:Table 10). Bureau of Land Management statistic taken from Table 5-10 of *Public Land Statistics 1996*, available at <<http://www.blm.gov/nhp/landfacts/pls96.html>>. The total amount of wilderness is not simply the sum of these figures, due to overlapping jurisdictions. All wilderness areas are listed in the Historical Note after 16 U.S.C.A. § 1132.

⁶⁸ See 16 U.S.C.A. §§ 1271-1287.

⁶⁹ 16 U.S.C.A. § 1271.

⁷⁰ Determining the exact number of rivers included in the system is complicated by the fact that some reports count streams and tributaries as rivers, and some rivers have multiple sections included in the system. The statistic provided in the text is from Palmer (1993), who provides an excellent summary of the wild and scenic river system.

⁷¹ 16 U.S.C.A. §§ 1531-1543.

⁷² 16 U.S.C.A. § 1538(a)(1)(B).

⁷³ 16 U.S.C.A. § 1536. These determinations are made by either the U.S. Fish and Wildlife Service or the U.S. National Marine Fisheries Service.

on private land management has also been considerable and highly controversial. Over 900 species are currently listed as threatened or endangered.

Minerals and Energy Resources: Incremental Federal Retention of Sub-Surface Resources

The last significant remnant from the era of land disposal is undoubtedly the General Mining Law (or Hardrock Act) of 1872; however, even this legislation and the associated federal program of mineral regulation has been modified in accordance with the modern philosophy of land retention and preservation. Several types of minerals have now been excluded from coverage under the General Mining Law and do not transfer immediately into private ownership upon discovery of a valuable mineral deposit on the public lands. Of particular significance are many energy resources. The 1920 Mineral Lands Leasing Act⁷⁴ began the practice of leasing the right to mine coal, oil, natural gas, oil shale, and other energy fuels on the public lands. Behind the imposition of a leasing system for these valuable fuels was a policy recognition by Congress that these substances were too important to the general public to be allowed to pass into private ownership. Instead, a leasing system was implemented to facilitate more strict management and control of energy fuels in the public interest, and to prevent the obvious dangers of a private monopoly of resources upon which the nation as a whole depends.

Leasing systems for energy resources have also been extended to offshore minerals on lands beyond state jurisdiction.⁷⁵ In addition to governing the leasing of drilling rights on submerged federal lands, the Outer Continental Shelf Lands Act of 1953⁷⁶ also regulates the exploration, production, and delivery of energy fuels and other minerals on these lands. Mineral extraction on so-called "acquired lands"—those lands acquired or purchased by the federal government after the establishment of the original public domain—also do not fall under the General Mining Law, but instead are subject to a leasing system established under the Acquired Lands Act of 1947.⁷⁷ Congress took a slightly different approach that same year in the Common Varieties Act⁷⁸ by establishing a competitive bidding system for sand, gravel, and similar minerals, ending the practice of allowing patentable mining claims for these common materials.

Along with specific minerals being excluded from disposition by discovery, other legislative acts occasionally reserved the right of the federal government to manage the

⁷⁴ See 30 U.S.C.A. §§ 181-287.

⁷⁵ The Submerged Lands Act of 1953 (43 U.S.C.A. §§ 1301 et seq.) made an explicit distinction between lands under federal versus state jurisdiction, with the first three miles from the coastal boundary being state lands.

⁷⁶ Amended in 1978.

⁷⁷ See 30 U.S.C.A. §§ 351-359.

⁷⁸ However, particularly large deposits of certain common varieties deposits are still patentable under the Hardrock Act. See 30 U.S.C.A. §§ 601-604.

surface estate for multiple-use. For example, the Surface Resources Act of 1955⁷⁹ provides that all mining claims established after 1955 “shall be subject, prior to the issuance of a patent therefor, to the right of the United States to manage and dispose of the vegetative surface resources thereof and to manage other surface resources thereof (except mineral deposits subject to location under the mining laws of the United States.)” That is, the land on the surface is subject to the right “of the United States, its permittees, and licensees, to use so much of the surface thereof as may be necessary for such purposes or for access to adjacent land” Legislation such as this has become increasingly necessary as much as of grasslands under the control of the BLM are now highly valued for their underground mineral and energy resources, while alternative uses of the public lands—like recreation—have steadily increased in importance.

As the discovery of new and valuable resources progresses, Congress continues to consider additional exclusions under the General Mining Law, such as the exception made for geothermal steam energy.⁸⁰ The prevailing judicial opinion in cases involving development of novel resources is that nothing passes from the government to private interests unless Congress explicitly expresses intent to provide for such passage in legislation. This judicial interpretation of federal statutes provides a further articulation of the modern policy of public lands retention.

The Special Case of Alaska

While the public lands policies of the nation have evolved over two centuries, gradually moving from an era of disposition to one of retention, the policy evolution in the nation’s second-youngest state, Alaska, has occurred within a much shorter time frame. This observation, when combined with an appreciation of the immense size of Alaska—approximately one-fifth the size of the continental United States—makes the public lands history of Alaska unique and highly significant.

In 1971, the Alaska Native Claims Settlement Act (ANCSA)⁸¹ extinguished all aboriginal Indian title to land in the state, instead transferring 44 million acres of federal lands—an area the size of Missouri—to Alaska Native corporations (Bates, 1992).⁸² ANCSA also authorized the Secretary of the Interior to temporarily withdraw up to 80 million acres of “national interests” lands, for possible permanent inclusion as federally protected lands.⁸³ Soon thereafter, the Alaska National Interest Lands Conservation Act (ANILCA) of 1980⁸⁴ designated over 103 million acres of public lands as National Parks, National Wildlife Refuges, and Wilderness Areas, as well as adding 13 new rivers to the

⁷⁹ See 30 U.S.C.A. §§ 611 - 615. Quoted material taken from section 612(b). Also see *United States v. Curtis-Nevada Mines, Inc.*, 611 F.2d 1277 (9th Cir. 1980) (surface rights of unpatented claim must be left open to the public for recreation).

⁸⁰ Geothermal Steam Act of 1970 (30 U.S.C.A. §§ 1001-1025).

⁸¹ 43 U.S.C.A. § 1601 et seq.-1629(f).

⁸² This program, financed by a federal fund of nearly \$1 billion, has made Native American corporations commonplace in Alaska.

⁸³ 43 U.S.C.A. § 1616(d)(2).

⁸⁴ See 16 U.S.C.A. §§ 3101-3233.

National Wild and Scenic Rivers system, and continued many existing uses of Wilderness Areas.⁸⁵ The state also features more than 2 million acres in BLM conservation and recreation areas (Coggins et al., 1992).

Potentially overshadowed by the enormity of the ANILCA land reservations is the legislation's articulation of the modern tenets of public lands policy: multiple-use management, land retention, and balance between human use and preservation. The ideals of multiple-use management and land retention are clearly conveyed in language describing the legislation's purpose "to preserve for the benefit, use, education, and inspiration of present and future generations certain lands and waters in the State of Alaska that contain nationally significant natural, scenic, historic, archeological, geological, scientific, wilderness, cultural, recreational, and wildlife values"⁸⁶ The desire to balance human use and preservation is also clearly articulated: "This Act provides sufficient protection for the national interest in the scenic, natural, cultural and environmental values on the public lands in Alaska, and at the same time provides adequate opportunity for satisfaction of the economic and social needs of the State of Alaska and its people; accordingly, the designation and disposition of the public lands in Alaska pursuant to this Act are found to represent a proper balance between the reservation of national conservation system units and those public lands necessary and appropriate for more intensive use and disposition"⁸⁷ Modern public lands conflicts in Alaska—including proposals for oil exploration in the Arctic National Wildlife Refuge and the continued logging of old-growth forests in the Tongass National Forest—suggest that striking a "proper balance" between human use and preservation will remain an issue of contention in Alaska, as elsewhere, as public demands on these resources continue to grow and diversify.

⁸⁵ Although ANILCA primarily deals with Alaska and serves as that state's foremost public lands statute, a few portions of the legislation also apply to the rest of the nation. One notable example is ANILCA's access provision, which requires the Secretary of Agriculture to provide access to private inholdings within national forests boundaries to an extent necessary to ensure the "reasonable use and enjoyment" of such private property. For more information, see § 3170(a) of the legislation, as interpreted in *Montana Wilderness Assoc. v. United States Forest Service*, 655 F. 2d 951 9th Cir. (1981).

⁸⁶ § 3101(a).

⁸⁷ § 3101(d).

III. PUBLIC LAND VALUES IN CONTEXT: PHILOSOPHICAL AND METHODOLOGICAL CONSIDERATIONS

[T]he first duty of the human race is to control the earth it lives upon.

Gifford Pinchot

The Fight for Conservation (1910:45)

The curious world we inhabit is more wonderful than convenient; more beautiful than useful; it is more to be admired and enjoyed than used.

Henry David Thoreau

Familiar Letters of Henry David Thoreau (1894:9)

The western world is now suffering from the limited moral outlook . . . [born of] the habit of ignoring the intrinsic worth of the environment which must be allowed its weight in any consideration of final ends.

Alfred North Whitehead

Science and the Modern World (1925:274)

The accurate determination of public land values raises a host of difficult issues. Perhaps most fundamentally is the observation that any individual's assessment of value cannot be adequately understood or articulated without first considering issues of philosophy. As shown by the foregoing quotations, radically different viewpoints exist to describe the desired relationship between humanity and the natural environment. Whether deriving from explicit theological or political doctrines or evolving from more ad hoc socioeconomic processes, the context within which individuals and societies view natural resources shapes how value is defined. The United States, like many countries, is not a philosophically homogeneous nation on issues of natural resources valuation, and the clash and integration of ideas has resulted in a wide variety of frequently contradictory statutes, regulatory and property rights regimes, management programs, and social norms regarding the public lands. While some of these philosophical differences can be accounted for by economic valuation tools, others raise overwhelming methodological challenges.

Philosophical Underpinnings of Public Land Management

An Evolving Framework of Competing Valuation Systems

The rules regarding the management of the nation's natural resources, including those of the public lands, are generally assumed to have derived from two competing philosophical perspectives: conservationism and preservationism. Furthermore, these two perspectives are generally described as taking hold in the United States during the Progressive Conservation era (circa 1890 to 1920), an era in which the modern preference for public lands retention and management evolved (Hays, 1959). An additional generalization is to nominate Gifford Pinchot, the father of American forestry, as the founding father of the conservation philosophy—sometimes referred to as utilitarian conservationism, or just utilitarianism; and John Muir, the founder of the Sierra Club in 1892, as the originator of the preservationist philosophy in the United States. More detailed historical reviews trace Pinchot's conservationist philosophies back to the European tradition of "telic forestry,"⁸⁸ While many of the tenets of preservationism are found to derive from the transcendentalism school of thought, and the works of men such as Henry David Thoreau, Ralph Waldo Emerson, and George Perkins Marsh.⁸⁹ This popular history of American environmental thought, although suffering from all the omissions and imprecisions associated with generalizations, provides a useful philosophical starting point for reviewing issues in public lands valuation.⁹⁰

The underlying tenet of conservationism is that the natural environment is something to be manipulated and utilized for human benefit, and that prudent management involves scientifically-grounded practices that allow for the efficient, long-term use of natural resources. As chief forester during the Teddy Roosevelt administration, Pinchot tailored this philosophy to suit the forests of the public lands, proclaiming that the National Forest system should be "devoted to its most productive use for the permanent good of the whole people . . . and where conflicting interests must be reconciled the question will always be decided from the standpoint of the greatest good of the greatest number in the long run" (Forest Service, 1906:16-17).⁹¹ This philosophy was rejected by Muir and other

⁸⁸ Telic forestry is the term used to describe the European, particularly German, tradition of forest management in which forests are intensively managed to provide desired outputs. In telic forestry, trees are essentially viewed as crops.

⁸⁹ The transcendentalist school of thought is illustrated in the essays of Emerson, who attributed a theological mysticism to the natural environment, and Thoreau, best known for *On Walden Pond* (1854), an account of his life at Walden Pond, Massachusetts.

⁹⁰ An additional common generalization is that these two philosophies can be correlated with the ideological positions of the modern political parties: conservationism with Republicans, and preservationism with Democrats. While this is undoubtedly true in many instances, overall this correlation is much too weak to be useful in this discussion (Paehlke, 1989).

⁹¹ While Pinchot's motto of the "greatest good of the greatest number in the long run" has been widely quoted as an insightful management philosophy, even a rudimentary understanding of mathematics is sufficient to reveal that the statement is a technical impossibility, as an equation cannot be manipulated to simultaneously maximize more than one variable.

preservationists as being overly materialistic and invasive, advocating instead the protection of wild areas from human development. Muir found pristine wilderness to be the highest good of the public lands, its preservation a spiritual, aesthetic, and intellectual boon to humanity providing primarily non-material benefits. Although Muir and Pinchot began as close friends, their philosophical differences ultimately turned them against one another. In the end, Pinchot and his "wise use" followers accused Muir and his Sierra Club of wanting to freeze valuable natural resources in a primitive state rather than providing for their careful management for human use and prosperity (Nash, 1982; Lyon, 1972; Paehlke, 1989). The establishment of the National Park system, exactly the type of action feared by Pinchot, is the best modern manifestation of the preservationist philosophy.

While the conservationist/preservationist dichotomy is often raised in valuation discussions distinguishing between traditional market and non-market values of resource use, it is perhaps more enlightening is to understand that there exists an ideological division within the preservationist philosophy itself. To understand this division first requires some comprehension of the concept of utilitarianism, which is often utilized as a synonym for conservationism, but which in reality is equally applicable to one division of the preservationist school. Utilitarianism is a belief that promoting human welfare is the appropriate objective of policy, a theme that underlies the majority of economic and political theories (Toman, 1994; Turner and Pearce, 1993). It is a "consequentialist . . . or teleological" approach in that it assumes that environmental policy should be evaluated according to its human consequences: a right action is one which has good consequences for humanity; a wrong action is one which has bad consequences for humanity (Gunn and Vesilind, 1986:137). In this way, utilitarianism is inherently anthropocentric, for the value of something is based on its human use.⁹² The protection of public lands as National Parks—the crowning achievement of preservationists like Muir—is, at least in part, an objective pursued on utilitarian grounds, as National Parks provide a resource primarily valued for human recreation and reflection.⁹³

It is the other branch of the preservationist philosophy which has the most significant ramifications for the discussion of public lands valuation. This division, best characterized by the Deep Ecology movement, asserts that any human benefit or value accruing from natural resource protection is merely an incidental, and not a primary, reason for environmental preservation. This is because natural systems and the individual species which make up ecosystems are believed to have "intrinsic value" or "inherent worth" (Devall, 1988; Roughgarden, 1995; Brown and Moran, 1994).⁹⁴ This ecologically-centered or "ecocentric" perspective is rooted in notions of justice for the environment: that is,

⁹² Anthropocentric is defined as "[r]egarding the human being as the central fact or final aim of the universe" or in the alternative as "[i]nterpreting reality solely in terms of human values and experience" (WEBSTER'S II NEW RIVERSIDE UNIVERSITY DICTIONARY, 1994:112; Boston: Houghton Mifflin Company, New Riverside Publishing Company). In short, anthropocentrism is human-centered thinking. Deep Ecologists regard anthropocentrism as "human chauvinism," an outgrowth of the notion that humans are the pinnacle of creation, the measure of all natural things, and the source of all value (Secd, 1985:243).

⁹³ Pinchot never saw the logic of the preservationism-oriented Park Service, remarking in 1911 that a Park Service was "no more needed than two tails to a cat" (Hays, 1959).

⁹⁴ "[I]nherent worth means that the value of a natural object is not dependent on a human observer of that object nor on the monetary value of the natural object to some human" (Devall, 1988:15).

because non-human entities have value in themselves, apart from any contribution to human happiness, human beings have an ethical obligation to respect the rights of non-human entities to continued existence. It is underlying concepts of "justice," "rights," and "moral obligations" associated with *ecocentric preservationism* that distinguishes this school of thought from the concepts of *conservationism* and *anthropocentric preservationism*.⁹⁵

Perhaps more than any other individual in the American conservation movement, Aldo Leopold articulated the philosophy of ecocentric preservationism. Leopold used the phrase "thinking like a mountain" to describe the revolutionary transformation of self and culture required to cultivate an "ecological consciousness" and thereby achieve genuine "biocentric equality" (Devall, 1980:309; Devall and Sessions, 1985:66). His "land ethic" placed human beings in the context of biological interconnectedness with their surrounding ecosystems in a way that implied moral obligations to the natural world. "All ethics," Leopold tells us, "rest upon a single premise; that the individual is a member of a community of interdependent parts. . . . The land ethic simply enlarges the boundaries of the community to include soils, waters, plants, and animals, or collectively: the land" (Leopold, 1968:239-240). A land ethic thus implies that the "role" of humanity is ethically transformed from "conqueror of the land community to plain member and citizen of it. It implies respect for fellow-members, and also respect for the community as such" (Leopold, 1968:210).⁹⁶

These observations are not meant to suggest that Muir was insensitive to the inherent rights of nature, for he once said that most of humanity is "blind to the rights of the rest of creation" (Muir, 1916:98). Similarly, it is unfair to conclude that Pinchot's motivations were strictly utilitarian, or were limited exclusively to the obvious market values of natural resources. *As a practical matter, most environmental leaders of yesterday and today see natural resources through several lenses, and recognize that these resources have several types of values.*⁹⁷ In practice, an array of policies can be supported through each of these viewpoints. For example, protection of waterfowl habitat is endorsed by conservationists as a way of maintaining hunting opportunities, by anthropocentric preservationists as a way of preserving natural beauty and wonder, and by ecocentric preservationists who feel that humanity has a moral responsibility to respect the rights of waterfowl and their wetland habitat to exist (Toman, 1994).

A Partial Congressional Philosophy: Multiple-Use and Sustained Yield

Most policies directing the management of the public lands are based upon an anthropocentric, utilitarian justification, and are usually best characterized as conservation-oriented programs. This is not to imply, however, that anthropocentric preservation is unrecognized, as the National Park and Wilderness systems provide compelling evidence to

⁹⁵ Note that the three quotations used at the beginning of this chapter roughly correlate to these three viewpoints.

⁹⁶ A highly similar concept is the "ethic of place" advocated by Wilkinson (in Udall et al., 1990).

⁹⁷ For example, Teddy Roosevelt, the so-called "conservation president" found wisdom in the philosophies of both Pinchot and Muir (Hays, 1959).

the contrary.⁹⁸ Similarly, the philosophy of ecocentric preservation is also articulated in statute, particularly the Endangered Species Act of 1973, which has been interpreted to mean that the value of endangered species is “incalculable” and should therefore be protected “whatever the cost.”⁹⁹ Notwithstanding these notable exceptions, the dominant themes permeating the management of most public lands are multiple-use and sustained-yield management—ideas most commonly ascribed to the conservation philosophy. The statutory origins of this philosophy are best articulated in the aptly named Multiple-Use, Sustained-Yield Act (MUSY) of 1960, which defines multiple-use management on the National Forests as involving several considerations, including:

management of all the various renewable surface resources of the national forests so that they are utilized in the combination that will best meet the needs of the American people, making the most judicious use of the land for some or all of these resources or related services over areas large enough to provide sufficient latitude for periodic adjustments in use to conform to changing needs and conditions; that some land will be used for less than all of the resources; and harmonious and coordinated management of the various resources each with the other, without impairment of the productivity of the land, with consideration being given to the relative values of the various resources, and not necessarily the combination of uses that will give the greatest dollar return or the greatest unit output.¹⁰⁰

The complementary concept of sustained-yield is defined to require the Forest Service to “achieve . . . and maint[ain] in perpetuity . . . a high-level annual or regular periodic output of the various renewable resources of the national forests without impair[ing] . . . the productivity of the land.”¹⁰¹

⁹⁸ For example, the Wilderness Act is designed, in part, to preserve areas offering “outstanding opportunities for solitude” (16 U.S.C. § 1131(c)).

⁹⁹ See *Tennessee Valley Authority v. Hill*, 437 U.S. 153, 178, 184 (1978). In this landmark case, the opening of Tellico Dam on the Tennessee River was temporarily halted to protect the endangered snail darter. The Endangered Species Act requires that every federal agency “insure that any action authorized, funded, or carried out . . . is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of habitat of such species which is determined by the Secretary” (16 U.S.C.A. § 1536(a)(2)). Implementation of this requirement in cases such as Tellico Dam can have significantly negative economic ramifications. This concern was addressed during the Reagan era by the creation of the Endangered Species Committee (or “God Squad”), which can authorize an exemption to the requirement of §1536(a)(2) if the following conditions are satisfied: “(i) there are no reasonable and prudent alternatives to the agency action; (ii) the benefits of such action clearly outweigh the benefits of alternative courses of action consistent with conserving the species or its critical habitat, and such action is in the public interest; (iii) the action is of regional or national significance; and (iv) neither the Federal agency concerned nor the exemption applicant made any irreversible or irretrievable commitment of resources prohibited by . . . this section . . .” (16 U.S.C.A. § 1536(h)(1)(A)(i-iv)). In only a few isolated cases has the “God Squad” been utilized to override the rigid standards of the Endangered Species Act.

¹⁰⁰ 16 U.S.C.A § 531(a).

¹⁰¹ 16 U.S.C.A § 531(b).

The dual managerial themes of multiple-use and sustained-yield in the National Forests were later reinforced by Congress in the National Forest Management Act (NFMA) of 1976, which cautions federal land managers that, in order "to serve the national interest, the renewable resource program must be based on a comprehensive assessment of present and anticipated uses, demand for, and supply of renewable resources from the Nation's public and private forests and rangelands, through analysis of environmental and economic impacts, coordination of multiple use and sustained yield opportunities as provided in the Multiple-Use Sustained-Yield Act of 1960, and public participation in the development of the program."¹⁰² Under this legislation, the Forest Service must specify guidelines for land management plans which "insure consideration of the economic and environmental aspects of various systems of renewable resource management, including the related systems of silviculture and protection of forest resources, to provide for outdoor recreation (including wilderness), range, timber, watershed, wildlife, and fish."¹⁰³

These dual themes also pervade management of public lands controlled by the BLM. The Federal Lands Policy Management Act (FLPMA) of 1976, in language highly similar to that found in NFMA, illustrates the formidable challenge of multiple-use, sustained-yield management by requiring:

the management of the public lands and their various resource values so that they are utilized in the combination that will best meet the present and future needs of the American people . . . a combination of balanced and diverse resource uses that takes into account the long-term needs of future generations for renewable and nonrenewable resources, including, but not limited to, recreation, range, timber, minerals, watershed, wildlife and fish, and natural scenic, scientific and historical values; and harmonious and coordinated management of the various resources without permanent impairment of the productivity of the land and the quality of the environment with consideration being given to the relative values of the resources and not necessarily to the combination of uses that will give the greatest economic return or the greatest unit of output.¹⁰⁴

Despite the obvious and laudable congressional efforts to provide the Forest Service and BLM with similar management mandates, the multiple-use, sustained-yield philosophy is, itself, an embodiment of contradictions, trade-offs, and compromises. Management for multiple, often incompatible, objectives is inherently problematic. As clearly exemplified by these statutes, implementation of this management philosophy requires the consideration and balancing of a staggering variety of factors, of both an economic and non-economic nature, over both short and long time periods. However, while these statutes provide thoughtful language about what factors deserve agency consideration, and feature a relatively coherent, albeit imprecise, picture of the desired management outcome, the question of process is largely ignored. How can trade-offs among different objectives,

¹⁰² 16 U.S.C.A. § 1600(3).

¹⁰³ 16 U.S.C.A. § 1604 (g)(3)(A).

¹⁰⁴ 43 U.S.C.A. § 1702(c).

different uses, and perhaps more fundamentally, different types of values be made in practice? Deciding among values is not solely a technical exercise suited to agency expertise, but instead is a challenge better suited, at least in theory, to a more explicitly political process.¹⁰⁵ Yet, in MUSY, FLPMA, and related statutes, the responsibility to make these choices is delegated to the land management agencies. This delegation of authority is probably not so much a vote of confidence for the Forest Service and BLM, as it is a recognition that some technical skills are associated with defining the range of possible choices, and perhaps more importantly, a recognition that making trade-offs among competing values is often a zero-sum undertaking without political benefits.¹⁰⁶ What is more politically expedient from a congressional standpoint is to state that all values are important and deserve consideration, and that existing uses should be maintained in perpetuity—this seemingly impossible task is, in a nutshell, what is promised by the multiple-use, sustained-yield philosophy.

These observations should not be interpreted, however, as a repudiation of the multiple-use, sustained-yield philosophy. To the contrary, it is a reasonable approach that recognizes the many values and uses of the public lands, and that states a commitment to preserving these values and uses over the long-term while assuming periodic adjustments to meet changing conditions. The Achilles' heel of this philosophy is simply that it is extremely difficult to apply in practice, as it involves making trade-offs among fundamentally different types of values. This process-related challenge has rightly been a focus of considerable public debate, legislative experimentation, and agency innovation. For example, process is a major focus of NFMA and FLPMA, both of which require the use of public input in the periodic preparation of land management plans (Hardt, 1997).¹⁰⁷ In practice, satisfying these planning requirements has proven to be a costly, lengthy, and litigious undertaking, leading to frequent criticism of the multiple-use, sustained-yield approach as terminally inefficient.

Even more sweeping has been the process-related requirements of the National Environmental Policy Act (NEPA) of 1969,¹⁰⁸ and namely the requirement that federal agencies must develop environmental impact statements before undertaking major federal actions that influence the environment.¹⁰⁹ Federal agencies are procedurally directed in

¹⁰⁵ In a critical assessment of western water management, Lord (1984:653) observes: "Science and technology are concerned with facts and means, not with values and ends. Ethics and politics are concerned with values and ends. Bad water management often occurs when facts are confused with values, when means are confused with ends, and when technical judgments are made by citizens and politicians while value judgments are made by scientists and professionals." This observation is equally applicable to issues of public land management.

¹⁰⁶ Culhane (1981) argues that this lack of specificity and mandated public participation requirement works to the advantage of the agencies, in that it allows them to strategically play competing interests off against each other in order to reach outcomes pre-determined by the resource manager.

¹⁰⁷ Many of the planning requirements associated with NFMA and FLPMA derived in part from the Resources Planning Act of 1974.

¹⁰⁸ See 42 U.S.C.A. §§ 321-4361.

¹⁰⁹ The broader purpose of NEPA is "to declare a national policy which will encourage productive and enjoyable harmony between man and his environment; to promote efforts which will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of man; to enrich the

NEPA to “include in every recommendation or report on proposals for legislation and other major Federal actions significantly affecting the quality of the human environment, a detailed statement by the responsible individual on (i) the environmental impact of the proposed action, (ii) any adverse environmental effects which cannot be avoided should the proposal be implemented, (iii) alternatives to the proposed action, (iv) the relationship between local short-term uses of man's environment and the maintenance and enhancement of long term productivity, and (v) any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented.”¹¹⁰ Often used as a basis for lawsuits by environmental activists, the courts have generally interpreted potential NEPA violations by reviewing agency adherence to procedure, rather than finding in the statute new substantive requirements for environmental protection.¹¹¹ In this way, legislation such as NEPA acknowledges and reinforces the need to consider competing uses and values on the public lands, but offers little practical guidance for actually making the difficult choices.

Use of Economic Valuation Methods

More than any other discipline, economics provides a variety of principles and methodologies for making difficult choices among competing outcomes. The economic marketplace, after all, is a forum where individuals interact to determine relative values of goods and services, with the outcomes of these choices being very well documented and analyzed as part of normal business operation. Economic valuation methodologies have found their way into many facets of public land management, a trend that is likely to continue. Despite tremendous recent advances in the science of economic valuation, in many cases it remains difficult to assemble credible economic statistics to fully quantify and illuminate all public land values. Problems of both a methodological and philosophical nature suggest that economic valuation methods should not, by themselves, be applied as *de facto* decision-making tools for selecting appropriate trade-offs among natural resource values. On the other hand, good economic statistics can be invaluable in introducing objective and empirical data into the public policy debate, and can provide the initial baseline from which to assess the significance of those public land values that defy monetary quantification. An understanding of the opportunities and limitations provided by the economic valuation approach is an essential prerequisite to effective participation in debates concerning public land values.

understanding of the ecological systems and natural resources important to the Nation . . .” (42 U.S.C.A. § 4321).

¹¹⁰ 42 U.S.C.A. § 4332 (2)(C)(i-v).

¹¹¹ NEPA requires that all potential environmental impacts be considered, but does not necessarily require avoidance or mitigation of these impacts. This conclusion has been articulated by the courts in many cases, particularly *Robertson v. Methow Valley Citizens Council*, 490 U.S. 332, (1989); and *Natural Resources Defense Council, Inc. v. Morton*, 388 F.Supp. 829 DC D.Ct. (1974).

A Primer in Natural Resource Economics and Valuation Techniques

At the core of economic theory is the “rational actor”—also known as “economic man”—model of individual behavior. The rational actor can be assumed to make choices that will maximize his own pleasure, or in the language of economics, his “utility.” By comparing these choices, some appreciation can be developed for how individuals value competing outcomes. The true elegance of economic theory is revealed when this concept is extrapolated to consider a society of decision-makers (i.e., consumers), who interact in the marketplace to influence pricing regimes, production levels, and product innovations. Using a phrase made famous by economic theorist Adam Smith, an “invisible hand” is at work guiding these interactions, automatically translating the utility-maximizing behaviors of individuals into *de facto* macroeconomic policies reinforcing the dominant preferences at the expense of the less frequently expressed preferences.

These concepts can be utilized as a basis for evaluating public policy decisions if it is assumed that proper policy decisions are those with the highest level of benefits, relative to costs, measured by summing all the preferences of individuals (Turner and Pearce, 1993). The classic tool used to implement this philosophy of “welfare economics” is the cost-benefit (sometimes called benefit-cost) analysis, which involves comparing and choosing among particular management options based on a comparison of total benefits and costs incurred by all individuals considered in the analysis (Hufschmidt et al., 1983). Typically, the option with the highest ratio of benefits to costs is assumed to be the preferred option.¹¹² Originally used primarily in the evaluation of proposed federal water projects, cost-benefit analysis, and its many incarnations, is now used in a wide variety of natural resource decision-making settings.¹¹³ For example, President Clinton recently directed all federal agencies to evaluate proposed environmental actions in terms of the “need for, and consequences of, the intended regulation,” to ensure that the social “benefits of the intended regulation justify its costs.”¹¹⁴

In order to use economic valuation decision aids such as cost-benefit analysis, the analyst must compile information on all positive and negative impacts of a proposed action,

¹¹² A more useful decision rule in some situations is to select the option featuring the greatest net benefits, calculated by subtracting total costs from total benefits. To illustrate, consider two alternative actions: option A involves costs of \$1 million and benefits of \$2 million, while option B involves costs of \$6 million and benefits of \$10 million. Option A has the higher benefit-cost ratio, 2.0 versus 1.67, but Option B offers the higher net benefits, \$4 million versus \$1 million. According to a benefit-cost analysis, both options would be worth pursuing as both feature a benefit-cost ratio greater than 1.0. If only one of the two options could be chosen, the best choice would likely depend on an assessment of other factors. For example, if capital resources were limited, Option A might be preferred over Option B since the initial investment in the former is substantially smaller (\$1 million versus \$6 million). Other factors to consider include the distribution of the costs and benefits under each scenario.

¹¹³ The origins of the cost-benefit analysis can be traced to administrative efforts to implement the 1936 Flood Control Act, and particularly, the development by the U.S. Federal Interagency River Basin Committee of the so-called “Green Book” (circa 1950), a cost-benefit “how to” manual. Cost-benefit analysis was not widely used in other substantive areas until the 1960’s, at which time it was phased into planning programs for transportation, urban development, and environmental regulation (Hufschmidt et al., 1983).

¹¹⁴ Executive Order #12866, 1993: § (1)(b)(6).

and then convert this information into common measurement units, in this case dollars, in order to facilitate comparisons. For products with correctly functioning markets, the marketplace can often be relied upon to provide appropriate indications of value in the form of prices. Market prices, however, are frequently not available or appropriate to measure goods and services associated with public lands (Freeman, 1993).

One reason for this is market failure—i.e., situations which prohibit the normal functioning of competitive markets. Common sources of market failures in the natural resources realm include externalities, common pool resources, and public goods. Externalities are situations in which some byproduct, usually a negative byproduct, associated with the production of a good creates social costs that are not reflected in the market price of the product. For example, the market price of silver may reflect the production expenses associated with labor, materials, and other “costs of doing business,” but may not reflect the negative costs of scarred landscapes, pollution, and impact on endangered species resulting from the mining operation.¹¹⁵ A somewhat similar type of problem occurs in common pool resource situations, which can occur when several parties have access to a commonly owned and finite resource, for example, a common aquifer underlying a farming region. In these situations, individuals have incentives to maximize their own use of the resource, since the negative costs of resource overuse will be distributed equally among all parties—including those that use only a small amount.¹¹⁶ Finally, a public good situation involves a natural resource good or service that, once provided to one party, cannot be withheld from others. For example, it would likely be impossible for one company to build a flood control structure that would protect its property without automatically protecting its neighbor’s property as well. Since the market provides the company with no mechanism for forcing these other beneficiaries to compensate it for its investment, the investment will not be made—even if the net benefits to all parties exceed the net costs.¹¹⁷ The public lands are most frequently described as featuring public goods situations, but all types of market failures can be readily found.¹¹⁸

In addition to these classic types of natural resource market failures, many other related complications can impede the development of useful price signals. Some of these

¹¹⁵ When externality situations exist, the price of the good produced is usually artificially low, and consequently, production levels are usually artificially high. Problems of this nature are usually corrected by either prohibiting the behavior outright, by requiring the externality generator to invest in new technologies or processes to reduce the problem, or by imposing some form of tax on the undesirable behavior (Baumol and Oates, 1988).

¹¹⁶ In a common pool resource situation—also known as a “tragedy of the commons” problem (Hardin, 1968)—each individual has the incentive to maximize their own ratio of benefits to costs by increasing their consumption; yet, the collective group incentive is to minimize consumption in order to preserve the resource. It is this conflict between individual and collective incentives which creates the market failure. These problems are typically addressed by regulating individual behavior or by converting the common resource to a private property regime.

¹¹⁷ For this reason, the government normally assumes responsibility for providing “public goods,” financed through tax and user fee systems that, in theory, allocate the costs in a manner that reflects the allocation of benefits.

¹¹⁸ Externalities are best thought of as involving negative impacts; common pool resource problems typically involve situations of overuse; public goods situations generally involve situations of under-investment.

other complications include the fact that some goods have no obvious substitutes or are provided through monopolies, thereby discouraging competition; many goods are subsidized in some manner; and some "non-market" uses of a resource, such as watching a sunset over a quiet lake, may go unrecognized as no market transactions may exist to suggest the importance of the use.

