

Assessing

**THE
FULL
COST**



of the

**FEDERAL
GRAZING
PROGRAM**

**KARYN MOSKOWITZ, MBA
CHUCK ROMANIELLO, MS AG. ECON.**

prepared for
the Center for Biological Diversity
Tucson, Arizona
in collaboration with American Lands, Western
Watersheds Project, Oregon Natural Desert
Association, Forest Guardians, Committee for
Idaho's High Desert and the National Public
Lands Grazing Campaign
October 2002

ASSESSING THE FULL COST OF THE FEDERAL GRAZING PROGRAM

KARYN MOSKOWITZ MBA

CHUCK ROMANIELLO, MS AG. ECON.

Prepared for

the Center for Biological Diversity

in collaboration with American Lands, Western Watersheds Project,
Oregon Natural Desert Association, Forest Guardians, Committee for
Idaho's High Desert and the National Public Lands Grazing Campaign

October 2002

ABOUT THE AUTHORS

Karyn Moskowitz received her MBA in Environmental Management from the University of Washington Graduate School of Business in Seattle in 1994. She is presently Executive Director of the Resource Stewardship Council, a nonprofit organization promoting quality education linking economics and the environment. She is presently a Rockefeller Fellow at the Appalachian Center of the University of Kentucky in Lexington.

Chuck Romaniello received his MS in Agricultural Economics from the University of Arizona in 1979. He has worked as an economist for the Bureau of Land Management since 1981. He currently serves in the Colorado State office of the BLM. He has co-authored this report as a private citizen and not as a representative of the BLM.

TABLE OF CONTENTS

Executive Summary	1
Introduction.....	3
Public Lands Ranching.....	5
History	5
The public range	6
Grazing fee income.....	9
History of the fee.....	9
Distribution of fee income	10
Grazing Direct Costs.....	13
Forest Service Direct Costs	13
BLM direct costs.....	14
Direct costs: both agencies	14
Indirect costs.....	17
Conclusion.....	19
Appendix A: Indirect BLM and Forest Service costs	21
Appendix B: Indirect costs: other federal agencies.....	24
Appendix C: Non-federal indirect costs.....	28
Literature Cited	33

EXECUTIVE SUMMARY

Several efforts have been made to estimate the full costs of the federal livestock grazing program. This study examines budget records and other relevant data to derive a minimum estimate of \$128 million for the full, annual cost to the U.S. Treasury of grazing on lands administered by the Bureau of Land Management and the Forest Service in the western U.S.

Grazing fees charged by the BLM and Forest Service are limited by regulation to a fraction of market rates. Moreover, 50 percent of the fee revenue is retained by agencies to construct range developments, and approximately 15 percent goes to county governments. This leaves approximately 35 percent for the U.S. Treasury.

As a result the federal grazing program operates at a loss to the U.S. Treasury, a loss that can be calculated as the Congressional Appropriations for the program, less the fee receipts to the Treasury. The net direct loss of the BLM's range management program was over \$72 million in 2001. The loss for the Forest Service exceeded \$52 million in 2000.

However, these direct costs of range management and administration are likely a minor part of the full costs of the grazing program to the public. Many other programs, both within the two agencies and in other federal posts, either support ranching operations on public lands or are needed to compensate for resource damage caused by livestock. Such programs include Wildlife Services, in the Department of Agriculture, which kills wild animals to protect livestock, among other purposes. Public lands ranching accounted for about \$4 million of Wildlife Services' costs in 2000. Another example is the Fish and Wildlife Service in the Department of the Interior, which is responsible with identifying, protecting and recovering threatened and endangered species, many of which are imperiled as a result of habitat loss due to livestock grazing.

Federal agency accounting does not operate transparently, failing to apportion costs explicitly to grazing on public lands. Instead these costs are dispersed among a plethora of programs. Agencies also change budget organization, thus masking trends. Poor accounting practice makes it nearly impossible for anyone inside or outside the agency to estimate the full costs of the grazing program.

In addition to federal costs, state, county and local governments as well as private institutions and individuals also pay costs as a result of the federal grazing program such as water treatment, flood mitigation and State game and fish management.

Taking into account the many direct and indirect federal expenditures that benefit or compensate for impacts of livestock grazing on federal lands, the full cost of the federal grazing program to the U.S. Treasury is likely to approximate \$500 million annually. Considering the many other indirect costs borne by state and local government agencies, individuals and private institutions due to resource damage and impaired opportunities for recreation and other non-commercial land uses, the full cost to the U.S. public could approach \$1 billion annually.

INTRODUCTION

A number of federal land management agencies permit livestock grazing on federal public lands in the United States. A fee is usually charged for the privilege of using federal public lands for this purpose. The two agencies with the largest such programs are the Bureau of Land Management (BLM) in the Department of Interior, and the Forest Service (FS) in the Department of Agriculture, mostly on lands in the western U.S. All other federal agencies with a land base, including the National Park Service, Fish and Wildlife Service, Department of Defense and Bureau of Reclamation, permit some grazing on lands they administer. State Trust lands are the other major category of public lands that are permitted to livestock grazing. However, the focus of this paper is on federal public lands, and the use of the term “public lands” should be understood hereafter to apply only to federal lands.

It has long been known that the federal livestock grazing program is run at a significant loss. Grazing fees collected by the land management agencies cover only a fraction of the direct costs of the program.

This shortfall is covered by Congressional appropriations from U.S. Treasury funds. These costs can be termed “direct costs” because they are appropriated explicitly for the federal grazing program.

Several attempts have been made to estimate the presumably much larger indirect costs of the program to the public. Indirect costs to the public are those payments made by various entities either to support or subsidize ranching on public lands, or to compensate or mitigate for the ecological and other impacts of such activities. Indirect costs can be broken into federal and non-federal portions. Federal indirect costs include all the budget items of federal agencies that are not explicitly devoted to the public lands range management program, but which nonetheless actually support and subsidize, or compensate for damage caused by public lands ranching.

Rogers (1999) examined agency budgets and reported a net loss of \$94 million for the combined BLM and FS grazing program in 1998. To this he added an estimate of \$14 million for the indirect cost of the Animal Damage Control program, which kills wildlife to benefit public lands ranching, to arrive at a minimum estimate of \$108 million for the full cost of the program to the U.S. Treasury.

Hess and Wald (1995) estimated \$500 million per year for the annual net cost of the federal grazing program across all federal agencies. Another more recent estimate put this figure at \$460 million (The Economist 2002). However, neither of these reports gave detailed justification for these estimates.

Jacobs (1991) did a more detailed examination of agency expenditures and arrived at an estimate of \$200-\$250 million for direct and indirect costs of the combined FS and BLM grazing program using “an educated guess” that 25 percent of the BLM budget and 5-7 percent of the Forest Service budget directly or indirectly supports the range program (Jacobs 1991 p 389). Jacobs also summarized all the other indirect costs of public lands grazing borne by other federal, state and local agencies, and

gave an estimate of \$1 billion for the full cost of the program to taxpayers (Jacobs 1991 p.401).

None of the federal agencies account for indirect costs in a transparent manner that permits unambiguous estimation of the full costs of the grazing program. As a result, good quantitative estimates of these costs are generally not obtainable. However, the scale of these indirect costs to the Treasury can be assessed by listing the programs involved, and in a few cases by citing concrete examples where firm estimates of the indirect costs are possible.

Non-federal indirect costs include expenses borne by all the state and local government agencies, as well as non-government institutions or individuals as a result of ranching operations on federal public lands such as flood mitigation or lost recreation opportunities. As for federal indirect costs, obtaining quantitative estimates for such costs is not presently possible, as no explicit accounting is made for costs due to public lands ranching.

This paper reports current estimates of the direct costs to the U.S. Treasury of the federal grazing program of the Bureau of Land Management and the Forest Service. The many indirect costs of the federal grazing program are also presented and discussed in appendices.

PUBLIC LANDS RANCHING

HISTORY

In the 1890s, following several decades of unregulated livestock grazing, as well as timber extraction, mining and homesteading, in the western United States, most forested lands not already privatized were withdrawn from privatization under various land laws and designated as “forest reserves.” In 1905, control of these lands was assumed by the newly established Forest Service and the lands renamed “national forests.”

The Forest Service did not regulate grazing use initially, but rather helped create and enforce allotment boundaries. All forest grazing fee receipts were reserved for forest management. The Forest Service charged ranchers 6 cents per month for cattle and 2 cents per month for sheep. Over the following fifteen years, grazing receipts outweighed receipts from timber cutting and other resource extraction (O’Toole 1994a).

Outside the national forests, homesteading and unregulated grazing on public lands continued until passage of the Taylor Grazing Act of 1934, which directed the Secretary of the Interior “to stop injury to the public grazing lands by preventing overgrazing.” A newly established Division of Grazing (renamed the Grazing Service in 1939) delineated allotments, issued grazing permits and collected fees. Seventy-five percent of these fees, which initially consisted of 5 cents per month for each head of cattle, were directed to range improvements and other costs attributable to the grazing program, while the remaining 25 percent went to the Federal Treasury (O’Toole 1994a).

