THE DEPARTMENT OF THE INTERIOR'S ECONOMIC CONTRIBUTIONS

June 21, 2011

EXECUTIVE SUMMARY

The Department of the Interior plays a substantial role in the U.S. economy, supporting over two million jobs and approximately $363 billion in economic activity for 2010. American citizens and industry, at work and at play, all benefit from Interior's natural and cultural resource management: maintaining lands for recreation, protecting cultural and historical resources, storing and conveying water, generating power, leasing mineral rights, and providing valuable information to mineral markets.

Highlights of Interior's economic contributions to key economic sectors in 2010 include:

- Recreation and Tourism: Americans and foreign visitors made some 439 million visits to Interior-managed lands. These visits supported over 388,000 jobs and contributed over $47 billion in economic activity. This economic output represents about 8% of the direct output of tourism-related personal consumption expenditures for the United States for 2009 and about 1.3% of the direct tourism related employment.
- Energy and Minerals: Exploitation of oil, gas, coal, hydropower and other minerals on Federal lands supported 1.3 million jobs and $246 billion in economic activity.
- Water, Timber and Forage: Use of water, timber and other resources produced from Federal lands supported about 370,000 jobs and $48 billion in economic activity.
- Grants and Payments: Interior administers numerous grants and payments, supporting programs across the country and improving Federal lands with projects ranging from reclaiming abandoned mines to building coastal infrastructure. Grants, payments, and support to tribal governments of $4.7 billion supported about 114,000 jobs and $10.2 billion worth of economic contributions.
- Interior's support for tribal governments represents an important mechanism to advance nation-to-nation relationships, improve Indian education, and improve the safety of Indian communities. In FY 2010, this funding contributed about $1.2 billion to economic output and supported about 13,000 jobs.
- Youth employment at Interior totaled 21,874 in FY 2010. The NPS employed the largest number, with 10,845 youth employed.
- The physical infrastructure managed by Interior supports a wide variety of resource management and recreation activities. In FY 2010, investments in construction and maintenance totaled about $2 billion. This funding contributed about $5.5 billion in economic activity and supported about 41,000 jobs.
- Land acquisitions are a key component to ensuring that the ecosystem services provided by Interior managed lands can be preserved and enhanced. The $214 million spent on land acquisitions in FY 2010 is estimated to contribute about $440 million in economic activity and support about 3,000 jobs.

Some of the valuable services produced under Interior's management cannot be fully counted in terms of output or jobs: habitat for a wide variety of species, drinking water, energy security, flood and disease control, scientific information, carbon sequestration, recreation, and culture. Evaluation and consideration of the services provided through human production and through land and resource conservation can engage new stakeholders, expand revenue sources, and enhance our treasured landscapes. This report also discusses Interior's non-market based efforts, including chapters on invasive species, and ecosystem services in general.

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Chapter 1 INTRODUCTION AND OVERVIEW OF THE DEPARTMENT OF THE INTERIOR'S ECONOMIC CONTRIBUTIONS

INTRODUCTION

The purpose of this report is to present information on the economic contribution of the activities of the Department of the Interior. This report, prepared at the direction of the Secretary of the Interior, contains information on economic contributions as well as information on other key issues that impact Interior's management responsibilities.[1]

The Department of the Interior plays a substantial role in the U.S. economy, supporting over two million jobs and approximately $363 billion in economic activity for 2010. Interior's economic contributions are underpinned by substantial investments made in past years. These include: physical infrastructure to support recreation activities and efficiency improvements in water storage and delivery systems; ecosystem restoration and land acquisitions to protect unique ecosystems, and knowledge that allow the provision of geologic, minerals, and other information to support decision making. In addition to physical infrastructure, key investments made in the last year include capacity building to evaluate and process applications for renewable energy technology on public lands. These investments have resulted in a substantial number of permits being issued in FY 2010, with the accompanying renewable energy generating facilities anticipated to follow in subsequent years.