These and related problems are generally well understood by natural resource economists, who utilize a wide variety of techniques to approximate natural resource values.¹¹⁹ One of the most common methods is known as "contingent valuation," which typically features surveys asking individuals what they would be willing-to-pay to receive a specified desirable change in the condition of an environmental resource.¹²⁰ Another common approach used to approximate market value is the "travel cost" method. This approach assumes that the costs incurred in travel by individuals to visit a natural site reflects the natural amenity values offered by that site. An additional category of valuation techniques relies on "shadow prices," which entails using prices paid for substitute goods as a measure of the value of the targeted good.¹²¹ The "land value" approach compares the market values of private property before and after a development modifies the physical attributes of the area. Along a somewhat similar vein is the "wage differential" approach, which relies upon a comparison of wages for similar jobs in areas featuring different natural amenities. Still other methods rely on the "replacement cost" of a damaged natural asset to measure the value of the undamaged asset, or on the "opportunity cost," which assumes that the benefits associated with a given economic activity approximates the upper bound of the worth of the environmental assets damaged by the activity. The creative use of these and related techniques can be highly useful in quantifying economic values of resources and resource uses that might otherwise escape the attention of policy-makers.

Limitations of the Economic Perspective

Methodological constraints can limit the usefulness of many economic valuation exercises. For example, approaches reliant upon surveys suffer from the observation that people often do not answer surveys truthfully or accurately, or that the phrasing of questions may introduce a bias into the study.¹²² Another problem plaguing survey methods and many other opinion-based valuation techniques is simply the question of determining who should be interviewed: locals, activists, tourists, retirees, landowners? What about the value that future generations may attribute to a resource? These issues are particularly

¹¹⁹ A full review of these techniques is well beyond the scope of this report. Detailed reviews are provided by Freeman (1993) and Hufschmidt et al. (1983), among others. Additional information on many relevant topics is available in the *Journal of Environmental Economics and Management*.

¹²⁰ Some surveys also ask parties what they would be willing-to-accept in compensation for a negative change in an environmental variable. This is sometimes done to partially compensate for the "income effect"—i.e., the observation that an individual's willingness-to-pay/accept is not simply a reflection of their values, but of their financial status.

¹²¹ For example, prices paid for swimming pools can potentially be used to assess the value of a public pond used for swimming.

¹²² Survey estimates of willingness-to-pay, for example, are notoriously high.

salient in many public lands debates. In many other techniques, it is difficult to control or account for all relevant variables. For example, in the travel cost method, it is difficult to know if the expenses of travel reflect the value of the destination site, such as a National Park, or reflect a value attributed to intermediate destinations or simply the act of travel itself.¹²³ Similarly, approaches based on land values or wages may not be able to distinguish between the values of natural resources amenities and other amenities, such as baseball stadiums, shopping facilities, employment opportunities, and transportation networks. Also troublesome is the challenge of quantifying values that most people do not understand, such as the role of wetlands in controlling floods and purifying water.¹²⁴ As these examples suggest, all methodological assumptions and uncontrolled variables associated with the production of public land value estimates must be rigorously evaluated if decision-makers are to place valuation statistics in proper context.¹²⁵

Significant and inherent philosophical deficiencies also underlie economic valuation techniques, ensuring that these techniques will never fully be able to capture the full range of public land values (Sagoff, 1988). Of particular concern is the anthropocentric focus of economic valuation techniques. For the economist, value resides in people, with gains in human value labeled as benefits and losses in human value labeled as costs (OECD, 1992; Goulder and Kennedy, 1997; Brown and Moran, 1994). National resource policy-making, it is therefore concluded, can be based on a "direct monetization" of the various elements which constitute the "total economic value" (TEV) of a natural resource or a particular ecosystem (Brown and Moran, 1994:214).¹²⁶ This approach is inherently anthropocentric

¹²³ Perhaps the money spent on travel reflects a dislike of the home area more than a special appreciation of the destination.

¹²⁴ The identification and valuation of these and related processes is described in detail in *Nature's Services*, edited by Gretchen Daily (1997). Among the many issues addressed is the value of the soil conservation function provided by forests. Research summarized by contributor Norman Myers indicates that India's forests provide an annual soil conservation benefit of \$5 to \$12 billion (\$100 to \$240 per hectare), while nationwide, the annual value of forests in regulating river flows and containing floods is \$72 billion. While it is difficult to determine the credibility of such statistics without evaluating the methodologies utilized, the major conclusion of the book is undoubtedly sound: i.e., that public policy decision-makers have notoriously underestimated the values of "nature's services" when considering land and water use proposals.

¹²⁵ A report by the National Academy of Sciences evaluating environmental risk regulation by cost-benefit analyses concluded that there are some 50 points in the risk assessment process where value-judgments requiring choice from "among several scientifically plausible options" must be made (NRC, 1983:5-8). The numbers emerging from these analyses are only as good as the underlying assumptions.

¹²⁶ The intent of a total economic value (TEV) calculation is to provide a full accounting of environmental resource values, usually organized into primary and secondary values (Brown and Moran, 1994; Pearce and Moran, 1994; Costanza et al., 1997). Primary values are akin to the "nature's services" described by Daily (1997), in that they include the basic biophysical and systemic properties upon which ecologic systems are dependent, and upon which all specific resource uses (i.e., the secondary values) are, to some degree, dependent. Primary values include macro environmental qualities such as climate regulation and nutrient and energy cycles. Primary values are notoriously difficult to quantify in precise, economic language; however, this is an active area of research and innovation (e.g., see Daily, 1997). Secondary values are generally defined to include both use and non-use values. Use values include the benefits associated with direct and indirect resource uses, as well as the "option value" of a potential future use of a resource. Direct resource uses, such as timber harvesting, are generally the easiest to quantify in economic terms. Indirect uses, such as the role of an undisturbed forested watershed in providing a clean, reliable drinking water source for a community, are typically more challenging to quantify in economic terms. Secondary non-use

because it does not directly attribute value to the natural environment, but instead defines values in terms of human preferences associated with various changes in the state of the environment (Brown and Moran, 1994; Toman, 1994; Turner, Pearce, and Bateman, 1993; Kellert, 1996).

It is difficult to assess the significance of this underlying limitation because, as Toman (1994:3) observes, "while the economic paradigm is anthropocentric rather than ecocentric, and utilitarian rather than based on inherent rights, it encompasses a very broad range of values that are advanced by proponents of ecosystem preservation on 'intrinsic worth' grounds." Economic valuation techniques can produce excellent estimates of natural resource values as viewed from the anthropocentric conservationism perspective of Pinchot and others, and in many cases, can produce useful estimates of values as viewed from the anthropocentric preservationism perspective articulated by Muir and others. What is completely omitted, however, is the perspective of the ecocentric preservationists who advocate environmental protection for its own sake.¹²⁷ This is because any attempt to place a monetary figure on the intrinsic value of nature commits what is sometimes known as a "category mistake," which occurs whenever one attempts to treat particular facts or concepts as if they belong to one logical type or category, when in fact they belong to another. For some public land activists, comparing economic values with natural rights—or more precisely, attempting to reduce natural rights to economic value—is philosophically tantamount to asking, "What color is seven?" This is a category error, and not a simple measurement error (Sagoff, 1988). No improvements in economic valuation methodologies can be expected to address this philosophical limitation.

A related limitation of using economic valuation methodologies in decision-making exercises is the frequent failure of these techniques to acknowledge the problems associated with translating individual preferences into social policy. As shown by the earlier discussion of "tragedy of the commons" situations (i.e., common pool resource problems), individual and collective preferences are not always consistent. While in that example familiar to virtually all economists the inconsistency was defined in the economic language of market failures, inconsistencies between individual and collective incentives are also well known in the world of political science. Many economic valuation methods inappropriately confuse citizens and consumers, values and preferences, and public and private interests. For this reason, it is "conceptually impossible," according to Sagoff (1981:1410), to attempt to

values can, in turn, be defined to include bequest and intrinsic values. Bequest value is a measure of a resource's potential value to a future generation, while intrinsic value is some measure of the inherent value of a resource. As discussed later in the text, the inclusion of "intrinsic values" in the TEV calculation can be problematic due to the methodological challenge of assigning monetary measures to resources valued, at least in part, for non-economic purposes, and due to the philosophical argument that resources that do not satisfy human needs or desires still have an inherent worth that cannot be captured by the anthropocentric, economic viewpoint.

¹²⁷ The distinction is between arguments for environmental protection based on the grounds that this protection will provide some human benefit, either a direct monetary benefit or a benefit such as human happiness, and arguments based on the notion that a resource should be protected in that it has an inherent value beyond its influence on humans. This concept is most clearly debated in the public policy arena in the context of the Endangered Species Act, with most parties understanding the rationale of protecting "popular" species such as bald eagles, but with many parties questioning the logic of protecting obscure and seemingly useless species such as the snail darter.

measure “public values” like environmental protection by economic valuation techniques because this “confuses what the individual wants as an individual and what he or she, as a citizen, believes is best for the community.”¹²⁸ Public values lie in the logical category of “social responsibilities,” while market preferences measure the entirely different logical category of “individual wants.”¹²⁹

An additional problem associated with translating individual preferences into social policy involves distributional effects. Often, economic valuation techniques ignore distributional effects entirely, since they are not an issue of efficiency—the primary criterion of economic evaluation—but rather a question of equity (OECD, 1992). For example, an analysis of the potential impact of a water project on the public lands may reveal that individuals would suffer \$10 million in costs, but receive \$20 million in benefits. This benefit-cost ratio of 2.0 and net benefits of \$10 million would normally be sufficient to justify construction; however, what if it was shown that one group would receive all the costs while another group all the benefits?

These observations suggest that while economic valuation techniques can and do provide useful statistics about public land values, this empirical data should not be considered independently of the methodological assumptions underlying these techniques, nor should these tools by themselves be expected to provide a mechanism for public policy decision-making. When utilized properly, valuation statistics can be employed to illuminate only that sub-set of costs and benefits that can readily be converted to a common monetary scale. Other types of values should be described independently, if necessary through discussions of philosophy and equity that, while lacking the formality and self-importance ascribed to empirical economic data, may better capture some types of public land values. Extreme efforts to assign monetary estimates to resources valued largely for non-economic qualities performs the dual disservice of unjustly ignoring some viewpoints while discrediting the economic valuation discipline through the production of nonsensical statistics.¹³⁰

¹²⁸ Some economists, particularly those associated with public choice theory (e.g., James Buchanan), reject the argument that individuals behave differently in making public (i.e., group oriented) decisions in a political setting than they do in making private (i.e., individual oriented) decisions in the marketplace. This, however, is primarily a methodological assumption. It is widely recognized that much of human behavior cannot be adequately explained by assuming the blind pursuit of self-interest (Dolan and Lindsey, 1988).

¹²⁹ By way of demonstration, Sagoff (1988) quizzed his students about a proposal by Walt Disney Enterprises to develop a ski resort in the Mineral King Valley, a quasi-wilderness area in the middle of Sequoia National Forest, accessible via a proposed road through Sequoia National Park. Only a few students indicated an interest in visiting the area should it remain undeveloped, while many more students indicated a desire to visit should the resort be constructed. However, when asked if the Interior Department should approve the plan, the students responded, nearly unanimously, that it should not be allowed, as the nation had a responsibility to protect the site. Why the different responses? The first question was posed to individual consumers, the second to citizens. This case was the subject of landmark litigation in *Sierra Club v. Morton*, 405 U.S. 727 (1972). An excellent discussion of this case, couched within the larger philosophical issue of environmental ethics, is provided by Stone (1972).

¹³⁰ As Roughgarden (1995:150-151) remarks: “Economics is not morality . . . Yet phrases such as ‘we need to take costs into account when setting environmental objectives’ confuses economics with morality.” It seems clear that Congress recognizes this fact in language, found in both MUSY and FLPMA (as quoted earlier in the text), stating that the best management option is not necessarily the combination of uses that

The Continued Search for Appropriate Valuation Criteria

Sustainability as a Valuation Criterion?

For many decades, even centuries, scholars and philosophers have openly recognized the need in public policy-making to better integrate the anthropocentric perspective of human resource use and consumption with a more biocentric focus that recognizes human beings as components of natural systems. An over-reliance on the institutions of utilitarianism, such as the unregulated economic marketplace, not only forebodes the well documented problems of market failures and the neglect of intrinsic resource values, but can also foster an unreasonable dependence upon scientific innovation,¹³¹ while failing to adequately consider temporal issues, cumulative impacts,¹³² and related challenges unique to resource management (Ophuls, 1977; Vickers, 1970).¹³³ However, it has also been persuasively argued in recent decades that properly structured market mechanisms can be highly useful tools for efficient environmental protection and restoration.¹³⁴ As part of this evolving struggle to craft a stable marriage of economics and ecology, the role of economics in natural resource policy-making has been reassessed, increasingly leading to the conclusion that economic principles and tools are well suited to the efficient *pursuit of* management objectives, but are largely inappropriate tools for the initial *determination of* management objectives. This realization has a profound relevance to public lands management, as it shapes our expectations about how to best value these

will give the greatest dollar return or the greatest unit output. (See 16 U.S.C.A. § 531(a) and 43 U.S.C.A. § 1702(c)).

¹³¹ An extreme faith in technological solutions is evident in remarks by Scott and Pearse (1992:164), who conclude that natural resource scarcity is ephemeral: "Any raw material need can be satisfied from the expanding range of sources and the invention of new combinations of new resources. The ultimate resource is innovation."

¹³² As John Muir once remarked, "When we try to pick out anything by itself, we find that it is bound fast by a thousand invisible cords that cannot be broken to everything in the universe" (Fox, 1981:291; see also Lyon, 1972:37).

¹³³ In theory, many of these issues can be addressed under a liberal definition of externalities. However, as a practical matter, most discussions of environmental externalities do not explicitly address issues of intergenerational impacts and impacts of a synergistic or cumulative nature.

¹³⁴ For a theoretical discussion of the role of market-based tools in environmental protection, see the classic text of Baumol and Oates (1988). For a recent review of how these tools have actually been implemented in the United States, and for a discussion of the somewhat disappointing track record of many of these strategies, see Hockenstein et al., (1997). The rationale behind using carefully structured market mechanisms as part of environmental regulation is aptly described in a recent report by the National Academy of Public Administration (NAPA, 1997:25): "Governments can use their authority to intervene in the markets in ways that change the prices of goods and services. Those changes, when carefully implemented, can encourage individuals to change their behavior in ways that are both environmentally beneficial, and in their financial self-interest. Because the strategies work through prices rather than prescription, individuals in the market have more choices, the results are more dynamic, and the overall cost of reaching the desired goal is likely to be lower."

lands and how to select the objectives to pursue in our use or preservation of these resources.

One of the primary origins of this modern debate—and more generally, to the modern environmental movement—was the “limits to growth” controversy of the 1970’s.¹³⁵ This debate focused public attention on the finiteness of many natural resources, including the world food supply, and how population growth and consumerism threatened to result in potentially devastating problems of scarcity. Over the next two decades, this dialogue evolved away from the narrow “source limits” focus to include “sink limits”—a concern for the assimilative capacity of the biosphere, as evidenced by global issues such as the impact of chlorofluorocarbon (CFC) emissions on ozone depletion and carbon dioxide induced global warming (Paehlke, 1989; Turner and Pearce, 1993).¹³⁶ One output of this thinking was the Brundtland Commission,¹³⁷ which in 1987 articulated what has become a widely acknowledged global prognosis: the world is becoming increasingly economically and ecologically interdependent, but that it is possible—at least in principle—to have “growth that is forceful and at the same time socially and environmentally sustainable” (WCED, 1987:9). In proclaiming that “humanity has the ability to make development sustainable,” the Commission offered a new criterion of “sustainable development” by which all environmental policy, including public lands policy, could, in theory, be evaluated (WCED, 1987:8). Good policy is policy that promotes both ecological and economic sustainability.

In many nations, including the United States, this concept is quickly gaining acceptance, no doubt in part due to its vagueness and its promise of continued resource use practices—features already found in the multiple-use, sustained-yield (MUSY) philosophy. One example of the modern support for the sustainable development concept comes from the establishment of President Clinton’s Council on Sustainable Development, which in 1996 called for a new “ethic of stewardship” which can “sustain natural resources protection and environmental quality” into the future, recognizing that “America is blessed with an abundance of natural resources which provide both the foundation for its powerful and vibrant economy and serve as a source of aesthetic inspiration and spiritual sustenance for many” (President’s Council, 1996:110). This philosophically diverse statement and Commission report, when considered alongside other recent writings, suggests that the next evolutionary step in public lands management beyond the existing MUSY mandate may be to more explicitly introduce the idea of ethics in public lands stewardship and to more

¹³⁵ The seminal essay examining the issue of resource depletion is Thomas Malthus’ *Essay on the Principle of Population* (1798), in which Malthus shows that all species, presumably including humans, do not independently regulate population growth, but instead tend to grow beyond the carrying capacity of the environment and are then decimated by famine or other compensating processes. Almost two centuries later, a modern but only slightly less horrific discussion of resource limits was cultivated in the 1960’s and 1970’s, in works such as *Limits to Growth* (Meadows et al., 1972), Paul Ehrlich’s *Population Bomb* (1968, 1975), William Ophuls’ *Ecology and the Politics of Scarcity* (1977), and Robert Heilbroner’s *An Inquiry into the Human Prospect* (1974). Paehlke (1989) provides an excellent overview of this literature.

¹³⁶ Global environmental issues were the primary focus of the “Earth Summit,” held in Rio de Janeiro, Brazil, in 1992, attended by heads and senior officials from 179 governments (Keating, 1993).

¹³⁷ The official name of the commission was the World Commission on Environment and Development (WCED), established by the United Nations and chaired by Ms. Gro Harlem Brundtland.

clearly acknowledge the frequently symbiotic relationship between vibrant economies and stable and pristine ecological systems.¹³⁸ This is the promise offered by this interpretation of “sustainable development”;¹³⁹ however, in order to ensure that this concept is utilized as a practical tool for valuing and management public land resources, rather than simply a hollow political buzzword, the challenge remains to find processes and criteria to translate noble ideas into agency practice.

Future Directions in Public Lands Valuation

Despite some of the aforementioned limitations of traditional economic theory, there remains a central role for economics and economic statistics in efforts to value public lands, and in attempts to operationalize philosophically inclusive strategies of public lands management—such as the interpretation and implementation of sustainable development.¹⁴⁰

It is increasingly apparent that, among economists, this role is best suited to researchers in the sub-discipline of environmental economics.¹⁴¹ One of the central themes of environmental economics, also central to most interpretations of sustainable development, is the importance of explicitly addressing the failure of most socioeconomic systems to adequately value the life-sustaining “services” provided by environmental systems, and not just the more obvious extractive benefits associated with short-sighted consumerism (Pearce, Markandya, and Barbier, 1989; Daily, 1997). This macroeconomic, long-term, systems approach to resource valuation is a useful contribution, as it fully acknowledges that our public lands are more than the sum of their parts, and certainly much more than the sum of those parts for which credible market prices are readily available.

The challenge of public lands valuation, however, will remain more than an economic exercise. In part due to its continued reliance on the cost-benefit framework, the usefulness of environmental economics and economic valuation methods as policy-making tools will continue to be limited by the formidable methodological deficiencies of economic valuation techniques, including most fundamentally, by the inability of the utilitarian focus to account for issues of rights and ethics, by the failure of the efficiency concept to illuminate important distributional issues, and by the danger of extrapolating individual

¹³⁸ One of the more interesting studies contributing to this evolution in thinking is Thomas Power’s *Lost Landscapes and Failed Economies* (1996), in which it is shown that the key to economic success in many communities is to maintain clean and healthy environments which, in turn, attracts skilled labor and investment capital.

¹³⁹ Pearce, Markandya, and Barbier (1989:173-185) provide a summary of several other definitions of sustainable development.

¹⁴⁰ Loomis (1994), Toman (1994), and Sagoff (1981) are among those authors who see a role for economic valuation methods in public policy exercises, but only if placed within a proper context. As Sagoff (1981:1410) cautions: “Economic methods cannot supply the information necessary to justify public policy. Economics can measure the intensity with which we hold our beliefs; it cannot evaluate those beliefs on their merits. Yet evaluation is essential to political decision making.” A similar argument is made by Lord (1979:1233): “Most economists will admit, if pressed, that economic science has been unable to determine what is or is not in the public interest.”

¹⁴¹ An excellent survey of environmental economics is provided by Krishnan et al. (1995).

preferences into sweeping social objectives.¹⁴² These deficiencies can also exist in the generally more promising set of techniques that create empirical data by asking stakeholders to make trade-offs among different “bundles” of resource goods and outcomes, but which avoid the artificial step of converting all variables to standard economic measures.¹⁴³ Public lands valuation is destined to remain an awkward marriage of philosophy and economics, bound together by the continued need to supplement the public policy process with sound statistical data regarding resource use and economic activity, but plagued with the irreconcilable disciplinary differences that unavoidably arise when attempting to calculate net resource values using fundamentally different units of measure.

¹⁴² Several of the theoretical and methodological deficiencies of environmental economics are described by Daly and Townsend (1993) and Daily (1997). The overwhelming challenge of measuring process-related environmental values has led Daily (1997:7) to conclude “there exists no absolute value of ecosystem services waiting to be discovered and revealed to the world by a member of the intellectual community.”

¹⁴³ Many such techniques have emerged from the science of MAUT (Multi Attribute Utility Theory). One example of this type of approach is MATS (Multi-Attribute Tradeoff System), a computer program developed by the U.S Bureau of Reclamation to help decision-makers express value trade-offs associated with western water developments (Brown et al., 1986; Henderson and Lord, 1995).

IV: PARTIAL STATISTICAL SUMMARY OF PUBLIC LAND USES AND VALUES

Summary of the Information Presented

While it is undoubtedly impossible to empirically describe the full value of the public lands, some relevant statistical data can be presented for most of the major uses and values, especially those of an explicitly economic nature. For those uses with well documented economic values, it is possible in theory to sum the relevant statistics to generate a picture of total economic value (TEV) for a given resource. A TEV calculation is not attempted in this paper for many reasons, including the practical impossibility of compiling and evaluating all needed statistics, and due to problems of double-counting that would inevitably occur in any categorization scheme. For example, consider the value of a particular National Forest. Forests have many types of values, from systemic (or "primary") values such as streamflow regulation and atmospheric carbon fixation, to particular secondary values such as timber production and the provision of habitat and recreation opportunities. These and other functions of the National Forests are interrelated through a variety of biological, physical, and economic mechanisms, occurring both within and outside of the forest boundaries and over variable temporal scales. Economic value generated from one type of use, such as timber harvesting, may augment or decrease the availability of the forest to provide a different type of value, such as the provision of wildlife habitat.

Experience with cost-benefit analyses aptly demonstrates the difficulties inherent in performing an accurate accounting of this nature at the micro-scale of a particular project and in the context of a particular stakeholder group; at the scale of a vast, multifaceted, and intensively managed resource, nested within a larger national system of resources reserved to provide broad societal benefits, the challenge of the TEV calculation is overwhelming.¹⁴⁴ Furthermore, even if this challenge could be overcome, the TEV calculation would still omit those "biocentric values" that lie outside the range of the utilitarian, anthropocentric perspective associated with economic valuation techniques.

This report, consequently, does not try to provide a numerical answer to the overriding question of "what are the public lands worth?" To the contrary, a central premise of this research is that this question will continue to defy a precise numerical answer, for both methodological and philosophical reasons.¹⁴⁵ It is possible, however, to present statistical data that partially describes the resources of the public lands, how they are utilized, the economic ramifications of particular uses, and the salient long-term trends and consequences associated with these patterns of use. Furthermore, it is frequently possible to discuss these factors using monetary measures, which not only provide a

¹⁴⁴ Perhaps the most ambitious study of this nature estimated the value of the services of the ecological systems and the natural capital stocks of the earth as a whole to be worth somewhere between \$16 and \$54 trillion (Costanza et al., 1997).

¹⁴⁵ This material is covered in depth in Section III.

useful—albeit philosophically limited—measure of value, but which also provide a preliminary basis for considering trade-offs and evaluating policy alternatives.

Categorization of Statistical Information

This section of the report features a partial statistical summary of the uses and values of the public lands. As shown below, the information is organized into two general categories: primarily consumptive uses and values, and primarily non-consumptive uses and values:

PRIMARYLY CONSUMPTIVE USES AND VALUES

- Minerals and Energy Resources
- Rangeland and Grazing
- Timber and Forest Products
- Water Resources

PRIMARYLY NON-CONSUMPTIVE USES AND VALUES

- Recreation
- Research and Knowledge
- Biodiversity Preservation

The consumptive/non-consumptive use criterion is commonly utilized in the natural resources vernacular, and provides a practically useful scheme for organizing statistical information primarily collected in regards to specific resource uses.¹⁴⁶ The consumptive/non-consumptive use criterion, however, has some inherent drawbacks. In particular, it is important to appreciate that the term consumption in this context is utilized to describe resource extraction and use rather than actual depletion, as the so-called “renewable resources,” such as timber and range, can be consumed at levels either above, below, or at the level of natural regeneration. For renewable resources, the requirement of ecological sustainability, increasingly a fixture in modern public lands policy, provides resource managers with a mandate to evaluate levels of consumption relative to levels of regeneration. Consequently, any discussion of renewable resources is incomplete without some assessment of how levels of consumptive use compare to levels of regeneration. In contrast, consumption of the so-called “non-renewable resources,” such as mineral deposits, carbon-based energy reserves, and genetic biodiversity, can more accurately be equated with depletion.¹⁴⁷

¹⁴⁶ The synonymous use of “use” and “value” in this scheme, a classic utilitarian assumption, is entirely appropriate for describing economic statistics, the major focus of this statistical summary. Public land values of a non-utilitarian nature, such as those based on notions of rights and ethics, are not readily amenable to statistical discussions, and are consequently largely outside the scope of this statistical summary.

¹⁴⁷ The renewable/non-renewable resource distinction is not used as the basis for classification in this report due to these ambiguities. Of particular concern is the fact that many resources considered to be

Also of concern is the observation that not all resource uses and values can be easily contained within the consumptive/non-consumptive use dichotomy. For example, some forms of recreation, such as fishing and hunting, are intended to be at least partially consumptive—i.e., part of the attraction of these activities is the consumption of game—while most other types of recreation, including hiking, boating, camping, and sightseeing, are not intended to be consumptive. Yet, any type of recreation when pursued to the extreme—including those activities which are intended to be non-consumptive—is likely to inadvertently cause temporary damage or deplete key attributes of the resource in question, and as such, can be characterized as consumptive in nature. Thus, it is difficult to evaluate the economic values of primarily non-consumptive uses without considering issues of unintended impacts and the costs of (and prospects for) resource restoration, much as it is difficult to evaluate the economic nature of consumptive uses without explicitly considering rates of resource regeneration or depletion. The true economic value of a resource use, after all, is not determined solely by the revenues associated with that use, but involves considering these revenues in the long-term context of depleted or degraded resources.¹⁴⁸

Types of Information Presented

Several types of biophysical and economic relationships must be considered to accurately describe the values associated with public land uses (Howe, 1979). In many cases, desired statistical information is not readily available to illuminate or quantify all important factors. In this report, statistical information was primarily collected and organized to document two types of parameters relating to resource values:

- **(1) Resource Inventory, Use and Prognosis.** The values of public land resources are, in large part, a function of the sheer magnitude of those resources as influenced by current levels of use. Some understanding of resource inventories and levels of use and consumption, when considered along with information about resource regeneration and discovery, is essential to developing a “prognosis” of future resource availability. For many types of resource uses and values this information is readily available; however, in

nonrenewable, such as fossil fuels, are renewable if viewed from sufficiently long time periods—such as geologic time. Most scholars tend to define as non-renewable those resources which cannot be replenished within a reasonable human planning horizon, perhaps as long as a century, a convention that is useful to distinguish between non-renewable fossil fuels and renewable streamflows, for example, but still problematic for considering resources which develop over longer time periods, such as redwood forests. Other challenges to the “non-renewable” concept are provided by changes in technology or human behavior, such as the modern practice of recycling minerals, and the emerging ability to modify and even re-establish exhausted gene pools. The terminology of consumptive/non-consumptive use tends to better elude these complications by avoiding any implications about whether the resources will eventually be replenished. Consumption implies only an immediate, short-term extraction and use of a resource, without speculating on how this will influence long-term reserves (Tietenberg, 1992).

¹⁴⁸ A common proposal today which captures this attitude is the suggestion to reform the computation of Gross Domestic Product (GDP) in order to account for the loss of “natural capital” associated with revenue generating activities.

other cases, particularly those involving non-consumptive uses, this information is often difficult to compile. In those cases where an inventory of current and future resource reserves is impossible or inappropriate to quantify, the status of the resource can often be described qualitatively using various types of "surrogate" statistics.¹⁴⁹

- **(2) Market Values and Revenue Streams.** Those economic uses of the public lands that generate revenues are, at least in theory, the easiest to value. Many activities, especially those that involve consumptive uses, deliver public land resources into the marketplace, where market prices provide a measure of economic value. In practice, however, these figures can be of limited value unless factors such as subsidies (including hidden environmental costs) and revenue streams are considered. For example, while public land management agencies generally maintain useful, if not altogether coherent, records on revenues generated for the federal treasury and related governmental expenditures, this tells only part of the economic picture. The other component concerns profits generated by the private entities utilizing these resources, and the multiplier effects that natural resources production and depletion have on a national economy. This macroeconomic information can be extremely difficult to acquire. Furthermore, as discussed earlier, statistics summarizing the economic value of some uses are likely to hide the extent to which these activities modify, either positively or negatively, the values associated with other types of public land uses. These factors should be considered when evaluating the relevance of economic statistics.

The issue of revenue streams is of particular interest to public lands communities. Because public lands are immune from nonfederal taxation, state and local efforts to obtain revenues from public land uses has been a contentious part of public lands policy for most of the nation's history (Fairfax and Yale, 1987). The concerns of state and local governments have primarily been addressed through federal tax exemptions and resource revenue sharing programs. While most public revenues collected from public land activities go to the Federal Treasury, a specified percentage is normally allocated to the relevant state government for general purpose uses, and another specified percentage is channeled through special funds serving particular needs.¹⁵⁰ These percentages vary depending upon

¹⁴⁹ A primary strategy employed in the discipline of economic valuation is to use readily available value statistics to illuminate those values that cannot be measured directly. For example, a description of current consumptive uses of a resource can provide some measure of the value attributed by society to the competing, non-consumptive uses.

¹⁵⁰ For example, two of the most significant special funds are the Reclamation Fund and the Law and Water Conservation Fund. The Reclamation Fund, created by the Reclamation Act of 1902 (32 Stat. 388; 43 U.S.C.A. § 391), was originally designed to function as a revolving fund, collecting revenues from the sale of public lands and making it available to western states to finance water projects. For most of its history, however, congressional expenditures from this fund have greatly outstripped collections, as a long series of subsidies have been introduced into the reclamation program. For example, the irrigation subsidy provided by Bureau of Reclamation projects averages 82%; other uses are also subsidized: e.g., hydroelectric power generation, 35%; water supply, 29% (Wahl, 1989; WRC, 1975). Most of the funds made available through the Land and Water Conservation Fund (LWCF), administered by the National Park Service, come from lucrative rents gleaned from offshore oil leases along the Continental Shelf. Revenues from the LWCF can be used by federal, state, and local governments to buy parks and recreation areas, and to plan, acquire, and

the type of resource and the type of land in question, and are discussed in more detail in the following pages under the appropriate resource use headings. While these amounts can be significant in some localities, it is important to note that, on average, resource revenue sharing programs on the federal public lands constitute less than 1% of most western states' annual revenues (Fairfax and Yale, 1987).

While revenue sharing programs help to compensate state and local governments for federal control of land and resources, these revenue sources have many drawbacks (Fairfax and Yale, 1987). Perhaps most important is the fact that some localities possess federal lands that are generally lacking in valuable resource commodities, resulting in small revenue sharing payments. The quantity and timing of revenue sharing payments are also highly vulnerable to normal market fluctuations influencing a given commodity. Additionally, a reliance on revenue sharing programs can create a strong economic incentive for a local government to promote these commodity uses, often at the expense of other public land values. Nationally, most local governments avoid these fiscal uncertainties by relying on the stability of property tax revenues, an option foreclosed in public land regions by federal land ownership. In many communities, this deficiency is now partially offset by the Payments in Lieu of Taxes (PILT) program, which originated in response to the federal acquisition of state lands for military and economic recovery purposes during the Great Depression and both World Wars. Under this program, the federal government now provides the public land states with some compensation for the loss of property tax revenues associated with federal landholdings (Fairfax and Yale, 1987).

Primarily Consumptive Uses and Values¹⁵¹

The consumptive uses and values of the federal public lands are generally defined to include all goods extracted from these public areas, even if the extracted element is actually privately owned. While this may seem like an odd convention, it is of particular importance in the following discussion of mineral reserves, as split estates on the public lands often involve federal surface land ownership, while the mineral rights are privately owned. For purposes of gross resource valuation, the distinction between public and private ownership is not necessarily relevant. For example, while it is typically assumed that a private mining

develop land and water resources for recreational uses. (The acquisition of sites with historical significance can also be financed with resources from the National Historic Preservation Fund, also administered by the Park Service.) LWCF is a "matching grant" program, appropriated on an annual basis by Congress and shared with the states on a 50% matching basis. Of the annual congressional appropriations to states, 40% is apportioned equally among all fifty states, while the remaining 60% is apportioned based on need, population, and on the quantity of federal property in the particular state (Fairfax and Yale, 1987; Nelson, 1995).

¹⁵¹ The statistics included in this report mostly derive from the federal government, usually the particular agency in charge of land and resource management. However, it is important to note that critics question the validity of some federal statistics, suggesting that their reliability may be compromised by political prerogatives. Whether or not these concerns are valid, rarely do adequate alternatives exist to the federal statistics. In this report, every effort is made to explicitly identify known shortcomings in the statistics utilized, and the reader is urged to use this information with caution and skepticism.

company will patent the discovery of valuable hardrock mineral resources and gain superior fee title interest, in some cases, the company may find it advantageous to not take a claim to patent. Once minerals are discovered, the company enjoys legal protection from competing interests except those of the United States, a situation that may be more beneficial to the company than bona fide legal ownership, which subjects the operation to state property taxation schemes and other responsibilities incidental to fee ownership. While many of these “dicey” issues must be considered in an analysis of revenue streams, they do not directly influence the more general determination of gross consumptive resource values on the public lands, roughly estimated herein as the product of market prices and quantities consumed.

Minerals and Energy Resources

Resource Inventory, Use, and Prognosis

The category of minerals and energy resources includes a tremendous diversity of hard and soft metals, rocks, fuels (including oil, gas, and solid energy fuels), and related tangible items extracted or “mined” from the public lands for their economic value. Although aggregating statistics obscures wide differences in the economic value of different deposits, maintaining separate accounts for all types of deposits results in an unwieldy mountain of statistics far beyond the scope of this report. Consequently, the statistics utilized in this report generally follow two classification conventions found in the statistical literature. The first point of distinction is between onshore and offshore resources, an important difference primarily due to the different administrative arrangements associated with the management of these two classes of resources. A second and generally more useful distinction in the valuation context is to follow the statutory framework (presented in Section II) that differentiates between *hardrock* minerals (which are generally patentable¹⁵²), *leasables*, and *salables*. This approach is utilized heavily in this discussion due to its utility in tracking revenue streams, and because these same categories are frequently used by the agencies that compile available statistics. These categories do not, however, provide a highly useful tool for discussing resource inventories, which are best characterized as being a product of geologic, technological, and market forces.¹⁵³

The United States Geological Survey (USGS), the agency primarily responsible for assessing the U.S. mineral resource base, addresses the resource inventory question through the use of a three-part “resource taxonomy”: (1) current reserves, (2) potential reserves, and

¹⁵² One major exception is hardrock minerals located on acquired lands, which are generally only leasable..