In 1946, the Grazing Service and General Land Office were merged to form the Bureau of Land Management (BLM). In 1976, the Federal Land Policy and Management Act (FLPMA) established a Range Betterment Fund into which half of all BLM grazing fees were to be directed for range developments. The concurrent National Forest Management Act (NFMA) of 1976 allowed the Forest Service to fund range improvements out of timber receipts.

The Public Rangelands Improvement Act (PRIA) of 1978 fixed grazing fees on both Forest Service and BLM lands in sixteen western states¹ according to a formula still used today.

¹ Arizona, California, Colorado, Idaho, Kansas, Montana, Nebraska, Nevada, New Mexico, North Dakota, Oklahoma, Oregon, South Dakota, Utah, Washington, and Wyoming (43 U.S.C. 1902 (i))

THE PUBLIC RANGE

Forty-eight percent of the eleven western states²— a landmass 361 million acres in area— is owned by the American people and managed by the federal government. Of this total, the Forest Service and the BLM together manage about 320 million acres, of which approximately 258 million acres or 81 percent, are grazed by privately owned livestock (O’Toole 1994a). There are approximately 23,600 public lands ranchers representing about 6 percent of all livestock producers west of the Mississippi River (Mathews *et al.* 2002).

Livestock grazing permits are issued on public lands on the basis of an annual fee paid per animal unit month (AUM), defined as the amount of forage required to sustain a cow and calf, or five sheep, for one month.

Other federal land management agencies also permit livestock grazing (O’Toole 1994a):

- The Fish and Wildlife Service permits livestock grazing on a number of wildlife refuges for \$5.50/AUM;
- The Bureau of Indian Affairs allows livestock use on Indian reservations, charging similar rates to those of nearby private landowners;
- The National Park Service, largely in response to Congressional mandates, allows grazing in several national parks;
- The Department of Defense allows grazing on some military bases and determines fees according to various mechanisms, including an assessment of fair market value.

In addition, large tracts of State Trust lands are leased for grazing in the western states, and many ranchers hold both federal and state grazing permits. States vary considerably in grazing management expenditures and methods of fee determination.

The remainder of this paper deals exclusively with grazing on Forest Service and BLM lands in the western United States, which constitute most of the public lands on which livestock are permitted.

Power (2002) estimates that public lands presently contribute four percent of all beef and cattle feed in the United States, including forage and feedgrains. Public lands ranching accounts for about 0.1 percent of western employment and income.

FOREST SERVICE LANDS

The Forest Service controls approximately 144 million acres in the western U.S. outside of Alaska. Ninety-one million of these acres (63 percent) are open to

² Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming.

livestock grazing. Most national forest lands are at higher elevations and are frequently used for summer pastures. Lower elevation lands which are more valuable for livestock in the winter months, passed quickly into private hands during the homesteading era. But many of those private ranches rely on the Forest Service lands for summer forage.

Grazing is administered primarily through issuance of ten year term permits for discrete grazing allotments. Ranchers must own adjacent ranch-land called “base property” to qualify for a grazing permit.

In addition to the national forests designated at the end of the nineteenth and the beginning of the twentieth centuries, the federal government recovered millions of acres of failed western homesteads during the Great Depression, under the authority of the Bankhead-Jones Farm Tenant Act of 1937. Many of these lands in California, Montana, New Mexico, and Texas were transferred to BLM management, while other large parcels came under Forest Service management as “national grasslands.” Fees for grazing on national grasslands are calculated similarly to, but at slightly higher rates, than the fees on other Forest Service and BLM lands. National grasslands cover about four million acres, less than three percent of Forest Service lands in the western states.

In eastern national forests, which account for a tiny portion of all Forest Service grazing, the fee is assessed by competitive bidding or market-based comparisons. Prices can run very close to those for private grazing land, with one bid going as high as \$25 per AUM in recent years (Herman 2002).

Most grazing capacity, measured as AUMs on Forest Service land, are located in the West, with the Rocky Mountain Region having the most capacity (Figure 1).

BUREAU OF LAND MANAGEMENT LANDS

Exclusive of Alaska, the BLM manages almost 179 million acres, 99 percent of which are in the eleven western states. Approximately 167 millions acres (93 percent) are authorized for livestock grazing.

The BLM manages three types of grazing lands: (1) Homesteads recovered under the Bankhead-Jones Act (see above); (2) lands in grazing districts, under which permits are issued similar to those of the Forest Service, and limited by the Taylor Grazing Act and subsequent amendments to 150 million acres; and (3) the remaining 17 million acres outside of grazing districts, for which leases are issued with fewer requirements than those included in permits.

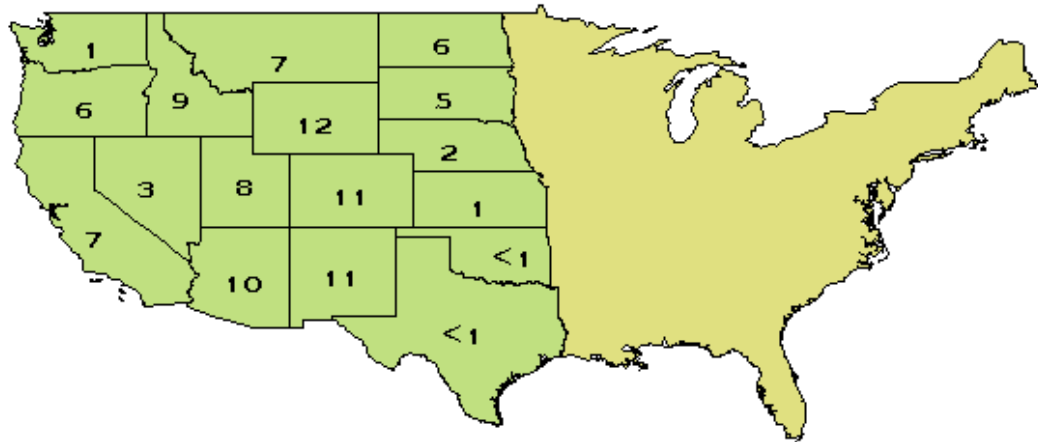


Figure 1. Forest Service grazing permitted in selected western states as percent of total AUMs (USDA Forest Service 2000).

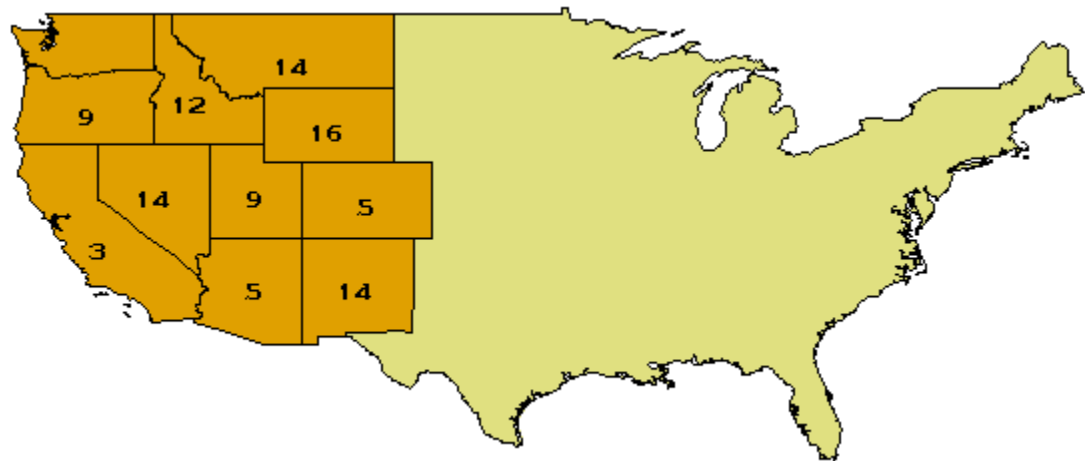


Figure 2. BLM grazing permitted in selected western states as percent of total AUMs (USDI Bureau of Land Management 2001).

GRAZING FEE INCOME

HISTORY OF THE FEE

Charging fees for grazing livestock has been Forest Service policy since 1906. The BLM, and its predecessor, the Grazing Service, has charged fees since 1939.

In the early 1900s, the Forest Service assessed fees by comparison with those of similar privately-owned range, so as to approximate fair market value. However, fees were later held constant for five years, thus inaugurating a *de facto* policy of deciding fees independently from private land grazing charges, which continued to rise (O'Toole 1994a).

Before World War II, Forest Service officials reasoned that they weren't in business to make money, but that they ought to recover costs to the taxpayers. Accordingly, they based fees not on market value but on the cost of providing the forage, which varied from forest to forest (O'Toole 1994a). Subsequent Forest Service regulations required that fees be set on the basis of an Office of Management and Budget circular of 1959, which directed that "fair market value" be obtained (36 C.F.R. §222.50 (b)).