The revenues resulting from Interior's management of natural resources on Federal lands include economic contributions associated with protecting unique natural resources, leasing mineral rights, storing and conveying irrigation and municipal industrial water supplies, and providing valuable information to mineral markets. Many of Interior's activities, such as the leasing of mineral rights, significantly impact the national economy because they enable private industry to create wealth and jobs. Table 1-1 provides a summary of values for these activities.

This report highlights the current economic contribution of Interior's existing programs and activities, and underscores the Department's contribution on a State-by-State basis. The economic contribution of outputs produced from Interior-managed lands and resources is an impressive tally, though this portrays only a portion of the overall economic value of Interior's activities. To broaden the scope, this report also addresses important non market economic benefits related to the Department of the Interior's mission. These topics all represent areas where Interior has significant management responsibilities and where market transactions do not fully reflect net economic values.

[1] This report includes the economic contribution of payroll, grants and other payments, although these transfers are not classified as benefits or costs. A full benefit-cost analysis or tally of net benefits is beyond the scope of this report.

Chapters 1 and 2 of this report use economic contribution analysis to track the economic contribution of Interior activities as those expenditures cycle through the economy. Chapters 3 and 4 focus on the non market economic benefits of ecosystem services and invasive species. Additional details on Interior's economic contributions at the State level, the bureau level, impacts by sector, as well as the methodology used to evaluate economic contributions are provided in Appendices to this report.

SECTOR HIGHLIGHTS

Highlights of Interior's economic contributions to key economic sectors in 2010 include:

- Recreation and Tourism: Americans and foreign visitors made some 439 million visits to Interior-managed lands. These visits supported over 388,000 jobs and contributed over $47 billion in economic activity. This economic output represents about 8% of the direct output of tourism-related personal consumption expenditures for the United States for 2009 and about 1.3% of the direct tourism related employment.
- Energy and Minerals: Oil, gas, coal, hydropower, wind power, geothermal power, and other mineral activities on Federal lands supported 1.3 million jobs and $246 billion in economic activity.
- Water, Timber and Forage: Use of water, timber, and other resources produced from Federal lands supported about 370,000 jobs and $48 billion in economic activity.
- Grants and Payments: Interior administers numerous grants and payments, supporting programs across the country and improving Federal lands with projects ranging from reclaiming abandoned mines to building coastal infrastructure. Grants and payments totaling $4.7 billion supported about 114,000 jobs and $10.2 billion worth of economic contributions.
- Interior's support for tribal governments represents an important mechanism to advance nation-to-nation relationships, improve Indian education, and improve the safety of Indian communities. In FY 2010, this funding contributed about $1.2 billion to economic output and supported about 13,000 jobs.
- Youth employment at Interior totaled 16,149 and 21,874 in FY 2009, and FY 2010, respectively. The NPS employed the largest number in FY 2010, with 10,845 youth employed.

BUREAU HIGHLIGHTS

- The Bureau of Land Management (BLM) oversees 245 million acres of Federal lands (and 700 million acres of subsurface onshore minerals) and has a contribution of about $122 billion on the national economy and supports over 550,000 American jobs.
- The Bureau of Ocean Energy Management, Regulation and Enforcement (BOEMRE) administers about 7,300 active mineral leases on 37 million offshore acres; energy and minerals production from offshore areas accounted for nearly $116 billion in economic contributions and supported over 642,000 American jobs.
- The Bureau of Reclamation maintains 476 dams and 348 reservoirs, irrigating about 10 million acres of land, providing water to over 31 million people, generating 40 million megawatt hours of electricity, and providing recreation opportunities. These activities have an economic contribution of $55 billion, and nearly 416,000 jobs.