¹⁵³ In order to have a practical use, the “resource inventory” concept must provide a measure of availability, which in the realm of mineral and energy resources, is that percentage of total geologic deposits that is practically available given technological limitations and costs of extraction. It can be generally assumed that technological advancements will continue to make resource extraction easier and less costly, and that resource scarcity will result in higher market prices, thereby encouraging greater exploration and technological innovation. It can also be assumed that changes in resource using practices, such as recycling of minerals, can also influence a practical measure of resource availability. When viewed from this perspective, resource inventory is a dynamic factor, even if the resource in question is, from a geologic perspective, relatively constant (Tietenberg, 1992).

(3) resource endowment. The term "current reserves" refer to those known resources which can be extracted for profit given current technologies and resource prices. Statistical estimates of "current reserves" are often readily available, although the accuracy of this information can be compromised by trade secrets guarded closely by private mining companies and, potentially, by national security considerations. Estimates of "potential reserves" are best described as a "function" rather than a number, as the magnitude of resources potentially available is calculated based upon an estimate of willingness-to-pay. Higher resource prices result in larger estimates of potential reserves. Finally, the concept of "resource endowment" ignores these socioeconomic issues entirely, and is instead a geological concept representing the physical magnitude of resources believed to exist in the earth's crust—a theoretical ceiling on the total availability of mineral and energy resources. These three categories should not be viewed as separate entities, but rather as points upon a continuum formed by considering economic and geologic issues in tandem.

The distinctions between the USGS concepts of current and potential reserves, and resource endowments, have significant policy implications. A common fallacy is treating data on current reserves like it represents the maximum potential reserves, an assumption that often leads to inaccurate resource prognoses (Tietenberg, 1992).¹⁵⁴ For example, although it was estimated in 1934 that copper would be exhausted in 40 years, revised estimates forty years later in 1974 suggested that known reserves would last another 57 years, a consequence of new exploration, technological advances, and shifting market signals.¹⁵⁵ Another common mistake is to assume that the total resource endowment can, at some point in the future, be made available through price increases. This is probably a poor assumption for resources which are "geochemically scarce," such as copper, lead, zinc, molybdenum, and gold. It is unlikely that a future society would be willing to pay the high costs necessary to extract traces of these minerals once the readily available deposits are depleted. For many of the more plentiful minerals and energy resources, including iron, aluminum, titanium, magnesium, and silicon, the relationship between price and availability must feature a consideration of ore grade. As higher grades of such ores are depleted, costly, but highly abundant, lower grades of ore become potential targets of exploration, but only as market prices rise.

While considerations of technology and market prices largely preclude the calculation of precise resource inventory and prognosis estimates, they do not discredit statistics showing current levels of production. The United States is among the top three world producers for all of the following minerals: aluminum, barite, beryllium, boron, bromine, cadmium, cement, copper, diatomite, feldspar, industrial garnet, germanium, gypsum, helium, lime, magnesium, mercury, mica, molybdenum, ammonia, perlite, phosphate, quartz crystals, rare earth metals, rhenium, salt, silicon, sodium carbonate,

¹⁵⁴ It is common for estimates of resource availability to be based on a simple division of current reserves by current rates of consumption. This is called a "static reserve index," which tends to underestimate the time until resource exhaustion. A static reserve estimate will only be valid if one assumes that (1) the consumption of the resource in question will remain steady at current levels until the point of resource exhaustion, and that (2) the mineral reserves will not be augmented during this period of time. These assumptions rarely prove to hold up in practice.

¹⁵⁵ Many additional estimates of this nature can be found in the "limits to growth" literature of the 1970's, summarized earlier in Section III and by Paehlke (1989).

sulfur, talc and prophyllite, titanium, and vermiculite (Forest Service, 1989). A variety of U.S. production statistics for minerals and fuel resources are provided in Table A1.¹⁵⁶

It is frequently difficult to accurately ascertain or generalize about how much of these yields originate from the public lands; however, there is no doubt that the public lands are the primary repository of most accessible mineral and energy resources. This accounting problem is particularly troublesome for *hardrock* minerals, the subject of the General Mining Law of 1872, which pass from public to private ownership upon the patenting of mineral discoveries. From a conceptual standpoint, it is useful to classify these patented claims as a component of public land values; but as a practical matter, governmental statistics tend to only include those activities still under federal jurisdiction. As shown in Table A2, almost 3 million hardrock mining claims have been filed on BLM lands from 1976 to 1996, of which about 307,000 are currently active. Approximately 136,000 of these active claims, and almost 700,000 of all claims, are located in Nevada.

The category of *leasable* minerals and energy resources primarily includes those resources explicitly covered by the Mineral Leasing Act of 1920: coal, phosphate, sodium, potassium, oil, oil shale, natural gas, and gilsonite.¹⁵⁷ However, the leasable category also includes many hardrock minerals located on acquired lands, except those in National Parks or Monuments, as specified in the Acquired Lands Act of 1947.¹⁵⁸ Geothermal energy is also a leasable as of 1970 under the Geothermal Steam Act.¹⁵⁹ This category is typically further subdivided by location: offshore, onshore, or on Indian Trust Lands.¹⁶⁰ Offshore leases involving the Outer Continental Shelf (OCS)¹⁶¹ are primarily liquid energy resources such as oil and gas, while onshore and Indian leases are likely to include a greater variety of mineral and energy resources.

¹⁵⁶ All tables are located in the Appendix.

¹⁵⁷ See 30 U.S.C.A. § 181.

¹⁵⁸ See 30 U.S.C.A. §§ 351 through 359.

¹⁵⁹ See 30 U.S.C.A. §§ 1001 through 1025. Geothermal energy is derived from the intrinsic heat of the earth. To distinguish this resource from water, the statute defines geothermal steam and resources as "(i) all products of geothermal processes, embracing indigenous steam, hot water and hot brines; (ii) steam and other gases, hot water and hot brines resulting from water, gas, or other fluids artificially introduced into geothermal formations; (iii) heat or other associated energy found in geothermal formations; and (iv) any byproduct derived from them" (section 1001(c)). There is a 10% royalty on the value of steam, heat, or energy derived from production (section 1004(a)) and a royalty of 5% for any byproduct of such lease for sale (section 1004(b)). Geothermal leases last for ten years, or if resources are found, continue as long as geothermal steam is produced or utilized in commercial quality for up to 40 more years, with a preference option on renewal (section 1005(a)).

¹⁶⁰ Indian trust lands are lands held in trust for Native Americans by the federal government which are administered by the Department of the Interior.

¹⁶¹ See the Outer Continental Shelf Lands Act of 1953 (43 U.S.C.A. § 1331-1356). The submerged land which lies beyond the limit to territorial waters is known as the outer continental shelf, extending seaward from as little as one mile to as much as 800 miles, covering approximately 1.7 billion acres. Because this is such a large land mass capable of generating huge revenues, there has been a long history of jurisdictional conflicts between states and the federal government over who should control the development of the shelf and the resulting revenue stream. This debate was largely resolved in the 1953 legislation by the determination that state boundaries extend three miles from the coast, with all other submerged lands being federal property. The legislation also includes most of the requirements that comprise the federal leasing program.

Although highly dependent upon imported energy reserves, the United States is one of the world's largest producers of crude oil, natural gas, and coal, much of which is located in (and under) the public lands and subject to leasing programs.¹⁶² Despite a general decline in production levels over the last decade, the United States remains a formidable crude oil producer, extracting over 6.5 million barrels in 1995. Production of natural gas has been slowly, but steadily, increasing in the United States, exceeding 18 quadrillion Btu's annually since 1990. Coal production in the United States is also significant, supporting exports of approximately 109 million short tons in 1991. Much of this production originates from the 25,916 *producing* federal onshore, offshore, and Indian oil, gas, and mining leases at the end of 1997 (MMS, 1998:28). As shown in Table A3, these *producing* leases only account for approximately one-third of total leases (MMS, 1998:29).

The category of *salable* minerals primarily includes those resources excluded from the jurisdiction of the 1872 General Mining Law in the Common Varieties Act of 1947 and the Surface Resource Act of 1955.¹⁶³ Minerals covered include sand, stone, gravel, pumice, pumicite, cinders, clay, and other mineral-like substances, as well as vegetative materials including but not limited to yucca, manzanita, mesquite, cactus, timber and other forest products. Sale of such common variety resources found on the public lands goes to the highest bidder after formal advertising or other public notice. As shown in Table A4, BLM statistics for 1996 recorded the actual removal of 8.89 million cubic yards of these materials in 3,432 active sales. Helium is also deemed a salable public lands resource, as the United States has reserved ownership of and the right to extract helium from all gas produced from leases on public lands or otherwise granted by the federal government.¹⁶⁴

Market Values and Revenue Streams

The consumptive use of mineral and energy resources on the public lands generates a substantial amount of public revenue. The Minerals Management Service (MMS), through its Royalty Management Program, is the primary federal entity responsible for the collection of fees. The vast majority of fees collected are associated with leasing programs in which the title to the land remains with the federal government, thereby entitling the government to collect royalty payments. A wide variety of formulas exist to calculate the required monetary payments.¹⁶⁵

The legal status of the resource in question is the primary factor determining the nature of public revenues, if any, created by disposition of the resource. Once *hardrock* minerals have been patented, virtually all revenues generated from the private marketing of these resources go entirely to the companies involved as long as nominal public fees are

¹⁶² The following statistics are taken from table numbers 1158 (world crude production), 1159 (world natural gas production), and 1166 (world coal trade), respectively, of the *Statistical Abstract of the United States* (Census, 1996).

¹⁶³ Common Varieties Act (30 U.S.C.A. § 601); Surface Resources Act (30 U.S.C.A. § 611).

¹⁶⁴ 30 U.S.C.A. § 181. Helium production from the public lands has been steadily decreasing for several years.

¹⁶⁵ Note that under the Mineral Leasing Act of 1920 and the Outer Continental Shelf Lands Act of 1953, the Federal government may take all or part of its oil and gas royalty "in kind," which means that the federal government asserts a right to a specified quantity of the mineral resource extracted in lieu of monetary royalty payments based upon a percentage figure of the total market value of the resources extracted.

paid and procedural requirements are respected.¹⁶⁶ In contrast, *leasable* minerals entitle the federal government, as owner of the land in question, to a combination of bonuses, rents, minimum royalties, and production royalties.¹⁶⁷ *Salable* are disposed of either by straight cash sales or by a production-based revenue formula akin to that for leasable minerals.

As of 1992, the annual market value of minerals and energy resources produced in the United States was approximately 136 billion dollars: 104 billion from energy fuels (primarily petroleum, coal, and natural gas), 12 billion from metals, and 20 billion from "industrial minerals," which include many of the materials classified herein as *salable*.¹⁶⁸ Although a majority of this income is derived from activities on public lands, only a small fraction of this total is directly captured by the Federal treasury, and most of this amount is derived from leasing programs associated with energy resources, especially those located along the OCS. As shown in Table A5, the MMS collected over \$6.2 billion in receipts from *leasables* in 1997. Approximately \$4.8 billion of this total came from offshore leases, mostly from oil and gas royalties. Onshore leases generated approximately \$1.2 billion, while Indian trust land leases provided an additional \$208 million. This is the highest level of revenue collection since the 1980's, a period during which revenues from the OCS leasing program trailed only IRS income tax collections and U.S. Customs fees as a source of federal revenue (Nelson, 1992; MMS, 1998:9).¹⁶⁹

Formulas for the disbursement of federal oil, gas, and mineral revenues are exceedingly complex, much like the rules for revenue collection.¹⁷⁰ In general, revenues collected from oil, gas, and mineral leases on the public lands are distributed to four types of recipients: (1) to the U.S. treasury, (2) to "special accounts" established by Congress to finance specific programs, (3) to the states where the production occurs, and to (4) tribal governments and allottees. Most public revenues associated with federal offshore leasing programs—the largest source of public revenues—are retained in federal accounts, distributed among the General Fund of the Treasury, the Land and Water Conservation Fund (LWCF), and the National Historic Preservation Fund (NHPF). Annual deposits to

¹⁶⁶ One major exception is those hardrock minerals on acquired lands subjected to leasing programs, which are frequently assessed a 5 percent royalty.

¹⁶⁷ Bonuses represent the cash amount successfully bid to win the rights to a lease in an area known to contain valuable minerals. Rents are annual payments, usually a fixed dollar amount per acre, designed to preserve the rights to a lease when a well or site is not in production. Minimum royalties are annual payments per acre required to maintain the rights to a lease until production exceeds a specified value. These modest fees (often tabulated as "other revenues") are designed to enable the lessee to gain back some of the capital costs involved with implementing extraction of the resource. Once these start-up costs have been recouped and production value exceeds the specified minimum, however, production royalties become due. These royalties are typically defined as a stated share or percentage of the total value of the mineral produced, which the federal government is entitled to as owner of the land (MMS, 1998).

¹⁶⁸ Statistic taken from table 1147 of the *Statistical Abstract of the United States* (Census, 1996).

¹⁶⁹ As a point of reference, compare these figures to revenues derived from *saleable* minerals. Over 2,500 new contracts sales and use permits were issued for saleable resources in 1996 covering 15.3 million cubic yards of material valued at \$10.2 million. The exercise of 3,432 contracts/permits in that same year generated \$5.8 million in federal revenues (BLM, 1996a). These figures do not even approach one percent of revenues earned from offshore oil and gas leases.

¹⁷⁰ For a detailed review of disbursement formulas, consult the annual *Mineral Revenues* publication of the Minerals Management Service. These and other MMS documents can be found online at <<http://www.mmp.mms.gov/>>.

the LWCP and NHPF can go as high as \$900 and \$150 million, respectively, with most of the remainder going to the Treasury's General Fund. One notable exception is payments to coastal states located within three miles of the offshore oil or natural gas field covered by the federal lease. In these cases, the states are entitled to a "fair and equitable" division of leasing revenues, which is currently interpreted as 27 percent of revenues from royalties, rent, and bonus payments generated within the state's coastal zone.

Different rules apply for revenues collected on the acquired lands, Indian lands, and the remaining public lands. On the acquired lands, the MMS collects all royalties, rents, and bonuses from mineral and energy leases issued under the Mineral Leasing Act. In general, revenue sharing on the acquired lands managed by the Forest Service and BLM follows a 75-25 split, with the larger share going to the Treasury's General Fund and the remaining 25 percent to the state or county in which the lease is located. Several other arrangements exist for remaining categories of acquired lands.¹⁷¹ For Indian lands, the Bureau of Indian Affairs (BIA) collects bonuses and rents from nonproducing wells or sites, while MMS transfers mineral royalties and rents from producing leases on Indian trust and allotted lands to the Office of Trust Funds Management (OTFM). Then, with some exceptions, BIA generally makes disbursements of revenues to the appropriate tribes. In the remaining public lands, states generally receive 50 percent of all royalties, rents, and bonuses within their boundaries, except for Alaska which receives 90 percent. The remainder is distributed to the General Fund (10 percent) and to the Reclamation Fund (40 percent), which is used to finance federal water projects in arid and semiarid regions. This revenue distribution formula is also frequently applied to coal mines subject to the Federal Coal Leasing Amendments of 1976¹⁷² and to leases on military lands acquired after 1981.

In fiscal year 1997, Federal and Indian lease revenues exceeding \$6.2 billion were collected and disbursed. The exact distribution of these funds is shown in Table A6. Over half of these funds (approximately \$3.9 billion) were channeled directly into the U.S. Treasury, followed by special accounts (\$1.5 billion), state payments (\$0.7 billion), and tribal payments (\$0.2 billion). The state share of these disbursements is summarized in Table A7. Among other findings, Table A7 illustrates the extreme importance of federal onshore leasing revenues to the states of Wyoming and New Mexico.

Rangeland and Grazing

Resource Inventory, Use and Prognosis

Another significant consumptive value of the public lands is rangeland used for grazing commercial livestock. While the economic value associated with grazing is

¹⁷¹ Receipts from flood control lands, managed by the U.S. Army Corps of Engineers, are also split between the General Fund and state and local governments, with the larger share going to the non-federal governments. All receipts from lands managed by the Bureau of Reclamation go into the Reclamation Fund. Leasing revenue from National Wildlife Refuge lands are split between county government and the General Fund. Finally, for military lands acquired before 1981, all leasing revenues go to the General Fund. For the purposes of leasing revenue allocation, military lands acquired after 1981 are generally not subject to the rules associated with acquired lands.

¹⁷² 90 Stat. 1083.

considerably smaller than that of minerals and energy extraction, grazing in many areas is the most intensive use of the public lands (Wilkinson, 1992). This is specially true for lands managed by the BLM and, to a lesser extent, National Grasslands and other areas managed by the Forest Service. Direct statistical comparisons of BLM and Forest Service grazing practices are somewhat difficult since these agencies generate statistics that are not always consistent, nor reported for the same time periods. Even more problematic is the documentation of grazing on public lands outside of the BLM and Forest Service systems. For example, grazing is occasionally allowed as a special use within National Parks under the National Park Service Organic Act, however, statistics on these uses are not readily available.¹⁷³ Despite these complications, federal statistics provide a relatively clear picture of grazing on the public lands.

More acres of the western United States are dedicated to grazing than any other consumptive use. The BLM manages approximately 165 million acres open to grazing, supporting about 4.4 million cattle, sheep, and horses; the Forest Service manages approximately 105 million acres of public rangeland in the United States, almost exclusively located in the West, grazed by over 2 million cattle, sheep, and horses (GAO, 1988; Forest Service, 1997). Grazing animals on the public lands requires a permit which can last up to ten years, and which includes a priority for renewal to the permit holder.¹⁷⁴ As shown in Tables A8 and A9, approximately 27,000 grazing permits were authorized in 1996 for almost 21 million AUMs.¹⁷⁵ This included over 8,000 permittees allowed to graze more than 8 million AUMs on Forest Service lands, as well as 11,900 grazing permits on Section 3 lands (i.e., lands within grazing districts) for 11.6 million AUMs, and 6,895 grazing leases on Section 15 lands (i.e., lands outside grazing districts) for 1.5 million AUMs on BLM lands. This intensity of use is significantly lower than historic levels (Foss, 1960; MacDonnell, 1993; GAO, 1988).

As a potentially renewable resource, the quantity of forage available on the public lands is largely determined by land productivity and rangeland health, which in turn are highly dependent upon factors such as climate, seasonal weather abnormalities, national and international food markets, and perhaps most importantly, intensity of use. Rangeland quality is a hotly contested, politically charged issue, featuring frequent disputes about the actual quality of the public rangeland. Although less than 2% of livestock ranchers use public rangelands, overgrazing has been and continues to be a significant problem (Wilkinson, 1992). Aggressive legislative reforms to address overgrazing of public lands began in the 1930s with the passage of the Taylor Grazing Act of 1934,¹⁷⁶ an era in which the Department of Agriculture estimated that “a range once capable of supporting 22.5 million animal units . . . can now carry only 10.8 million” (Foss, 1960:4).¹⁷⁷ In the modern era, the most salient legislative attack on overgrazing has come in the Public Rangeland

¹⁷³ 16 U.S.C.A. § 3. Also see *Special Park Uses* (NPS, 1996).

¹⁷⁴ See 43 U.S.C.A. § 315(b).

¹⁷⁵ AUMs refers to “Animal Unit Month,” one AUM being equivalent to the average amount of forage required by a thousand pound cow for one month.

¹⁷⁶ See 43 U.S.C.A. §§ 315-315(r).

¹⁷⁷ Overgrazing on the public domain lands—public lands not yet reserved or disposed by the federal government—was even more pervasive during this era (Foss, 1960).

Improvement Act of 1978.¹⁷⁸ Legislative and administrative reforms have been successful in reducing grazing levels, although poor range condition remains a chronic problem. The Forest Service has overseen the most dramatic declines in grazing levels. By 1910, grazing levels in the National Forests were as high as 15 million AUMs, later rising to over 20 million AUMs during World War I. This level of use was gradually reduced to the current level from the 1920s to 1960s, driven by concerns about overgrazing. Levels of grazing on BLM lands peaked in the 1940s at approximately 15 million AUMs before steadily declining to just over 10 million AUMs in the late 1970s (MacDonnell, 1993).

Despite the fact that 40 percent of the nation's rangeland is in federal ownership, these lands support only 14 percent of the total AUMs consumed by livestock (MacDonnell, 1993). This statistic not only illustrates the fact that public rangelands tend to be more arid, and thus less productive, than private rangeland holdings, but also underscores the fact that these lands are relied upon to support millions of wild horses, burros, antelope, deer, moose, mountain sheep, bison, and other ungulates (MacDonnell, 1993). It is these non-livestock species that are most at risk from chronic overgrazing. As of 1989, 68 percent of BLM grazing lands are characterized as being in "unsatisfactory" condition—defined as the sum of fair (42 percent) and poor (26 percent) condition lands—a rating that is particularly disconcerting given that the working definition of "fair" lands are those that cannot support more than half of their historic carrying capacity (NWF and NRDC, 1989; Wilkinson, 1992; Bates, 1992). This information, shown in Table A10, is a slight improvement from the 71 percent unsatisfactory rating compiled in the 1985 assessment (NWF and NRDC, 1989). Forest Service rangeland is generally considered to be in slightly better condition, although only 27 percent is rated as "satisfactory" (Bates, 1992:48).¹⁷⁹

Another important consideration in evaluating resource condition is the status of the riparian zones, those lush areas along streams and creeks that, in various ways, sustain the majority of wildlife species in arid and semi-arid regions.¹⁸⁰ In addition to providing wildlife

¹⁷⁸ In the Public Rangeland Improvement Act (PRIA), Congress asserts that "(1) vast segments of the public rangelands are producing less than their potential for livestock, wildlife habitat, recreation, forage, and water and soil conservation benefits, and for that reason are in an unsatisfactory condition; (2) such rangelands will remain in an unsatisfactory condition and some areas may decline further under present levels of, and funding for, management; (3) unsatisfactory conditions on public rangelands present a high risk of soil loss, desertification, and a resultant underproductivity for large acreage's of the public lands; contribute significantly to unacceptable levels of siltation and salinity in major western watersheds . . . negatively impact the quality and availability of scarce western water supplies; threaten important and frequently critical fish and wildlife habitat; prevent expansion of the forage resource and resulting benefits to livestock and wildlife production; increase surface runoff and flood danger; reduce the value of such lands for recreational and esthetic purposes; and may ultimately lead to unpredictable and undesirable long-term local and regional climatic and economic changes . . ." PRIA, 43 U.S.C.A. § 1901 (a)(1-3) (emphasis added).

¹⁷⁹ However, given that most Forest Service lands are at higher altitudes and thus less arid than BLM lands, this slight statistical disparity may suggest that Forest Service grazing lands are even more abused than rangelands managed by the BLM. Given relatively more moisture, Forest Service lands are often better suited to rangeland productivity and may for this reason be more intensively used without harm than arid, less productive BLM lands.

¹⁸⁰ Riparian corridors make up less than 1 percent of total western lands, but provide critical habitat to the majority of the approximately 3,000 species dependent upon the public lands for habitat (Bates, 1992).

habitat, maintaining vegetation along riparian zones is also important to minimize erosion, sedimentation, and associated non-pointsource water pollution.¹⁸¹ In order for riparian/wetland areas to remain healthy, deep-rooted vegetation normally must be maintained to help dissipate the energy associated with high water flows. In areas characterized by poor grazing management, cattle are allowed to consume or trample riparian vegetation, leading to localized soil erosion along stream banks and the eventual development of “cut banks” along stream channels from the scouring of exposed stream channels during high flow periods. Furthermore, the loss of good soil reduces the ability of the land to capture, hold and gradually release excess flows, resulting in a reduction in groundwater recharge and the ability of root systems to locate water. As shown in Table A11, most riparian/wetland zones in BLM lands are considered by the agency to be in “proper functioning condition”¹⁸²; however several states, most notably Nevada, Arizona, New Mexico, Montana, and Wyoming, have significant problems.

Market Values and Revenue Streams

Receipts for grazing in 1996 on BLM lands totaled about \$14 million, nearly 11 percent of total BLM revenue collected for that year. Grazing receipts for the Forest Service in 1996 totaled \$7.3 million, a significant decrease from previous years. These totals are shown in Table A12. While these are significant revenue amounts, it is frequently asserted that public grazing fees are artificially low when compared to fees on private grazing lands. Fees associated with public grazing permits are based on a formula found in the Public Rangeland Improvement Act of 1978 (PRIA), provided in Table A13, which specifies a required payment based on the total number of AUMs consumed. In 1990, the BLM assessed grazing fees of \$1.81 per AUM, while Forest Service fees ranged from \$0.84 to \$4.36 per AUM (Bates, 1992).¹⁸³ This federal rate rose modestly to \$1.86 per 1993, before falling again in 1996 to \$1.35 (Olinger, 1998). Despite these occasional fluctuations in public grazing fees, a stark disparity prevails between public and private grazing fees, with private grazing fees being nearly five times greater on average than public fees (Watts and LaFrance, 1994).¹⁸⁴ Some parties have interpreted this discrepancy as a federal grazing

¹⁸¹ Pollution enters watercourses in two general ways: (1) through point sources, such as the outlets of factories and wastewater treatment plants; and (2) through “nonpoint” sources, such as agricultural and urban runoff, and occasionally through contaminated precipitation. The water pollution laws and programs of the United States have generally been much more effective in the control of point sources than nonpoint sources, as the former provides obvious sites at which to enforce technology standards and to concentrate monitoring.

¹⁸² Under the BLM rating system, a riparian-wetland areas is considered healthy and functional when adequate vegetation, landforms, or large woody debris is present to dissipate the energy associated with high water flows (BLM, 1996a).

¹⁸³ These fees have risen extremely slowly over time. For example, on BLM lands, grazing fees have climbed 5 cents (per AUM) from 1936 to 1993 (Watts and LaFrance, 1994:62-63).

¹⁸⁴ The authors suggest a more appropriate range of fees would lie between \$6 and \$15 per AUM, averaging \$9.22 per AUM. Supporters of current fee structures counter that the public lands are frequently less productive than private grazing lands, as the most productive lands were converted to private ownership in the homesteading era leaving the remaining, less productive lands in public ownership.

subsidy as high as \$1,435 per permittee.¹⁸⁵ Several congressional and administrative attempts have been made to raise grazing fees, however, it has proven to be a highly contentious and politically resistant issue despite the statistically small number of total ranchers dependent on the public rangelands (Olinger, 1998).¹⁸⁶

The revenue collected from federal grazing fees go into a revenue sharing program somewhat similar to those created for dispersing minerals leasing revenues. Federal grazing receipts, from both BLM and Forest Service lands, are allocated into three categories (Fairfax and Yale, 1987).¹⁸⁷ One half of all funds roll into a "Range Improvement Fund," utilized exclusively for improvements in the western states. Another significant percentage is allocated to states and counties. As provided by the Taylor Grazing Act, states and counties receive 12.5 percent of revenues from grazing lands located within grazing districts (Section 3 lands), while receiving 50 percent of revenues from lands outside districts (Section 15 lands). All remaining funds are earmarked to the General Treasury Fund established by FLPMA.

Timber and Forest Products

Resource Inventory, Use and Prognosis

The third category of consumptive values involve public forests. Forests provide several functions, including wildlife habitat, recreation opportunities, watershed maintenance, forage, wood products, and carbon dioxide reduction. The primary consumptive value is commercial timber; other consumptive forest products include Christmas trees, nuts and seeds, mushrooms, yew bark, plants such as cactus and yucca, and other vegetative materials. Similar to rangeland, the full spectrum of forest products on the public lands is not tracked by a single federal agency because federal timberlands falls under the jurisdiction of several agencies, including the Forest Service, the BLM, and the National Park Service. With very few exceptions, most public timber sales occur on National Forests managed by the Forest Service or in lands in the Pacific Northwest, namely the O&C lands in Oregon, managed by the BLM. Statistics on timber sales are generally readily available.

As seen with other renewable resources, public timber inventories are dynamic, affected by factors such as climatic and weather trends, disease, fire, regional and international timber markets, and management programs. Total timber inventories in a given region can be calculated as the product of timberland acreage, the average biomass of trees on that acreage, and the observed density (i.e., trees per acre). Most published estimates of timber volume, however, customarily include only "commercial" timberland,

¹⁸⁵ Comments of Congressman Synar (Oklahoma), U.S. House of Rep. report #99-593, *Federal Grazing Program: All is Not Well on the Range*, 99th Congress, 2d Session, 1986, page 61; as quoted in Wilkinson (1992:101). Olinger (1998) estimates the subsidy, in 1996, to be approximately \$787 per permittee.

¹⁸⁶ In addition to the political challenge of raising grazing fees, legislative restrictions provide that "the annual increase or decrease in such fee for any given year shall be limited to not more than plus or minus 25 percent of the previous year's fee" (43 U.S.C.A. § 1905).

¹⁸⁷ A few exceptions exist. For example, no grazing receipts from the O&C lands under BLM jurisdiction go into the Range Improvement Fund.

defined as land producing at least 20 cubic feet of timber per acre, per year.¹⁸⁸ Commercial forestland does not include lands with either a lesser annual growth rate or those lands which have been withdrawn from timber management programs and placed under a protective designation such as a wilderness area. Estimates of commercial forest volume can include all types of tree stands, including tightly packed forests as well as older forests with less tree density per acre—as long as the aforementioned commercial timberland test is satisfied. Approximately 136 of the 483 million acres of forestlands in the United States satisfying the “commercial” timberland criteria are publicly held.¹⁸⁹ Total forested acreage decreased by a total of 8 million acres (1.6 percent) between 1977 and 1987.¹⁹⁰ As of 1989, 72 percent of commercial timberland is located in the eastern United States (Forest Service, 1990).

Table A14 provides a detailed accounting of timber inventories, harvests, other removals,¹⁹¹ and regeneration in the United States as a whole; while Tables A15 and A16 focus exclusively on the National Forest system, examining softwoods and hardwoods, respectively (Haynes et al., 1995). As of 1991, total “growing stock” inventories of timber in the United States are shown to total approximately 785 billion cubic feet, about 450 billion cubic feet (57 percent) in softwoods and 335 billion cubic feet (43 percent) in hardwoods.¹⁹² For softwoods, approximately 41 percent (185,574 million cubic feet) is found in the National Forest system, followed by 33 percent in farm and other private holdings, 15 percent in forestry industry holdings, and the remaining 11 percent in other public lands. While slightly more than half of the softwood inventory is found on public lands, the distribution of harvests, totaling 10.7 billion cubic feet in 1991, is skewed heavily in favor of private lands, with only 17 percent (1,789 million board feet) from the National Forest system and 7 percent (769 million board feet) from other public lands. Rates of regeneration exceed rates of harvest overall and in all land ownership categories, with the

¹⁸⁸ The productivity of a given stand is an important consideration in determining long-term inventories, and in considering future inventory prognoses. Growth rates not only vary by species and location, but by the age of the stand in question. In some cases, for example, the harvesting of old growth forests is advocated as a means of increasing long-term inventories, as younger stands will feature higher rates of growth (Carroll, 1995).

¹⁸⁹ Approximately 85 million acres of the 136 million acres of public commercial timberland is located within the National Forest system. Other major public holdings of commercial timberland include the O&C lands in Oregon under BLM jurisdiction. The nation’s remaining commercial timberland is held by the forest industry (approximately 71 million acres) and by other private sources (approximately 276 million acres).

¹⁹⁰ However, much of this decrease was due to withdrawal of four million acres of land in Alaska for classification as national parks or wilderness areas, as well as withdrawals of timberland in Oregon and Washington for similar preservation purposes.

¹⁹¹ The category of “other removals” shows timber that was removed from the forest for a variety of reasons other than a timber sale, including fire, disease, and mortality. Removals of dead timber do not modify calculations of growing stock inventory.

¹⁹² Major softwood species in the West include firs (especially Douglas fir), pines (primarily Ponderosa and Lodgepole), and spruces. In the East, major softwood species include a variety of pines (including Loblolly, Longleaf, Red, White, and Yellow), spruces, and Balsam fir. Western hardwoods primarily include Red alder and a variety of aspens. Eastern hardwoods forests show much greater variety, including oaks, (especially White and Red), maple, yellow birch, sweet gum, yellow-poplar, ash, black walnut, and black cherry.

notable exception of forest industry lands.¹⁹³ Future projections show significant increases in softwood inventories both nationally and on the public lands.

In contrast to softwoods, only about 8 percent of hardwood inventories (25,641 million cubic feet) as of 1991 are found in the National Forest system. Relatively small holdings are also found in other public lands (10 percent of total) and forest industry holdings (10 percent of total). In contrast, approximately 72 percent (242,177 million cubic feet) are found in farm and other private holdings. Statistics for harvests and regeneration follow a similar pattern. Of annual hardwood harvests of approximately 6,979 million cubic feet, only 9 percent occur on National Forest or other public lands and 16 percent (1,120 million cubic feet) on forestry industry lands, leaving a remainder of 75 percent (5,252 million cubic feet) on farm and other private holdings. Overall, net annual growth (totaling 9,650 million cubic feet nationally) significantly exceeds harvests for all land ownership categories except forest industry lands, a similar trend to that seen for softwood forests. Hardwood inventories are expected to increase both nationally and on the public lands in coming decades, continuing a long trend.

Clearcutting on National Forests declined between 1994 and 1995 from 100,796 to 67,899 acres, in part due to a general decline in harvesting levels. While this decline resulted in a corresponding decrease in acres reforested, dropping from 441,000 acres in 1994 to 387,000 acres in 1995, efforts to restore the health of National Forests generally were intensified. Approximately 273,000 acres received timber stand improvements in 1995, compared to 264,000 acres in 1994¹⁹⁴, while the number of watershed improvements increased between 1994 and 1995 from 24,836 to 35,500 acres (Forest Service, 1995a).

Market Values and Revenue Streams

Timber is among the most important cash crops in the United States economy, with Forest Service programs contributing an estimated \$123 billion to gross domestic product (about 2 percent of total GDP) and 3.1 million jobs in 1993 (Forest Service, 1995b). The magnitude of the public lands contribution to the industry is closely tied to harvesting levels, which are generally declining. In 1996, approximately 3.7 BBF (billion board feet) of National Forest timber was harvested under Forest Service contracts, a decline of more than 1 BBF from 1994 levels (Forest Service, 1997). This decline is largely a result of environmental restrictions, especially those associated with the Spotted Owl controversy in the Pacific Northwest, the exhaustion of easily harvested federal stands, and broader economic trends hampering the timber industry. Timber harvest reductions in 1995 would

¹⁹³ However, net growth on forest industry timberland averages 52 cubic feet/acre annually, higher than lands in any other ownership category, reflecting the high productivity of intensively managed timberlands (Forest Service, 1995a). At the other end of the spectrum are National Forest lands (growing at 40 cubic feet/acre), which are less productive because of lower net annual growth rates resulting from less intensive harvesting rotations and the maintenance of large areas of old-growth stands of trees with relatively little, if any, annual growth. In fact, some old growth forests of the Pacific Northwest actually have a negative growth rate. This observation has encouraged some timber proponents to recommend clearcutting of old-growth stands, which would increase short-term harvests and long-term growth rates at the expense of the old growth ecosystems. Approximately 90 percent of all old-growth forests in the Pacific Northwest have been cut, with the remaining 10 percent located largely on public lands (BLM, 1996a:50).