In 1978, the Public Rangeland Improvements Act (PRIA) established a fee formula on an experimental basis for Forest Service and BLM grazing operations in the sixteen western states, with the objective to "prevent economic disruption and harm to the western livestock industry." The PRIA formula is based on the value of forage to ranchers rather than the cost to the taxpayer of providing the service. This was to be achieved by linking annual changes in the fee to "annual changes in the cost of production" (43 C.F.R. §4130.8-1).

In reality, the fee formula is flawed, as it deducts annual increases in rancher costs twice but adds in annual increases in beef prices-paid to ranchers only once (GAO 1991a, Torell *et al.* 2001). Consequently, the fee fails to track changes in market rates, and in recent years has barely risen above the regulatory minimum of \$1.35/AUM.

In 2002, the PRIA-derived grazing fee was set at \$1.43/AUM, while the average market rate in the sixteen western states was reported to be \$13.10/AUM. Market rates vary from a low of \$7.00/AUM in Arizona to a high of \$20.60 in Nebraska (National Agricultural Statistics Service 2002.)

Fair market value is the price that a willing buyer and a willing seller agree to, provided both know the value of the product. The PRIA formula approximates only what a willing buyer of public forage would pay, not how much a willing seller (i.e. the public) might demand. Since the agencies and Congress represent the sellers, one would expect them to incorporate all costs to the taxpayer into the formula in order to meet any reasonable definition of fair market value.

The late Congressman Mike Synar (OK) made efforts throughout the 1980s and early 1990s to increase the federal grazing fee toward fair market value,

commissioning General Accounting Office reports and initiating legislation in Congress.

In the early 1990s, the Clinton administration moved to reform the management of public rangelands through a wide-ranging revision of the fee formula as well as BLM administrative regulations, known as *Rangeland Reform '94* (USDI and USDA 1994). A new base rate for the years 1990-1992 of \$3.96/AUM was proposed with annual adjustments based solely on changes in a Forage Value Index and a cap of 25 percent change per year. This reform was predicted to greatly increase cost recovery for the U.S. Treasury. Revenues from the increase were projected to be \$76 million over five years, beginning with an increase of \$6 million in 1994, increasing to \$35 million in 1997. By comparison, actual receipts for 1992 were about \$10.7 million. Ultimately, the fee reform was never adopted, however.

Proponents of the current formula argue that public rangeland is not as high quality as private rangeland, thus accounting for the disparity in fees. However this argument neglects to account for the fact that on both private and public lands the fee is calculated per AUM rather than per acre. An AUM is the quantity of forage needed to sustain a cow and calf for one month. Lesser value forage requires a larger tract of land to sustain the animals for the same period of time. Thus, to a large extent, variation in forage quality is covered by basing fees on AUMs of use.

It has also been suggested that costs to run cattle on public lands are higher than costs on private lands. In fact, private ranchers spend up to \$40 more per head of cattle than public lands ranchers (USDI and USDA 1994).

Furthermore, ranchers who do not have public permits often sublease public lands (legally in some cases on BLM lands, but usually illegally) at market rates several times more than what the permittee pays. This indicates that public rangeland is comparable to private, unirrigated rangeland and is undervalued by the present fee formula (GAO 1986).

DISTRIBUTION OF FEE INCOME

Forest Service grazing fee income is divided as follows: 50 percent to the Range Betterment Fund which is used solely for construction of range developments such as fences, cattleguards, tanks, pumps and pipelines by local agencies; 25 percent to states and counties (some of which may also support ranching), and 25 percent to the U.S. Treasury.

By authority of the Taylor Grazing Act, approximately 90 percent of BLM grazing lands are administered by permits and 10 percent under less stringent leases. Bankhead-Jones lands are a negligible component and are not discussed further here. The U.S. Treasury receives nothing from leased land, and 37.5 percent from lands in grazing districts.

At present, approximately 21.6 million AUMs are permitted throughout the West. At present fee levels, the Forest Service and BLM collect approximately \$21 million in fee receipts, or 97 cents per permitted AUM, on an annual basis. Actual use is always less than permitted use, and fees are charged only on actual use. Currently

actual use is about 14.5 million AUMs or 67 percent of permitted grazing use for the period 2000-2001. From 1988-1997 actual use declined greatly and grazing fee receipts declined by a third or more, although numbers of permitted AUMs declined only slightly (Mathews *et al.* 2002).

If the average market rate of \$13.10/AUM were applied, as much as \$190 million could be available to agencies and to the Treasury from fee receipts, assuming the demand for forage remains at the same level, as the federal agencies concluded in *Rangeland Reform '94* (USDI & USDA 1994).

Table 1. Distribution of fee receipts by agency and land classification.

Type of land	Area of land	Payments to Counties	Range Betterment Funds	U.S. Treasury
Forest Service	16 western states (excl TX)	25 %	50 %	25 %
BLM Section 3 (permits)	90 % of BLM land	12.5 %	50 %	37.5 %
BLM Section 15 (leases)	10 % of BLM land	50 %	50 %	0 %
BLM Bankhead- Jones	<1 % of BLM land	25 %	50 %	25 %

GRAZING DIRECT COSTS

FOREST SERVICE DIRECT COSTS

In 2000, Congress appropriated \$54.3 million for the Forest Service range management program. The Forest Service collected \$6.4 million in grazing fees from approximately 7,500 permittees. Half of the grazing fee is kept by the agencies for the “Range Betterment Fund,” and half of the remainder is given to states or counties *in lieu* of property taxes. This means that the U.S. Treasury received just \$1.6 million from permittees, for a net loss of \$52.7 million to the taxpayer (Table 2).

The Forest Service receives funds from Congress for range management in two major categories: range grazing and range vegetation. Range grazing includes the salaries, travel, office, clerical assistance and other like costs of administering the grazing program.

Within the category of range vegetation, there are six different line items: Range vegetation, which includes planting, restoration, planning, and protection; weed control, management of wild horses and burros, National Environmental Policy Act (NEPA) implementation and analysis, maintaining the allotment database, and Hazmat, which includes cleanup of chemicals used to control noxious weeds. Range improvements such as fencing and water developments are funded not only via Congressional appropriations, but also from the Range Betterment Fund, which is directly funded by fee receipts.

In 2001, the Forest Service changed its budgeting categories. Some of the range management costs previously (and more transparently) listed under “range management” were moved to a new “watershed and vegetative management” line item, the scope of which is much broader than that associated with the livestock management program. This has made it more difficult to break out costs in the same way as in previous years, and difficult to track trends in budgeting from year to year. However, total Forest Service range management costs for 2001 are thought to be similar to the costs in 2000 (Herman 2002).

As noted, half of all Forest Service fee receipts, comprising approximately \$3.2 million per year, are dedicated to range developments through the Range Betterment Fund. Range Betterment Funds also receive money directly from Appropriations. Much of these expenditures, particularly in brush, seeding and pest control, mitigates damage caused by livestock (Fig. 2). Increasingly, such funds are directed at reducing conflicts between livestock and other uses of the range, through such means as fencing to protect wildlife habitats and fragile archeological sites.

Two examples of expenditures of this type are (Wolff 1999):

- In 1995, the Coconino National Forest, Arizona spent more than \$600,000 on a livestock management plan for the Apache Maid grazing allotment. The expense was primarily for fencing to keep cattle out of sensitive riparian areas.

- In 1995, on the Six Bar Allotment in the Tonto National Forest, Arizona, the Forest Service spent \$98,000 on range developments also to protect sensitive habitat from 250 cattle.

BLM DIRECT COSTS

The Congressional appropriation for the BLM range management budget was \$77.3 million in 2001. Income from grazing fees to the U.S. Treasury was approximately \$4.5 million, leaving a net deficit for the Treasury of \$72.8 million. Unlike the Forest Service budget, the BLM range management budget is disclosed by the agency as a single line item without division into range vegetation or other sub-programs (Table 3).

DIRECT COSTS: BOTH AGENCIES

The total direct cost of the combined Forest Service and BLM grazing program is at least \$124 million annually. This estimate is mixed across the years 2000-2001. The deficit to the U.S. Treasury in 2001 for the BLM was nearly \$73 million. The 2000 estimate of \$52.7 million for the Forest Service is used because allocations were more transparently revealed in that year than in 2001.