- The National Park Service (NPS) maintains 84 million acres on 394 sites in 49 States, providing a recreation-related economic contribution of about $30 billion, and supporting nearly 247,000 American jobs.
- The Bureau of Indian Affairs (BIA), Bureau of Indian Education (BIE) and the Office of Indian Energy and Economic Development (IEED) provide services to 1.7 million American Indians and Alaska Natives from 565 tribes, contributing more than $14 billion in economic output and supporting nearly 137,000 jobs through activities on tribal lands (including oil, gas, coal, other minerals, timber, irrigation, and grazing). Other support for tribal governments (through loan guarantees, and other aid to tribal governments) contributes $1.2 billion in economic output and around 13,000 additional jobs.
- The U.S. Fish and Wildlife Service (FWS) manages the 150 million-acre National Wildlife Refuge System of 553 National Wildlife Refuges and thousands of small wetlands and other special management areas, providing an economic contribution of $4.0 billion and supporting over 32,000 jobs.
- The U.S. Geological Survey (USGS) science informs management of water, mineral, energy, and biological resources, as well as mitigation and adaptation to climate change and natural hazards.
- The Office of Insular Affairs (OIA) carries out the Secretary's responsibilities for U.S. affiliated insular areas, including the Territories of Guam, American Samoa, the U.S. Virgin Islands, and the Commonwealth of the Northern Mariana Islands, as well as the three Freely Associated States: the Federated States of Micronesia, the Republic of the Marshall Islands, and the Republic of Palau. The OIA works to improve the financial management practices of insular governments, maximize economic development opportunities, and increase Federal responsiveness to the unique needs of island communities. Grants, payments, and technical assistance from OIA support nearly 29,000 jobs and close to $1.5 billion in economic impact in these areas.
- The Office of Surface Mining Reclamation and Enforcement (OSM) protects citizens and the environment during coal mining, and restores the land to beneficial use following mining. OSM collaborates with States and Indian tribes in reclaiming more than 200,000 acres of abandoned coalmine lands.

Interior's youth initiatives engage, educate, and employ young adults between the ages of 15 and 25. Employment opportunities include environmental monitoring, visitor and interpretive services, fire prevention, erosion control, trail construction and maintenance, etc. The programs introduce high school and college age youth to resource management career opportunities.

OVERVIEW OF INTERIOR'S ECONOMIC CONTRIBUTIONS

The economic analysis below is based on tracing spending through the economy and measuring the cumulative effects of that spending. Results are presented in terms of the value of output and number of jobs supported by Interior's activities. This sort of *contribution analysis* differs from other measures of economic activity, such as a tally of net benefits.

Economic benefits are a measure of the extent to which society is better (or worse) off because of a given policy or action, and include both market and non-market benefits. Economic activity

analysis measures expenditures from a policy, program or event and how those dollars cycle through the economy. This type of analysis can include economic contribution analysis, which tracks the gross economic activity attributed to a policy or event in a regional economy, and economic impact analysis, which measures net changes in new economic activity in a regional economy resulting from a policy or event.[2] The distinction between economic benefits, economic impacts, and economic contributions is discussed more fully in Appendix 6.

In FY 2010, investments in construction and maintenance totaled about $2 billion. The physical infrastructure makes it possible to use, enjoy, and benefit from Interior managed resources. This funding contributed about $5.5 billion in economic activity and supported about 41,000 jobs.

In addition to providing direct and indirect economic benefits to the communities where they are located, the jobs supported by Interior's activities provide benefits for the environment that include protection, conservation, preservation and restoration of natural resources; support for renewable energy production and energy efficiency; environmental education, environmental awareness and promotion of sustainable practices; and scientific research. These jobs can be categorized as "green jobs", and include positions that work directly in the field, such as physical scientists (geology, biology, forestry, etc.), park rangers, and fire fighters, as well as positions that communicate the importance of environmental conservation to the public, such as natural resource educators, museum curators, and positions that create interpretation material, such as maps and environmental education curriculum.

Increasingly, law makers and the public are pointing to green jobs as a win-win solution for unemployment and the environment, with $90 billion from the American Recovery and Reinvestment Act of 2009, focused on green jobs growth. With over 44% of Interior's workforce estimated to be engaged in green jobs[3], as compared to 1.5% to 2% of private sector jobs[4], the Department offers expertise for the burgeoning green economy. Interior's twin missions in resource conservation and development can help ensure that jobs are created in growing and environmentally sound sectors, such as renewable energy and environmental protection.