¹⁹⁴ Typical timber stand improvements include thinning, pruning, and fertilization projects.

have been even more precipitous if not for special timber sales implemented pursuant to the Emergency Timber Salvage Sale Program,¹⁹⁵ which authorized an additional 1.8 BBF of salvage volume for sale. This “rider” has expired, and further declines in harvest levels are expected to continue.

As shown in Tables A17 and A18, receipts from federal timber harvests in 1996 exceeded \$619 million, of which \$544 was collected by the Forest Service. This is less than half the level of receipts collected in 1991 (BLM, 1996a; Forest Service, 1997). Approximately 95 percent of the remaining \$75 million in 1996 federal timber receipts, generated from BLM timber sales, came from the timber rich O&C lands of western Oregon. BLM revenues are also declining due to the same factors affecting National Forest harvests, and it is unlikely that projected modest increases in stumpage prices, summarized in Table A19, will be sufficient to notably offset federal timber revenue declines.

As is done for other consumptive uses of the public lands, a significant proportion of federal timber receipts are distributed back into the local economies based on formulas unique to each type land classification (Fairfax and Yale, 1987). These funding arrangements between Federal, State, and local governments are a means of compensating western states with large federal landholdings immune from local property tax requirements. One fourth of all gross revenues (i.e., receipts) generated from National Forest timber sales are distributed to the states for expenditure on roads and schools in the counties producing the revenues. As shown in Table A17, payments of this nature totaled over \$255 million in 1996. While this is a formidable sum, National Forest timber royalty payments to states exceeded \$309 million just two years earlier, graphically illustrating one economic impact on state and local governments of reduced federal timber sales (Forest Service, 1997). An additional 10 percent of these revenues is also available to the Forest Service for expenditure on roads and trail construction in the affected states.

Revenue sharing of timber receipts generated on BLM’s O&C lands in western Oregon are considerably more favorable to state and local governments (Fairfax and Yale, 1987). The O&C formula, re-authorized annually by Congress as part of the appropriations process, directly disperses 50 percent of gross revenues to the general funds of the affected counties, prorated according to each county’s proportion of the 1925 assessed value of the land. An additional 25 percent is generally invested in roads and O&C land productivity projects. The local generosity of this formula is evident by examining Oregon’s share of federal forestry receipts, which total over 95 percent of BLM and 37 percent of Forest Service forestry receipt disbursements to states (see Tables A17 and A18). Remaining revenues from BLM and Forest Service timber sales not allocated to state or local governments are generally returned to the treasury, or allocated to specific federal funds serving land or water management purposes.

¹⁹⁵ This provision was attached as part of the annual appropriations rider (1995 Rescissions Act, P.L. 104-19 § 2001).

Water Resources

Resource Inventory, Use and Prognosis

While a complete inventory of values associated with water resources is well beyond the scope of this report, at least a partial overview of these values is a needed element of a public lands valuation as most of the major river systems of the United States originate on the public lands, and the use and development of public land and water resources are frequently closely related. Water is clearly the most difficult of all public land resources to classify; nonetheless, it can be concluded that most of the major economic uses of water are, at least partially, consumptive. The most obvious exceptions are many forms of recreation and the maintenance of biodiversity and undisturbed habitats, uses which are discussed later with other primarily non-consumptive values.

Major consumptive values include water supply for domestic, industrial, and agricultural purposes; energy production, including both hydroelectric and thermal power; and waste disposal.¹⁹⁶ The degree to which these water uses are truly consumptive is influenced by many factors and by the method of accounting.¹⁹⁷ From a quantity standpoint, municipal and industrial water supply withdrawals, for example, are usually mostly offset by returns of sewage flows to the same water source. Similarly, most agricultural withdrawals also generate return flows, albeit at lower percentages.¹⁹⁸ These uses are consumptive not only in that some flows are not directly or promptly returned to the system of origin, but these flows are returned in a somewhat degraded condition, which limits the range and values of other potential uses. While this concept of reduced opportunities can be applied to virtually all types of public land uses, it is particularly relevant in the context of water since values typically accrue in the right and opportunity to use water in a highly specified manner and time. It is this concept that justifies the classification of hydroelectric power generation and waste disposal activities as partially consumptive, for the water developments, facility operations, and water quality and flow modifications associated with these operations dramatically modify the qualities and opportunities inherent to the undistributed resource.

¹⁹⁶ Note that commercial navigation is largely excluded from discussion in this report, as it has been determined that the relationship between navigation industries and the public lands is generally too weak to merit its inclusion. This, of course, is a somewhat arbitrary determination, but is based on several observations. First, many river systems in the major public land regions, especially the West, do not support significant navigation industries. Navigation is primarily an industry confined to the main channels of drainage basins, whereas the location of public lands is typically confined to upper watersheds. Furthermore, where these industries do exist, the connection between this use of the stream channel is often not closely tied to land uses. Recreational boating is discussed under the recreation heading.

¹⁹⁷ If a sufficiently long geographic and temporal perspective is utilized, then the concept of "water consumption" loses its utility altogether and gives way to the broader systemic perspective of the hydrologic cycle.

¹⁹⁸ Postel (1988) estimates that 55 percent of agricultural withdrawals in the United States are not directly returned to the water system. The magnitude of return flows from M&I uses varies significantly based on factors such as climate and season. Generally, water that is used for landscaping is not directly returned to the system, while most indoor water uses are almost completely returned. A M&I return rate of 70 percent is fairly typical.

Because water often starts, but rarely ends, its journey through the hydrologic cycle on the public lands, it is difficult if not impossible to inventory the entire water supply. Additionally, determining the quantity of freshwater is complicated by the fact that availability of water is influenced by technological and economic variables, and by shifting patterns of water reuse.¹⁹⁹ Globally, the prevailing scientific consensus is that only 3 percent of all water is freshwater, most of which is located underground or in a few massive lakes (e.g., Lake Baikal and the Great Lakes), leaving only a small fraction in streams and other freshwater bodies (White, 1988).²⁰⁰ Much of this surface water in the United States is captured by impoundments. The United States is a nation of dams, with over 75,000 of these structures at least six feet high, creating reservoirs covering 3 percent of the nation's surface area and able to store approximately 60 percent of annual streamflows (Collier et al., 1996).²⁰¹ Approximately one-third of groundwater in the United States is considered to lie within an economically feasible pumping depth (White, 1988).

Given these considerations, most statistical assessments of water quantity do not directly provide inventories, but focus on patterns of withdrawal and use. A general historic summary of water use in the United States is provided in Table A20.²⁰² Water quality statistics typically focus on the value of various biochemical parameters or on the suitability of a given water body to support a specified use with predetermined water quality requirements. Six major categories of pollutants limit the uses of waters: (1) disease-causing organisms, (2) nutrients, (3) silts and suspended solids, (4) biochemical oxygen demand (BOD), (5) salinity and total dissolved solids, and (6) toxins (Guldin, 1989).²⁰³

The western United States is the location of most public lands, most federal water supply projects (especially for irrigation), and most consumptive water uses.²⁰⁴ As shown in

¹⁹⁹ For example, improved seismic and geological surveys, well drilling, and pumping methods are currently opening up a huge volume of water previously ignored or inaccessible. Additionally, advances in water treatment methods have made the reuse of water an increasingly practical measure in both urban and agricultural settings. Other technological fixes which can influence the water supply equation include augmentation strategies such as cloud seeding, desalination, and perhaps even iceberg reclamation, while countless demand management technologies and pricing regimes are having a more immediate, if less exciting, influence on the water balance (White, 1988).

²⁰⁰ Miller (1990) estimates that only 0.003 percent of all freshwater globally is readily accessible and useable. Still, this amount translates to approximately 2.2 million gallons per person.

²⁰¹ Guldin (1989) estimates that 2,654 of these reservoirs have capacities of 5,000 acre feet or more, with the 574 largest structures accounting for over 90 percent of total storage. The federal government is the owner of approximately 2,100 dams, including most large structures (USCOLD, 1997). Major federal water projects are constructed by both the Bureau of Reclamation and the Army Corps of Engineers. While the Corps operates under a variety of authorizing statutes, particularly related to navigation and flood control, the Bureau is primarily guided by the Reclamation Act of 1902, which limits the agency's focus to projects in the 17 western-most states and typically to those with a strong irrigation component. The states within the Bureau's jurisdiction generally have large percentages of public lands.

²⁰² Note that water statistics for the western United States are typically measured in million acre-feet (MAF), while eastern and national statistics typically are in billion gallons per day (bgd). One bgd is approximately 1.12 MAF.

²⁰³ A detailed summary of water quality parameters in the United States is provided in the *National Water Summary 1990-91*, prepared by the U.S. Geological Survey (USGS, 1993).

²⁰⁴ As of 1980, federal projects supplied either full or supplementary irrigation water to over 11 million acres of farmland (Frederick, 1988).

Table A21, freshwater withdrawals in the West totaled approximately 179 million acre-feet (MAF) in 1990: 140 MAF for agriculture, 17.5 MAF for domestic and commercial uses, 16.2 MAF for thermoelectric power, and 5.6 MAF for industrial and mining activities.²⁰⁵ Approximately 120 MAF of this total (or 67 percent) were from surface water sources, with the remainder (59 MAF or 33 percent) from groundwater.²⁰⁶ Approximately 82 MAF of withdrawals were used consumptively, about 75 MAF of this total (91 percent) being attributed to agriculture. The high level of consumptive use by western agriculture has significant national implications, perhaps accounting for as much as 78 percent of national water consumption (Solley, 1997). Approximately 1,730 MAF in 1990 was used in-stream by hydroelectric power facilities, generating 195 billion kilowatt hours of electricity. Net generation of hydroelectric power at Bureau of Reclamation facilities exceeded 53 billion kilowatt hours in 1996, an increase of 16 billion kWh from 1994 levels.²⁰⁷ An additional 80 billion kWh is annually generated by facilities of the U.S. Army Corps of Engineers, approximately three-fourths in the West (COE, 1997). For both agencies, the Columbia River system is the major site of hydropower generation.²⁰⁸

Water use continues to increase in most areas of the United States, including the West. From the period of 1960 to 1990, total water withdrawals in the West increased by approximately 30 percent, with the percentage of withdrawals devoted to agriculture dropping from 86 to 78 percent, while domestic uses rose from 5 to 8 percent (Solley, 1997). This rise in domestic uses was fueled by a 75 percent increase in population and by a per capita use increase from 129 to 160 gallons per day.²⁰⁹ Translating statistics of this nature into a resource prognosis is difficult given that water resources, particularly surface water supplies, are renewed on annual cycles. Consequently, for surface water resources, resource depletion is perhaps best described in terms of de-watered watercourses, shrinking supplies of water reserved for the natural environment, and increased risks of shortages. A consideration of these factors suggests that the water resources of the public lands will continue to be the subject of intense use and scrutiny, as the impacts of overuse escalate. For example, several regions dependent on flows originating in the public lands have already lost significant percentages of functioning wetlands and riparian areas, a finding shown

²⁰⁵ Total water withdrawals in the United States are currently in the range of 390 MAF (Guldin, 1989).

²⁰⁶ Nationally, about 93 MAF (or 83 billion gallons per day, bgd), about 8 percent of total groundwater recharge (or rate of flow), was pumped in the United States in 1985, representing about 24 percent of all withdrawals. While over half of this total was for irrigation, it is important to note that roughly half the United State's population depends on groundwater for domestic uses, making groundwater pollution an acute public health concern (Guldin, 1989). This is especially true in rural areas, where groundwater comprises approximately 96 percent of drinking water supplies (Miller, 1990).

²⁰⁷ A project-by-project accounting of this information is available at <http://www.usbr.gov/power/data/fy96gen.htm>.

²⁰⁸ The Bureau of Reclamation and the Corps of Engineers own/operate seven of the ten largest hydroelectric plants in the United States, all seven in the western United States (Driver, 1997).

²⁰⁹ Note that most of the fastest growing states in the nation have heavy concentrations of public lands, suggesting that the water resources of the public lands, as well as other resources, will likely encounter further stresses. From 1990 to 1994, the ten fastest growing states (in order) are: Nevada, Idaho, Arizona, Colorado, Utah, Alaska, Washington, New Mexico, Georgia, and Oregon (WWPRAC, 1997).

earlier in Table A11.²¹⁰ Furthermore, the risk of drought, already high in many public land states, is a growing concern in many regions as the possibility of global climatic change is considered.

For groundwater resources that are not readily renewable over short time periods, the concept of resource depletion is much more tenable. Nationally, groundwater consumption is well within limits of safe yield, however, many areas have acute groundwater overdrafting problems. These problems are particularly significant in arid and semi-arid agricultural regions, including parts of Kansas, New Mexico, Oklahoma, Texas, and Arizona (Guldin, 1989). Much of this area is served by the massive Ogallala Aquifer, which is being pumped at a level approximately 8 times that of natural recharge (Miller, 1990). Efforts to manage groundwater overdrafting can significantly impact the demands placed on the surface water resources of the public lands.²¹¹

Market Values and Revenue Streams

Although most of the nation's rivers originate in the federal public lands, particularly high altitude forested watersheds, water supplies are typically allocated among private individuals and uses through state administrative and market-driven processes, utilizing a variety of contracts, permits, and quasi-private property rights regimes.²¹² The role of federal agents primarily include the large-scale development of river systems, the interstate allocation of major water systems using powers derived from the Commerce and Property clauses, the allocation (through contracts) of water from federal projects, and in the modern era, the regulation of water uses to achieve environmental and public health objectives (WWPRAC, 1997).²¹³ Very few of these allocation systems and legal conventions provide

²¹⁰ In the West, over 20 native fish species have become extinct in the past century, while approximately 100 more species, or 70 percent of all native species in the region, are endangered, threatened, or otherwise of special concern (WWPRAC, 1997).

²¹¹ For example, the primary strategy being utilized by the City of Tucson, Arizona, to address decades of groundwater overdrafting is the importation of Colorado River water via the Central Arizona Project. The Colorado River Basin is 56 percent federal public lands, and over 8 percent state lands (Weatherford and Brown, 1986).

²¹² In general, western water law is based on the doctrine of prior appropriation, which allows private parties to acquire water rights by diverting currently unused (i.e., unappropriated) water from the channel and applying it to a specified beneficial use, usually defined primarily in terms of consumptive uses. The "first-in-time, first-in-right" principle of priority ensures that the rights of the oldest, or most senior, appropriators are fully satisfied before those of the junior appropriators. In the East, the system of riparian rights entitles owners of riparian lands (i.e., lands adjacent to water bodies) to utilize water for "reasonable uses," typically defined as those which do not significantly degrade the quality or quantity of the water resource, nor impose an undue inconvenience on other riparian landowners (Sax and Abrams, 1986). Elements of both systems can be found in some of the "High Plains" states (e.g., Kansas, Oklahoma) and the Pacific Coast states. Water rights are typically marketable under both systems, although under a riparian doctrine, these rights are tied to the legal ownership of land. The right to use water from federal water projects is typically allocated through contracts. The rights to transfer federal water often vary on a case-by-case basis, but the trend is to encourage marketability (Wahl, 1989).

²¹³ For example, eight federal statutes provide some protection to sources of groundwater, including the: Safe Drinking Water Act (SDWA); Resource Conservation and Recovery Act (RCRA); Comprehensive Environmental Response, Compensation and Liability Act (CERCLA); Clean Water Act (CWA); Toxic

tools for directly estimating market values for water, as the water itself is rarely privately owned or valued—in fact, water is typically free. Instead, values are usufructuary in that it is the “right” and “ability” to use water that are the real determinants of economic value. Costs paid by water users typically are designed to offset the energy and capital equipment costs associated with transportation, and in some cases, the up-front costs associated with acquiring the water right. These costs, however, do not necessarily correspond to market values. A better approximation of market value is typically found by examining water markets, as most types of water rights are in some way transferable. Even these figures, however, are not always useful as subsidies and hidden costs (e.g., environmental externalities) can distort price signals for water—as can similar market deviations found in the energy sector—and factors such as the timing, location and reliability of allocations can influence prices more so than simply quantities (Wahl, 1989).

Bureau of Reclamation projects are particularly fraught with subsidies and other accounting abnormalities.²¹⁴ While beneficiaries of these projects must repay some costs, these repayments are limited only to the “reimbursable” project purposes, which include water supplies for irrigation, municipal, industrial water supplies, and power generation purposes, but exclude flood control, recreation, and fish and wildlife purpose costs. Although a reimbursable function, irrigation water is particularly subsidized, primarily through the use of interest-free capital construction charges, delayed repayment schedules, and by “ability to pay” considerations. As of 1994, the General Accounting Office estimates that irrigators have only been assessed \$3.4 billion of the \$7.1 billion in federal irrigation project costs (GAO, 1996). On the other hand, with the notable exception of environmental externalities, the hydropower component of Reclamation projects are generally self supporting. In fact, revenues from hydropower are frequently used to help offset the subsidies and non-reimbursable costs associated with other project purposes. Federal hydropower revenues are not, however, based on market prices, but instead on the costs of facility construction and operation. Federal hydropower rates are generally much lower than market prices, which has the effect of providing an energy subsidy to major uses of federal power—which in many regions is irrigators. As shown in Table A22 examining the facilities managed by the Western Area Power Administration (which include the Columbia and Colorado River hydropower networks), these subsidies are significant.

One recent study published by Resources for the Future summarizes the results of 41 studies featuring nearly 500 value estimates of water values based on different categories of use and different geographic regions (Frederick et al., 1996). The study estimated values associated with four major in-stream uses (waste disposal, recreation and fish and wildlife habitat, navigation, and hydropower) and four major withdrawal uses (irrigation, industrial processing, thermoelectric power, and domestic use). As shown in Table A23, national economic values associated with withdrawal uses are considerably higher than in-stream uses, with industrial processing, domestic use, and navigation being the most highly valued uses averaging \$282, \$194, and \$146 per acre foot, respectively. Table A24, focusing on values for recreation and fish and wildlife habitat, is provided to illustrate how these

Substances Control Act (TSCA); Federal Insecticide, Fungicide and Rodenticide Act (FIFRA); Surface Mining Control and Reclamation Act (SMCRA); and the National Environmental Policy Act (NEPA).

²¹⁴ This subject is addressed in detail by GAO (1996) and Wahl (1989), among many others.

calculations of value reflect the unique qualities of each major hydrologic region. Areas with extreme shortages of water for environmental purposes, such as the Lower Colorado River system, show the highest values for these uses, measured at \$597 per acre foot. While these estimates of value are based on dozens of methodological assumptions and should be used cautiously, they do recognize that the economic value of water is a product of many different factors.

Fees collected for federal water and power resources are used to satisfy project repayment obligations on a project-by-project accounting basis. An additional public revenue source is provided from the payment of hydropower license fees.²¹⁵ Half of these revenues are distributed to the states (37.5 percent of the total) in which the projects are located, and to the United States Treasury (12.5 percent). The other half of revenues are placed into the Reclamation Fund. The Reclamation Fund also collects a portion of receipts from the sale and disposal of public lands, 95 percent of the proceeds from such transactions in the West. These funds are used in the planning, construction and maintenance of western irrigation projects. While the Reclamation Fund was originally designed to be self supporting, congressional appropriations have far exceeded inflows to the fund, as water and power prices assessed to irrigators have not been sufficient to recoup federal investments (Wahl, 1989).

Primarily Non-Consumptive Uses and Values

While it is conceptually very easy to measure consumptive use values as the product of extracted material and market prices, this same formula cannot be readily applied to primarily non-consumptive uses and values. However, in many cases, surrogate measures of the level of use can be obtained, and estimates of economic value can subsequently be approximated. This strategy is perhaps most applicable to the quantification of recreation activities, which are typically best measured in terms of activity levels, rather than through a quantification of consumption. As described below, outdoor recreation is not only the largest of the primarily non-consumptive use values, but is rapidly becoming the largest overall economic activity in many public land regions. The rapid and largely unmanaged growth of the outdoor recreation industry promises to have significant and, as of yet, largely unrecognized implications for the future of public lands management.

The value of the other major primarily non-consumptive uses of the public lands are considerably more difficult to quantify, in large part due to the importance of "nonuse" values. This broad category can include the value of merely knowing that wilderness or public lands exist (i.e., existence values), including the value of vicariously experiencing wilderness or public lands without a personal visit through either television or stories. Quantification of these nonuse values often requires a survey approach or other contingent valuation tool, because actual market and non-market behavior gives little hint of their true magnitude as people do not leave a "behavior trail from which their valuations can be

²¹⁵ Hydroelectric licenses are administered by the Federal Energy Regulatory Commission (FERC), created under the Federal Water Power Act of 1920 (41 Stat. 1063).

inferred" (Daily, 1997:34). As discussed in detail in Section III, it can frequently be difficult to develop reasonable economic estimates of the nonuse values.²¹⁶

Further complicating the quantification of primarily non-consumptive uses and values is the fact that some activities, like scientific research or environmental restoration and preservation, are sometimes driven by economic incentives, while in other cases, the motives are more nebulous, involving broader social or scientific goals. For example, some advocates of biodiversity preservation utilize an economic justification, citing the potential value of unique biochemicals and genetic stock in industrial applications, such as pharmaceuticals; others utilize arguments based on rights or other non-economic criteria, or talk about broad objectives of ecosystem integrity that have both economic and social dimensions. This observation suggests that it is frequently impossible to precisely categorize or quantify the non-consumptive values on the public lands without considering motives, something that can be very difficult to ascertain even if activity levels are known.

Although limited by these formidable methodological and philosophical complications, the following pages provide a review of three major categories of primarily non-consumptive uses and values: outdoor recreation, research and knowledge, and biodiversity protection.

Outdoor Recreation

Resource Inventory, Use and Prognosis

A tremendous variety of outdoor recreational activities occur on the federal public lands, ranging from highly mechanized and intensive activities such as off-road vehicle (ORV) use and downhill skiing, to more primitive activities such as hiking and nature photography. Other major recreational activities include sightseeing by automobile, hunting and fishing, and boating. Most agencies maintain records of these activities, although many such activities are poorly documented since access is often poorly controlled and fees are frequently not collected—observations most directly applicable to recreation on BLM lands. Recreation data is normally presented using the terms "visitors," "visitor hours," and "visitor days." The term "visitors" is used to describe the number of different people attending a site, or the same person entering one or more sites on multiple occasions; the terms "visitor hours" and "visitor days," in contrast, provide a measure of the length of time spent on each visit.²¹⁷

²¹⁶ The methodological challenge is aptly summarized by Daum (1993:402-403): "When someone decides to visit a park, the decision involves a real cost and also an economic choice. But when someone casts a vote to set an area of land aside as wilderness—the type of conduct that is cited to prove the existence of nonuse values—it is at least as plausible to explain the vote as the expression of a belief about how society should act as to explain it as an economic choice. . . . [N]onuse values do not involve decisions about how we will spend our money, but beliefs about how we and others should live our lives; in attempting to monetize such values, one commits what a philosopher would describe as a category mistake, such as asking for the street address of the average American family or investigating what color is three."

²¹⁷ A visitor day is typically assumed to equate to 12 visitor hours, although other formulas are occasionally used.

Virtually all components of the federal public lands feature recreational use, with the most intensive activity occurring on lands managed by the Forest Service, Park Service, and BLM. In fiscal year 1996, the Forest Service recorded over 341 million visitor days on over 859 million visits. As shown (in part) in Table A25, major activities included camping, picnicking, and swimming (87 million days); mechanized travel and viewing scenery (122 million days); hiking, horseback riding, and water travel (33 million days); winter sports (20 million days); resorts, cabins, and organization camps (18 million days); hunting (19 million days); fishing (18 million days); non-consumptive fish and wildlife use (3 million days); and other miscellaneous recreational activities (21 million days). In 1995, the National Park Service recorded over 110 million visitor days (from over 269 million visits).²¹⁸ This total, shown in Table A26, is approximately five times the number of visitors seen forty years ago (NPS, 1995:29). Lands managed by the BLM are also increasingly becoming major recreational destinations, attracting almost two-thirds as many recreation visitor days as the Park Service and one-fifth of the Forest Service total (in visitor days/hours).²¹⁹ As shown in Table A27, the agency recorded almost 73 million visitor days in fiscal year 1996, with the most common activities being camping, hunting and fishing, and trail activities. Over 5 million additional visitor days on BLM lands were recorded for activities requiring permits and fees.²²⁰ Recreation is also a significant activity on many lands managed by the Fish and Wildlife Service, Bureau of Reclamation, and Tennessee Valley Authority, among other federal agencies.

Recreational demands on the federal public lands have increased dramatically since the end of World War II, and future increases are expected. Most projections suggest future increases in visitation of approximately 2 percent annually for many components of the federal public land and waterway systems.²²¹ The Forest Service, in particular, has recently embraced outdoor recreation as the central focus of the agency, primarily due to economic considerations.²²² According to Under Secretary of Agriculture Jim Lyons: "Recreation is going to be our business in the future. By the year 2000, recreation will amount for \$97.8 billion of the \$130.7 billion generated by activities on national forests. Fish and wildlife [will] generate \$12.9 billion, minerals \$10.1 billion, timber \$3.5 billion and grazing about \$1 billion."²²³ Over two-thirds of all adult Americans now participate in some form of outdoor recreation, a fact reflected in escalating sales of outdoor recreation equipment: e.g., sales of tents, backpacks and sleeping bags have increased from approximately \$270 million in 1992 to \$450 million in 1995; mountain bike sales have

²¹⁸ This figure includes all lands within the National Park System, which includes national parks; monuments; historical, commemorative, and archeological sites; parkways; recreation areas; seashores and lakeshores; and capital parks.

²¹⁹ Given that recreational use of BLM lands has not historically been closely monitored, agency statistics may actually underestimate the magnitude of use.

²²⁰ Statistic adapted from Table 4-5 of *Public Land Statistics, 1996* (BLM, 1996a:127), produced by the BLM using data from the *BLM Recreation Management Information System Report # 17*.

²²¹ A detailed review of outdoor recreation at federal water facilities is currently being conducted as part of the National Recreation Lakes Study <<http://www.doi.gov/nrls/>>.

²²² The agency projects recreational use to increase 64 percent by 2045 (Forest Service, 1995c).

²²³ Comments from the Western Summit on Tourism and Public Lands, December 1997.

increased from \$3.8 billion in 1993 to \$4.6 billion in 1995.²²⁴ Future rapid growth in the outdoor recreation industry is widely expected, as travel and tourism are now among the top three employers in 34 states.²²⁵

Market Values and Revenue Streams

Preliminary data collected as part of the National Recreation Lakes Study²²⁶ estimates that outdoor recreation now accounts for 10.5 percent of all consumer spending, up from 6.5 percent in 1980, contributing approximately \$350 billion annually to the Gross Domestic Product. Over half of this total (about \$180 billion) is generated by public lands and waterways.²²⁷ Despite this huge economic contribution, recreation on the public lands is highly subsidized, in part because recreational user fees are rarely correlated with management costs, and because there is rarely an explicit connection between the amount of revenue generated at a public land facility and the operating budget of that facility. Additionally, most profitable recreational services on the public lands have been, or are increasingly being, privatized, with most benefits flowing directly to the private sector.²²⁸ As a result, use fee and royalty collections from agencies rarely are sufficient to offset management costs.²²⁹ Modest recreational user fees at Forest Service facilities totaled \$46 million in 1995; Park Service receipts were approximately \$80 million in 1995; and BLM recreational receipts totaled approximately \$1 million in 1996.²³⁰ Most user fee receipts are channeled into the federal Land and Water Conservation Fund (LWCF), where they join with the considerably larger revenues collected from Outer Continental Shelf oil and gas leases. Expenditures from this fund—which have been declining since 1979—are used

²²⁴ Statistic is from *Human Powered Outdoor Recreation: State of the Industry Report, 1995*; available on-line at <<http://www.outdoorlink.com/infosource/StateOfIndustry/state.industry.sect.1.2.html>>.

²²⁵ Statistic provided in *USDA News* by Secretary Dan Glickman (Volume 55, Number 6, July 1996) available on-line at <<http://www.usda.gov/news/pubs/newslett/old/vol5no6/article3.htm>>.

²²⁶ The National Recreation Lakes Study was authorized in the Omnibus Parks and Public Land Management Act of 1996 (P.L. 104-333), which created a nine-member commission to “review the current and anticipated demand for recreational opportunities at federally-managed manmade lakes and reservoirs” and “to develop alternatives for enhanced recreational use of such facilities.” For more information, see <<http://www.doi.gov/nrls/>>.

²²⁷ Preliminary research suggests that nearly 1,800 federal water facilities combine to generate over \$44 billion annually in economic benefits, including 600,000 jobs and a full 46 percent of all fishing activity (excluding the Great Lakes).

²²⁸ For example, concessionaires in the National Parks generated approximately \$662 million in revenues in 1995, but paid only \$15 million in fees to the federal treasury. Typical federal concessionaire royalties of only 2 or 3 percent are dramatically below those received from state parks, which average 10 to 15 percent. Consequently, reform of concessionaire arrangements has been a hot congressional topic in recent years. For more information, visit the website of the National Parks and Conservation Association: <<http://www.npca.org/>>.

²²⁹ For example, National Park Service entrance fees are normally sufficient to cover about 5 percent of total operating costs or one-fourth of those costs directly associated with visitor services.

²³⁰ Forest Service data is from Table 58 of *Report of the Forest Service, 1995*. (Forest Service, 1995a) Park Service data is available from Michael Doyle in *Open your wallet; visit a national park*. *High Country News*, May 27, 1996, volume 28, number 10. Available on-line at <http://www.hcn.org/1996/may27/dir/Western_Open_your.html>. BLM data is from Table 4-5 of *Public Land Statistics, 1996* (BLM, 1996a).

primarily to fund the purchase of new federal, state, and local parks, while annual operating budgets are typically provided through other congressional appropriations.²³¹

One of the hottest issues in the outdoor recreation industry involves the expanded application of user fees to finance recreation on the public lands.²³² These proposals tend to feature two elements: first, a recognition that user fees must be increased in order to offset the escalating recreational management costs; and second, a belief that collected user fee revenues should be available for agency use in the area that generates the revenues, thereby providing a direct accountability between recreationists and resource managers. In recognition of these ideas, Congress in 1996 established a four-year experimental program known as the Recreation Fee Demonstration Program authorizing all major public land management agencies to modify fees at selected land management units and, more importantly, to retain 80 percent of collected revenues for use in those areas, with the remaining 20 percent being shared regionally with other participating units. This program is expected to be particularly useful for units of the National Park Service, which currently have a facility maintenance backlog estimated between \$4 to 6 billion.

Another option to more equitably and completely finance public outdoor recreation is the "Teaming With Wildlife" proposal (also known as the Fish and Wildlife Diversity Funding Initiative), developed by the International Association of Fish and Wildlife Agencies and backed by more than 2,500 outdoor recreation groups. The proposed program would establish taxes on the sale of various types of outdoor recreation equipment, with proceeds going to recreation-oriented public land and water management programs.²³³ This version of private cost-sharing of public land management is modeled after the equipment fee programs used to finance public hunting and fishing management, including the Pittman-Robertson, Dingell-Johnson, and Wallop-Breaux user fee systems.²³⁴ Even more controversial than the Recreational Fee Demonstration Program and related proposals

²³¹ The use of the LWCF is becoming a hot political issue. In 1995, only \$138 million of the scheduled \$900 million from the LWCF actually went to fund park acquisitions, with the remainder being used in totally unrelated budget areas. Further curtailment of spending is under consideration, mostly in the name of federal budget deficit reduction.

²³² The issue of public land user fees is frequently addressed in *High Country News*, frequently available online at <http://www.hcn.org/>.

²³³ The program is targeted at a variety of products, including backpacks, sleeping bags, tents, canoes, mountain bikes, binoculars, film and cameras, bird feeders, field guides, recreational and sport utility vehicles. For more information on the Teaming With Wildlife proposal, see <http://www.gorp.com/teamww/>.

²³⁴ The Federal Aid in Wildlife Restoration (or Pittman-Robertson) Act of 1937 imposes an 11 percent federal excise tax (originally 10 percent) on the sale of "firearms, shells, and cartridges" to fund state wildlife research and management programs (50 Stat. 917). The Federal Aid in Fish Restoration (or Dingell-Johnson) Act of 1950 provides a similar support mechanism for state sport-fishing programs, funded by a federal excise tax on "fishing rods, creels, reels, and artificial lures, baits, and flies" (64 Stat. 431). Typically, these funds were channeled exclusively to *freshwater* programs, an arrangement that proved to be controversial in coastal states with both freshwater and marine sport-fisheries. This issue was addressed in the Wallop-Breaux Act (section 1014 of the Tax Reform Act of 1984), which calls for these intrastate allocations among freshwater and marine sport-fishery programs to reflect the actual distribution of fishing activity in each recipient state. These sport-fishery programs refer generally to a 10 percent tax on non-commercial fishing equipment and a 3 percent tax on electric outboard motors, sonar devices, motorboat fuel, and import duties on fishing tackle and boats (98 Stat. 1017-1020) (Adams, 1993).

involving public/private partnerships in outdoor recreation, the Teaming With Wildlife proposal currently lacks adequate congressional support to qualify as a viable short-term alternative to federal underfunding and subsidization of recreation on the public lands and waterways.

Research and Knowledge

Resource Inventory, Use and Prognosis

One of the most difficult types of public land values to describe and quantify involve research activities designed to generate scientific or cultural knowledge. While some of these activities, such as the search of native plant species for new medicinal compounds or agricultural genetic stock, can result in commercially valuable products, historical and archeological research is rarely pursued for economic gain. Nonetheless, this information is *valuable*. Researchers in dozens of fields utilize public land and water resources as their laboratories and libraries of uncatalogued information, generating knowledge that enriches our lives and broadens our understanding in countless ways. Additionally, the public lands are home to many sites of religious significance, particularly for Native American peoples. Many of these historic, archeological, and religious values are particularly significant in that they are place-specific and consequently do not have substitutes, and can be negatively impacted by other types of land use activities and administrative classifications.²³⁵

Approximately 60 million visits per year to National Park Service historical, commemorative, and archeological sites provide tangible evidence of these values (Census, 1996:250). These visitation numbers, when combined with survey data (Pokotylo and Mason, 1991), provide a clear indication of these values. An additional, albeit negative, indication of value is also provided by the increased commercialism and looting of historical artifacts on the public lands (Smith and Ehrenhard, 1991; Coggins et al., 1992). Preventing the loss of historic artifacts and knowledge on the public lands has been a recognized federal responsibility since passage of the Antiquities Act of 1906, which authorizes the President to "declare by public proclamation historic landmarks, historic and prehistoric structures, and other objects of historic or scientific interest that are situated upon the lands owned or controlled by the Government of the United States to be national monuments, and may reserve as a part thereof parcels of land."²³⁶ To the extent possible, modern

²³⁵ The most complete listing of sites of historical significance is the National Register of Historic Places, a system of over 66,000 properties under the jurisdiction of the Park Service.