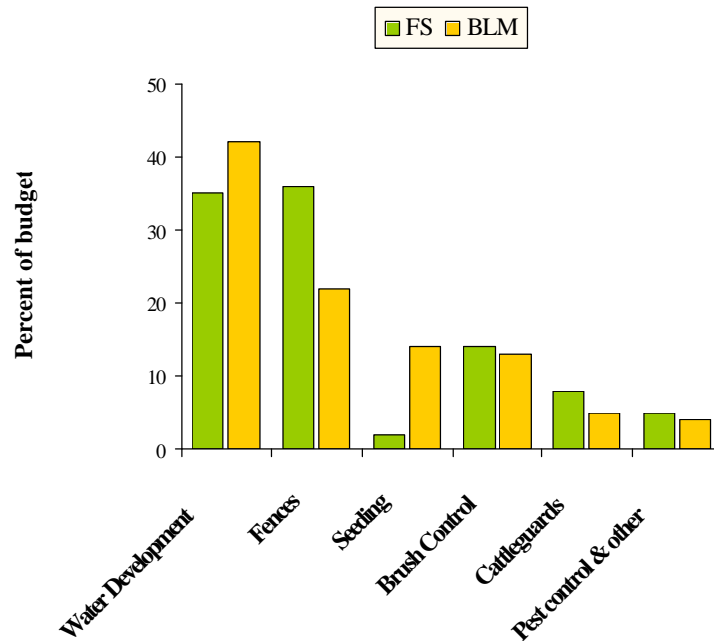


Figure 2. Breakdown of expenditures from Range Betterment Funds for Forest Service and BLM (O'Toole 1994a)

Table 2. FY 2000 Forest Service range program expenditures and receipts (USDA Forest Service 2002a).

RECEIPTS	\$thousands
Total fee receipts	\$6,403
National Forests	\$5,786
National Grasslands	\$617
- Payment to Counties (25 percent)	-\$1,601
- Payment into Range Betterment Fund (50 percent)	-\$3,202
Net fee receipts to Treasury	\$1,601
<hr/>	
EXPENDITURES	
Rangeland Management	\$26,399
Total Watershed and Vegetative Management	\$22,942
Vegetative Management	\$10,242
Weed Control	\$4,700
NEPA implementation	\$8,000
Infrastructure Allocations	\$0.250
Administrative overheads	\$4,985
Total Congressional appropriations	\$54,327
- Net fee receipts to Treasury	\$1,601
Net deficit to the U.S. Treasury of direct costs of range program	\$52,726

Table 3. FY 2001 BLM range program expenditures and receipts (USDI BLM 2002a).

RECEIPTS	\$thousands
Total fee receipts	\$13,197
- Payment to Counties (16.25 percent)	-\$2,145
- Payment into Range Betterment Fund (50 percent)	-\$6,599
Net fee receipts to Treasury	\$4,453
<hr/>	
EXPENDITURES	
Congressional appropriations- Rangeland Management	\$77,298
- Net estimated fee receipts to Treasury	\$4,453
Net deficit to the U.S. Treasury of direct costs of range program	\$72,845

INDIRECT COSTS

The direct, budgeted costs are not the only costs of the federal grazing program. The Forest Service and Bureau of Land Management administer many projects not budgeted under range management that nevertheless benefit public lands ranching operations, or that compensate for the impact of those operations on public resources.

The defining test for whether such costs can be attributed to the federal grazing program is if they would still be expended at the same level in the absence of the federal grazing. In many cases, such as fencing around a back-country archeological site, it is clear that they would not. In other cases such as fire control, the connection is less clear.

The full cost of the Forest Service and BLM grazing program are difficult to determine with any accuracy, but are likely to be much higher than just the expenses within those two agencies as enumerated above. The agencies likely spends far more on grazing indirectly through other programs than through range management budgets alone. However, it is difficult to ascertain exactly how much is spent each year out of these other budget line items, since the apportionment to public lands ranching is not made explicit in agency accounting. These costs are listed and discussed briefly in Appendix A. Using the “educated guesses” of Jacobs (1991) these indirect costs could be as high as \$280 million a year (Appendix A).

Expenditures by many other federal agencies also either benefit public lands ranching, or compensate for the resource damage done by public lands ranching. However, these programs are never targeted solely at ranching on public lands. Thus it is difficult to determine what portion of the budgets for the relevant programs of these agencies are attributable to livestock grazing on federal lands alone, as opposed to livestock production on private or state lands. Furthermore, when estimating the costs of compensating for the impacts of public lands ranching, it is often difficult to determine the proportion of damage done by livestock as opposed to other causes, such as off road vehicles, logging or natural events such as drought.

These programs are listed and discussed briefly in Appendix B. The only program for which a somewhat firm estimate is available is the predator control program of Wildlife Services. This estimate is \$4 million for FY 2000 (Appendix B). Rogers (1999) reported this figure as \$14 million in 1998.

The full cost of the federal grazing program to the U.S. public goes beyond just the appropriations from the U.S. Treasury either directly to range management program, or indirectly through the many federal programs that support the federal grazing program or compensate for the damage caused. Livestock grazing on federal public lands also imposes costs on state and local agencies, as well as private agencies and individuals.

These costs take two main forms. The first type is a cost-paid, when money is paid out for a specific public good or service such as construction of a flood control

project, part of which may be necessitated by the watershed degradation caused by livestock. This type of cost appears in government, institutional or individual budgets. The second type of cost is an opportunity cost; that is, the lost opportunity of realizing the full value of a resource such as water quality, due to the degrading effects of livestock grazing on that resource. To some extent these costs may be “mirror-images.” For example, the opportunity cost of degraded water may appear as a cost-paid in construction of a water treatment plant.

Costs may also be divided into tangible and intangible. Tangible costs are easily expressed in monetary terms, such as state funding of game and fish management agencies. Intangible costs, such as the loss of an endangered species due to public lands grazing, are not readily expressed in monetary terms, although “willingness to pay” surveys have been used to arrive at monetary equivalents (Loomis and Ekstrand 1997). Grazing diminishes “ecosystem service” values such as wildlife habitat, pollinators, clean water and functional hydrologic systems, none of which are readily expressed in budgets, and which have both tangible and intangible elements.

Such costs are usually “externalized”, or paid unwittingly by communities that would otherwise benefit from the goods and services that flow from unimpaired forests, grasslands, deserts and rivers (Talberth and Moskowitz 1999).

By regulation, public agencies must account for all benefits and costs of their land management decisions, including such externalized costs (Office of Management and Budget, Circular A-94). Costs and benefits must be evaluated from the perspective of society as a whole, and not simply be limited to costs and benefits to the public agency involved or the beneficiaries of public programs (Talberth *et al.* 2002). However, agencies routinely follow the narrowest scope of analysis, focusing on monetary benefits to permittees and limiting consideration of costs to range developments.

The federal agencies could use readily-available methods to determine some of the costs of damage to public rangelands from livestock grazing. Certain indirect costs-paid can be used as a proxy for estimating externalized, intangible, ecological and social costs. Costanza *et al.* (1997) for example, used the cost of irrigation, a technologically produced, artificial solution of water regulation, as a proxy for determining the value of an ecosystem’s water-regulating services.

In Appendix C, we identify and briefly discuss non-federal, indirect costs under the main categories of ecosystem services and other values lost or diminished due to public lands grazing. Quantitative estimation of these losses is presently not possible and is not attempted here. Although difficult to quantify, they are no less real.

CONCLUSION

Congressional appropriations for the federal grazing program were approximately \$132 million in 2000-2001. The minimum net cost to the federal taxpayer of the combined BLM and Forest Service grazing program is \$128 million annually, after subtracting fee receipts, for 2000-2001 and including the \$4 million estimate of the indirect cost of predator control by Wildlife Services in 2000. This figure represents an 18 percent increase since 1998, when the equivalent cost was estimated at \$108 million (Rogers 1999).

Hess and Wald (1995) estimated \$500 million per year for the full net cost to the Treasury of the federal grazing program including direct and indirect costs. Jacobs (1991) estimated that the full cost to taxpayers from all federal, state and local government programs approached \$1 billion annually. Considering the many federal and non-federal indirect costs and other intangible ecological and social costs, the full cost to the public of the federal grazing program is most likely to lie in the range of these earlier estimates of \$500 million to \$1 billion.

The public pays all these costs to support the commercial operations of approximately 23,600 permittees, which include some very large corporations whose primary business is not beef production (Rogers 1999, Mathews *et al.* 2002).

In 2000-2001 there were approximately 14.5 million AUMs of active use on BLM and Forest Service lands. The gross direct cost of the program is at least \$9/AUM annually, calculated at total appropriations divided by AUMs of active use. The full cost probably exceeds \$35/AUM, based on the \$500 million estimate of Hess and Wald (1995). Thus, the full cost of the program is likely to exceed the fees that could be collected by applying the average west-wide private market rate of \$13.10/AUM for rental of unirrigated rangeland, and certainly exceeds the current grazing fee of \$1.43/AUM.

Grazing fees on federal lands bring in less than \$6.5 million a year to the U.S. Treasury. Raising grazing fees to market rates could raise fee receipts from \$6.5 to approximately \$63 million, and could cover the direct costs of the grazing program. Raising the fees to intermediate levels, as proposed by the Departments of Interior and Agriculture in *Rangeland Reform 1994*, would also increase net revenues to the Treasury, and could be sufficient for the grazing program to break even, considering only direct costs. However, as shown above, even market-determined fees are unlikely to cover the full costs of the program, including both direct and indirect costs.