The FY 2010 budget included $214 million for Land acquisition. These acquisitions support $440 million in economic activity and support about 3,000 jobs. These long-term investments expand and protect ecosystem services, including recreation, ecotourism, cultural heritage, water filtration, habitat, and flood control.

[2] For additional information on economic contribution and economic impact analysis see: Watson, P., J. Wilson, D. Thilmany, and S. Winter. 2007. Determining Economic Contributions and Impacts: What is the difference and why do we care? *The Journal of Regional Analysis and Policy*, 37(2): 140-146.

[3] The number of green jobs at DOI is based on an assessment of occupational codes and the duties associated with each occupation.

[4] "Measuring the Green Economy". U.S. Department of Commerce, Economics and Statistics Administration. April 2010.

Non Market Economic Values

Valuing Ecosystem Services: The Department of the Interior's lands and managed resources produce a wide range of valuable ecosystem services, including agriculture, drinking water, energy, flood and disease control, carbon sequestration, recreation, and cultural resources. Understanding the value of these services can result in better land management decisions. While tremendous progress has been made in both the scientific understanding and economic valuation of ecosystem services, additional work is needed to more fully understand and value the benefits of cultural uses, particularly by Native peoples; the benefits from investment in public lands like refuges and national parks; returns from public investment in private lands through acquisition, grants, and conservation easement programs; the benefits from indirect uses like climate regulation, flood control, pollination and waste assimilation; and uses by future generations.

Ecosystem restoration activities represent an important component of Interior's activities. The estimated economic contributions associated with these activities, however, do not represent the full economic value of ecosystem restoration activities because they do not capture the net benefits associated with environmental goods and services not bought and sold in markets. In FY2010, about $178 million was provided for ecosystem restoration activities in the Chesapeake Bay, Great Lakes, Everglades, and the Gulf Coast. This funding is estimated to contribute about $490 million to economic output and support about 3,700 jobs.

Managing Invasive Species: Invasive species have significant impacts on DOI land and water resources. These species affect human uses such as recreation, hydropower, water supplies, agriculture, and ranching, as well as ecosystem functions including pollination, water filtration, climate, pest control, and erosion protection, wildfires, and other natural hazards. Invasive species, particularly terrestrial weeds, pose a serious threat to land resources managed by Interior bureaus. Economics can inform invasive species policy, including the economic consequences of invasive species introduction, cost-benefit analysis of different management options, the allocation of scarce resources and funding for invasive species management, and the implications of trade and sanitary and phytosanitary (SPS) policies. Although economic analyses of invasive species issues have been limited at DOI thus far, future work could utilize previous studies of individual species and advancements in economic tools for estimating impacts and assessing management strategies.

Valuing Information Provision: Interior provides valuable scientific information on natural hazards (earthquakes, floods, hurricanes, landslides, tsunamis, volcanoes and wildfires), helping to mitigate costly disasters and build resilient communities. Information on supply, demand and flows of minerals and other essential commodities supports well-functioning markets and industries. This information in turn helps private industry explore and develop mineral properties, leading to additional revenue and private-sector jobs. Satellite imagery improves agricultural planting and management decisions. National water-use information reflects the impact of demographic, economic, and climatic trends. Although scientific information is generally provided at a price of zero, it does have a value to its users. Studies that place a value on scientific information can help decision makers prioritize funding for its provision.

This report represents a follow-up to a preliminary report released by Interior in December 2009. While the reports relied on generally similar methodological approaches, the results are not directly comparable due to changes in some of the underlying modeling. Furthermore, the 2010 report does not include the impact of funding provided by the one-time American Recovery and Reinvestment Act of 2009. Taken as a whole, the Department of the Interior's market and nonmarket based economic values represent a substantial contribution to the national economy. This report provides context and supporting data to illustrate this important role.