²³⁶ 16 U.S.C. §§ 431-433. Small and largely ineffective penalties for looting under the Antiquities Act helped encourage passage of the Archaeological Resources Preservation Act of 1979, which found that: "(1) archaeological resources on public lands and Indian lands are an accessible and irreplaceable part of the Nation's heritage; (2) these resources are increasingly endangered because of their commercial attractiveness; (3) existing Federal laws do not provide adequate protection to prevent the loss and destruction of these archaeological resources and sites resulting from uncontrolled excavations and pillage; and (4) there is a wealth of archaeological information which has been legally obtained by private individuals for noncommercial purposes and which could voluntarily be made available to professional archaeologists and institutions" (16 U.S.C. § 470aa(a)). Among the items covered by the legislation include pottery, baskets, bottles, weapons and projectiles (e.g., arrowheads), tools, structures (or portions of

archeology calls for the preservation of these sites *in situ* (in place) in order to better maintain the historical context and record.²³⁷

Market Values and Revenue Streams

The generation of economic revenues from research and knowledge on the public lands is extremely difficult to quantify, and is an exercise of dubious merit since some of the most significant values are undoubtedly of a non-economic nature. This observation is particularly relevant to efforts to value archeological resources, which are “finite, depletable, and nonrenewable” (Gerstenblith, 1995:564), comprising a “bank of unique values for future recreationists, believers, and scientists” (Knudson, 1991:5). This observation is occasionally discussed using the phrase “cultural capital,” an expression reflecting the fact that the value of a historical site of interest is, in part, dependent upon its cultural attributes (Berkes and Folke, 1994). The phrase also connotes that such cultural resources are assets which should be conserved.

The predominance of non-economic values associated with research and knowledge on the public lands does not mean, however, that this category of value is without an explicitly economic component. A few significant sources of economic value include those revenues associated with tourism and recreation at historic sites, the frequently illegal marketing of cultural artifacts, and the marketing of genetic and biochemical extracts primarily in medicinal and industrial applications. Recreation, as discussed earlier, generates vast revenues, primarily concentrated in the private sector but still containing a notable public component. In contrast, revenues from cultural and biochemical knowledge gained from the public lands are much less likely to be economically significant, and in those few cases, are typically concentrated almost exclusively in the private sector.

There is no realistic potential for collecting sizable public revenues from the marketing of cultural artifacts, because such exchanges usually involve trade in private collections which were amassed prior to statutory protection being extended to cultural resources, or because such exchanges involve black-market transactions of artifacts obtained illegally. Illegal looting of historical and archeological resources remains a serious problem on the public lands. For example, the General Accounting Office (GAO, 1987) conservatively estimates that one-third of all surveyed areas in the Four Corners region have been impacted by looting, while research for the House Committee on Interior and Insular Affairs (1988) suggests the figure may be as high as 90 percent. System-wide, the Park Service reported over six hundred thefts of artifacts from Native American sites in 1994 (Gerstenblith, 1995).²³⁸ The economic magnitude of looting, while difficult to measure, is

structures), pit houses, rock paintings, rock carvings, graves, human skeletal materials, and related items over 100 years in age (16 U.S.C. § 470bb(1)). Additional protection is provided by the Native American Graves Protection and Repatriation Act of 1990 dealing with Native American cultural items, human remains, and associated funerary objectives of Native Americans (25 U.S.C. §§ 3001-13).

²³⁷ As one commentator has observed of the traditional approach to excavation, “[a]rcheology is perhaps unique among scientific disciplines in that it destroys its own research base in the course of doing the research. Thus, yesterday’s archaeologist, no matter how competent, missed many clues” (Michel, 1991:283).

²³⁸ Keep in mind that most federal public lands have not been systematically evaluated for archeological resources; thus the magnitude of the problem is difficult to accurately assess (Smith and Ehrenhard, 1991).

undoubtedly large, as evidenced by the fact that ancient Anasazi pots in excellent condition can command tens of thousands of dollars apiece in market exchanges (Shields, 1991).

Biochemical and genetic research and product development is an area where the collection of public revenues is theoretically viable, as plant extracts account for roughly half of all new drug discoveries, with an annual value exceeding \$1 billion. The vast majority of these discoveries, however, occur in tropical rainforests in the third world and not in the temperate forests of the U.S. public lands which only rarely yield compounds of medical value (Krutilla and Fisher, 1975).²³⁹ Perhaps holding greater economic potential in the U.S. is rare heat-tolerant microbes found in the geothermal waters of Yellowstone National Park. Over 40 companies are currently exploring the economic potential of these microorganisms, and one Swiss biotechnology firm has already developed a patent on a microbe which earns the company more than \$100 million annually (Miniclier, 1997). The potential economic value of biochemical discoveries on the public lands is subject to wide speculation, as are estimates of the economic rationale for preserving endangered species on the grounds of maintaining genetic stock of potential future economic application (Pearce and Moran, 1994; Benjamin, 1997). Despite the difficulties in valuation of research activities on the public lands, however, it is safe to conclude that these values, of both an economic and non-economic nature, are significant.

Biodiversity Preservation

Resource Inventory, Use and Prognosis

Most estimates of public land values are derived from measurements of human activities, such as timber harvesting, ranching, mining, recreation, and research. Since direct human use and economic value are often readily correlated, statistically inventories of the public land values disproportionately focus on these types of values, perhaps leading to the erroneous impression that use and value are synonymous. In some cases, value may be better understood by examining the activities that society expressly forbids. In the realm of public lands management, for example, these types of values are particularly prominent in environmental preservation efforts, including biodiversity maintenance and the protection of environmental amenities (primarily through pollution regulation). While policies in these areas are influenced by economic concerns to some extent, they are primarily pursued on non-economic grounds. This is best illustrated on the public lands by the prohibition of activities that threaten biodiversity, and similarly, by the implementation of management programs to rectify past environmental abuses.

Biodiversity is perhaps the most commonly utilized concept to measure overall environmental preservation, in part because the health of species, especially predatory species, can provide an indicator of overall environmental health. The deceptively complex concept of biodiversity can be applied at three distinct substantive levels: genetic, species,

For example, the Bureau of Land Management has only inventoried about 12.3 million acres, while identifying over 200,000 properties of cultural interest located within (BLM, 1996a:Table 5-6).

²³⁹ One of the few exceptions is the bark of the Pacific Yew tree, which contains an anti-cancer agent. This agent is now synthetically reproduced and marketed.

and ecosystem. Genetic diversity refers to gene pool diversity within a particular species necessary for robustness and adaptability over time, such as resistance to new diseases or the capability to evolve and adapt to meet new environmental conditions. Species diversity, the most common measure of biodiversity, refers to the total number of species found in a particular region or biome, generally described in relation to the pre-human condition.²⁴⁰ Finally, ecosystem biodiversity refers to the overall variety in habitats, biotic communities, and ecological processes in a given region, as well as diversity within individualized ecosystems. These concepts are useful for describing the breadth of environmental variability, but may not be sufficient to give a true picture of net variability or environmental health, as some species, or alleles²⁴¹ or ecosystems, may be represented by only a few isolated manifestations (Pearce and Moran, 1994). Despite this shortcoming, biodiversity provides a clear example of a public land value that is, at least in part, outside of the economic use approach to value quantification.

The value of ecosystem-level biodiversity is perhaps best illustrated by the popularity of the National Park and wilderness systems, designed to satisfy the twin goals of environmental preservation and outdoor recreation. A more explicitly preservationist (and regulatory) focus is provided by the Endangered Species Act (ESA),²⁴² which currently focuses on species-level biodiversity maintenance. The act requires federal agencies to “insure that actions authorized, funded, or carried out by them do not jeopardize the continued existence” of an endangered species or “result in the destruction or modification of habitat of such species”²⁴³ It is this habitat requirement that can be particularly salient, requiring dramatic changes to land-use policies and water development and management regimes.²⁴⁴ Concerns over spotted owls and anadromous fisheries in the Pacific Northwest, for example, have forced dramatic modifications to federal land and water management programs, influencing hundreds of species in addition to those listed as threatened or endangered. The impact of the Pacific salmonid restoration programs are geographically widespread, influencing land and water management regimes from Alaska to northern California, and stretching inland as far as Eastern Idaho, covering over 15,000 miles of streams in the Columbia River Basin alone (BLM, 1996b).

²⁴⁰ In some cases it is important to distinguish whether this point of reference refers to the onset of Anglo civilizations, or to the earlier establishment of Native American communities in North America. One of the most significant periods of extinctions in North America occurred in this interim period, between 15,000 and 8,000 years ago. Some researchers argue that the so-called Pleistocene megafauna extinctions can be correlated to hunting practices of Native American communities, although this point is hotly debated (Brown and Gibson, 1983).

²⁴¹ An allele refers to the information found at a particular gene, which is simply a specific spot on a chromosome known to be associated with a given trait.

²⁴² See 16 U.S.C.A. §§ 1531-1543.

²⁴³ 16 U.S.C.A. § 1536.

²⁴⁴ Loss of habitat is the primary source of species endangerment. In the United States, about 30 percent of all forest land, 50 percent of wetlands, and most Midwestern native prairies have been converted to agricultural uses since Anglo settlement. Ten states have lost over 70 percent of their original wetland area, and at least 20 percent of the nation's 1 million stream miles have been modified by channelization, reservoir construction, or other conversions (Forest Service, 1994).

Over 3,000 plant and animal species are dependent upon the federal public lands for at least a portion of their habitat needs.²⁴⁵ As of 1994, 909 of these species were listed as threatened or endangered (FWS, 1994). The Fish and Wildlife Service is responsible for the recovery of 893 of these species, while the National Marine Fisheries Service is the lead agency responsible for the remaining 16 species.²⁴⁶ Approximately 41 percent of these listed species are stabilized in population or are improving; seven listed species have been recognized as extinct and subsequently delisted. As shown in Table A28, species that have been listed the greatest length of time are enjoying the greatest stability, suggesting that the endangered species program is at least partially successful. Reform of the program in the near future appears likely however, in order to address concerns over costs and private property "takings," and to more explicitly shift the focus from species to ecosystems—an approach commonly referred to as "ecosystem management."

Market Values and Revenue Streams

A wide variety of values are associated with the preservation of biodiversity and related environmental values. While some of these values can be quantified in economic terms, most measures of biodiversity are not easily quantified due to their non-use orientation, their justification on grounds of ethics and responsibilities, and their status as public goods.²⁴⁷ In some cases, estimates of economic value can be inferred from mitigation costs expended to rehabilitate a resource or benefits foregone through the regulation of environmentally harmful activities.²⁴⁸ Also increasingly common is the use of contingent valuation methods (i.e., surveys) to measure public willingness-to-pay to achieve the preservation objective. For example, one recent contingent valuation study determined that

²⁴⁵ The habitat range of most species includes both public and private lands, a factor that greatly complicates species recovery programs. Private landowners are frequently involved in recovery programs through the use of Habitat Conservation Plans (HCP's), negotiated on a case-by-case basis by the implementing agency (either the Fish and Wildlife Service or the National Marine Fisheries Service) and the private landowner(s). HCPs generally allow the landowner to take some actions that may harm the species in question if, in exchange, the landowner limits other actions and implements mitigation measures to encourage species survival. These agreements usually contain a "no surprises" clause, which ensures that if the landowner honors the terms of the original HCP agreement, they will be protected from future regulatory actions should a more aggressive recovery effort prove to be necessary. More than half of all listed endangered species have over 80 percent of their habitat on private lands. There are currently over 200 HCPs in operation, with another 200 in various stages of negotiation. Over 18 million acres of land are currently subject to HCP agreements, involving over 300 threatened or endangered species (Margolis, 1997a).

²⁴⁶ The National Marine Fisheries Service is the lead Endangered Species Act agency in those cases involving marine species, including anadromous fisheries (e.g., salmon).

²⁴⁷ In the language of economics, a public good is a benefit that cannot be provided to one person without providing it to everyone (e.g., the preservation of an endangered species). The value of public goods are impossible to accurately infer from market processes, as these benefits are not subject to private market transactions.

²⁴⁸ For example, restoration of the Bay-Delta ecosystem in Central California is expected to cost between \$4 and \$8 billion, allocated over 20 to 30 years. The "CALFED" program has already secured federal and state funding commitments of approximately \$2 billion, to pursue objectives of anadromous fishery recovery, water quality improvement, water supply augmentation, flood control protection, and general environmental restoration. (For more information on the CALFED program, visit <<http://calfed.ca.gov>>.

individuals, on average, were willing-to-pay \$86 apiece (or \$215 billion as a nation) to preserve the Northern Spotted Owl (Mead, 1993). A similar study on the Whooping crane yielded willingness-to-pay estimates within the range of \$21 to \$149 per individual (Mead, 1993).

These figures should be used very cautiously, as willingness-to-pay estimates are notoriously high when compared to actual spending behavior, and since the values ascribed to these individual species are probably more reflective of the perceived worth of the ecosystems for which these species are indicators.²⁴⁹ The credibility of these estimates also suffers from the observation that species which attract the greatest media attention and are most “photogenic” are likely to yield the greatest value estimates from the public.²⁵⁰ Beyond these methodological issues is the more fundamental concern about the merits of assigning an economic value to a preservation activity promoted on grounds of rights and responsibilities, a real but largely unavoidable concern in all contingent valuation studies.

Perhaps more illustrative is the philosophy of the Endangered Species Act, which utilizes biological, rather than economic, criteria to determine which species are listed and protected under recovery programs. While the program does show an obvious bias in favor of well known species, the most significant of all ESA cases involved a seemingly trivial and largely unknown species, the snail darter. In Tennessee Valley Authority v. Hill,²⁵¹ the Supreme Court found the value of the snail darter—and, implicitly, other endangered species—to be “incalculable,” asserting that the ESA was enacted to “reverse the trend towards species extinction, whatever the cost.”²⁵² These costs can be significant, as evidenced by 1994 congressional appropriations to the Fish and Wildlife Service of over \$29 million for recovery efforts.²⁵³ Approximately \$10 million of this total was allocated to specific species recovery programs, listed in Table A29. When the full economic costs of the regulatory actions required under these programs are considered, however, the true cost of biodiversity preservation is considerably higher than indicated by these totals.

²⁴⁹ For example, many parties advocating preservation of the Northern Spotted Owl are, in reality, more concerned about the old growth forest ecosystem of which the owl is only one member.

²⁵⁰ Compare public support for preservation of bald eagles, grizzly bears, and gray wolves, for example, to that for the mission blue butterfly, Stephen’s kangaroo rat, surf thistles, sheath-tailed bats, Santa Cruz long-toed salamanders, black legless lizards, and Southwestern arroyo toads.

²⁵¹ See 437 U.S. 153 (1978).

²⁵² *Id.* at 178, 184.

²⁵³ The funding history of the federal endangered species program is reviewed by Campbell (1991).

V: POTENTIAL ALTERNATIVES TO FEDERAL PUBLIC LANDS MANAGEMENT: MARKETIZATION, PRIVATIZATION, AND LOCALIZATION

No sector of the government is more rife with wasteful duplication, fragmentation and undependable service than the agencies that are involved in environmental and natural resource issues.

— Senator Ted Stevens, R-Alaska²⁵⁴

This quote from a recent Senate hearing on public lands management underscores a broadly held frustration with the multiple federal agencies responsible for public lands management. Many parties have responded to these frustrations by advocating an expanded use of market-based tools and incentive structures to encourage improved resource management. A tremendous variety of market-based tools are potentially applicable and are enjoying renewed political support in the modern era as the carefully arranged marriage of economics and environmental policy promises tremendous efficiency gains (NAPA, 1997; NPR, 1996).

Many other disgruntled parties advocate more sweeping reforms, interjecting a fundamental question into the public lands debate: Should the federal government retain ownership and control of the public lands, encompassing 29 percent of all the land in the United States and nearly 50 percent of the land in the 11 Western States (Pendley, 1995)? This question, more often drawing fiery rhetoric rather than rational discussion, is not new. There have been several periodic challenges to federal ownership of public lands throughout American history (Cawley, 1993). Many of these challenges predictably occurred in the early 1900's, as the nation completed the dramatic shift in public lands policy away from one of federal divestment to private and state interests to the modern policy of federal land retention (discussed in detail in Section II). For example, the establishment of the National Forest system beginning in the Progressive Era generated calls for state and private (rather than federal) ownership of public lands, proposals that gradually escalated with the imposition of grazing fees by the Forest Service in these areas. In 1930, President Hoover even appointed a commission recommending transfer of surface rights of federal lands to the western states, a proposal that generated additional support following the establishment of a comprehensive federal grazing fee program in the Taylor Grazing Act of 1934.

Similar proposals have been a prominent feature of modern public lands policy. For example, the Sagebrush Rebellion of the late 1970's and early 1980's, led by a loose coalition of western politicians and economic interests, advocated the transfer of federal BLM lands to the states (Lehmann, 1995; Cawley, 1993).²⁵⁵ A lesser known offshoot of

²⁵⁴ Chairman of Senate Appropriations Committee (Public Lands Hearing, 1996:1).

²⁵⁵ The origins of the Sagebrush Rebellion can be traced to Nevada and to the decision of the Public Land Law Review Commission rejecting Nevada's request for a land grant of six million acres of federal public lands to be selected over twenty years. In response to that decision, the state legislature in 1978 formally and independently asserted a claim to public-domain lands within the state, and in 1979, enacted the

this rebellion, led by the "new resource economists," called for the privatization of "unneeded public lands."²⁵⁶ The modern progeny of these unsuccessful efforts are the Wise Use Movement and its close cousin, the County Supremacy movement.²⁵⁷ These efforts primarily seek to unburden local commodity users and other economic interests of the public lands from federally imposed burdens, especially those associated with environmental regulation. Increasingly, these calls for state or local control of public lands are linked with proposals for additional resource privatization or management using market-based tools.

Both individually and collectively, these types of reform proposals have the potential to dramatically alter the administration and management of the public lands. In the following pages, several potential options for change are described and evaluated based on how they address the most commonly cited deficiencies with the current system of federal land management.

Criticisms of Existing Arrangements: An Overview

The management of the public lands is extremely difficult, and to the causal observer and critic undoubtedly appears disjointed, inefficient, and ripe for reform. Overall, it costs about 30 billion dollars annually to manage federal lands and resources (Stevens *in* Public Lands Hearing, 1996). Many public land management decisions and activities require that multiple agencies with conflicting rules, regulations, and objectives take concurring actions. Unfortunately, interagency negotiations often degrade into seemingly chronic power struggles among largely autonomous bureaucracies, each vying for an upper hand in what should be, by all accounts, a more cooperative effort. These struggles are ultimately tied to the ongoing bureaucratic competition for authority and funding appropriations, best maintained by the zealous guarding of regions and subject matters of exclusive agency jurisdiction. In a mechanism with Darwinian parallels, those agencies which succeed in these battles maintain dominant positions in the bureaucratic landscape, ensuring a

"Sagebrush Rebellion Act" flatly declaring the public-domain lands in Nevada to be the property of the state based on the "equal footing" doctrine which requires that states must be entered into the Union on equal terms with other states (Cawley, 1993). By 1980, Utah, Arizona, New Mexico, and Wyoming had followed suit. California passed a related bill later vetoed by Governor Jerry Brown, while in Washington, voters rejected a referendum item upon which the relevant bill was contingent. Several other states considered similar actions.

²⁵⁶ The primary accomplishment of this effort was the establishment of the Cabinet Council Working Group on the Sale of Federal Property, a product of the Reagan-Bush Asset Management Program (AMP) established in 1982 (Klyza, 1996). Based on the deliberations of the Working Group, the President's FY 1983 budget proposal called for 5 percent of all federal lands (outside of Alaska) to be sold over a five year period, generating \$17 billion. Congressional and public opposition prevented these proposals from being acted upon.

²⁵⁷ Ground zero in the County Supremacy movement has been Nye County Nevada, where the Board of Commissioner recently declared that Nevada owns all federal public lands and associated mineral rights in the state. The County backed away from this declaration after a threatened legal skirmish with federal attorneys, but not before defiantly authorizing the bulldozing of a National Forest road that the Forest Service had closed.

perpetuation of this behavior (Clarke and McCool, 1985).²⁵⁸ Four agencies, collectively managing 95 percent of the federal public lands, have generally prevailed in these struggles: the Forest Service in the Department of Agriculture; and the BLM, National Park Service, and Fish and Wildlife Service within the Department of Interior.

Overlapping agency authority is generally seen as duplicative and unnecessary, as “the responsibilities of the four major Federal land management agencies have grown more similar over time, and managing Federal lands, has [at the same time] become very complex” (Gryszkowiec *in* Public Lands Hearing, 1996:23).²⁵⁹ One example of this overlap in agency objectives is the fact that both the Forest Service and the BLM are required by statute to categorize land for potential wilderness designation by Congress. While there may have been a historical reason to divide public land management responsibilities between different agencies, the gradual merger of objectives between agencies over time suggests to many observers that continued agency separation serves nothing more than bureaucratic convenience and perpetuation. Proposals to establish “super-agencies,” however, generally lack political viability, and do not necessarily provide a realistic option to interagency specialization and conflict, instead only promising to internalize these conflicts within branches of the new “super-agencies”.²⁶⁰

Perhaps the most fundamental deficiency of the public lands bureaucracy is found in the conflicting statutory mandates of the major agencies, a problem best epitomized by the conflict-producing concept of multiple-use management. For virtually all facets of public lands management, the magnitude of statutes and agency regulations is overwhelming in volume and complexity, a problem increasingly compounded by the addition of management rules from both state and local authorities that often have overlapping jurisdiction over some aspects of the federal public lands, such as hunting and fishing. This patchwork of frequently inconsistent regulations governing federal land management often results in an undesirable level of bureaucratic stasis and status quo maintenance, making agencies slow to react to new or sudden developments—natural or manmade—that arise on the public lands.²⁶¹ One obvious example is provided by the federal legacy of fire suppression on the public lands, a policy which in many areas has allowed the build-up of fuels on the forest floors resulting in alarmingly high fire dangers. Although it is theoretically possible to deal with this increased fire danger through management tools such as intensive harvesting and prescribed burning, such actions would undoubtedly conflict with priorities specified in other federal legislation such as the Clean Air Act, Clean Water Act, and the Endangered

²⁵⁸ Note that this problem is endemic to most components of the public sector, not simply the arena of federal public lands. Further note that this type of competitive behavior is strongly encouraged in many facets of society, and is a fundamental tenet of the private sector. This is one of many observations that should be factored into ongoing debates about how to best pursue increased public sector efficiencies utilizing private sector principles.

²⁵⁹ Michael Gryszkowiec is Director of Planning and Reporting Resources, Community and Economic Development Division, within the United States General Accounting Office.

²⁶⁰ This observation should be obvious to any student of the Department of Interior, which is notoriously fraught with internal conflicts regarding the management of public land and water resources.

²⁶¹ The hesitancy of Congress to consider or implement meaningful reforms in the budgeting process also contributes to bureaucratic inertia (Davis, 1994).

Species Act, which incidentally, are generally administered by federal and state agencies other than those with primary forestry and fire management responsibilities.²⁶²

Many other criticisms of the federal public lands bureaucracy concern the location of decision-making authority. Of particular concern to proponents of the Sagebrush Rebellion and the Wise Use Movement is the seemingly undemocratic tradition of empowering “outside” federal resource managers to control public land resources most intensively utilized by local stakeholders. One component of this larger concern is the issue of where should management decision-making authority be housed within a federal agency: at the level of field-level resource managers sensitive to local concerns but potentially vulnerable to undue local influence, or at more distant regional or national headquarters, where a broader perspective can theoretically be maintained, but where local knowledge may be unavailable?²⁶³ Along somewhat similar lines has been the historic challenge to find an appropriate balance within agencies among scientific decision-making, an idea particularly in vogue in the early decades of the twentieth century, and more politically sensitive decision-making. This issue is gaining in importance as many resource managers and stakeholders come to fully realize the biophysical complexity of the public lands and as the strategy of “adaptive management” becomes more widely endorsed. The apparently declining ability of the Forest Service to make autonomous, scientifically-grounded decisions is of particular importance to many critics of the public lands bureaucracy, especially Senator Larry Craig of Idaho-R, Chairman of the Forests and Public Land Management Subcommittee of the Energy and National Resources Committee.²⁶⁴

²⁶² Many of these issues are discussed in *Public Lands Hearing* (1996), and in particular, the comments of Gryszkowiec.

²⁶³ No agency has provided a better laboratory on this issue than the BLM, which was generally considered in its early years to be dominated—or “captured” in the jargon of political science—by “grazing boards” dominated by private ranching interests (Foss, 1960). As discussed by Culhane (1981), resource managers within the BLM eventually regained the ability to control agency decision-making processes by pitting divergent interest groups against each other, allowing the agency some discretion to pursue policies within the middle ground. In recent years, the agency has begun experimenting with Resource Advisory Councils (RACs) in yet another attempt to find an appropriate balance between local involvement and agency autonomy.

²⁶⁴ Craig’s criticisms of Forest Service decision-making generally feature the following assertions: (1) President Clinton’s administration has involved itself in more of the Forest Service’s detailed decisions than any other administration, rather than allowing the Forest Service to make decisions based on its administrative expertise; (2) other agencies lacking specialized knowledge have vetoed Forest Service decisions, despite the fact that decision-making expertise lies within the Forest Service; (3) Forest Service decision-making tends to be meek and dominated by fear of legal challenge; (4) the operating costs of the Forest Service are increasing at an unacceptable rate; (5) the Forest Service is losing its ties to local communities because of a lack of clear responsibility to take local needs into account as part of Forest Service decision-making; and (6) laws drafted and interpreted by the judiciary often require the Forest Service to meet an unrealistic standard for justifying decisions that unavoidably contain uncertainty. (For more information, see the comments of Craig in *Public Lands Hearing* (1996).)

Recent Proposals for Change

While the management of the public lands can undoubtedly be improved and administrative reforms should be explored and pursued where appropriate, ultimately it is important to recognize that the problems associated with fragmented, overlapping, and frequently contradictory agencies and programs are not simply a product of an out-of-control bureaucracy, but instead reflect that the public lands support many different types of competing uses and values. This is a situation that is unlikely to change and should not be viewed as a "problem" that can or should be completely resolved through bureaucratic reform. Instead, the focus of reform efforts should simply be to better clarify the priorities and goals of management regimes, and to more efficiently pursue desired outcomes.

Potential reforms for improving public lands management come from all ends of the political and ideological spectrums. Proposals range from the tweaking²⁶⁵ of existing statutory regulations and administrative responsibilities to wholesale privatization of the public lands. This report does not attempt to survey the entire spectrum of potential innovations, but instead focuses on three major categories of reform proposals generally focusing on the location of decision-making authority and the nature in which market incentives and processes are utilized to efficiently pursue objectives. For the purposes of this discussion, these three strategies are termed *marketization*, *privatization*, and *localization*.²⁶⁶ The broad category of *marketization* includes those proposals calling for the application of market incentives and pricing structures to public land management, allowing free markets, rather than political processes, for example, to establish grazing, recreation, and royalty fees. A closely related—but more politically ambitious and controversial—concept is *privatization*, which involves formally transferring ownership or control of public land resources into private hands. Privatization is frequently discussed in the context of federal divestiture, which in the language of this report, also includes those reform proposals described as localization. *Localization* refers to the formal transfer of federal public land resources into the hands of state and local governments. While these categories do not capture the entire spectrum of potential management reforms, this typology does provide a useful pedagogical division for discussing those proposals that offer the most fundamental changes in the future of federal public lands management.

Marketization

Of the three categories of reform proposals, the category of marketization features the widest variety and greatest political viability of innovations, as marketization elements can be found in most areas of existing natural resources policy. These reforms are linked by their use of market prices and economic incentives in the management of public land resources. Marketization proposals differ from the two divestiture options (privatization and localization) in two significant ways. The first and most obvious distinction is that the

²⁶⁵ Examples of "tweaking" include proposals to incrementally improve the coordination and integration of functions, activities, programs, and field locations, as well as modest structural reorganizations (Gryszkowiec *in* Public Lands Hearing, 1996).

²⁶⁶ As shown in the following discussions, these categories are frequently not mutually exclusive.

marketization option does not require a formal legal transfer of ownership from the federal government to either private hands or to state or local governments. The second, and closely related, distinction relates to differing philosophies regarding the appropriate role of nongovernmental processes in establishing policy. Proponents of marketization argue that the establishment of public lands policy is an appropriate function of the federal government, and that the use of markets should be confined to the development and implementation of strategies to ensure an efficient pursuit of these politically determined policy objectives. In contrast, proponents of divestiture are more inclined to see a role for nongovernmental—at least non-federal—processes in the establishment of goals and policies, in addition to using markets to implement the programs designed to achieve these goals. It is this belief in decentralized market systems for implementing resource management, allocation and use activities that unifies these three general categories of reform proposals.

The market oriented practices of the private sector are increasingly being viewed as holding the solutions to the modern problems of governmental inefficiency and bureaucratic malaise. This broad trend in public administration is seen both nationally and abroad, influencing virtually every substantive area of governmental activity. This look toward the private sector is not surprising, given the modern public demand for a government that is more efficient and flexible—areas where the private sector excels. At the center of this revolution is the notion of “reinventing government,” a term pioneered by Osborne and Gaebler (1992) to describe the recent proliferation of “entrepreneurial governments” springing from this marriage of private sector principles in public sector agencies.²⁶⁷ Fashioning a federal government that “works better and costs less” is the goal of the National Performance Review (NPR), established in 1993 as a major cost-cutting initiative of the Clinton-Gore Administration (NPR, 1996).²⁶⁸ The NPR is an active and ambitious program requiring all federal departments and agencies to devise customer-oriented missions and to implement strategies to improve bureaucratic efficiency.²⁶⁹

²⁶⁷ Osborne and Gaebler (1992:19-20) define entrepreneurial governments based on the typical qualities of these entities: “Most entrepreneurial governments promote *competition* between service providers. They *empower* citizens by pushing control out of the bureaucracy, into the community. They measure the performance of the agencies, focusing not on inputs by on *outcomes*. They are driven by their goals—their *missions*—not by their rules and regulations. They redefine their clients as *customers* and offer them choices—between schools, training programs, between housing options. They *prevent* problems before they emerge, rather than simply offering services afterward. They put their energies into *earning* money, not simply spending it. They *decentralize* authority, embracing participatory management. They prefer *market* mechanisms to bureaucratic mechanisms. And they focus not simply on providing public services, but on *catalyzing* all sectors—public, private, and voluntary—into action to solve their community’s problems.”

²⁶⁸ The roots of the NPR can be traced, in part, to the Reagan-Bush establishment of the President’s Private-Sector Survey on Cost Control, better known as the Grace Commission after chairman J. Peter Grace. The Commission identified 2,478 recommendations to enhance governmental efficiency, promising \$424 billion in savings over three years, and \$1.9 trillion annually by the year 2000 (Grace Commission, 1984). Public land and water resources were not a major focus of the recommended cost savings, which were later shown to be approximately three times higher than could be realistically expected (CBO and GAO, 1984).

²⁶⁹ The most publicized results of the NPR program from 1993 to 1996 include the elimination of almost one-quarter million federal jobs, an approximately \$118 billion reduction in the cost of government, and a gradual reduction in federal budget deficits (NPR, 1996).

The gains in efficiency sought through marketization programs are best understood by comparing the nature of incentives and activities associated with market-based regimes and more traditional prescriptive approaches to resource management. This comparison has been most extensively explored in the realm of pollution control, where the traditional regulatory approach of "command-and-control" has long been viewed as inefficient.²⁷⁰ Market proponents correctly argue that a more efficient approach is to allow individual polluters to devise their own production strategies and technological innovations in order to achieve pre-determined standards.²⁷¹ Not only do properly designed market systems establish incentives for limiting emissions and for encouraging technological and procedural innovations, these systems also allow polluters to target their pollution-minimization activities at their most inefficient and easily upgraded facilities, or if trading systems are utilized, allow the already efficient companies to finance pollution reduction activities at less efficient companies or industries.

While pollution reduction efforts are frequently a desired element of improved public lands management, the more pressing need in most cases is to limit consumption and overuse. Again, these are situations where market processes can potentially be used in lieu of regulatory programs to provide incentives for conservation and efficient use. As discussed throughout this report, prices charged for federal land and water resources are frequently held below the level of market prices, a situation which encourages overproduction and consumption while discouraging conservation and the development of more efficient technologies and patterns of resource use. By using market-based strategies in these and related areas, it is theoretically possible to improve the use of virtually all public land resources while retaining federal ownership and oversight. This is exactly the type of proposal introduced before the 105th Congress by Representative George Miller (D-California), calling for the use of market-based pricing to achieve the twin goals of environmental health and fiscal responsibility. Specifically, the bill calls for "no timber, minerals, forage, or other natural resource owned by the United States, no Federally owned water, and no hydroelectric energy generated at a Federal facility may be sold, leased, or otherwise disposed of by any department, agency, or instrumentality of the United States for an amount less than fair market value, as determined by such department, agency, or instrumentality."²⁷² While this and similar sweeping reform proposals generally lack political viability, many types of marketization reforms are moving forward incrementally.

²⁷⁰ In a command-and-control pollution abatement program, governmental agencies require polluters to utilize specific technologies or processes in order to minimize discharges. Familiar examples include requirements for secondary (or higher) treatment facilities for controlling wastewater pollution and the use of smokestack scrubbers to limit airborne emissions.

²⁷¹ There is a rich literature exploring the pros and cons of market-based strategies for pollution control. The classic theoretical discussion is provided by Baumol and Oates (1988), while a more focused and balanced review of field-level experimentation is provided by Hockenstein et al. (1997). Issues associated with regulatory versus market strategies utilized by the Environmental Protection Agency, the nation's primary regulator of pollution, are explored by the National Academy of Public Administration (NAPA, 1997).

²⁷² See H.R. 919, the Public Resources Deficit Reduction Act of 1997, section 101(a).

Arguments against Marketization

While most marketization proposals feature a sound theoretical basis, several arguments are raised to effectively discourage many innovations of this nature. Among the most salient arguments are those derived from the general fear of allowing market forces to play a role in establishing public lands policy, as market-based processes are unlikely to adequately acknowledge and protect those values lying outside of the utilitarian perspective—an idea explored in detail in Section III. Although this skepticism of markets is certainly reasonable, it is in actuality an argument more appropriately directed at privatization schemes which effectively delegate policy-making responsibilities to nongovernmental bodies. Marketization schemes, as defined in this report, focus exclusively on strategies of implementation and goal achievement, not policy-setting. Nonetheless, even the use of market tools for the limited purpose of goal achievement is viewed by some parties as improperly subordinating many non-economic values. This concern is best illustrated by the rejection of market-based pollution control strategies on the grounds that they appear to “legitimize” pollution, whereas traditional regulatory programs imply a more punitive relationship.²⁷³ This argument is further buoyed by the observation that market-based pollution control instruments have generally not performed as well as expected (Hockenstein et al., 1997).