The values of non-consumptive recreation, biological diversity and other ecological services are rising relative to traditional consumptive uses of public lands (Mathews *et al.* 2002). Lost quality of life, reduced recreation values, diminished wildlife and game, degraded archeological resources, impaired watersheds and water quality, and flammable forests that result from livestock grazing all represent lost "opportunity costs" of the grazing program.

However, the BLM and Forest Service methods of accounting do not fully disclose the extent of all these losses and costs, contrary to regulatory requirements. The accounting methods used prevent estimation of the full costs of the federal grazing program, by dispersing costs into many other programs. Costs are never fully assessed by any agency because an assortment of agencies pay separately to support or compensate for impacts of the federal grazing program. Trends in spending are also difficult to track, due to changes in accounting practices. With costs dispersed into many different program budgets in multiple agencies, firm quantitative estimation of the full costs of the program is not yet possible.

Recently, federal auditors criticized the BLM and Forest Service along with many other federal agencies for the lack adequate financial accounting that would permit an audit to be done. The USDA was described as the “worst managed” agency. The Forest Service was unable to figure out how much money was available and overspent by \$274 million in 2001 (Brinkley 2002).

In an era of increasing demands for greater fiscal accountability, there is a need to make explicit the costs of a program whose impact in the West is ubiquitous, and whose expense to taxpayers is considerable. In order to make rational public policy decisions, more transparent accounting of grazing program costs across multiple agencies is imperative.

APPENDIX A: INDIRECT BLM AND FOREST SERVICE COSTS

The direct, budgeted costs are not the only costs of the grazing program. The two main agencies administer many projects not budgeted under range management that benefit public lands ranching operations, or that are needed to compensate for the impacts on forest resources from livestock.

The BLM and Forest Service may spend far more on grazing indirectly through other budget items than through the range management budgets alone. However, it is difficult to ascertain exactly how much is spent each year out of these other budget items, since the apportionment to range is not made explicit.

Range management accounts for only 6 percent of the four main Forest Service user-oriented program of range, recreation, mining and timber. Jacobs (1991) estimated that 5-7 percent of the Forest Service budget could be attributed directly or indirectly to grazing. Forest Service programs which entail some indirect cost due to the grazing program are listed in Table A-1. Applying the method of Jacobs (1991), 6 percent of the programs shown in Table A-1 gives an estimate of \$176 million for Forest Service indirect costs.

Livestock grazing is the principal use of most BLM lands, unlike the national forests, in which recreation and timber production have traditionally been major land uses. Range accounts for 37 percent of the four main user-oriented program of range, recreation, mining and timber. Jacobs (1991) estimated that 25 percent of the BLM budget could be attributed directly or indirectly to grazing. BLM programs which entail some indirect cost due to the grazing program are listed in Table A-2. Following Jacobs' method (1991), 25 percent of the programs shown in this table gives an estimate of \$104 million for BLM indirect costs.

Programs for which costs due to grazing are unlikely or highly uncertain are not included in these lists.

Table A-1: Forest Service resource programs that indirectly support public lands ranching or compensate for impacts (2001 data, USDA 2002b).

Program	Appropriations (\$ millions)	Federal grazing program involvement.
Land Management Planning	\$78	Every 10-15 years land management plans must be revised. These plans must include a suitability analysis for grazing, and an Environmental Impact Statement for the forest-wide and region-wide range program.
Inventory and Monitoring	\$174	Inventory and monitoring are required for forage use, range condition, or as required by AMPs, Forest Plans and Biological Opinions. There is a greater need for monitoring livestock compared with other uses.
Recreation, Heritage and Wilderness	\$230	Fencing of campgrounds and archeological sites may be necessitated largely due to livestock.
Wildlife and Fisheries Habitat Management	\$129	Habitat improvement projects often entail fencing to exclude livestock or water developments whose use is primarily for livestock. Grazing is the most ubiquitous land use and often the most in conflict with wildlife habitat needs.
Vegetation and Watershed Management	\$182	Grazing is the most pervasive use and most damaging of soils and vegetation causing weed, shrub and conifer invasions of grasslands and widespread continual erosion (Belsky and Blumenthal 1995).
Forest and Rangeland Research	\$240	Research stations spend some of their effort studying the impacts of grazing on native species and ecosystems, or studying different methods of grazing.
National Fire Plan	\$1,910	Grazing is a principal cause of the growth of highly flammable thickets in western ponderosa pine forests, and for invasion of rangelands by pinyon, juniper and other woody shrubs (Belsky and Blumenthal 1995). The National Fire Plan funding is for thinning thickets or prescribed fires to reduce fuel loads.

Table A-2: Bureau of Land Management program budgets that partly support public lands ranching or compensate for impacts (2001 data, USDI BLM 2002b).

Program	Appropriations (\$ millions)	Federal grazing program costs
Soil, Water, and Air	\$34	Much of this budget is necessitated by or benefits ranching. Livestock are the principal cause of soil erosion and stream degradation (Jones 2000, Belsky <i>et al.</i> 1999).
Riparian	\$22.5	Livestock are the most pervasive cause of riparian damage. Up to 80 percent of western streams have been damaged by livestock (Belsky <i>et al.</i> 1999).
Cultural Resources Management	\$13.9	Most harm to archeological resources is from livestock and from ranch access roads, fences, tanks and other ground disturbing range developments (Osborne <i>et al.</i> 1987, Broadhead 1999)
Wildlife and Fisheries Resources	\$37.9	Considerable harm to wildlife results from the pervasive competition for forage and removal of cover by livestock (Fleishner 1994).
Threatened and Endangered Species	\$21	As above and also Flather <i>et al.</i> (1994), Czech and Kraussman (1997)
Transportation and Facilities Maintenance	\$74	Ranching requires more frequent inspections and monitoring than most other uses.
Construction and Access	\$16.8	Ranching requires frequent road maintenance. New field offices and additions are necessitated in part by the range program.
Workforce and Organizational Support	\$126.6	Ranching involves numerous allotment plans, billing, inspections and monitoring.
Central Hazardous Materials Fund	\$10	Weed control is largely herbicidal. Many noxious weeds were either deliberately introduced to benefit grazing, or are spread by livestock operations (Belsky and Gelbard 2000)
Hazardous Materials Management	\$16.5	As above
Resource Management Planning	\$25.8	Grazing is a major element of planning because it covers a larger area than all other uses.
Land and Resource Info Systems	\$19.5	Keeping track of allotment and resource conditions is required for planning.

APPENDIX B: INDIRECT COSTS: OTHER FEDERAL AGENCIES

The full cost of the Forest Service and BLM grazing program is likely to be much higher than just the expenses generated within those two agencies.

Many other programs in a range of federal agencies also support federal public lands ranching or compensate for the impacts to public resources of ranching on public lands. The test applied is to ask if programs would still be expended at the same level in the absence of the federal grazing program. It is mostly impossible to derive quantitative estimates for such costs. Estimation of costs in many cases requires estimation of the proportion of ecological damage done by livestock as opposed to those from other causes, such as off road vehicles, logging and natural occurrences like drought. It is also difficult to determine what percentage of the budgets for these other agencies is attributable to livestock grazing on federal lands alone, as opposed to livestock production on private or state lands.

USDA'S WILDLIFE SERVICES

FY 2000, Wildlife Services in the USDA spent approximately \$10.7 million to kill over 100,000 predators in the western states to protect agriculture (Predator Conservation Alliance 2002). Animals killed include prairie dogs, coyotes, bobcats, mountain lions, and black bears. These activities primarily benefit ranchers in arid regions where stock must be relatively dispersed, and thus vulnerable to predators, in order to access the low abundance of forage. These conditions are largely found on federal lands, and as a result the beneficiaries tend to be federal grazing permittees. About 40 percent of Wildlife Service's budget is estimated to be attributable to public lands ranching, giving an estimate of \$4 million in FY 2000 as an indirect cost of the federal grazing program (O'Toole 1994b).

USDA's Animal and Plant Health Inspection Service has an insecticide spraying program to kill grasshoppers, which compete with livestock for forage on both federal and non-federal lands. During 1993, for example 30,000 acres of the Little Missouri National Grasslands were sprayed to kill grasshoppers, at a cost of \$186,561 (O'Toole 1994a).

THE FISH AND WILDLIFE SERVICE

The Department of the Interior's Fish and Wildlife Service expends a large part of its budget for listing native species impacted by grazing as threatened or endangered, for consultations with the Forest Service and BLM over the impacts of grazing on listed species, and for recovery plans for such species.

Grazing is the principal cause in the endangerment of many southwestern species and one of the leading causes in the U.S. (Flather *et al.* 1994). Czech and Kraussman (1997) identify grazing as the fifth most significant as a cause of species endangerment in the U.S. However, several of the other leading causes – exotic pests, agriculture, water diversions and modified fire regimes – are also attributable in

part to public lands ranching. Endangered animals and plants have lost habitat or food supply due to trampling and feeding by cattle and sheep. These include the Lesser long nosed bat, Mexican spotted owl, Southwestern willow flycatcher, Lahotan cutthroat trout, Pacific salmon, Loach minnow, Red-legged frog and Desert tortoise.