Table 1-1. Summary of Values and Economic Contributions of DOI Activities

	Inputs (DOI Activity)	Outputs Resulting from DOI Activity		
Category	Value (billions, $2010)	Estimated DOI Inputs as % of National Sector	Total Economic Impact (billions, $2010)	Total Domestic Jobs Supported (jobs)
DOI Payroll (~79,700 employees in 2010)	5.05		9.45	65,059
Grants & Payments to non-Federal Entities (excludes payments via U.S. Treasury)	4.69		10.21	114,304
Support for tribal governments	0.70		1.44	13,040
Public Resources as Inputs to Production				
Recreation and Tourism	18.53	2.5%	47.87	388,127
Energy				
Oil, gas and coal	82.01	37.5%	225.38	1,151,879
Hydropower	2.51	0.04%	5.11	19,851
Wind power			0.03	206
Geothermal	0.14		0.33	2,016
Non-fuel Minerals	6.32		15.63	92,290
Other Production				
Irrigation water	13.12	11.1%	40.21	280,436
M&I water	2.20	19.7%	5.35	78,479
Forage	0.31	0.5%	0.64	4,914
Timber	0.08	0.7%	1.53	6,385
Total	**135.65**		**363.18**	**2,216,985**

Chapter 2 BUREAU-LEVEL ECONOMIC CONTRIBUTIONS

Each bureau within the Department contributes to Interior's overall economic impacts. The Bureau of Land Management's multiple-use mission allows it to have an impact in recreation as well as mineral, timber, renewable energy, and rangeland resource management. The Bureau of Reclamation is a major water supplier as well as the second largest producer of hydropower in the western States and supports the production of a large proportion of the nation's high-value crops. The National Park Service and U.S. Fish and Wildlife Service's land and wildlife protection mandates create substantial recreation and tourism opportunities, which in turn support jobs for hundreds of thousands of Americans. The Bureau of Ocean Energy Management, Regulation and Enforcement and the Office of Surface Mining's more focused duties on resource extraction (and protection of the environmental resources that might be impacted by such activities) enable them to have a substantial impact on the economy, both in the public and private sectors. The U.S. Geological Survey science informs management of water, mineral, energy, and biological resources, as well as mitigation and adaptation to climate change and natural hazards. Finally, The Bureau of Indian Affairs and the Office of Insular Affairs focus on social and infrastructure needs as well as providing programs that help educate and train workers in America's territories and Indian communities.

The following bureau-level analysis presents the impact of Interior's programs and activities on major economic sectors, which in this report include recreation, energy and minerals, timber and grazing, and water. These sectors do not represent the entire suite of Interior's influence: bureaus have an impact on other sectors through additional programs and activities, e.g., land acquisition, construction, road building, education, law enforcement, and conservation activities. However, information was not readily available for some of these activities, and some were not included because of their relatively small impact on the economy. If all of Interior's activities were included in the analysis, the impacts may be considerably higher. Efforts will be made to expand the scope of Interior activities presented in future economic reports.

Table 2-1 provides a bureau-level summary of economic impacts. More detailed information on economic impacts by each bureau follows the table.

Table 2-1. Summary Economic Contributions by Bureau

Bureau	Payroll Total ($ billions)	Total Economic Contribution ($ billions)	Total Domestic Jobs Supported (jobs)
DOI Payroll (~79,000 employees in 2010)	5.05	9.45	65,059
National Park Service	1.44	2.69	18,540
U.S. Fish and Wildlife Service	0.68	1.27	8,762
Bureau of Land Management	0.73	1.37	9,430
Bureau of Reclamation	0.38	0.72	4,928
Bureau of Ocean Energy Management, Regulation & Enforcement	0.16	0.29	2,006
Indian Affairs	0.54	1.01	6,979
US Geological Survey	0.72	1.34	9,227
Office of Surface Mining	0.05	0.09	602
Other Interior Offices	0.36	0.67	4,585
Grants & Payments to non Federal entities (Grants & Payments to States excludes payments via U.S. Treasury)	4.69	10.21	114,304
Support for tribal governments	0.70	1.44	13,040
Subtotal Grants, Payments, Tribal Government support, and Payroll	10.45	21.10	192,402