A more politically practical argument against marketization proposals lies in the fact that many companies and industries have evolved around existing patterns of resource allocation and management, and any reforms that utilize pricing and other market mechanisms to encourage behavioral changes are bound to change the distribution of costs and benefits associated with resource use.²⁷⁴ Similarly, what is considered to be an unwarranted subsidy by one group may be viewed as an appropriate support or compensation by another (Lehmann, 1995). While users of public land resources undoubtedly receive benefits, they also are likely to provide certain types of benefits and also incur certain costs. As some of these costs and benefits may not be readily subject to market exchange, the development of appropriate price signals can be exceedingly difficult—through either a political process or a market-based process.²⁷⁵ Additionally, while there is a strong national tradition of assessing fees for consumptive uses of public land resources, many parties use or value public lands in ways that have not traditionally been subjected to fees. A below-cost timber sale, for example, may only be “below cost” in that some of the benefits, such as improved deer habitat, are not directly recouped in fees

²⁷³ The observations of Hockenstein et al. (1997:15) are illustrative: “Although some environmental groups have welcomed the selective use of [market-based] instruments, others are concerned that increased flexibility in environmental regulation will lead to less protection overall. Furthermore, some in the environmental community still see environmental quality as an inalienable right that market-based programs curtail by condoning the ‘right to pollute.’”

²⁷⁴ While this observation is primarily directed at resource users, it also has implications for resource managers. Agencies with large staffs organized to handle the duties associated with regulatory programs can potentially face significant personnel reductions or dislocations in moving to market-based programs (Hockenstein et al., 1997; NAPA, 1997).

²⁷⁵ For example, if a rancher takes steps to stabilize channels and to provide watering holes serving a variety of species in addition to livestock, shouldn't the cost of grazing fees reflect these larger contributions to the public good?

assessed to the timber interests. Arguments of this nature can provide a politically formidable and philosophically potent obstacle to the establishment of market prices for public land and water resources, while not discrediting the larger desire to infuse greater efficiency and flexibility into the pursuit of management objectives.

Potential Influence of Marketization in Several Substantive Areas

In order to develop an appreciation of the many complex issues that can be associated with marketization proposals, it is useful to briefly reconsider the way in which public land resources are currently managed and the opportunities and constraints these existing regimes pose for potential reforms.²⁷⁶ Several substantive areas of public lands management are reviewed below, focusing on the primarily consumptive uses where the market-oriented reforms are generally most applicable.

Minerals and Energy Resources. The category of mineral and energy resources provides one of the best examples of differing management approaches, with hardrock materials subject to patenting (i.e., privatization), while most other mineral and energy resources are covered by leasing and royalty programs. Policies which permit hardrock discoveries to be patented allow a potential public revenue stream to dissolve into private ownership. A strong case can be made that the public interest would be better served by reform of the General Mining Law of 1872 revoking this arrangement, and instead implementing royalty or leasing schemes.²⁷⁷ Certainly, leases for many resources, particularly the Outer Continental Shelf energy reserves, generate vast public revenues that are made available for many purposes, including public lands management. Similar programs for hardrock minerals now patentable would undoubtedly also generate vast public revenues. However, would such a program be useful in more efficiently achieving the goals of national hardrock policy? While answering this question is essential to evaluating the potential merits of marketization in this substantive area, existing policy is probably not sufficiently clear to provide real guidance. What are the most important policy objectives: maximizing public revenues from public mineral and energy resources, or maintaining the strength of the mining and energy industries? Similarly, what is more important: minimizing the loss of mineral and energy reserves and the environmental impacts of extraction, or maximizing mineral and energy production? Ultimately, the potential applicability of additional marketization elements in the mineral and energy resources area should not be considered outside of these larger policy issues, as the utility of a tool is inexorably linked to the nature of the intended job.

Grazing. Grazing on the public lands is currently controlled by a system of leases between ranchers and federal land managers.²⁷⁸ Two general types of proposals are

²⁷⁶ This material is also useful in the evaluation of privatization and localization reforms.

²⁷⁷ Among the reform proponents are the Mineral Policy Center, who estimates that over \$245 billion in national reserves have been given away since 1872 through patenting and royalty-free mining (<http://www.defenders.org/mining-1.html>).

²⁷⁸ The grazing lease system is specified in detail in the Federal Lands Policy and Management Act (FLPMA) (43 U.S.C.A. § 1701-84). Currently, grazing permits may last as long as ten years, but are not vested property rights (§ 1752(h)). Leases can be terminated by the government with two years notice, or

currently under consideration to better utilize market incentives in these arrangements: (1) raise grazing fees to reflect market rates; and (2) convert grazing leases to transferable property rights.²⁷⁹ It is the first of these two proposals that is the subject of most reform proposals, in part because grazing fee increases can potentially be implemented incrementally and without significant transformations in administrative arrangements. Any market-based modification of grazing fees should address two conditions. First, grazing fees on the public lands are generally only one-fifth of that seen on the private lands, a disparity only partially explained by the generally poorer natural productivity of the public rangelands (Watts and LaFrance, 1994). Second, grazing fees on public rangelands are based on a formula that does not account for regional differences, which can be significant: for example, private grazing fees in 1993 ranged from \$11.40 (per AUM) in Montana to \$5.72 in Arizona, a disparity primarily associated with climate and aridity (Watts and LaFrance, 1994).

While these deficiencies can theoretically be addressed in the political process through revised public rangeland fee formulas, they could also be addressed by market forces if grazing leases or permits were transferable property rights. Such a system may also have the benefit of providing stronger incentives for leaseholders to invest in range improvements, recognizing that the value of such investments could later be recouped through a higher market price for the associated grazing lease or permit. Of course, the impact that a marketable property rights approach would have on public revenues would depend upon the rules of initial allocation of rights and upon the potential continuance of some form on annual fee assessed by the federal government, something that is clearly implied by the concept of marketable "leases" but not necessarily by the concept of marketable "permits."²⁸⁰ This observation suggests that, for the public rangelands, the issues of economic efficiency and public revenue generation are "flexibly" related, as greater efficiency through marketization can be pursued in reforms having a wide variety of impacts on revenue streams.

immediately in emergency situations if reasonable compensation is provided (§ 1752(g)). Rangeland re-evaluation over time is expected, in which AUMs can be reduced if necessary to improve rangeland quality (§ 1752(e)). No compensation is required for AUM reductions (*See McKinley v. United States*, 1993 (N.M. D.Ct. 1993)).

²⁷⁹ Again, these options are not necessarily mutually exclusive; in fact, a transferable property right system may be the best tool to identify market rates. Also note how the second proposal to privatize a "right of use," rather than the resource itself, blurs the line between marketization and privatization proposals. This line is further blurred by considering the different implications between privatizing a "lease" and a "permit."

²⁸⁰ Note that while these considerations about public revenues streams are extremely important, they do not necessarily influence the pursuit of economic efficiency. The goals of efficiency can be achieved by privately allocating leases/permits through public revenue-generating auctions or by simply giving existing leaseholders marketable property rights and then allowing subsequent market transactions to facilitate efficient reallocation. This second approach has the questionable merit of providing a financial windfall to parties who already have received decades of subsidized grazing resources, although it would nonetheless lead to more efficient allocations of forage. The issue of recurring annual payments is similar in nature in that the goals of efficiency are achieved by allowing market transactions, whether or not an annual "rent payment" is part of the cost of ownership. A required lease payment would reduce the market price of the property right, but would not hinder the pursuit of economic efficiency.

Timber. Marketization proposals pertaining to the federal timber program generally consider the manner in which timber sales are priced,²⁸¹ which in many cases leads to “below-cost” timber sales. A below-cost timber sale is one in which the public revenues from the sale are insufficient to cover the federal administrative costs of managing and preparing the land for the timber harvest.²⁸² The allocation of the implied subsidy is a key issue of debate, as timber proponents argue that it is the costs of non-timber management programs, including those for recreation, grazing, and habitat and watershed maintenance, that are most significantly subsidized.²⁸³ Additionally, it is argued that timber harvests serve many non-timber interests in several ways: for example, by reducing fire hazards, providing some types of desired wildlife habitats, and creating roads used by recreationists. The counter argument is that these other uses of public forests are adequately financed through a combination of user fees and national appropriations, and that a proper accounting of forest management activities would consider the negative costs inflicted by timber harvesting programs upon the non-timber values.

To sort through these arguments conceptually can be a difficult challenge; to perform the actual accounting duties associated with critically analyzing such claims is even more difficult. This is especially true given the existence of many unique Forest Service accounting conventions used in the tabulation of below-cost timber sales.²⁸⁴ In an analysis of recent timber sales in 121 public forests, Shields (1995) found 50 to feature below-cost timber sales, as compared to 36 as computed by the Forest Service. These different estimates reflect divergent assumptions about how costs and benefits should be tabulated and evaluated, a complex subject matter that is central to any meaningful discussion about the merits of additional marketization reforms for national timber harvests.

Water Resources. The use of water resources, most of which originate on the public lands, is a subject area with a strong history of subsidies, inefficiencies, and

²⁸¹ Market forces play a partial role in determining timber sale prices. Federal timber is sold after a competitive bidding process, in which the agency typically establishes an appraised price to guide bidders. The accuracy of the appraisal is often highly questionable, as many bids exceed the advertised price, and in some regions—such as the South—private timber industry data is jealously guarded making it difficult to determine credible market stumpage prices. Sealed bids are used outside the West, often with a base price established to ensure that the agency will have enough to set aside for the mandatory “K-V fund.” The K-V fund refers to the Knutson-Vandenberg Act, which since 1930 authorizes the Secretary of Agriculture to collect fees from National Forest timber sales to establish nurseries and to finance reforestation and related stand improvements (Fairfax and Yale, 1987).

²⁸² There is some debate as to whether revenues allocated to local and state governments should count in this accounting, or whether or not it should be confined to simply receipts into the federal treasury. Proponents of federal timber prefer the first method, as it reduces the number of timber harvests deemed below-cost.

²⁸³ For example, Anderson (1994:2) concludes that recreationists are the “biggest pigs at the federal trough,” with federal expenditures of \$1.5 billion generating only \$136 million in receipts.

²⁸⁴ For example, Forest Service calculations omit sales of less than one million board feet. Additionally, salvage sales are also omitted from most official timber sale accountings, in part because salvage sales are small and often serve non-timber interests. Salvage sales do not have to be sufficient to cover the cost of essential reforestation for the site logged or even the costs incurred to arrange the sale, nor must they generate any revenues for the federal Treasury. Additionally, they can be exempted from the environmental impact process under NEPA if they are under 1 million board feet in size (Shields, 1995).

externalities (Anderson, 1983; Frederick, 1988). Consumers of a finite water supply, for example, rarely have reason to consider the negative opportunity costs of foregone uses; in fact, many water consumers (as discussed in Section IV) pay nothing for the water itself, but only for costs of conveyance. Similarly, parties degrading the quality of water are rarely assessed charges to reflect this devaluation, outside of the costs of regulatory compliance. A wide variety of potential marketization proposals are theoretically available to internalize these costs, making water use more efficient and socially equitable, and likely reducing the demands on the water resources of the public lands by encouraging less consumption. The most heralded of the marketization tools concern the marketing of water rights, an activity that increases efficiency of use through market-based reallocations, but which can impose negative "third party" impacts influencing, for example, regions and economic sectors losing water, the natural environment, and all non-market values of water (NRC, 1992; Frederick, 1994). Failure to adequately consider these impacts in the design of water marketing programs is likely to create new externalities, thereby eliminating any potential efficiency gains. Less risky are marketization programs that transform existing water rate structures, such as efforts to limit municipal consumption through uniform rate increases or by the use of increasing block rate pricing structures (Martin et al., 1984). Policies of this nature have tremendous potential to improve the rationality of water use without requiring wholesale changes in legal or administrative arrangements.

Privatization and Localization

Proposals classified as *privatization* and *localization* are conceptually quite different. *Privatization*, after all, shares the same market-emphasis as *marketization*, calling for the formal transfer of resources to private entities presumably responsive to the incentives provided by the economic marketplace. *Localization*, in contrast, generally calls for a retention in public ownership, primarily state or local governments, or quasi-governmental bodies such as special districts. In practice, however, proponents of privatization and localization have much in common; in particular, a strong faith in the economic marketplace and an equally strong distrust of the federal government.²⁸⁵ These two ideas are major pillars of the conservative political philosophy, and are often most uniformly and forcefully expressed in the rural, public land communities of the West.²⁸⁶ Additionally, localization is frequently viewed by proponents as an incremental step toward a system of privatization or, if not actual privatization, a close approximation as local economic interests are expected to exercise more influence over state and local resource

²⁸⁵ One of the most forceful attacks on federal land management is provided in Pendley's (1995) review, which advocates an expanded use of private property regimes on the public lands. In contrast, the anti-privatization argument is perhaps best articulated by Lehmann (1996).

²⁸⁶ A review of the 1997-1998 Congressional directory illustrates the conservative politics of the West. Congressional representation in the twelve westernmost states, excluding Hawaii, is highly Republican: 16 Republican Senators to just 8 Democratic; 52 Republican Representatives to 39 Democratic. California and Oregon and the major Democratic strongholds. Furthermore, the Council of State Governments reports that, in the 17 westernmost states, Republicans occupy the governor's office in 12 states, control the state senate in 13 states, and control the state house in 11 states.

managers than the more politically isolated federal land managers.²⁸⁷ For these reasons, these two types of reform proposals are most readily discussed together, as close cousins. In fact, the only time in which it may have real utility to rigidly distinguish between these two categories is after federal control has been successfully challenged, and the anti-federal forces will need to determine whether the future of the public lands lies with private parties or state/local governments. Despite the intensity of anti-federal rhetoric, this day will probably not arrive in the foreseeable future.

Arguments in favor of privatization and/or localization generally begin with an assertion that federal land management is inefficient, followed with the corollary that private or state/local control is more efficient. Federal revenues generated on Forest Service and BLM lands, for example, are not sufficient to cover the full operating budgets of these agencies (Nelson, 1995). Critics argue that this, in part, is due to the inefficiencies of centralized planning, such as the use of standardized grazing formulas that do not account for regional climatic and land productivity differences. It is also, in part, due to highly fragmented land ownership patterns in many locales, with federal holdings interspersed with state and private lands. Many other cited sources of inefficiency can be tied to the inherent inefficiencies of government itself, including the costs of debate and collective decision-making, electoral politics, bureaucratic turf wars, and "rent seeking" (i.e., subsidies) behavior (Lehmann, 1995). These costs can, in theory, be reduced through localization, and eliminated through privatization. Specifically, proponents of privatization contend that private property regimes lead to more efficient land uses and reallocations, more consumer-responsive land management, and provide valuable individual incentives for investments in resources productivity and technological innovations (Lehmann, 1995).²⁸⁸ These arguments, like those reviewed earlier for marketization, are based on the notion that economic efficiency is an important and largely ignored goal of current public lands management. Successes achieved in the realm of marketization further legitimize the case for privatization.

In no sector are these arguments more forcefully articulated than in regards to forest management, as federal, state, and private parties hold large reserves that invite comparisons. While it should be no surprise that private forest lands are almost always managed at a profit, it is noteworthy, according to localization proponents, that state lands also typically generate surplus revenues. As articulated recently by Senator Craig (R-Idaho), the federal government manages about 190 million acres of forested land, while the states manage 153 million acres of trust lands for mining, timber, grazing, recreational properties, and wildlife habitat.²⁸⁹ Although these are roughly comparable acreages of

²⁸⁷ As Lehmann (1996:224) observes, "Federal agencies tend to be better funded and better staffed with better people than corresponding state agencies. State legislatures are even more vulnerable to lobbyists than the national legislature, because state legislators, unlike their federal counterparts, generally cannot call on a professional staff or on resources similar to the Congressional Budget Office or Office of Technology Assessment for independent assessment of the effects of contemplated legislation."

²⁸⁸ Keep in mind that the privatization option not only promises increased management efficiencies, but significant governmental budgetary savings as public expenditures are ceased and potentially massive windfalls are collected from the initial sale of public resources (Jeffery, 1996).

²⁸⁹ Note that many scholars utilize different assumptions and statistics than Craig in the discussion of state public lands. Bates (1992:57), for example, suggests that the actual state total is actually 68 million acres.

frequently similar lands, the state lands were managed for two-thirds less money than the federal lands, as nearly every acre returned a profit to the state agencies (Craig *in* Public Lands Hearing, 1996). In most areas, federal forest management operates at a net loss. Furthermore, according to Senator Craig, in almost every instance the states have met or nearly met all national environmental standards in managing state lands, and in some cases, state lands were in better shape than federal lands. This last conclusion is supported by a recent study conducted by Montana's Forestry Division that found that state lands were better managed to protect against the negative watershed impacts of logging than lands in other ownership categories (Leal, 1994).²⁹⁰

The argument in favor of more localized management of public lands also is based on the fact that states and local governments already manage a sizable quantum of nonfederal public lands, many of which are managed for primarily non-consumptive values. Approximately 60 million acres of state lands, 5 million acres of county lands, and 3 million acres of municipal lands are found in parks, recreation areas, wildlife areas, and other forested reserves. These areas draw approximately 724 million visitors per year and about \$400 million in annual revenue (Bates, 1992). Additionally, even on the federal public lands, the federal agencies with primary management responsibility frequently defer to state or local management agencies in many substantive areas, particularly in regards to hunting and fishing management (Bates, 1992). Many critics of federal land management see this type of intergovernmental arrangement as a potential incremental model of reform, perhaps leading to more formal localization or even privatization.²⁹¹ Proposals featuring a formal transfer of ownership are particularly advocated in those areas featuring highly fragmented land ownership.

Arguments Against Privatization and Localization

Critics of existing public land arrangements make a pervasive case that federal land management is highly inefficient, and that greater efficiency can be achieved through fundamental reforms, especially those involving privatization. What is frequently missing from this argument, however, is the recognition that efficiency is not an appropriate criterion upon which to singularly evaluate federal public lands management. Government, after all, is generally not designed to be a profit-maximizing enterprise. To the contrary, the jobs that fall to government are usually those that the private sector has proven itself either unwilling or unable to perform (Wilson, 1989). Federal reservations of forest lands, for

while the Western States Land Commissioners Association identifies 370 million acres in 23 western states (<http://www.wslca.org>). These discrepancies are primarily due to whether or not Alaska or eastern states are included in the summaries, and whether lands beneath navigable waterways (including offshore lands) are also included.

²⁹⁰ Not surprisingly, proponents of continued federal management are quick to offer examples of poor management under state or local regimes (Lehmann, 1996).

²⁹¹ Babcock's (1996) review of three current institutional models is potentially useful in designing localization strategies featuring shared intergovernmental decision-making authority in the context of retained federal ownership and primacy. The models reviewed include the "dual regulation" model of federal pollution control, the "collaborative management" model of the National Estuary Program (within the Clean Water Act), and the "federal consistency" (or "layered federalism") model of the Coastal Zone Management Act.

example, occurred only after rampant deforestation by private timber barons threatened the long-term forest resources of the nation. Similarly, the protection of non-market values on the public lands—for example, endangered species or ecosystems, such as the old growth forests of the Pacific Northwest—is unlikely to occur outside of governmental control.²⁹² These values can be protected through public control, however, since the goals of governmental action are more generally shaped by concerns of equity rather than efficiency, and more driven by the goals of citizens than consumers.²⁹³ The inherent inefficiencies of democratic decision-making are a largely unavoidable cost associated with pursuing these types of goals.

These concerns about the appropriateness of the efficiency criterion for evaluating administrative regimes raise serious questions about the merits of public lands privatization. They do not immediately challenge the concept of localization, as reforms in that category still call for public land resources to remain in governmental control. However, as discussed earlier, an important part of the localization concept is to make governmental resource managers more directly responsive to state and local economic interests, an objective which makes the localization proposals somewhat vulnerable to the same criticisms levied at the privatization proposals. Furthermore, the statistics that illustrate the greater economic efficiency of state-managed public lands (versus their federal counterparts) can be challenged on the grounds that efficiency is an inappropriate criterion for comparison, especially considering that state public lands are often managed in accordance with different mandates than federal public lands. For example, profit-driven management regimes are a common feature of many state public lands, such as school trust lands managed to generate revenues for educational purposes. Additionally, these profits generated on state lands remain in state, whereas significant percentages of revenues from federal public lands management are allocated to state, local, and private interests.²⁹⁴ These differences in accounting can significantly influence the calculation of net profits (or lack thereof) associated with federal lands management. These observations suggest that the transfer of federal public lands to state or local governments will either not fully achieve the efficiency gains promised by localization proponents, or will achieve these goals only at the cost of shifting the focus of management from the protection of public goods and non-market values to a more explicitly profit-maximizing orientation.

²⁹² As Loomis (1994:72-73) explains, many of the values and uses of the public lands are not well suited to control through privatization: “[M]ost of the natural resources on public lands do not fit the market model of perfectly divisible resources, the production of which does not impinge upon any third parties. That is, forests are more than timber; they are watersheds, wildlife habitat, and recreation areas; cutting timber will affect the value these other resources provide to people outside the timber transaction. Rivers are more than potential hydropower and agricultural water supply; they are fish habitat and in many cases outstanding recreational resources. Thus although many of the resources on public lands have some private marketable component, what makes them special is that they contain a large nonmarketable public goods component that would be largely undervalued by private market transactions.”

²⁹³ The distinction between citizens and consumers was discussed in Section III, drawing upon the work of Sagoff (1988). Generally, it was shown that market-based systems of resource allocation and management are ideal for responding to the demands of individual consumers; however, the goals of citizens are generally more shaped by concerns of distributional and intergenerational equity, and by concerns for non-market values.

²⁹⁴ Formulas for revenue allocation are discussed throughout Section IV.

Two other arguments are frequently raised to challenge the localization proposals. First is the idea that the states do not have a constitutional right to independently assume ownership or management responsibility over the public lands, a conclusion supported by the failed historical efforts of states, counties, and other interests to gain control over these lands. Of course, this right could be gained by state and local governments, but it would require sweeping new legislation at the federal level—something that has not been forthcoming since the era of federal land retention began firmly established in the 1930's. The second, and more pragmatic, argument is that the changes in land management policy generally sought by the critics of federal control would not necessarily be forthcoming from state or local governmental management (Nelson, 1995). Proponents of localization generally see these reforms as encouraging greater land uses, especially those of an economic nature, rather than the "locking away" of these resources through federal environmental programs. However, it is hard to imagine that state and local governments would be willing to continue the subsidies that encourage many current public land uses, such as grazing, timber harvesting, mining, and recreation.²⁹⁵ Existing policies in these areas encourage intensive land uses and facilitate the transfer of federal moneys into state and local coffers, results that are potentially vulnerable under localization schemes.

Specific Proposals and Areas of Experimentation

As discussed earlier, proposals for public lands privatization and localization are certainly not new, most often being articulated in the modern era as part of the Wise Use Movement. Despite modern calls for federal divestment, however, very few acres of public land have recently left federal ownership. The sale of public lands through the decade from 1974-1983 was almost nonexistent; less land was sold in that time than in any single year from 1950 to 1968 (Nelson, 1995). Transfer of related federal resources, such as water projects, to nonfederal entities has also progressed slowly.²⁹⁶ Nonetheless, federal divestment of public land resources remains a major component of the public lands debate. Most of the current proposals for privatization and localization remain hypothetical academic exercises, frequently featuring a strange synthesis of theory and dogma; however, focused legislative proposals are beginning to materialize in several areas.

Among the many privatization proposals articulated in recent years is that of Robert K. Davis, who advocates breaking up the public lands to focus decision-making among

²⁹⁵ After all, grazing fees on state managed lands, for example, are generally higher than those for federal lands.

²⁹⁶ The Bureau of Reclamation has recently developed a "title transfer framework" to structure negotiations for the transfer of federal water projects to nonfederal entities, typically water districts or municipalities. Of the 592 water districts served by 191 Reclamation projects, approximately 50 districts and municipalities have expressed an interest in title transfer, primarily focusing on eight projects: Clear Creek, Contra Costa, Lower Yellowstone, Canadian River, McGee Creek, Palmetto Bend, Nampa Meridian, and Freemont Madison. Several other projects have been, or are being, considered for transfer through separate legislative processes, including completed transfers of four projects: Rio Grande (below Elephant Butte), Vermejo Project, Boulder City Pipeline, and San Diego Aqueduct. Other projects being considered for transfer through legislative processes include Republican River, Burley (Idaho), Carlsbad, Oroville Tonasket, and Collbran (Garner, 1997). These efforts have been encouraged by the privatization focus of the National Performance Review program. While title transfer of Reclamation projects remains quite rare, transfer of O&M (operation and maintenance) functions to water districts has been common for many decades.

smaller, more distinctly homogeneous groups (Davis, 1994).²⁹⁷ This innovation is seen as promoting local experimentation and flexibility, qualities lacking in a federal government driven by a “large, sophisticated, professionalized, and to a considerable extent self-serving industry dedicated to accumulating and defending subsidies and benefits” (Davis, 1994:13-14). Davis advocates a system of well-defined property rights that recognize local land users as the most logical focus of land management. A considerably less drastic program of reform is advocated by Robert H. Nelson (Nelson, *in* Public Lands Hearing, 1996).²⁹⁸ Nelson suggests that control over some of the existing public lands and activities be allocated to state, local, and private interests, based on which sector is most directly involved with a particular area or use. Only those resources that constitute significant national interests should remain under federal control, and those management functions should be more logically organized within the bureaucracy. While the approach has an obvious logic, it is difficult to imagine what process could be utilized to determine which areas of these multidimensional resources would be best allocated to each of these sectors, and how this resulting pattern of fragmented jurisdiction would achieve significant improvements in administrative efficiency.²⁹⁹ On the other hand, an incremental and selective pattern of federal public lands divestiture is perhaps the most practical strategy for those parties seeking an end to federal primacy in public lands management. While not quite serving as ends on a continuum, the proposals of Davis and Nelson do illustrate the wide range within which most divestment reforms are located.

Of more immediately political significance is the proposal being fashioned by Senator Craig, Idaho-R. A major focus of Craig’s bill³⁰⁰ is to streamline the statutory morass guiding federal public lands policy by integrating and simplifying the Federal Land and Policy Management Act and the National Forest Management Act, and by transferring implementation of the National Environmental Policy Act and the Endangered Species Act to the Forest Service and BLM, away from the Fish and Wildlife Service and the National Marine Fisheries Service. The proposal further suggests a continuance of the multiple-use, sustained-yield philosophy as implemented by professional resource managers. While Craig envisions an enhanced role for the Forest Service, the proposal also calls for transferring some public lands to the states, and transferring some day-to-day management functions of Forest Service lands to the states under specified circumstances. Specifically, these transfers of authority would occur only after the Chief of the Forest Service determines that a state can properly manage the National Forest in question, and after Congress ratifies the

²⁹⁷ Davis is a professor at the Institute of Behavioral Science, University of Colorado, Boulder.

²⁹⁸ Nelson is a Professor of Environmental Policy, School of Public Affairs, University of Maryland; and is a Senior Fellow at the Competitive Enterprise Institute, Washington, D.C.

²⁹⁹ One potential strategy is described by Jeffery (1996), based in part on the land inventories conducted by the Forest Service under the National Forest Management Act. Specifically, Jeffery’s plan calls for the establishment of interdisciplinary teams to generate and review all relevant data for a given area, including the location of natural resource features, values and uses. This data would then be subjected to public review and comment, leading to recommendations to the relevant governmental entities about the appropriateness of federal divestments. Once potential land transfers have been identified, public interests could potentially be protected in the divestment process through the use of tools such as restrictive covenants, repurchase options, eminent domain or zoning actions, and perhaps even some form of leasing systems.

³⁰⁰ The Public Land Management Responsibility and Accountability Restoration Act (HR 4236).

appropriate contract between Forest Service and the state agency. It seems extremely unlikely that these conditions could ever be satisfied (Margolis, 1997b). Of greater significance are the elements of the proposal that appear to weaken the influence of pro-environment agencies, statutes, and appeals processes in the decision-making activities of the Forest Service and BLM, agencies with strong ties to the extractive industries. In this way, the proposal apparently seeks to strengthen the ties between private natural resource industries and federal resource managers, a *de facto* federal divestment.

Another recent bill seeking to more explicitly encourage timber industry control of federal forest lands involve the O&C lands in Oregon, managed by the BLM (Blumm and Lovvorn, 1997). The proposed Oregon Resource Conservation Act calls for the formal legal transfer of these lands to the State of Oregon, primarily to promote the “economic stability of local communities.”³⁰¹ Proponents of the scheme claim it would increase management efficiency, reduce federal expenditures, address issues of fragmented land ownership, and most importantly, would facilitate increased harvests benefiting local timber economies. Critics counter that the transfer would eviscerate or dilute many federal environmental regulations and programs, especially those pertaining to endangered species. Pressure to abandon the terms of the Northwest Forest Plan, for example, would be particularly high, given that the timber harvesting restrictions of the plan would likely prevent the state from managing these lands at a profit—in fact, an annual deficit of \$61 million is predicted.

In several other localities within the Pacific Northwest, the role of local parties in federal policy-making is being augmented through the rapid proliferation of dozens of collaborative groups organized to promote improved management of forest and watershed resources. These groups generally seek improved resource management through the informal shifting of decision-making authority away from centralized federal agencies to local groups of governmental and non-governmental resource managers, stakeholders, and other concerned parties (Wondolleck and Yaffee, 1994; Kenney, 1997). The most extreme and controversial example of this form of localization is found in the Quincy Library Group, a collective of resource managers, environmentalists, timber industry representatives, business people, and other citizens concerned with the management of the Plumas National Forest near Quincy, California. The group organized when the competing concerns of environmental protection and timber industry continuance appeared to be irreconcilable through existing processes of forest planning and litigation. Operating outside of formal forest planning processes, the group determined that if appropriate lands (e.g., riparian areas) were set aside from development, if clearcutting were eliminated, if fire hazard reduction programs were implemented, and if related management standards and guidelines were adopted, significant logging in the Plumas National Forest could continue for the next 100 years (Jackson, 1995). In 1997, the group crafted this plan into legislation considered by Congress, simultaneously drawing praise and raising eyebrows concerning the merits of delegating federal public lands management decisions on a piecemeal basis to largely independent local groups.³⁰²

³⁰¹ The Oregon Resource Conservation Act of 1996 (SB 1662). Quote from section 5(a)(1).

³⁰² Quincy Library Group Forest Recovery and Economic Stability Act of 1997 (SB 1028; HR 858).

VI: CONCLUDING THOUGHTS: PARTICIPATING IN THE VALUATION DEBATE

The value of the federal public lands is both vast and incalculable. While it is frequently possible to quantify public and private revenues associated with specific public land resources, activities, and programs, this information rarely paints a complete picture of resource valuation. Of particular concern is the observation that many qualities of the public lands are valued in ways that are not explicitly economic, thus impeding efforts to quantify all resource values with a singular, monetary valuation criterion. Additionally, many types of values with an economic component defy easy measurement. This can be particularly troublesome for resource goods and services that are not directly associated with human consumption or use, and for those which are not amenable to market transactions due to their public good orientation, their intergenerational nature, or to related qualities promoting market failures. The proliferation of natural resource subsidies can further hinder the use of economic statistics which, despite these shortcomings, still provide an essential empirical measure of value that is impossible to escape or ignore. For these reasons, the authors of this report have chosen to nest the review of economic statistics within discussions of the history, ideology, politics, and law of resource management, leading to a highly socioeconomic construct of value. This is the *appropriate perspective* discussed in the Introduction—an imprecise, but necessary, approach for accurately valuing the federal public lands.

A major stimulus behind this research was the concern that some parties, particularly public land activists, often do not have sufficient information or understanding to participate in policy debates involving public land values. This report partially fills that void in several ways. For starters, the information in this report can be used to describe and evaluate the manner in which the existing legal and administrative arrangements define and allocate particular resource values. This is highly useful background information: an understanding of the status quo, after all, is an essential prerequisite to assessing the merits of any proposed reform. This review may indicate a pattern of resource valuation and management based on assumptions that are historically antiquated, methodologically flawed, or otherwise inconsistent with prevailing societal norms of equity and efficiency, leading to a philosophical justification for action. This information, when considered along with a more explicit review of the particular resource value allocation of concern—specifically values of an economic nature (e.g., revenue streams)—can then be utilized to perform a political analysis, identifying opportunities and constraints for coalition-building, compromise, and ultimately, problem-solving. Additional opportunities may also be illuminated by reviewing the management traditions and innovations pertaining to other types of resources and resource values. Only after this full spectrum of information is gathered and synthesized can the public land activist be expected to participate in a meaningful and effective way in the public policy process.

Evaluating the Reform Proposals

Merits of Marketization, Privatization, and Localization

While it is difficult to comment on the merits of modern reform proposals on anything other than a case-by-case basis, it is possible to generalize about the broader issues that shape the policy environment and how these issues should influence the overall direction of future reforms. The very fact that the reform of federal public lands management remains a hotly contested issue among scholars, stakeholders, and political leaders suggests that this kind of inquiry is useful and legitimate.

There are at least three “givens” that should be understood by all participants contributing to this debate. First, the federal public lands involve a tremendous variety of multifunctional and valuable resources, and the control of these resources will consequently always be a subject of considerable controversy and competition. This is inevitable, and should not be viewed as evidence of a dysfunctional policy environment. Second, these fundamental controversies about the goals and objectives of resource management are the primary root cause for many of the problems inappropriately attributed to the resource management bureaucracy. Conflicting and overlapping agency missions, for example, are generally best understood as being products of fundamental policy disagreements, rather than as administrative deficiencies that can be corrected through bureaucratic reforms pursued in isolation of these larger policy questions. And third, federal resource managers—just like nonfederal agencies and private resource users—should be expected to continue those behaviors that provide them with the greatest benefits. Long-term agency success is typically best maintained by jealously guarding turf (defined both in terms of substantive areas and geography), by continuously seeking larger budgets and expanded decision-making authorities, by protecting those existing policies and operating norms that have contributed to the agency’s evolution and growth, and by concentrating on those management programs that cultivate and reward supportive constituencies (Clarke and McCool, 1985).

These observations suggest that it is the incremental and ongoing reform efforts that have the greatest potential for making meaningful contributions to public lands management, a conclusion supported by a review of history. Additionally, it can also be concluded that it is of little practical benefit to attribute only to the federal resource agencies qualities which are also seen in state and local agencies, and in somewhat similar ways, in private companies and individuals. This is one of many considerations that has a place within the extremely salient debate about the merits of public or private control, which is closely linked to the decision about whether policy should be primarily driven by equity or efficiency concerns. Ultimately, this must be recognized is a false choice, as the ideal regime is probably one in which policy is determined through political processes primarily

driven by concerns of equity and fairness,³⁰³ while implementation is, to the extent possible, driven by private sector mechanisms offering efficiency, competition, and flexibility.³⁰⁴

This promise is primarily offered by those proposals categorized as marketization; nonetheless, privatization and localization can play a role in this larger strategy. Some public land resources—and to a greater degree, goods and services flowing from these resources—are sufficiently isolated and marketable to facilitate various forms of privatization.³⁰⁵ In many other cases, it may be appropriate to pursue localization of decision-making functions, which then could be implemented through marketization strategies managed by state or local, rather than federal, agencies. In most cases, however, transboundary impacts and other interrelationships among resources and uses encourage a continued reliance on federal primacy, improved to the extent possible through incremental reforms and aggressively featuring marketization tools in policy implementation. This is likely to provide the best, and most politically viable, future for the federal public lands.