Other species have been extirpated by direct persecution to protect livestock. These species are primarily carnivores and scavengers and include the Mexican gray wolf, grizzly bear, jaguar and California condor.

Some portion of the Fish and Wildlife Service's endangered species budget request of \$126 million in FY 2003 is therefore, attributable to the federal grazing program (USDI Fish and Wildlife Service 2002a).

OTHER FEDERAL PROGRAMS

Portions of the following programs also support public lands ranching or compensate for the impacts of public lands ranching:

- The USDA's Livestock Assistance Program(LAP) with a FY 2003 budget of \$500 million, provides direct payments to eligible livestock producers suffering losses due to natural disasters such as drought or flood. The average public lands rancher qualifies for this subsidy in four out of every ten years. For example, in 1989 and 1990—neither of which were drought years—the LAP paid medium-sized ranches in southwestern New Mexico an average of \$3,600 per year (O'Toole 1994a). In the absence of the federal grazing program these payouts would likely decrease.
- The National Marine Fisheries Service of the Department of Commerce performs the functions of the Fish and Wildlife Service for anadromous fish such as salmon that are also impacted by livestock grazing.
- USDA's Natural Resources Conservation Service administers the Emergency Watershed Protection Program (EWP) to protect lives and property from flood disasters, some of which are caused or exacerbated by grazing on federal watersheds. Livestock damage watersheds, causing greater run-off and flooding (Belsky *et al.* 1999). In addition, inappropriate diversion of EWP funds to pay for ranch developments has been revealed in an audit of the program in Arizona (USDA Inspector General's Office 2001).
- The Bureau of Reclamation's dam projects are affected by the ecological impacts of grazing. Sedimented waterways shorten the useful life of reservoirs and higher peak flows affect the design of dams.
- The U.S. Army Corps of Engineers spends much of its total annual budget of over \$3 billion on flood control. Grazing has resulted in increased peak flows due to compaction of soils and removal of vegetation in entire watersheds, as well as higher erosion and sediment loads (Belsky *et al.* 1999).

- The Environmental Protection Agency requested \$3.2 billion for its clean water budget in 2003. A portion of this budget is devoted to monitoring and addressing the impacts of public lands ranching on water quality, in particular excess sediment flowing off public lands into waterways as a result of the impact of livestock on soil erosion (EPA 2002). As one example of the importance of grazing to water quality, Arizona Department of Environmental Quality recently determined that 20 percent of the excess sediment in the Verde River was due to livestock grazing mostly on public lands in the watershed, while a further 25 percent was due to pinyon and juniper encroachment, in turn largely the result of long-term livestock grazing (ADEQ 2001).
- The Department of Justice requested \$70.8 million for the Environmental and Natural Resources Division in FY2003 (USDI Department of Justice 2002). Some portion of this budget is spent defending the Federal land agencies and the Fish and Wildlife Service in lawsuits brought by environmental groups and grazing industry groups in regard to livestock grazing on public lands. In the instances where the Federal government loses such cases under the Endangered Species Act, they must also pay litigation costs of the plaintiffs.

OTHER USDA PROGRAMS

As noted earlier, public lands accounts for about four percent of national livestock production. A number of USDA programs benefit farmers and ranchers generally. While public lands ranchers undoubtedly benefits from these programs, ending public lands ranching would not necessarily reduce total expenditure in these programs, as production may just shift elsewhere to make up the loss in public land forage. Therefore the contribution of these programs to the full cost of the federal grazing program is less certain. These programs include:

- The Farm Service Agency's Emergency Loan Program lent \$200 million in FY 2000 to ranchers as fixed interest loans at below-market rates of 3.75 percent.
- The Cooperative State Research, Education, and Extension Service conducts and funds studies in experimental stations all over the West in association with Colleges of Agriculture in "land grant" colleges. Animal health, animal drugs, animal and rangeland research line items amounted to over \$30 million in 2001 (USDA 2002a).
- The Agricultural Marketing Service promotes U.S. livestock in the global marketplace through market news, marketing programs, and commodity price support, with a budget of approximately \$100 million (Sessions 2002).
- The Grain Inspection, Packers And Stockyards Administration enforces regulations pertaining to auctions, stockyards, packing houses, and other

facets of buying and selling livestock, with a total FY2003 budget of \$43 million.

- The Economic Research Service and National Agricultural Statistics Service with budgets together exceeding \$230 million in FY 2003, assist farmers and ranchers with economic advice, statistics and forecasting.
- The Rural Utilities Service, Rural Housing Service and Rural Business-Cooperative Service provide grants and low interest loans amounting to \$10.8 billion annually for rural infrastructure development.

APPENDIX C: NON-FEDERAL INDIRECT COSTS

Many costs are borne by non-federal agencies, private institutions and individuals as a result of livestock grazing on public lands. These are discussed below under categories of public resource values affected. The harm to resources from public lands ranching is not distributed evenly, however, but highly variable from area to area, depending on many variables. For example, the BLM has reported that the land used by the 20 largest grazing permittees is 46 percent unsatisfactory in condition, compared with the overall average of 27 percent unsatisfactory (Rogers 1999). In addition to the costs of public lands ranching resulting from harm to public resources, there are also many state and county subsidies that benefit public lands ranchers. Ranchers generally pay agricultural property tax rates which can be up to 100 times less than regular residential or commercial rates. Other subsidies include “open space” grants, tax credits and exemptions (Coalition for Sonoran Desert Protection 2001).

WATER SUPPLY, FLOODING AND EROSION

Livestock grazing has well established negative impacts on soils and vegetation at the scale of entire watersheds. By compacting soils and removing stabilizing vegetation and biological soil crusts, livestock reduce the rate of infiltration of rainfall through soils to the water table, and increase the rate of run-off and erosion. This means that peak stream flows are higher, and water is more contaminated with sediment while base flows are reduced to the point that many streams become intermittent or ephemeral (Ohmart 1996, Belsky *et al.* 1999, Jones 2000). Because public lands grazing contributes to the lowering of water tables, it also increases costs of drilling wells for water supply.

Public lands comprise a large part of the watersheds of metropolitan areas in the West. Flooding is due in part to impaired watershed function as a result of livestock on public lands (Trimble and Mendel 1995). In addition to federal agencies, state, county, and city governments spend many billions of dollars to repair and realign roads, rebuild and enlarge bridges, install culverts, channelize drainages and banks, haul fill, remove debris, repair structures, re-vegetate, and build flood control dams. Insurance companies and individual victims suffer considerable monetary and personal costs as a result of flood damages.

The role of livestock in soil erosion is well established (Jones 2000, Belsky and Blumenthal 1995). Erosion increases water turbidity, which inhibits reproduction of many native fish that evolved in clear streams, entailing costs for wildlife protection agencies and the EPA as summarized above. Turbidity, as well as nutrient and pathogen loading from grazing, also increase the costs of water filtration for suppliers of municipal drinking water. Costs-paid by water treatment utilities resulting from sedimentation may not rise in simple proportion to amount of sediment produced. For example, the costs of water treatment due to reduced water

quality in Texas was found to increase 25 percent for a 1 percent increase in turbidity (Dearmont *et al.* 1998).

RECREATION

Recreational visits to BLM and Forest Service lands almost doubled from 1983 to 1997, from 225 to 400 million visitor-days (Mathews *et al.* 2002). The two agencies recognize that ranching imposes a cost on recreational users of public lands by degrading the quality of the recreational experience (USDI and USDA 1994):

“Recreation values are degraded by livestock grazing and by declines in water quality and riparian habitat conditions. Livestock trampling and fecal matter reduce aesthetics and environmental quality at developed and undeveloped sites. Declining riparian conditions reduce wildlife viewing opportunities, make streams less floatable and fishable, and degrade a variety of recreation experiences.

Continued declines in riparian conditions and concentration so livestock in riparian areas would lessen naturalness, solitude, and other values of designated wilderness and wilderness study areas.

Cultural resources are often associated with riparian areas and would continue to be harmed by livestock trampling and accelerated erosion in nonfunctioning riparian habitats. Overgrazing also reduces native food-source plants important to Native Americans.

Commercial guides and outfitters say that grazing practices reduce the marketability of their services. Customers complain about the livestock and their adverse effects.

Greatly improved wildlife and fisheries habitat and recreation site improvements could increase employment and income as hunting, fishing, and wildlife viewing opportunities increase.”

No estimate is available however, for diminishment of recreational value on public lands by grazing. Some authors have done such an analysis for the costs of logging and this methodology could also be applied to grazing (Talberth *et al.* 2002).

WILDLIFE, GAME AND FISH

Millions of people engage in various forms of non-consumptive wildlife appreciation activities, such as birding, photography, and amateur study. According to the Audubon Society in 1996, 23.7 million American adults took a total of 267 million trips for the primary purpose of watching wildlife (Audubon Society 2002). Americans were estimated to spend \$108 billion in 2001 on hunting, fishing and non-consumptive wildlife enjoyment (USDI Fish and Wildlife Service 2002).

Bird watching is a form of non-consumptive wildlife use with high economic importance. It is also a use that is diminished by livestock grazing, especially livestock grazing in streamside or riparian areas, which are generally rich in bird species (Ohmart 1994). The BLM has estimated that 80 percent of western riparian habitats have been damaged due to livestock (Chaney *et al.* 1993).

More than 3,000 species of mammals, birds, reptiles, fish, and amphibians inhabit public lands that are grazed (USDI and USDA 1994). Over 136 species in the mainland U.S. have been listed as threatened or endangered due in part to livestock grazing (Czech and Kraussman 1997). Many more species are in serious decline and have been given sensitive, special status, or other designations indicating

imperilment. More than 100 special status riparian species inhabit Arizona and New Mexico alone. Many salmon species and stocks that use rangeland streams have been listed as endangered or have suffered population declines (USDI and USDA 1994). The General Accounting Office audited the BLM's grazing program in the hot deserts of the Southwest and pointed out the severe ongoing impairment to desert wildlife and wildlife habitat caused by livestock grazing in these fragile areas, for little economic benefit (GAO 1991b).

Hunting and fishing on national forests and BLM land is a highly valuable activity which is diminished by the negative impacts of livestock on game animals due to destruction of habitat, competition for forage and shelter and transmission of diseases. Domestic livestock serve as a vector to spread disease and parasites, both native and exotic, to wild animals throughout the West. Although Yellowstone bison are killed by government agencies to protect cattle from brucellosis, it is cattle that are the source for this disease in bison (Meagher and Meyer 1994). Bighorn sheep populations are imperiled by a pathogen from domestic sheep (Goodson 1982).

The American Fisheries Society in 1983 estimated that the cost of fishery resources lost and opportunities foregone on Forest Service land as a direct result of grazing was \$112 million annually (Jacobs 1991 p.406).

Several studies have shown that the economic value of game animals is many times higher than the value of livestock (Mathews *et al.* 2002). Dispersed recreation on the Central Winter Ecosystem Management Area of the Kaibab National Forest was found to bring in \$6.4 million, while hunting brought \$1.3 million to the local and regional economies of northern Arizona. In contrast livestock grazing and fuelwood brought only \$45,000, about 170 times less (Souder 1997). The increase in revenues to rural communities from hunting that results from grazing reductions can be as much as six times the lost income to ranchers (Donahue 1999).

The impairment of wildlife habitat, endangerment of wildlife and diminishment of game and fish by public lands livestock grazing all represent opportunity costs with tangible and intangible elements. To some extent these costs are captured in cost-paid terms by the expenditures of wildlife agencies in studying, monitoring, listing species as endangered, developing and implementing recovery plans and wildlife enhancement projects.

The federal costs of such actions were dealt with above. However, State wildlife agencies also have programs for wildlife management and rehabilitation which in part, are necessitated by public lands ranching. For example, state agencies take a lead role in reintroduction programs for endangered species such as the Black-tailed prairie dog and the Mexican gray wolf, species that were formerly extirpated by livestock interests, often with government assistance.

State wildlife agencies also expend resources to assist public lands ranching operations in controlling native predators and competitors. For example, Montana's Department of Livestock assists federal agencies in removing bison to protect against putative threats to the health of cattle on Forest Service grazing allotments adjacent to Yellowstone National Park. The Forest Service gains \$2,000 annually in

grazing fees from this allotment, while combined government agencies spend nearly \$1.7 million a year on killing and hazing bison (France 2002).

Public lands ranching also affects pollinators and other useful insects. Ranching often entails insecticide spraying for ticks and parasites as well as broadcast spraying to reduce grasshoppers that compete with livestock for forage. This affects native and honeybee populations. For example, as a result of grasshopper spraying by APHIS, mostly for the benefit of livestock on public lands, Idaho beekeepers in 1985 lost 20 - 30 percent of the state's commercial bees, worth more than \$1.7 million (Hawkins 1987). This represents in part, a cost of the federal grazing program that is borne by private commercial interests.

FIRE

Grazing is known to play a primary role in making western ponderosa pine forests prone to catastrophic wild-fires. Livestock prevent low intensity grass fires in ponderosa pine forests by consuming the principal fuel, grass. Ungrazed grasses also inhibit conifer seedling germination even in the absence of fire. The historic and ongoing elimination of grass in many ponderosa pine forests has significantly increased the growth of dense thickets of spindly conifers and shrubs. These are extremely flammable in dry periods and form “fuel ladders” that carry fire into the crowns of the old-growth trees (Belsky and Blumenthal 1995). Active fire suppression by agencies has also been a significant factor in accumulating fuel loads, that have led to infrequent, catastrophic forest fires. However, tree-ring studies have revealed that frequent, low-intensity fires declined severely in the 1880s in the southwestern U.S., over two decades before active fire suppression began on the national forests, and at the precise historic period when livestock numbers increased dramatically in the region (Swetnam and Baisan 1994).

A significant portion of the costs of thinning and prescribed fire treatments under the National Fire Plan is likely to have been necessitated by these long term impacts of public lands livestock grazing. State, county and local governments as well as insurance companies and individuals also bear costs, both tangible and intangible, due to fires that derive in part from public lands grazing.

WEEDS

Livestock grazing assists weed invasions (Belsky and Gelbard 2000). Costs of control of weeds increase as a result. Weeds also impact native wildlife. Some invasive exotic species, such as tamarisk in the southwest or cheatgrass in the Great Basin were deliberately introduced either to mitigate for the destruction of soil and watersheds caused by grazing, or to provide higher quality forage for livestock. State county and local government agencies all have weed control programs in some form, and some portion of these costs may be attributed to the federal grazing program, which acts to maintain weed populations on federal lands that can become source populations for invasion of other lands.

ARCHAEOLOGICAL RESOURCES

Studies have shown that livestock grazing has a dramatic and destructive impact on archeological sites (Osborne *et al.* 1987, Broadhead 1999). As a result of cattle trampling, increased soil erosion from excessive runoff, as well as range development techniques such as chaining, bulldozing, and plowing, countless ancient artifacts been displaced, broken and washed away. These losses impair the ability of archaeologists to study ancient cultures and destroy the cultural heritage of indigenous peoples of the West. Some of the cost of this damage is captured in dollars when land agencies fence sites to protect them from livestock. The administration of the National Historic Preservation Act is largely conducted by State Historic Preservation Offices. Thus, costs of consultations over the impacts of public lands grazing on archeological resources are borne in part by respective state governments.

HUMAN HEALTH

Livestock, particularly young calves, are a source of the human intestinal pathogen *Cryptosporidium* as well as other other pathogens such as *Giardia*. *Cryptosporidium* cannot be killed by chlorination and can only be removed by microfiltration (Atwill 1996). The costs of monitoring and control of this and other livestock borne pathogens must be borne by water utilities throughout the West, and ultimately by consumers.

Cattle-related accidents run to the thousands per year. These costs are paid by private individuals, insurance companies, and government agencies. Hundreds of vehicles are damaged or destroyed, dozens of people are injured, and every year, people are killed in the western U.S. as a result of automotive collisions with livestock, some of which come from public lands. Accidents are also caused by wildlife. However, large game animals tend to be less common, smaller in size and faster moving than cattle, and thus the relative impact of cattle on vehicle accidents is likely to be greater than that of wild game.

There is no complete study of this phenomenon, but the few available reports suggest the likely extent of the costs:

- The Arizona Department of Transportation estimates that in 2000 alone 1,671 accidents involved an animal, resulting in two deaths and 280 injured. There is no estimate of which portion is due to wild animals and which to livestock (ADOT 2000).
- In 1997, the Portland *Oregonian* reviewed state accident records in Oregon, Idaho, Montana, Wyoming and Utah and found that more than 10,000 motorists had collided with livestock during the previous ten years. These accidents resulted in at least 35 deaths.

LITERATURE CITED

ADEQ Arizona Department of Environmental Quality 2001. *TMDL for sediments in the upper Verde River*. Online at www.adeq.state.az.us/environ/water/assess/tmdl.html

ADOT Arizona Department of Transportation. 2000. *Crash Facts 2000*. Online at www.dot.state.az.us/ROADS/crash/00crashfacts.pdf

Atwill, E. R. 1996. Assessing the link between rangeland cattle and waterborne *Cryptosporidium parvum* infections in humans. *Rangelands* 18, 48-51.

Audubon Society 2002. *The economic impact of birdwatching*. Online at www.audubon.org/campaign/refuge/econbird.html

Belsky, J. A. and J. L. Gelbard. 2000. *Livestock grazing and weed invasions in the arid West*. Oregon National Desert Association, Bend, OR. 31 pp. Online at www.onda.org

Belsky, J. and D. M. Blumenthal. 1995. Effects of livestock grazing on stand dynamics, and soils in upland forests of the Interior West. *Conservation Biology* 11, 315-327. Online at www.onda.org

Belsky, J., A. Matzke, and S. Uselman. 1999. Survey of livestock influences on stream and riparian ecosystems in the western United States. *Journal of Soil and Water Conservation* 54, 419-431. Online at www.onda.org

Brinkley, J. 2002. Auditors say U.S. agencies lose track of billions. *New York Times* Oct. 14, 2002.