Proponents of greater marketization in public lands management have identified dozens of situations and opportunities where these tools deserve greater application. For example, the modification of pricing and fee structures associated with public land uses is one area that clearly deserves the intense scrutiny it is currently receiving. However, largely lost in the debate over grazing fees and below-cost timber sales are the subsidies associated with many other emerging uses and values of the public lands—most notably, recreation.³⁰⁶ Those uses of the public lands which are clearly market-oriented should at least approach self-sufficiency through user fees, which does not necessarily preclude the subsidization of some users deemed to possess an equity-based rationale for special treatment. Those values lacking well-defined markets, such as endangered species preservation, should be funded

³⁰³ While the narrow agendas of influential interest groups undoubtedly limit the ability of political processes to consider broad issues of equity and fairness, the American political system offers more potential for considering such issues than does a market-driven system, which would be responsive only to market values and active consumers.

³⁰⁴ As Osborne and Gaebler (1992), the intellectual fathers of reinventing government, have observed, effective governmental bodies are those that aggressively define problems and goals, and then establish cooperative relationships with the private sector (including free markets) to pursue determined objectives. The role of the public sector is to “steer” (i.e., to coordinate policy development); the role of the private sector is to “row” (i.e., provide goods and services).

³⁰⁵ Ongoing efforts to privatize the functions of the federal Power Marketing Administrations are one example. Driver (1997) provides a thoughtful review of some of the important issues associated with the impacts of electric power industry restructuring and the future of federal hydropower.

³⁰⁶ The National Park system is an interesting case study (Leal and Fretwell, 1997). Initially, National Parks paid their own way through auto and concession fees; revenue stayed in parks and managers saw a clear link between serving visitors and having funds to manage facilities. Over time, however, the ties between revenues and expenditures became severed, both being independently funneled through federal coffers under congressional control. Now, as recreation levels reach an all-time high, a \$4.5 billion backlog of construction improvements has amassed, and many critics point to recreation as the most subsidized of all public land uses (Anderson, 1994). Marketization proponents suggest that the appropriate solution—especially given the existence of a competing private recreation industry—is to raise user fees to support recreation activities, and to coordinate the revenues and expenditures on a park-by-park basis. Some progress in this area is being made (Leal and Fretwell, 1997). For example, many components of the National Park Service participating in the Recreational Fee Demonstration Project (adopted January 1, 1997), have been able to dramatically increase revenues from modified entrance and user fee structures.

from general appropriations, or potentially from “impact fees” associated with market-based activities that contribute to these biodiversity management challenges.³⁰⁷ Endorsing the tools of marketization should in no way be construed as imposing a self-sufficiency requirement on those uses and values which are explicitly non-market, or are only partially marketable. Failure to do so would burden marketization reforms with many of the deficiencies of unwarranted privatization.

The tools and philosophies of marketization should also be utilized to review existing revenue sharing formulas, which can provide inappropriately strong local incentives to encourage those uses which provide local revenue-sharing, while unduly discouraging other activities that lack revenue-sharing. The goal of providing appropriate incentives is also central to regulatory programs designed to use market-based tools to encourage efficient goal achievement, such as the “bubble policies” used in air pollution control that are increasingly being considered in nonpoint water pollution control.³⁰⁸ These, and countless other reforms of this nature, promise to best improve the quality of management programs in a way that recognizes the diversity of values and uses of public land resources, while maintaining the tradition of public ownership and control.

What About Subsidies?

The language of these public land debates is increasingly being centered around the concept of *subsidies*, a term used liberally, and often inconsistently, to normally describe one of two non-exclusive situations: first, any arrangement in which beneficiaries of a resource value do not pay the full costs of providing that value, with these deficits being made-up by society through tax payments or other societal costs; and second, any arrangement in which a public benefit is transferred to private hands for a level of compensation that is below what would have been obtained through a more explicit market-driven transaction.³⁰⁹ Prominent public lands examples of the first category include below-

³⁰⁷ The “impact fee” concept provides a legitimate justification for using revenues from one activity to finance another. The public lands provide many examples, however, of revenue-sharing relationships that do not feature an obvious rationale. For example, federal hydropower revenues from Bureau of Reclamation projects are typically utilized, in part, to finance irrigation water systems and deliveries (GAO, 1996). By using hydropower revenues to subsidize the irrigation component of a water project, Congress is essentially articulating a belief that irrigation is a use which has a non-market component that deserves a public subsidy—a potentially defensible position, but one that is largely hidden from public scrutiny by existing rules of revenue allocation. In order for benefits and limitations of marketization proposals to be fully explored, these special accounting conventions must be exposed to public scrutiny.

³⁰⁸ The concept of a bubble is to define the amount of pollution allowed in a given region (or bubble), and then to allow market forces to allocate among pollution-causing industries the right to contribute to that maximum ceiling of pollution. In such a system, only the most efficient and profitable companies will generate pollution, with less efficient or notoriously dirty emitters being driven from the marketplace. The right to pollute within a pollution bubble is expensive, thereby encouraging technological and process innovations that reduce emissions (Hockenstein et al., 1997).

³⁰⁹ Other subsidy situations can exist in the natural resources realm. For example, federal agricultural price supports are generally considered a subsidy in that the public, through tax payments, provides a higher level of compensation to farmers than would be available to them through unfettered market transactions.

cost" timber sales and federal reclamation projects, while examples of the second category include "preference" hydropower rates and hardrock mining patenting procedures (Munson, 1994).³¹⁰ Several specific sources of natural resource subsidies are described in Table A30 (House Report, 1994:11). The General Accounting Office conservatively suggests that federal subsidies for mining, grazing, logging, and recreation industries on federal lands and waterways exceeds \$1 billion annually, a figure that is likely quite conservative (Losos et al., 1995).

All types of subsidies are increasingly controversial in this era of budgetary constraints, especially when many natural resources benefits of the public lands can, in theory, be provided at a net profit to the public. Among the parties making this conceptually simple observation is the General Accounting Office (GAO, 1992:13), who has recommended that the federal government should:

. . . (1) seek a better return for the sale or use of the mineral, renewable, and other natural resources on its lands; (2) cover programs' costs to the extent reasonable and make some programs revenue producers rather than contributors to the national debts, as they are now; and (3) provide a revenue base that can be used to better manage and improve federal lands so that they will remain a viable public resource in the future.³¹¹

This is certainly not a novel idea; in fact, it is largely consistent with language found in the Federal Land Policy Management Act (FLPMA) of 1976 in which "Congress declares that it is the policy of the United States that . . . the United States shall receive fair market value of the use of the public lands and their resources unless otherwise prohibited by statute."³¹²

What is frequently missing from the subsidy debates, however, is the recognition that subsidies are not always unwarranted. Subsidies are used in virtually all policy arenas to stimulate desired behaviors, promote useful innovations, to compensate for past abuses, to provide opportunities, and to correct for market failures. A century ago, federal subsidies to railroads and later irrigation districts, for example, were instrumental in achieving important national goals of western settlement; similarly, in the modern era, scientific and technological subsidies, such as tax breaks for renewable energy technologies, may likely play an important role in achieving modern objectives of resource sustainability.³¹³ These observations have prompted Wilkinson (1992:19) to caution that

³¹⁰ The term "preference power" is used to describe certain classes of electricity users who are empowered to purchase federally-generated power at a rate below that paid by other users. Preference power is typically provided to rural and/or agricultural users, reflecting a historic national objective of rural electrification.

³¹¹ The GAO (1992) estimates that additional federal revenues of \$4.5 billion annually could be achieved by eliminating major natural resource subsidies.

³¹² 43 U.S.C. § 1701(a).

³¹³ For example, as part of the debate surrounding the enactment of the Hardrock Mining Act of 1872, Congressman Aaron Sargent was quoted as making the following argument: "We are inducing miners to purchase their claims, so that large amounts of money are brought into the Treasury of the United States, causing the miners to settle themselves permanently . . . and in every way to improve their own condition and to build the communities and States where they reside" (Quoted in House Report, 1994:111; emphasis added).

“the real objection . . . ought not to be to subsidies generally, but to irrational or unexamined subsidies.” This is the appropriate perspective from which to approach the subsidy debate, even though that in accepting this premise, the analyst must acknowledge that the determination of what is “rational” is destined to be an inexact science best approached through a political exercise. Policy-makers burdened with these responsibilities should seek out and utilize economic valuation statistics as part of these efforts, but ultimately, determining what is a rational subsidy will require balancing resource values of both an economic and non-economic nature. This is probably best accomplished through a non-quantitative approach that considers factors such as the appropriateness of the incentives provided, the economic and social commitments implied, the investments made, and the objectives found in the underlying policies.

With these formidable caveats in mind, a thoughtful and comprehensive examination of natural resource subsidies should be encouraged as part of the ongoing assessment and review of public land values and policies. Even if non-market values are afforded appropriate consideration in these examinations—something not consistently seen in many ongoing subsidy debates—it is still highly likely that many, if not most, existing subsidy arrangements will be found to be at least partially inappropriate. This observation is particularly relevant to the West, as the “New West” is considerably different than the territorial region upon which many subsidy regimes were originally targeted (Wilkinson, 1992). Many parties are convinced that we are destined as a nation to pay twice for these natural resource subsidies: once to subsidize the development of resource extraction economies, and twice to mitigate the resulting environmental and socioeconomic impacts associated with the transformation to more sustainable uses of the public lands and waterways (Losos et al., 1995). In many public land communities, this process is already well underway. This should not be a cause for discouragement, however, as shifting public objectives will inevitably require the abandonment of some past investments and the increment of some new costs. This is inevitable byproduct of maturation. The challenge now, as always, will be to do this gracefully and compassionately, in a manner which is guided by wisdom more so than dogma, and that recognizes that we not only will be here for a long time, but we have been here for a long time. Inherent in both perspectives are values that defy easy explanation and elude quantification, but that merit our continued respect and attention.

VII. APPENDIX: STATISTICAL TABLES

The following pages contain thirty tables of empirical data summarizing various facets of public land attributes, usage, and values. Each of these tables was referenced earlier in the text, in most cases in Section IV. Most tables are a synthesis or summary of information originally published elsewhere in a slightly different format. Modifications have been made, as necessary, to improve the clarity and presentation of the data. The reader is strongly encouraged to consult the original data sources for a greater explanation of the figures provided, and to develop independent opinions as to the credibility of the estimates.

Table A1. Mineral Production in the United States, 1990 and 1994.

| Substance | Units | 1990 | 1994 |
|-------------------------|----------------------|--------|--------|
| Fuel Minerals | | | |
| Coal | Million tons | 1,029 | 1,034 |
| Natural Gas | Trillion cubic feet | 18.59 | 19.64 |
| Petroleum (crude) | Million barrels | 2,686 | 2,420 |
| Uranium | Million pounds | 8.9 | 3.4 |
| Nonfuel Minerals | | | |
| Cement | | | |
| Portland | Million tons | 75.6 | 74.3 |
| Masonry | Million tons | 3.3 | 4.0 |
| Clays | Thousand metric tons | 42,904 | 42,200 |
| Garnet (abrasive) | Thousand metric tons | 47.0 | 51 |
| Gypsum (crude) | Million metric tons | 16.4 | 17.2 |
| Helium (refined) | Million cubic meters | 87 | 100 |
| Lime | Million tons | 17.5 | 17.4 |
| Peat | Thousand tons | 795 | 552 |
| Potash | Thousand metric tons | 1,713 | 1,470 |
| Salt (common) | Million metric tons | 36.9 | 39.2 |
| Sand & gravel | Million metric tons | 852 | 918 |
| Sulfur | Thousand metric tons | 3,676 | 3,010 |
| Vermiculite | Thousand metric tons | 209 | 177 |
| Metals | | | |
| Copper | Thousand metric tons | 1,590 | 1,810 |
| Gold | Metric tons | 294 | 326 |
| Iron ore (gross) | Million metric tons | 57.0 | 57.6 |
| Lead | Thousand metric tons | 497 | 363 |
| Magnesium metal | Thousand metric tons | 139 | 128 |
| Platinum metal | Kilograms | 1,810 | 1,960 |
| Silver | Metric tons | 2,121 | 1,480 |
| Zinc | Thousand metric tons | 515 | 570 |

Adapted from: Census (1996:Table 1146). Most measurements are derived from mine shipments, mine sales, or marketable production. Unless otherwise indicated for trace elements, units are for recoverable content.

Table A2. Mining Claims Recorded by the BLM, 1976 through FY 1996.

| Administrative Area | Total Claims at Beginning of 1996 | New Claims Filed in 1996 | Total Claims at End of 1996 | Active Claims End of 1996 |
|---|-----------------------------------|--------------------------|-----------------------------|---------------------------|
| Alaska | 111,047 | 952 | 111,999 | 9,832 |
| Arizona | 335,078 | 6,004 | 341,082 | 34,423 |
| California | 265,887 | 3,581 | 269,468 | 32,882 |
| Colorado | 247,117 | 1,068 | 248,185 | 8,371 |
| Eastern States | 10,984 | 2 | 10,986 | 28 |
| Idaho | 172,251 | 2,186 | 174,437 | 16,136 |
| Montana, North and South Dakota | 199,101 | 1,717 | 200,818 | 20,564 |
| Nevada | 697,879 | 27,466 | 725,345 | 135,967 |
| New Mexico, Oklahoma, Texas, and Kansas | 162,694 | 2,063 | 164,757 | 8,676 |
| Oregon and Washington | 139,423 | 1,701 | 143,003 | 11,523 |
| Utah | 345,925 | 3,104 | 349,029 | 14,167 |
| Wyoming and Nebraska | 249,709 | 1,326 | 251,035 | 13,951 |
| TOTALS | 2,937,094 | 55,170 | 2,988,264 | 306,520 |

Adapted from: BLM (1996a:100, Table 3-19). The "Eastern States" designation includes all states bordering, or east of, the Mississippi River.

Table A3. Federal and Indian Leases for Oil, Gas, and Mining, FY 1997

| | Producing Leases | Non-Producing Leases | Total Leases |
|---|---------------------|-------------------------|-----------------|
| Oil and Gas Leases | | | |
| Federal onshore | 19,863 | 43,708 | 63,571 |
| Federal offshore | 2,008 | 5,680 | 7,688 |
| Indian | 3,720 | 62 | 3,782 |
| Sub-Total | 25,591 | 49,450 | 75,041 |
| Mining Leases | | | |
| Federal onshore | 272 | 1,063 | 1,335 |
| Federal offshore | 1 | 5 | 6 |
| Indian | 52 | 78 | 130 |
| Sub-Total | 325 | 1,146 | 1,471 |
| Summary: Oil, Gas, and Mining Leases | | | |
| Federal onshore | 20,135 | 44,771 | 64,906 |
| Federal offshore | 2,009 | 5,685 | 7,694 |
| Indian | 3,772 | 140 | 3,912 |
| Total | 25,916 | 50,596 | 76,512 |

Adapted from: MMS (1998:29, Table 17).

Table A4. Disposition of Materials Tracked by the BLM Through Exclusive Sales, Non-Exclusive Sales, and Free-Use Permits, FY 1996.

| Administrative Region | Method of Disposition | Number | Quantity (cubic yards) | Value (\$) |
|--|-----------------------|------------|--------------------------|----------------|
| Arizona | Sales | | | |
| | Exclusive | 124 | 365,524 | 518,340 |
| | Non-Excl. | 2 | 54 | 32 |
| | Free-Use | 8 | 19,061 | 15,829 |
| | Total | 134 | 384,639 | 534,201 |
| California | Sales | | | |
| | Exclusive | 72 | 59,189 | 37,640 |
| | Non-Excl. | 35 | 85,432 | 30,708 |
| | Free-Use | 15 | 28,044 | 25,672 |
| | Total | 122 | 172,665 | 94,020 |
| Colorado | Sales | | | |
| | Exclusive | 26 | 206,578 | 159,724 |
| | Non-Excl. | 79 | 609 | 2,467 |
| | Free-Use | 28 | 372,532 | 263,698 |
| | Total | 133 | 579,719 | 425,889 |
| Idaho | Sales | | | |
| | Exclusive | 24 | 62,930 | 29,946 |
| | Non-Excl. | 416 | 38,452 | 14,602 |
| | Free-Use | 111 | 538,944 | 197,546 |
| | Total | 551 | 640,326 | 242,094 |
| Montana, North Dakota, and South Dakota | Sales | | | |
| | Exclusive | 5 | 145,009 | 58,008 |
| | Non-Excl. | | no recorded dispositions | |
| | Free-Use | | no recorded dispositions | |
| | Total | 5 | 145,009 | 58,008 |

Table A4 continued

| Administrative Region | Method of Disposition | Number | Quantity (cubic yards) | Value (\$) |
|--|-----------------------|--------|------------------------|------------|
| Nevada | Sales | | | |
| | Exclusive | 119 | 1,504,922 | 1,242,303 |
| | Non-Excl. | 416 | 1,143,094 | 870,167 |
| | Free-Use | 49 | 1,328,847 | 689,689 |
| | Total | 584 | 3,976,863 | 2,802,159 |
| New Mexico, Oklahoma, Texas, and Kansas | Sales | | | |
| | Exclusive | 239 | 310,490 | 119,934 |
| | Non-Excl. | 469 | 112,185 | 156,805 |
| | Free-Use | 218 | 195,816 | 235,907 |
| | Total | 926 | 618,491 | 512,646 |
| Oregon and Washington | Sales | | | |
| | Exclusive | 18 | 2,642 | 2,793 |
| | Non-Excl. | 44 | 10,129 | 14,363 |
| | Free-Use | 57 | 354,689 | 166,110 |
| | Total | 119 | 367,460 | 183,266 |
| Utah | Sales | | | |
| | Exclusive | 43 | 85,976 | 61,069 |
| | Non-Excl. | 503 | 228,770 | 126,037 |
| | Free-Use | 52 | 501,217 | 267,539 |
| | Total | 598 | 815,963 | 454,645 |
| Wyoming and Nebraska | Sales | | | |
| | Exclusive | 117 | 1,073,307 | 439,598 |
| | Non-Excl. | 104 | 55,322 | 44,632 |
| | Free-Use | 39 | 63,695 | 58,517 |
| | Total | 260 | 1,192,324 | 542,747 |

Table A4 continued

| Administrative Region | Method of Disposition | Number | Quantity (cubic yards) | Value (\$) |
|-----------------------|-----------------------|--------------|------------------------|------------------|
| TOTALS | Sales | | | |
| | Exclusive | 787 | 3,816,567 | 2,669,355 |
| | Non-Excl. | 2,068 | 1,674,047 | 1,259,813 |
| | Free-Use | 577 | 3,402,845 | 1,920,507 |
| | | 3,432 | 8,893,459 | 5,849,675 |

Adapted from: BLM (1996a:93-98, Table 3-17). Based on aggregated statistics for sand, stone, gravel, pumice, clay, calcium, gemstone, and soil.

Table A5. Leasing Revenues by Source and Land Category, FY 1997.

| Revenue Source | Offshore Leasing (\$) | Onshore Leasing (\$) | Indian Land Leasing (\$) | Totals (\$) |
|----------------------|-----------------------|----------------------|--------------------------|----------------------|
| Royalties | | | | |
| Coal | -- | 309,316,832 | 68,706,598 | 378,023,430 |
| Gas | 2,045,301,890 | 447,147,740 | 76,025,322 | 2,568,474,952 |
| Oil | 1,345,077,333 | 222,156,568 | 52,220,194 | 1,619,454,095 |
| Other | 96,881,592 | 94,382,979 | 8,506,184 | 199,770,755 |
| Sub-Total | 3,487,260,815 | 1,073,004,119 | 205,458,298 | 4,765,723,232 |
| Other Sources | | | | |
| Bonuses | 1,179,101,394 | 115,846,125 | -- | 1,294,947,510 |
| Rents | 140,980,011 | 36,625,385 | 950,020 | 178,555,416 |
| Misc. | 15,094,863 | 22,617,263 | 1,837,276 | 39,549,402 |
| Sub-Total | 1,335,176,268 | 175,088,773 | 2,787,296 | 1,513,052,337 |
| TOTALS | 4,822,437,083 | 1,248,092,892 | 208,245,594 | 6,278,775,569 |

Adapted from: MMS (1998:11, Table 8).

Table A6. Disbursement of Leasing Revenues Collected by the MMS and BLM, FY 1982 to FY 1997.

Revenues in Thousands of Dollars

| | Historic Preservation Fund | Land & Water Conservation Fund | Reclamation Fund | Indian Tribes & Allottees | State Share: Offshore | State Share: Onshore | U.S. Treasury | TOTALS |
|------|----------------------------------|--------------------------------------|---------------------|---------------------------------|-----------------------------|----------------------------|------------------|------------|
| 1982 | 150,000 | 825,950 | 435,688 | 203,000 | -- | 609,660 | 5,476,020 | 7,700,318 |
| 1983 | 150,000 | 814,693 | 391,891 | 169,600 | -- | 454,359 | 9,582,227 | 11,562,770 |
| 1984 | 150,000 | 789,421 | 414,868 | 163,932 | -- | 542,646 | 5,848,044 | 7,908,911 |
| 1985 | 150,000 | 784,279 | 415,688 | 160,479 | -- | 548,937 | 4,744,317 | 6,803,700 |
| 1986 | 150,000 | 755,224 | 339,624 | 122,865 | 966,186 | 424,446 | 4,983,055 | 7,741,400 |
| 1987 | 150,000 | 823,576 | 265,294 | 100,499 | 613,083 | 337,030 | 4,030,979 | 6,360,461 |
| 1988 | 150,000 | 859,761 | 317,505 | 125,351 | 370,065 | 397,558 | 2,627,721 | 4,847,961 |
| 1989 | 150,000 | 862,761 | 337,865 | 121,954 | 46,850 | 433,422 | 2,006,837 | 3,959,689 |
| 1990 | 150,000 | 843,765 | 353,708 | 141,086 | 49,023 | 452,184 | 2,102,576 | 4,092,342 |
| 1991 | 150,000 | 885,000 | 368,474 | 164,310 | 43,683 | 480,524 | 2,291,085 | 4,383,076 |
| 1992 | 150,000 | 887,926 | 328,081 | 170,378 | 68,392 | 432,474 | 1,624,864 | 3,662,115 |
| 1993 | 150,000 | 900,000 | 366,593 | 164,385 | 77,467 | 466,250 | 1,945,730 | 4,070,425 |
| 1994 | 150,000 | 862,208 | 410,751 | 172,132 | 83,327 | 523,183 | 2,141,755 | 4,343,356 |
| 1995 | 150,000 | 896,987 | 367,284 | 153,319 | 75,468 | 477,544 | 1,541,048 | 3,661,650 |
| 1996 | 150,000 | 896,906 | 350,264 | 145,791 | 89,871 | 457,754 | 2,866,509 | 4,957,095 |
| 1997 | 150,000 | 896,979 | 442,834 | 196,462 | 116,132 | 569,422 | 3,867,865 | 6,239,694 |

Adapted from: MMS (1998:9, Table 7).

Table A7. Disbursement of Leasing Revenues Collected by the MMS and BLM to States, FY 1997.

Revenue in Thousands of Dollars

| State | Offshore (OCS) | Onshore | TOTAL |
|---------------|----------------|----------------|----------------|
| Alabama | 13,438 | 599 | 14,037 |
| Alaska | 17,331 | 5,515 | 22,846 |
| Arizona | --- | 69 | 69 |
| Arkansas | --- | 1,000 | 1,000 |
| California | 32,596 | 20,336 | 52,932 |
| Colorado | --- | 37,424 | 37,424 |
| Florida | 12 | 4 | 16 |
| Idaho | --- | 2,211 | 2,211 |
| Illinois | --- | 68 | 68 |
| Kansas | --- | 1,329 | 1,329 |
| Kentucky | --- | 123 | 123 |
| Louisiana | 26,631 | 817 | 27,448 |
| Michigan | --- | 712 | 712 |
| Minnesota | --- | 13 | 13 |
| Mississippi | 723 | 952 | 1,675 |
| Missouri | --- | 1,273 | 1,273 |
| Montana | --- | 20,379 | 20,379 |
| Nebraska | --- | 16 | 16 |
| Nevada | --- | 5,707 | 5,707 |
| New Mexico | --- | 188,840 | 188,840 |
| North Dakota | --- | 3,894 | 3,894 |
| Ohio | --- | 153 | 153 |
| Oklahoma | --- | 2,144 | 2,144 |
| Oregon | --- | 45 | 45 |
| Pennsylvania | --- | 21 | 21 |
| South Dakota | --- | 566 | 566 |
| Texas | 25,401 | 637 | 26,038 |
| Utah | --- | 34,317 | 34,317 |
| Virginia | --- | 85 | 85 |
| Washington | --- | 818 | 818 |
| West Virginia | --- | 327 | 327 |
| Wisconsin | --- | 1 | 1 |
| Wyoming | --- | 239,027 | 239,027 |
| TOTAL | 116,132 | 569,422 | 685,554 |

Adapted from: MMS (1998:3-5, Tables 3 and 5). States receiving less than \$500 in revenues have been omitted from the table.

Table A8. Grazing on Lands Management by the Forest Service, FY 1996.

| | Number of Permittees | Cattle | | Horses and Burros | | Sheep and Goats | | TOTALS | |
|----------------------|----------------------|-----------|-----------|-------------------|--------|-----------------|---------|-----------|-----------|
| | | Number | AUMs | Number | AUMs | Number | AUMs | Number | AUMs |
| Permitted to Graze | | 1,260,265 | 7,921,868 | 9,867 | 56,056 | 958,929 | 837,800 | 2,229,061 | 8,815,724 |
| Authorized to Graze | | | | | | | | | |
| Paid Permits | 8,526 | 1,157,939 | 6,803,617 | 9,342 | 51,638 | 859,195 | 689,829 | 2,026,476 | 7,545,084 |
| Free Use | 58 | 2,479 | 6,835 | 521 | 6,412 | 2,350 | 120 | 5,350 | 13,367 |
| Crossing | 4 | 505 | 266 | 103 | 6 | 5,985 | 424 | 6,593 | 696 |
| Authorized Sub-Total | 8,588 | 1,160,923 | 6,810,718 | 9,966 | 58,056 | 867,530 | 690,373 | 2,038,419 | 7,559,147 |
| Private Land Permits | 132 | 49,382 | 300,514 | 469 | 4,303 | 7,521 | 9,361 | 57,372 | 314,178 |
| Wild Horses | | | | 2,279 | 26,373 | | | | 26,373 |
| Wild Burros | | | | 353 | 4,271 | | | | 4,271 |

Adapted from: Forest Service (1997:117, Table 31).

Table A9. Grazing on Lands Managed by the BLM, FY 1996.

| Administrative State | Section 3 Lands | | Section 15 Lands | |
|----------------------|-------------------|-------------------|-------------------|------------------|
| | Number of Permits | AUMs | Number of Permits | AUMs |
| Arizona | 438 | 529,794 | 375 | 165,447 |
| California | 263 | 278,766 | 405 | 145,806 |
| Colorado | 1,191 | 634,204 | 482 | 47,365 |
| Idaho | 1,592 | 1,323,055 | 504 | 34,568 |
| Montana | 2,712 | 1,152,060 | 1,652 | 243,258 |
| Nevada | 697 | 2,235,942 | 14 | 49,416 |
| New Mexico | 1,529 | 1,647,806 | 807 | 225,114 |
| Oregon | 755 | 982,087 | 967 | 101,711 |
| Utah | 1,648 | 1,280,656 | 0 | 0 |
| Wyoming | 1,075 | 1,543,996 | 1,689 | 465,284 |
| Totals | 11,900 | 11,608,366 | 6,895 | 1,477,969 |

Adapted from: BLM (1996a:64-65, Table 3-7 and 3-8). Note that this data is by *administrative state*, rather than by *geographic state*. While the two regions are typically quite similar, notable exceptions exist. For example, California BLM administers some lands within Nevada, thus the California *administrative state* contains some lands that are actually within Nevada.

Table A10. Condition of Selected BLM Rangelands, 1989.

| State | Condition of the Rangeland | | | |
|--|----------------------------|------------|------------|------------|
| | Excellent | Good | Fair | Poor |
| Arizona | | | | |
| Acreage | 420,389 | 2,796,953 | 5,897,584 | 3,042,604 |
| Percent | 3.5 | 23.0 | 48.5 | 25.0 |
| California | | | | |
| Acreage | 16,019 | 3,158,497 | 4,000,261 | 985,835 |
| Percent | 0.2 | 38.7 | 49.0 | 12.1 |
| Colorado | | | | |
| Acreage | 45,920 | 1,030,703 | 2,804,116 | 2,191,381 |
| Percent | 0.8 | 17.0 | 46.2 | 36.1 |
| Idaho | | | | |
| Acreage | 112,092 | 2,145,732 | 3,232,698 | 4,399,914 |
| Percent | 1.1 | 21.7 | 32.7 | 44.5 |
| Montana | | | | |
| Acreage | 524,915 | 4,439,515 | 1,807,578 | 62,828 |
| Percent | 7.7 | 65.0 | 26.4 | 0.9 |
| Nevada | | | | |
| Acreage | 427,394 | 7,991,322 | 14,535,726 | 16,694,219 |
| Percent | 1.1 | 20.1 | 36.7 | 42.1 |
| New Mexico | | | | |
| Acreage | 107,263 | 3,734,248 | 7,035,195 | 2,893,325 |
| Percent | 0.8 | 27.1 | 51.1 | 21.0 |
| Oregon and Washington | | | | |
| Acreage | 89,546 | 3,305,339 | 6,484,445 | 2,164,398 |
| Percent | 0.7 | 27.4 | 53.8 | 18.0 |
| Utah | | | | |
| Acreage | 934,525 | 6,219,557 | 8,746,961 | 2,907,324 |
| Percent | 5.0 | 33.1 | 46.5 | 15.5 |
| Wyoming | | | | |
| Acreage | 708,769 | 5,533,304 | 3,615,038 | 1,170,463 |
| Percent | 6.4 | 50.2 | 32.8 | 10.6 |
| TOTALS: | | | | |
| Acreage | 3,386,832 | 40,355,170 | 58,159,602 | 36,512,219 |
| Percent | 2.4 | 29.2 | 42.0 | 26.4 |
| • Total acreage included in this review: 138,413,895 | | | | |

Adapted from: NWF and NRDC (1989:5-6, Tables 1 and 2).

Table A11. Status of Riparian-Wetland Areas on Western BLM Lands, FY 1996.

| Administrative State | Properly Functioning | Functional but at-risk | Non-Functional | Unknown Status |
|------------------------------|----------------------|------------------------|----------------|----------------|
| Alaska | | | | |
| Riparian Miles | 131,483 | 32 | 818 | 8,357 |
| Wetland Acres | 12,565,000 | 102,000 | 650 | 2,938,000 |
| Arizona | | | | |
| Riparian Miles | 287 | 393 | 42 | 78 |
| Wetland Acres | 123 | 18,038 | 3,027 | 838 |
| California | | | | |
| Riparian Miles | 1,543 | 1,270 | 47 | 140 |
| Wetland Acres | 52,186 | 7,922 | 50 | 2,235 |
| Colorado | | | | |
| Riparian Miles | 1,481 | 1,309 | 753 | 774 |
| Wetland Acres | 20,568 | 1,003 | 300 | 745 |
| Idaho | | | | |
| Riparian Miles | 749 | 910 | 342 | 1,915 |
| Wetland Acres | 1,011 | 1,243 | 214 | 10,857 |
| Montana | | | | |
| Riparian Miles | 1,978 | 1,965 | 652 | 154 |
| Wetland Acres | 153 | 324 | 758 | 61,279 |
| Nevada | | | | |
| Riparian Miles | 332 | 476 | 570 | 974 |
| Wetland Acres | 4,192 | 491 | 4,090 | 25,750 |
| New Mexico | | | | |
| Riparian Miles | 135 | 153 | 140 | 12 |
| Wetland Acres | 111 | 0 | 0 | 4,510 |
| Oregon and Washington | | | | |
| Riparian Miles | 2,977 | 3,402 | 850 | 1,275 |
| Wetland Acres | 9,072 | 5,040 | 1,008 | 236,880 |
| Utah | | | | |
| Riparian Miles | 1,442 | 1,415 | 627 | 1,418 |
| Wetland Acres | 8,750 | 3,661 | 558 | 6,052 |
| Wyoming | | | | |
| Riparian Miles | 1,137 | 2,917 | 958 | 1,903 |
| Wetland Acres | 5,660 | 4,652 | 223 | 9,926 |
| TOTALS: | | | | |
| Riparian Miles | 143,544 | 14,242 | 5,799 | 17,000 |
| Wetland Acres | 12,666,826 | 144,374 | 10,878 | 3,297,072 |

Adapted from: BLM (1996a:34, Table 2-2).

Table A12. Grazing Revenues on the Federal Public Lands, FY 1996.

| Geographic State | Bureau of Land Management | | | Forest Service (all land areas) | |
|--------------------------|---------------------------|------------------|----------------|---|------------------|
| | Section 3 | Section 15 | Other | | |
| Arizona | \$ 527,224 | \$ 171,706 | | | |
| California | 211,911 | 146,333 | | | |
| Colorado | 601,608 | 63,743 | | | |
| Idaho | 1,685,754 | 41,424 | | | |
| Montana | 1,056,939 | 223,732 | \$ 548,112 | <i>Forest Service data is not provided on a state-by-state basis; cumulative total provided below</i> | |
| Nebraska | | 822 | | | |
| Nevada | 2,149,902 | 23,217 | | | |
| New Mexico | 1,675,183 | 283,654 | 30,723 | | |
| North Dakota | | 16,512 | | | |
| Oklahoma | | 146 | | | |
| Oregon | 1,144,576 | 55,019 | 14,205 | | |
| South Dakota | | 152,296 | | | |
| Utah | 1,268,099 | | | | |
| Washington | | 43,525 | | | |
| Wyoming | 1,637,460 | 714,896 | | | |
| All States Totals | 11,958,656 | 1,937,025 | 593,040 | | 7,352,000 |

GRAND TOTAL: \$21,840,721

Adapted from: BLM (1996a:106, Table 3-23) and Forest Service (1997:150, Table 58).

Table A13. Formula for the Calculation of Federal Grazing Fees.

$$\text{Calculated Fee (CF)} = \$1.23 * \frac{(\text{FVI} + \text{BCPI} - \text{PPI})}{100}$$

FVI = Forage Value Index. This is an index of private grazing land lease rates (PGLLR) for eleven states.

BCPI = Beef Cattle Price Index. This is an index of U.S. Department of Agriculture prices of beef cattle over 500 pounds.

PPI = Prices Paid Index. This is an index of prices that livestock producers must pay for selected production input items.

Taken from the Public Range Improvement Act of 1978 (43 U.S. C. § 1905). The use of this formula was extended indefinitely by order of President Reagan in 1986 (Executive Order No. 12,548, 3 C.F.R. 188) (Olinger, 1998).