Broadhead, W. 1999. Cattle, Control, and Conservation. *Cultural Resource Management* 22, 31-32.

Coalition for Sonoran Desert Protection. 2001. *Livestock grazing and the Sonoran Desert Conservation Plan: A conservation perspective*. April 2001, Tucson, Arizona. 45 pp. Online at <http://www.sonorandesert.org/GrazingReport.pdf>

Chaney, E., W. Elmore, and W.S. Platts. 1993. *Livestock grazing on western riparian areas*, U.S. Environmental Protection Agency. 45 pp.

Costanza, R. *et al.* 1997. The value of the world's ecosystem services and natural capital. *Nature* 387, 253-260.

Czech, B. and P.R. Krausman. 1997. Distribution and causation of species endangerment in the United States. *Science* 277, 1116.

Dearmont, D., B. McCarl, *et al.* 1998. Costs of water treatment due to diminished water quality: a case study in Texas. *Water Resources Research* 34, 849-853.

Donahue, D. 1999. *The western range revisited*. Norman: University of Oklahoma Press.

Economist, The. 2002. Subsidized cow chow. *The Economist* Mar. 7, 2002.

EPA Environmental Protection Agency. 2002. *Budget FY 2003*. Online at www.epa.gov/ocfo/budget/2003/2003bib.pdf

Flather, C.H., L.A. Joyce, and C.A. Bloomgarden. 1994. *Species endangerment patterns in the United States*, USDA Forest Service, Ft Collins. 42 pp.

Fleischner, T.L. 1994. Ecological costs of livestock grazing in western North America. *Conservation Biology* 8, 629-644.

France, T. Telephone conversation with author, 28 June.

GAO (General Accounting Office). 1986. *Grazing lease arrangements of Bureau of Land Management Permittees*. Washington DC.

GAO. 1991a. *Current formula keeps grazing fees low*. Washington D.C.

- GAO. 1991b. *Rangeland Management: Bureau of Land Management's Hot Desert Program Merits Reconsideration*. Washington D.C.
- Goodson, M. 1982. Effects of domestic sheep grazing on bighorn sheep populations. In *Third Sheep and Goat Biannual Symposium Proceedings*, pp. 287-313.
- Hawkins, B. 1987. *Final environmental impact statement on the rangeland grasshopper cooperative management program*. USDA-APHIS. Washington D. C.
- Herman, Daryl. 2002. Telephone conversation with author, 15 May.
- Hess, K. and J.H. Wald. 1995. Grazing reform: here's the answer. *High Country News* 27(18).
- Jacobs, Lynn. 1991. *Waste of the west: public lands ranching*. Tucson, AZ. 602 pp.
- Jones, A. 2000. Effects of cattle grazing on North American arid ecosystems: a quantitative review. *Western North American Naturalist* 60, 155-164.
- Loomis, J., and E. Ekstrand. 1997. Economic benefits of critical owl habitat for the Mexican spotted owl: A scope test using a multiple-bounded contingent valuation survey. *Journal of Agricultural and Resource Economics* 22, 356-366.
- Mathews, K. H. J., K. Ingram, J. Lewandrowski, and J. Dunmore. 2002. Public lands and western communities. *Agricultural Outlook, Economic Research Service, USDA* June-July 2002, 18-22.
- Meagher, M. and M.E. Meyer. 1994. On the origin of brucellosis in bison of Yellowstone National Park: A review. *Conservation Biology* 8, 645-653.
- National Agricultural Statistics Service. 2002. *Agricultural Prices, January 31*. Washington, D.C.
- O'Toole, R. 1994a. Reforming the western range. *Different Drummer* 1(2). Thoreau Institute, Portland, Oregon.
- O'Toole, R. 1994b. *Audit of the USDA animal damage control program*. Predator Defense Institute, Eugene, OR. Online at pdi.enviroweb.org/audit.htm
- Ohmart, R. D. 1994. The effects of human-induced changes on the avifauna of western riparian habitats. *Studies in Avian Biology* 15, 273-285.
- Ohmart, R. D. 1996. Historical and present impacts of livestock grazing on fish and wildlife resources in western riparian habitats. Pp. 245-279 in P. R. Krausman (ed.) *Rangeland Wildlife*. Society for Range Management, Denver.
- Osborn, A., S. Vetter, R. Hartley, L. Walsh, and J. Brown. 1987. *Impacts of domestic livestock grazing on the archeological resources of Capitol Reef National Park, Utah*. Midwest Archeological Center Occasional Studies in Anthropology. 136 pp.
- Power, T. 2002. Taking stock of public lands grazing, an economic analysis. Pp. 263-269 in G. Wuerthner and M. Matteson (eds) *Welfare Ranching*. Island Press, San Francisco, CA.
- Predator Conservation Alliance. 2002. *Wildlife "Services"? A presentation and analysis of the USDA Wildlife Services Program's Expenditures and Kill Figures for Fiscal Year 2000*. Feb 2002. Bozeman, Montana Online at http://www.predatorconservation.org/about_us/research/wildlifeservicesreport2002.html
- Rogers, Paul. 1999. Cash Cows. *San Jose Mercury News*. 7 November 1999.
- Sessions, W. Personal communication with author. June 19, 2002.
- Souder, J. 1997. *Valuing resources and uses in the Central Winter Ecosystem Management Area, North Kaibab Ranger District*. College of Ecosystem Science and Management, School of Forestry, NAU, Flagstaff, Arizona.
- Swetnam, T. W. and Baisan, C. H. 1994. Historical fire regime patterns in the Southwestern United States since AD 1700. Pp. 11-32 in C. D. Allen (ed.) *Fire effects in Southwestern forests: proceedings of*

the second La Mesa Fire symposium. USDA Forest Service Rocky Mountain Forest and Range Experiment Station, General Technical Report RM-GTR-286.

Talberth, J., and K. Moskowitz. 1999. *The economic case against national forest logging*. Forest Conservation Council, Santa Fe, NM.

Talberth, J., K. Moskowitz, B. Byrd, and N. Raheem. 2002. *Hidden costs of logging on national forests in Texas (1987-1999)*. Ecology and Law Institute, Santa Fe, NM.

Torell, L.A., N.R. Rimbey, E.T. Bartlett, L. W. Van Tassel and J.A. Tanaka 2001. An evaluation of the PRIA grazing fee formula. *Annual Meeting Society for Range Management, Hawaii, Feb. 17-23 2001*.

Trimble, S. W. and A.C. Mendel. 1995. The cow as a geomorphic agent - a critical review. *Geomorphology* 13, 233-253

USDA (U.S. Department of Agriculture). 2002a. *Budget FY 2003*. Online at www.reeusda.gov/budget/webfund.htm

USDA. 2002b. *FY 2003 Budget summary- Forest Service*. Online at www.usda.gov/agency/obpa/Budget-Summary/2003/2003budsum.htm#fs

USDA Forest Service. 1995. *Forest Service program for forest and rangeland resources: a long term strategic plan, draft 1995 RPA program*.

USDA Forest Service. 2000. *Grazing statistical summary FY 2000*. Online at www.fs.fed.us/rangelands/ftp/docs/graz_stat_2000.pdf

USDA Forest Service. 2002a. *Special budget report prepared for the authors*.

USDA Inspector General's Office. 2001. *Audit report of the Arizona Natural Resources Conservation Service's Emergency Watershed Protection Program (EWP)*. Report number 10099-01-SF, Washington D.C.

USDI BLM (U.S. Department of the Interior, Bureau of Land Management). 2001. *Public land statistics 2001*. Online at www.blm.gov:80/natacq/pls01/

USDI BLM. 2002a. *Special budget report prepared for the authors*.

USDI BLM. 2002b. *FY 2003 Budget Justification*. Online at www.blm.gov/budget/

USDI Department of Justice. 2002. *2003 Budget Summary*. Online at www.usdoj.gov/jmd/2003summary/

USDI Fish and Wildlife Service 2002a. *Budget proposal for FY 2003*. Online at news.fws.gov/NewsReleases/

USDI Fish and Wildlife Service 2002b. 2001 *National Survey of Fishing, Hunting, and Wildlife-Associated Recreation*. U.S. Department of the Census. October 2002. Online at <http://www.census.gov/prod/2002pubs/FHW01.pdf>

USDI and USDA. 1994. *Rangeland Reform '94, Draft Environmental Impact Statement*.

Wolff, P. 1999. *Taxpayer's guide to subsidized ranching in the Southwest*. Center for Biological Diversity and New West Research, Tucson AZ. Online at www.biologicaldiversity.org/swcbd/program/grazing/taxguide.html