Table A14. National Timber Harvest and Inventory Statistics by Ownership Category.

| Ownership | 1970 | 1991 | Projections | |
|------------------------|---------|---------|-------------|---------|
| | | | 2000 | 2020 |
| National Forest | | | | |
| Softwoods | | | | |
| Timber Harvests | 1,918 | 1,789 | 1,011 | 1,070 |
| Other Removals | 2,082 | 1,681 | 934 | 986 |
| Net Annual Growth | 2,367 | 2,747 | 2,779 | 3,061 |
| Inventory | 211,927 | 185,574 | 191,645 | 230,036 |
| Hardwoods | | | | |
| Timber Harvests | 123 | 299 | 281 | 305 |
| Other Removals | 146 | 186 | 184 | 200 |
| Net Annual Growth | 573 | 544 | 532 | 491 |
| Inventory | 19,721 | 25,641 | 28,860 | 35,352 |
| Other Public | | | | |
| Softwoods | | | | |
| Timber Harvests | 702 | 769 | 890 | 953 |
| Other Removals | 750 | 616 | 705 | 741 |
| Net Annual Growth | 1,113 | 1,130 | 1,099 | 1,214 |
| Inventory | 57,521 | 50,002 | 54,088 | 62,450 |
| Hardwoods | | | | |
| Timber Harvests | 170 | 309 | 310 | 312 |
| Other Removals | 199 | 326 | 234 | 236 |
| Net Annual Growth | 749 | 834 | 788 | 754 |
| Inventory | 23,894 | 32,857 | 37,623 | 48,292 |
| Forest Industry | | | | |
| Softwoods | | | | |
| Timber Harvests | 2,758 | 3,936 | 3,823 | 4,918 |
| Other Removals | 2,898 | 3,942 | 3,621 | 4,715 |
| Net Annual Growth | 2,523 | 3,063 | 3,867 | 5,400 |
| Inventory | 69,494 | 66,142 | 61,500 | 82,957 |
| Hardwoods | | | | |
| Timber Harvests | 487 | 1,120 | 1,156 | 1,037 |
| Other Removals | 567 | 1,211 | 976 | 783 |
| Net Annual Growth | 1,068 | 1,098 | 1,086 | 921 |
| Inventory | 29,281 | 34,773 | 34,117 | 33,226 |

Table A14 continued

| Ownership | 1970 | 1991 | Projections | |
|-------------------------------|---------|---------|-------------|---------|
| | | | 2000 | 2020 |
| Other Private Holdings | | | | |
| Softwoods | | | | |
| Timber Harvests | 3,317 | 4,238 | 5,336 | 5,645 |
| Other Removals | 3,457 | 4,678 | 5,477 | 5,538 |
| Net Annual Growth | 5,337 | 5,033 | 5,335 | 5,743 |
| Inventory | 121,345 | 148,175 | 145,486 | 148,692 |
| Hardwoods | | | | |
| Timber Harvests | 2,625 | 5,252 | 6,706 | 8,234 |
| Other Removals | 3,926 | 3,595 | 5,420 | 6,719 |
| Net Annual Growth | 6,088 | 7,174 | 7,043 | 6,331 |
| Inventory | 168,474 | 242,177 | 251,073 | 251,614 |
| TOTALS: United States | | | | |
| Softwoods | | | | |
| Timber Harvests | 8,695 | 10,731 | 11,060 | 12,585 |
| Other Removals | 9,187 | 10,917 | 10,738 | 11,979 |
| Net Annual Growth | 11,339 | 11,973 | 13,080 | 15,418 |
| Inventory | 460,287 | 449,893 | 452,719 | 524,136 |
| Hardwoods | | | | |
| Timber Harvests | 3,405 | 6,979 | 8,453 | 9,888 |
| Other Removals | 4,208 | 5,318 | 6,814 | 7,938 |
| Net Annual Growth | 8,478 | 9,650 | 9,449 | 8,497 |
| Inventory | 241,370 | 335,448 | 351,674 | 368,484 |

Adapted from Haynes et al. (1995:44, Table 34). The category of "other removals" can include a variety of factors other than timber harvests that result in extracted timber, including non-commercial thinnings, fire, disease, and conversion of forestlands to other uses or classifications.

Table A15. Softwood Timber Harvest and Inventory Statistics for the National Forests.

| Region | 1970 | 1991 | Projections | |
|---|--------|--------|-------------|--------|
| | | | 2000 | 2020 |
| Northeast | | | | |
| Timber Harvests | 3 | 7 | 6 | 7 |
| Other Removals | 3 | 5 | 4 | 5 |
| Net Growth | 16 | 17 | 17 | 21 |
| Inventory | 637 | 723 | 772 | 1,036 |
| Northcentral | | | | |
| Timber Harvests | 34 | 56 | 45 | 49 |
| Other Removals | 28 | 48 | 35 | 36 |
| Net Growth | 75 | 84 | 116 | 125 |
| Inventory | 2,170 | 3,216 | 3,689 | 5,327 |
| Southeast | | | | |
| Timber Harvests | 33 | 54 | 44 | 47 |
| Other Removals | 35 | 59 | 48 | 51 |
| Net Growth | 129 | 50 | 50 | 64 |
| Inventory | 2,705 | 2,826 | 2,511 | 2,632 |
| Southcentral | | | | |
| Timber Harvests | 147 | 163 | 126 | 133 |
| Other Removals | 156 | 169 | 131 | 138 |
| Net Growth | 314 | 174 | 174 | 197 |
| Inventory | 4,952 | 6,013 | 5,844 | 6,783 |
| Rocky Mountains (including the Great Plains) | | | | |
| Timber Harvests | 480 | 425 | 334 | 374 |
| Other Removals | 524 | 389 | 292 | 331 |
| Net Growth | 905 | 1,285 | 1,285 | 1,406 |
| Inventory | 63,825 | 71,657 | 78,402 | 99,274 |
| Pacific Southwest | | | | |
| Timber Harvests | 346 | 336 | 98 | 100 |
| Other Removals | 378 | 314 | 91 | 92 |
| Net Growth | 338 | 463 | 463 | 498 |
| Inventory | 28,694 | 31,448 | 33,957 | 41,541 |

Table A15 continued

| Region | 1970 | 1991 | Projections | |
|--|---------|---------|-------------|---------|
| | | | 2000 | 2020 |
| Pacific Northwest: Douglas-fir subregion | | | | |
| Timber Harvests | 489 | 297 | 108 | 108 |
| Other Removals | 530 | 266 | 96 | 95 |
| Net Growth | 240 | 320 | 320 | 320 |
| Inventory | 45,478 | 33,621 | 33,894 | 38,255 |
| Pacific Northwest: Ponderosa Pine subregion | | | | |
| Timber Harvests | 286 | 352 | 152 | 152 |
| Other Removals | 314 | 330 | 142 | 141 |
| Net Growth | 329 | 269 | 269 | 269 |
| Inventory | 25,911 | 17,338 | 16,472 | 18,849 |
| Alaska | | | | |
| Timber Harvests | 100 | 99 | 99 | 99 |
| Other Removals | 114 | 99 | 95 | 97 |
| Net Growth | 20 | 85 | 85 | 160 |
| Inventory | 37,555 | 18,733 | 16,104 | 16,340 |
| TOTALS: United States | | | | |
| Timber Harvests | 1,918 | 1,789 | 1,011 | 1,070 |
| Other Removals | 2,082 | 1,681 | 934 | 986 |
| Net Growth | 2,367 | 2,747 | 2,779 | 3,061 |
| Inventory | 211,927 | 185,574 | 191,645 | 230,036 |

Adapted from Haynes et al. (1995:18, Table 9). The category of "other removals" can include a variety of factors other than timber harvests that result in extracted timber, including non-commercial thinnings, fire, disease, and conversion of forestlands to other uses or classifications.

Table A16. Hardwood Timber Harvest and Inventory Statistics for the National Forests.

| Region | 1970 | 1991 | Projections | |
|---------------------|-------|-------|-------------|-------|
| | | | 2000 | 2020 |
| Northeast | | | | |
| Timber Harvest | 15 | 42 | 40 | 44 |
| Other Removals | 19 | 22 | 22 | 25 |
| Net Growth | 105 | 88 | 86 | 36 |
| Inventory | 3,007 | 3,711 | 4,303 | 4,646 |
| Northcentral | | | | |
| Timber Harvest | 40 | 95 | 121 | 133 |
| Other Removals | 47 | 61 | 76 | 85 |
| Net Growth | 140 | 123 | 114 | 86 |
| Inventory | 3,994 | 5,228 | 5,783 | 6,280 |
| Southeast | | | | |
| Timber Harvest | 17 | 11 | 11 | 12 |
| Other Removals | 26 | 13 | 13 | 14 |
| Net Growth | 122 | 114 | 112 | 146 |
| Inventory | 3,511 | 5,565 | 6,480 | 9,181 |
| Southcentral | | | | |
| Timber Harvest | 32 | 37 | 30 | 32 |
| Other Removals | 36 | 36 | 32 | 33 |
| Net Growth | 122 | 147 | 149 | 151 |
| Inventory | 3,947 | 4,959 | 5,957 | 8,324 |
| West | | | | |
| Timber Harvest | 19 | 114 | 79 | 84 |
| Other Removals | 19 | 54 | 41 | 44 |
| Net Growth | 85 | 71 | 71 | 71 |
| Inventory | 5,262 | 6,178 | 6,338 | 6,920 |

Table A16 continued

| Region | 1970 | 1991 | Projections | |
|------------------------------------|--------|--------|-------------|--------|
| | | | 2000 | 2020 |
| <u>TOTAL: United States</u> | | | | |
| Timber Harvest | 123 | 299 | 281 | 305 |
| Other Removals | 146 | 186 | 184 | 200 |
| Net Growth | 573 | 544 | 532 | 491 |
| Inventory | 19,721 | 25,641 | 28,860 | 35,352 |

Adapted from Haynes et al. (1995:20, Table 10). The category of "other removals" can include a variety of factors other than timber harvests that result in extracted timber, including non-commercial thinnings, fire, disease, and conversion of forestlands to other uses or classifications.

Table A17. Timber Sales, Receipts, and Disbursements on the National Forest System, FY 1996.

| State | Volume of Timber Harvested (thousand board feet, MBF) | Total Receipts from Timber Sales (\$) | Payments to States from all National Forest Receipts (\$) |
|----------------|---|---------------------------------------|---|
| Alabama | 65,027 | 8,046,913 | 2,049,878 |
| Alaska | 123,473 | 14,469,296 | 5,905,520 |
| Arizona | 31,507 | 2,276,540 | 1,631,749 |
| Arkansas | 176,959 | 23,867,251 | 6,648,382 |
| California | 536,757 | 80,470,247 | 36,157,526 |
| Colorado | 83,169 | 7,907,991 | 5,955,614 |
| Florida | 35,830 | 3,329,576 | 1,066,316 |
| Georgia | 40,006 | 3,100,884 | 907,779 |
| Idaho | 351,632 | 61,901,697 | 17,457,712 |
| Illinois | 1,168 | 41,206 | 27,727 |
| Indiana | 180 | 13,710 | 7,411 |
| Kentucky | 19,754 | 1,500,315 | 494,032 |
| Louisiana | 72,379 | 9,607,440 | 2,735,547 |
| Maine | 2,073 | 85,013 | 34,774 |
| Michigan | 176,937 | 8,725,884 | 2,384,196 |
| Minnesota | 156,991 | 6,357,432 | 3,179,462 |
| Mississippi | 210,252 | 29,414,158 | 8,276,154 |
| Missouri | 48,227 | 4,478,647 | 1,231,668 |
| Montana | 198,623 | 31,580,130 | 9,383,236 |
| Nebraska | 6 | 60 | 30,563 |
| Nevada | 14,092 | 417,423 | 298,540 |
| New Hampshire | 16,451 | 775,042 | 510,233 |
| New Mexico | 14,787 | 398,244 | 652,646 |
| New York | 189 | 18,609 | 6,375 |
| North Carolina | 30,550 | 1,824,041 | 692,309 |
| North Dakota | 45 | 450 | 82 |
| Ohio | 145 | 7,249 | 11,400 |
| Oklahoma | 21,208 | 3,633,684 | 883,416 |
| Oregon | 546,066 | 140,619,413 | 95,238,953 |
| Pennsylvania | 59,641 | 23,016,156 | 6,207,364 |

Table A17 continued

| State | Volume of Timber Harvested (thousand board feet, MBF) | Total Receipts from Timber Sales (\$) | Payments to States from all National Forest Receipts (\$) |
|----------------|---|---------------------------------------|---|
| South Carolina | 37,292 | 4,157,306 | 960,281 |
| South Dakota | 45,006 | 8,207,279 | 2,349,598 |
| Tennessee | 11,552 | 792,070 | 319,485 |
| Texas | 88,959 | 16,045,259 | 4,337,309 |
| Utah | 44,420 | 4,014,218 | 1,831,245 |
| Vermont | 5,412 | 622,945 | 256,961 |
| Virginia | 36,274 | 2,998,446 | 822,089 |
| Washington | 229,667 | 23,916,399 | 29,429,026 |
| West Virginia | 29,620 | 5,804,606 | 1,860,935 |
| Wisconsin | 125,522 | 5,672,227 | 1,621,386 |
| Wyoming | 36,704 | 4,233,558 | 1,844,049 |
| TOTALS | 3,724,552 | 544,349,011 | 255,698,928 |

Adapted from: Forest Service (1997:112 and 125, Tables 26 and 37). Over two-thirds of all Forest Service receipts are from timber activities.

Table A18. BLM Forest Product Sales, FY 1996.

| Admin. State | Sales (\$) | | Totals |
|-----------------|-----------------------------|-------------------------------|-------------------|
| | Timber and Wood Products | Non-Timber Forest Products | |
| Arizona | 44,799 | 2,010 | 46,809 |
| California | 1,320,963 | 1,935 | 1,322,898 |
| Colorado | 88,647 | 37,067 | 125,714 |
| Idaho | 467,426 | 338 | 467,764 |
| Montana | 577,489 | 12,551 | 590,040 |
| New Mexico | 6,621 | 4,310 | 10,931 |
| Nevada | 42,330 | 64,928 | 107,258 |
| Oregon | | | |
| Eastern | 1,350,259 | 7,968 | 1,358,227 |
| Western | 71,093,986 | 76,011 | 71,169,997 |
| Utah | 29,624 | 14,504 | 44,128 |
| Wyoming | 104,835 | 6,220 | 111,055 |
| Totals | 75,126,980 | 227,841 | 75,354,821 |

Adapted from: BLM (1996a:66, Table 3-9). The category of "non-timber forest products" includes items such as Christmas trees, mushrooms, cactus, seeds, nuts, bark, and related materials. The O&C lands are in the western Oregon administrative region. Some numbers do not add correctly due to rounding.

Table A19. Stumpage Prices in the United States in Constant (1982) Dollars.

| Region and Product | 1970 | 1991 | Projections | |
|--|------|------|-------------|------|
| | | | 2000 | 2020 |
| Softwoods-Sawtimber | | | | |
| <i>Price per thousand board feet, Scribner log rule</i> | | | | |
| North | 54 | 49 | 82 | 160 |
| South | 120 | 121 | 234 | 285 |
| Rocky Mountains | | | | |
| North | 41 | 55 | 182 | 221 |
| South | 32 | 55 | 92 | 116 |
| Pacific Northwest (w/o Alaska) | | | | |
| Douglas fir subregion | 105 | 254 | 248 | 302 |
| Ponderosa Pine subregion | 60 | 125 | 203 | 234 |
| Pacific Southwest (w/o Hawaii) | | | | |
| | 66 | 134 | 208 | 247 |
| Hardwoods-Sawtimber | | | | |
| <i>Price per thousand board feet, international 1/4" scale</i> | | | | |
| North | 76 | 94 | 121 | 131 |
| South | 45 | 40 | 65 | 95 |
| Delivered Pulpwood | | | | |
| <i>Price per cubic feet</i> | | | | |
| Softwoods | | | | |
| North | | 0.95 | 1.06 | 1.25 |
| South | | 0.84 | 0.70 | 0.66 |
| West | | 1.01 | 0.94 | 0.79 |
| Hardwoods | | | | |
| North | | 0.77 | 0.66 | 0.74 |
| South | | 0.69 | 0.61 | 0.87 |
| West | | 1.10 | 1.02 | 0.86 |

Adapted from: Haynes et al. (1995:36, Table 26).

Table A20. Historical Summary of Water Use in the United States as a Function of Population, 1950 to 1980.

| | Estimated water use in billion gallons per day | | | |
|----------------------------------|--|------------|------------|------------|
| | 1950 | 1960 | 1970 | 1980 |
| Population (in millions) | 151 | 179 | 206 | 230 |
| Withdrawals | | | | |
| Public Supply | 14 | 21 | 27 | 34 |
| Rural Domestic and Livestock | 4 | 4 | 5 | 6 |
| Irrigation | 89 | 110 | 130 | 150 |
| Thermoelectric Power | 40 | 100 | 170 | 210 |
| Other Industrial Uses | 37 | 38 | 47 | 45 |
| TOTAL: Withdrawals | 180 | 270 | 370 | 450 |
| Sources of Withdrawals | | | | |
| Surface Water (fresh and saline) | 150 | 222 | 304 | 362 |
| Groundwater (fresh and saline) | 34 | 50 | 69 | 89 |
| Total Freshwater Consumption | unknown | 61 | 87 | 100 |
| Instream Use for Hydropower | 1,100 | 2,000 | 2,800 | 3,300 |

Adapted from: Solley et al. (1988:124, Table 10-4). Some numbers do not add correctly due to rounding and due to different assumptions and data sources. All values are estimates for the 50 states with the following modifications: the 1950 data does not include water use estimates for Alaska and Hawaii; the 1970 data also includes Puerto Rico; the 1980 data also include Puerto Rico and the Virgin Islands. Consumptive use data for 1960 includes some saline consumption.

Table A21. Water Usage in the Western United States by Region, 1990.

| Region | Population (thousands) | Ground Water | Surface Water | Total Withdrawals | Reclaimed | | Conveyance Losses | Consumptive Use |
|--------------------|---------------------------|-----------------|------------------|----------------------|----------------|---------------|----------------------|--------------------|
| | | | | | Waste Water | Water | | |
| Souris-Red-Rainy | 388 | 86 | 58 | 144 | 0 | 0 | 0 | 82 |
| Missouri Basin | 7,050 | 9,140 | 27,600 | 36,700 | 3 | 10,100 | 10,100 | 13,300 |
| Arkansas-Red-White | 5,850 | 7,460 | 6,180 | 13,600 | 12 | 842 | 842 | 7,990 |
| Texas-Gulf | 15,226 | 6,140 | 8,990 | 15,100 | 57 | 383 | 383 | 6,630 |
| Rio Grande | 2,229 | 2,400 | 4,320 | 6,720 | 1 | 1,200 | 1,200 | 3,880 |
| Upper Colorado | 625 | 142 | 7,790 | 7,930 | 1 | 1,800 | 1,800 | 2,780 |
| Lower Colorado | 4,747 | 3,450 | 5,230 | 8,680 | 208 | 1,210 | 1,210 | 5,610 |
| Great Basin | 2,182 | 2,210 | 5,860 | 8,070 | 58 | 1,530 | 1,530 | 3,860 |
| Pacific Northwest | 8,912 | 11,000 | 29,700 | 40,700 | 14 | 10,800 | 10,800 | 13,600 |
| California | 29,442 | 16,200 | 23,500 | 39,700 | 144 | 1,960 | 1,960 | 23,300 |
| Alaska | 550 | 71 | 248 | 319 | 0 | 0 | 0 | 29 |
| Hawaii | 1,108 | 660 | 673 | 1,330 | 7 | 143 | 143 | 703 |
| TOTAL | 78,309 | 58,900 | 120,000 | 179,000 | 553 | 30,000 | 30,000 | 81,700 |

Adapted from: Solley (1997:4, Table 2). Some figures do not add due to rounding.

Table A22. Projected Differences in Hydropower Rates and Resulting Revenue Streams Between the WAPA (Western Area Power Administration) Rate Structure and Market Rates.

All Rates are Projected in mills/kWh

| WAPA Sub-Region | year: | 2000 | 2005 | 2010 | 2015 |
|--|-------|------------------|------|------|------|
| Pick-Sloan / Upper Great Plains | | | | | |
| WAPA's Rates | | 14.5 | 15.5 | 18.0 | 19.7 |
| Market Rates | | 31.2 | 34.4 | 38.0 | 42.0 |
| Net Present Value of Difference Over a 20 Year Period (1998-2018) | | \$1.708 billion | | | |
| Sierra Nevada | | | | | |
| WAPA's Rates | | 19.6 | 20.8 | 22.0 | 23.3 |
| Market Rates | | 33.8 | 37.3 | 41.2 | 45.5 |
| Net Present Value of Difference Over a 20 Year Period (1998-2018) | | \$ 1.278 billion | | | |
| Salt Lake City Area / Integrated Projects | | | | | |
| WAPA's Rates | | 20.2 | 20.9 | 22.1 | 23.3 |
| Market Rates | | 31.2 | 34.5 | 38.1 | 42.0 |
| Net Present Value of Difference Over a 20 Year Period (1998-2018) | | \$ 0.952 billion | | | |
| Loveland/Rocky Mountain | | | | | |
| WAPA's Rates | | 24.5 | 27.5 | 30.0 | 31.7 |
| Market Rates | | 28.6 | 31.6 | 34.9 | 38.5 |
| Net Present Value of Difference Over a 20 Year Period (1998-2018) | | \$ 0.086 billion | | | |

Table A22 continued

All Rates are Projected in mills/kWh

| WAPA Sub-Region | year: | 2000 | 2005 | 2010 | 2015 |
|--|-------|------|------|------|------------------|
| Desert Southwest | | | | | |
| WAPA's Rates | | 11.6 | 12.2 | 12.9 | 13.7 |
| Market Rates | | 31.2 | 34.5 | 38.1 | 42.0 |
| Net Present Value of Difference Over a 20 Year Period (1998-2018) | | | | | \$ 1.748 billion |
| REGIONAL TOTAL | | | | | |
| Net Present Value of Difference Over a 20 Year Period (1998-2018) | | | | | \$ 5.739 billion |

Adapted from: Driver (1997:14, Table 4). Values are for long-term, firm power.

Table A23. Summary of Economic Value Estimates for Water by Use and Location in Constant (1994) Dollars.

| Water Use Classification | Dollars per acre-foot | | | | Estimates Used (n) |
|-------------------------------|-----------------------|--------|---------|---------|--------------------|
| | Average | Median | Minimum | Maximum | |
| Instream | | | | | |
| Waste Disposal | 3 | 1 | 0 | 12 | 23 |
| Recreation & Habitat | 48 | 5 | 0 | 2,642 | 211 |
| Navigation | 146 | 10 | 0 | 483 | 7 |
| Hydropower | 25 | 21 | 1 | 113 | 57 |
| Eastern U.S. (all uses) | 16 | 4 | 0 | 483 | 89 |
| Western U.S. (all uses) | 56 | 8 | 0 | 2,642 | 203 |
| Withdrawal (offstream) | | | | | |
| Irrigation | 75 | 40 | 0 | 1,228 | 177 |
| Industrial Processing | 282 | 132 | 28 | 802 | 7 |
| Thermoelectric Power | 34 | 29 | 9 | 63 | 6 |
| Domestic | 194 | 97 | 37 | 573 | 6 |
| Eastern U.S. (all uses) | 29 | 19 | 0 | 198 | 17 |
| Western U.S. (all uses) | 80 | 42 | 0 | 1,228 | 167 |

Adapted from: Frederick et al. (1996:9, Tables 3.1 and 3.2). Please consult the source material for a full discussion of methodological assumptions.

Table A24. Summary of Economic Value Estimates (in Constant 1994 Dollars) for Water in Recreation and Fish and Wildlife Habitat Uses.

| Water Use Classification | Dollars per acre-foot | | | | Estimates Used (n) |
|--------------------------|-----------------------|--------|---------|---------|--------------------|
| | Average | Median | Minimum | Maximum | |
| By Type of Use | | | | | |
| Fishing | 34 | 5 | 0 | 2,642 | 158 |
| Wildlife Refuges | 24 | 6 | 1 | 404 | 44 |
| Fishing & Whitewater | 1,042 | 1,505 | 6 | 1,615 | 3 |
| Whitewater | 9 | 9 | 5 | 12 | 4 |
| Shoreline Recreation | 19 | 19 | 17 | 21 | 2 |
| By Region | | | | | |
| New England | 4 | | 0 | 12 | 6 |
| Mid-Atlantic | 6 | | 3 | 9 | 7 |
| S. Atlantic-Gulf | 3 | | 1 | 7 | 9 |
| Great Lakes | 9 | | 1 | 42 | 8 |
| Ohio | 3 | | 0 | 8 | 14 |
| Tennessee | 2 | | 1 | 4 | 4 |
| Upper MI | 4 | | 0 | 12 | 10 |
| Lower MI | 0 | | 0 | 0 | 5 |
| Souris-Red-Rainy | 3 | | 3 | 3 | 1 |
| Missouri | 14 | | 0 | 95 | 29 |
| AK-Red-White | 21 | | 0 | 187 | 12 |
| Texas-Gulf | 8 | | 3 | 15 | 5 |
| Rio Grande | 313 | | 6 | 1,615 | 12 |
| Upper CO | 51 | | 5 | 70 | 8 |
| Lower CO | 597 | | 62 | 2,642 | 5 |
| Great Basin | 60 | | 0 | 461 | 9 |
| Pacific NW | 1 | | 0 | 3 | 13 |
| California | 27 | | 0 | 404 | 48 |
| unspecified | 19 | | 12 | 32 | 6 |

Adapted from: Frederick et al. (1996:22, Tables 4.2 and 4.3). Please consult the source material for a full discussion of methodological assumptions.

Table A25. Recreational Visits in the National Forest System, FY 1996.

| State or Territory with a National Forest Recreation Program | Recreational Visits (thousands) | |
|--|---------------------------------|---------|
| | Visitor Days | Visits |
| Alabama | 689 | 1,406 |
| Alaska | 6,962 | 17,181 |
| Arizona | 35,000 | 72,044 |
| Arkansas | 2,210 | 5,909 |
| California | 71,165 | 195,880 |
| Colorado | 30,971 | 60,488 |
| Florida | 2,960 | 8,878 |
| Georgia | 2,925 | 8,332 |
| Idaho | 15,365 | 23,201 |
| Illinois | 1,188 | 1,034 |
| Indiana | 684 | 525 |
| Kansas | 86 | 184 |
| Kentucky | 2,326 | 5,670 |
| Louisiana | 599 | 1,748 |
| Maine | 158 | 1,000 |
| Michigan | 4,866 | 9,997 |
| Minnesota | 5,982 | 12,833 |
| Mississippi | 1,828 | 3,827 |
| Missouri | 2,518 | 7,299 |
| Montana | 13,495 | 31,836 |
| Nebraska | 320 | 528 |
| Nevada | 3,857 | 21,423 |
| New Hampshire | 3,354 | 5,500 |
| New Mexico | 9,326 | 12,644 |
| New York | 39 | 19 |
| North Carolina | 6,979 | 20,935 |
| North Dakota | 133 | 387 |
| Ohio | 524 | 900 |
| Oklahoma | 393 | 1,868 |
| Oregon | 37,029 | 97,466 |

Table A25 continued

| State or Territory with a National Forest Recreation Program | Recreational Visits (thousands) | |
|--|---------------------------------|----------------|
| | Visitor Days | Visits |
| Pennsylvania | 3,268 | 13,837 |
| Puerto Rico | 171 | 630 |
| South Carolina | 1,011 | 2,532 |
| South Dakota | 3,571 | 6,173 |
| Tennessee | 3,309 | 9,911 |
| Texas | 2,302 | 3,712 |
| Utah | 19,378 | 44,105 |
| Vermont | 1,395 | 2,699 |
| Virginia | 4,927 | 18,755 |
| Washington | 24,797 | 97,456 |
| West Virginia | 1,499 | 4,284 |
| Wisconsin | 2,527 | 9,981 |
| Wyoming | 2,527 | 9,981 |
| TOTALS | 341,200 | 859,283 |

Adapted from: Forest Service (1997:72-73, Table 11). A visitor day is 12 hours of visitation. Visits is a measure of entries into the system for a recreational purpose. Visitor days and visits are not directly related in that only the visitor day calculation includes a time component. Colorado data is for 1995; Oregon and Washington data is for 1994. Totals may not add correctly due to rounding.

Table A26. Recreational Visits to National Park Service Lands, FY 1995.

| State | Visits | State | Visits |
|----------------------|------------|----------------|------------|
| Alabama | 1,321,155 | Montana | 4,140,670 |
| Alaska | 1,803,311 | Nebraska | 498,221 |
| Arizona | 10,436,195 | Nevada | 9,926,532 |
| Arkansas | 2,560,569 | New Mexico | 2,250,766 |
| California | 35,439,030 | New York | 14,711,981 |
| Colorado | 5,837,918 | New Jersey | 5,207,911 |
| Connecticut | 10,519 | New Hampshire | 34,773 |
| District of Columbia | 15,473,708 | North Dakota | 178,730 |
| Florida | 8,055,531 | North Carolina | 18,585,983 |
| Georgia | 6,505,296 | Ohio | 3,427,831 |
| Guam | 125,806 | Oklahoma | 1,686,136 |
| Hawaii | 4,674,892 | Oregon | 921,539 |
| Idaho | 576,903 | Pennsylvania | 9,061,277 |
| Illinois | 428,202 | Puerto Rico | 1,350,829 |
| Indiana | 1,963,225 | Rhode Island | 38,318 |
| Iowa | 317,049 | South Carolina | 828,982 |
| Kansas | 97,869 | South Dakota | 3,723,474 |
| Kentucky | 3,581,518 | Tennessee | 7,999,757 |
| Louisiana | 943,504 | Texas | 5,801,610 |
| Maine | 2,845,378 | Utah | 8,998,204 |
| Maryland | 3,502,027 | Virgin Islands | 711,540 |
| Massachusetts | 9,736,410 | Virginia | 22,832,257 |
| Michigan | 1,638,114 | Washington | 7,610,952 |
| Minnesota | 620,018 | West Virginia | 1,924,684 |
| Mississippi | 6,747,478 | Wisconsin | 397,172 |
| Missouri | 5,011,765 | Wyoming | 6,460,791 |

Total Visits: 269,564,310
Total Visitor Days: 110,204,000

Adapted from: NPS (1995:3, Tables 2 and 3). States not listed do not have National Park Service recreational facilities.

Table A27. Recreational Visits to Lands Managed by the Bureau of Land Management, FY 1996.

| Type of Activity | Number of Participants (thousands) | Visitor Days (thousands) |
|----------------------|---------------------------------------|-----------------------------|
| Adventure sports | 1,231 | 642 |
| Camping | 12,753 | 28,709 |
| Driving for pleasure | 12,419 | 4,111 |
| Eco/Cultural tourism | 21,955 | 4,702 |
| Hunting and Fishing | 15,695 | 10,620 |
| Other | 11,382 | 3,155 |
| Picnicking | 5,296 | 999 |
| Trail Activities | 28,133 | 13,474 |
| Water Sports | 12,974 | 5,633 |
| Winter Sports | 1,773 | 748 |

Adapted from: BLM (1996a:123, Table 4-1).

Table A28. Status and Population Trends (as of 1994) of Listed Species Based on the Time Since They Were Listed.

| Year Listed | Species That Are Stable or Improving | Species That Are Declining | Species with Uncertain Population Trends |
|-------------|--------------------------------------|----------------------------|--|
| 1968 - 1973 | 58% | 30% | 12% |
| 1974 - 1978 | 42% | 41% | 17% |
| 1979 - 1983 | 44% | 27% | 29% |
| 1984 - 1988 | 45% | 39% | 16% |
| 1989 - 1993 | 22% | 34% | 44% |

Adapted from: FWS (1994:12, Table 1). Approximately 1 percent (7 species) listed between 1968 and 1993 have been officially recognized as extinct and consequently delisted.

Table A29. Recovery Programs Funded by Congressional Directives, FY 1993-1994.

| Specific Recovery Program Directives | Appropriations (\$) | |
|---|---------------------|-------------------|
| | 1993 | 1994 |
| Kirtland's warbler | 77,000 | 100,000 |
| Grizzly bear | 450,000 | 200,000 |
| Peregrine falcon | 377,000 | 400,000 |
| California condor | 848,000 | 600,000 |
| Sea turtles | 265,000 | 300,000 |
| Southern sea otter | 339,000 | 300,000 |
| Hawaiian birds | 681,000 | 500,000 |
| Rocky Mountain wolf | 805,000 | 600,000 |
| Whooping crane | 340,000 | 400,000 |
| Black-footed ferret | 280,000 | 300,000 |
| Florida panther | 74,000 | 100,000 |
| West Indian manatee | 435,000 | 500,000 |
| Aluetian Canada goose | 395,000 | 400,000 |
| Northern spotted owl | 2,685,000 | 2,000,000 |
| Desert tortoise | 286,000 | 300,000 |
| Red wolf | 665,000 | 600,000 |
| Upper Colorado River fishes | 624,000 | 624,000 |
| Piping plover | 296,000 | 100,000 |
| San Juan | 147,000 | 200,000 |
| Mexican grey wolf | 154,000 | 400,000 |
| Pacific Islands | 297,000 | 300,000 |
| Puerto Rican parrot | 680,000 | --- |
| Cui-ui | 144,000 | --- |
| Bruneau hot springsnail | 132,000 | --- |
| Hawaiian species | 297,000 | --- |
| Central Valley | 91,000 | --- |
| Southeast fishes | 30,000 | --- |
| Steller's/Spectacled eider | --- | 218,000 |
| Freshwater molluscs | --- | 450,000 |
| Mexican spotted owl | --- | 350,000 |
| Edward's aquifer | --- | 150,000 |
| Total of Directives | 11,894,000 | 10,392,000 |
| Total Spending for all Recovery Activities | 20,065,000 | 29,550,000 |

Adapted from: FWS (1994:29, Table 3).

Table 30. Some Sources of Federal Natural Resource Subsidies, by Activity.

| Subsidy Mechanism | Mineral Extraction | | | Other Activities | | | | |
|--|--------------------|----------|---------|------------------|------------|---------|------------|--------|
| | Hardrock | Leasable | Salable | Irrigation | Hydropower | Grazing | Recreation | Timber |
| Free use of resources and direct payments to operators | X | | | X | | | | |
| Royalty forgiveness schemes and artificially low royalty rates | | X | | | | | | |
| Sale or lease of property, resources, or services at below market prices | X | X | X | X | X | X | X | X |
| Favorable treatment for operators under the tax code | X | X | X | | | | | X |
| Prices that yield insufficient revenue to cover program costs | X | | ? | X | X | X | ? | X |
| Site-specific benefits for certain operators | ? | X | | X | X | | X | X |
| Failure to inspect and enforce existing regulations | ? | X | X | X | | X | X | X |
| Exemptions from environmental statutes | X | X | X | X | | | | |

Table A30 continued

| Subsidy Mechanism | Mineral Extraction | | | Other Activities | | | | |
|---|--------------------|----------|---------|------------------|------------|---------|------------|--------|
| | Hardrock | Leasable | Salable | Irrigation | Hydropower | Grazing | Recreation | Timber |
| Federally funded research and development | X | X | | X | | ? | ? | X |
| Additional subsidies from other agencies | X | X | X | X | X | X | | |

Adapted from: House Report (1994:11).

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