	Inputs (DOI Activity)	Outputs Resulting from DOI Activity	
Bureau	Sales Value ($ billions)	Total Economic Contribution ($ billions)	Total Domestic Jobs Supported (jobs)
National Park Service			
Recreation	11.89	30.39	246,956
Fish and Wildlife Service			
Recreation	1.50	3.98	32,564
Bureau of Indian Affairs			
Oil, gas and coal	2.48	10.47	89,363
Irrigation water	0.47	1.33	12,448
Grazing	0.05	0.10	733
Timber	0.04	0.71	2,637
Other minerals	0.63	1.84	31,580

Bureau of Land Management			
Oil, gas and coal	30.44	99.17	420,207
Geothermal	0.14	0.33	2,016
Hardrock Minerals	3.76	9.58	42,265
Non-Metallic Minerals	1.93	4.22	18,445
Grazing	0.25	0.54	4,181
Timber	0.04	0.81	3,748
Recreation	2.86	7.43	58,947
Wind		0.03	206
Bureau of Reclamation			
Hydropower	2.51	5.11	19,851
Irrigation water	12.65	38.88	267,988
M&I water	2.20	5.35	78,479
Recreation	2.28	6.07	49,660
Bureau of Ocean Energy Management, Regulation & Enforcement	49.08	115.74	642,309
Office of Surface Mining	AML grants included in Grants and Payments		
U.S. Geological Survey			
Office of Insular Affairs	Grants and payments to insular areas included in Grants and Payments		
Subtotal Bureau Production Impacts	125.21	342.08	2,024,583
Total	**135.65**	**363.18**	**2,216,985**

For additional information about data and sources, refer to Methods and Data Appendices.

Box 2-1 American Recovery and Reinvestment Act Funding

The American Recovery and Reinvestment Act (ARRA) of 2009 is providing $2.3 billion to preserve and improve the quality and accessibility of Federal lands. Federal Agencies that have allocated ARRA funding for conservation projects include the Department of Agriculture, the Department of the Interior and the Environmental Protection Agency. For example, the U.S. Forest Service has allocated $1.15 billion in ARRA funding to help reinvigorate the economy while restoring natural resources. The majority of these projects are employment-intensive efforts that will improve infrastructure on Federal lands or improve forest health by collecting and removing forest materials that pose wildfire risks.

Infrastructure at Federal recreation sites supports visitation. Through ARRA, the Administration has increased investment on Federal lands, reducing the problems of deferred maintenance and ecosystem degradation and creating a stronger foundation for the future of rural tourism.

Table 2.2 shows that the ARRA investments focused on preserving and improving the accessibility and experience of America's extraordinary Federal lands. Much of this spending goes disproportionately to rural areas. The funding is roughly evenly split between the Department of the Interior (NPS, FWS, and BLM) and the USDA's Forest Service. To make parks and forests safer and more accessible, these funds will repair eroded trails and roads, close hazardous abandoned mines near tourist sites, build visitor facilities, and invest in many other assets. Expenditures on ecosystem recovery have been found to support significant numbers of jobs. For example, it has been estimated that for each $1 million spent on ecosystem recovery up to about 30 jobs could be supported. Ecosystem recovery will improve the natural capital that draws people to Federal lands. ARRA funds will reforest, reduce hazardous fuel build-up, remove structures preventing fish from accessing spawning and feeding areas, and remove damaging invasive species. DOI is funding the construction of water control infrastructure that will increase the wetlands available to migratory birds at Tule Lake, in rural Siskiyou County, California, which attracts one of the largest concentrations of migratory waterfowl in the world.[5]

Table 2-2 Recovery Act Spending Benefiting Tourism on Federal Lands

Type	Spending ($ millions)
National Parks	750
U.S. Fish and Wildlife Service	
Construction at Service Facilities	227
Habitat Restoration	50
Bureau of Land Management	
Habitat Restoration	37
Abandoned Mine Land Remediation and Alaska Well Legacy	53
Roads, Bridges, and Trails	26
Construction and Deferred Maintenance	42
Forest Service	
Capital Improvement and Maintenance	650
Wildland Fire Management	500
Total	2,335

The Recovery Act included a total of $3 billion appropriated to Interior's bureaus. Approximately one-third of Interior's Recovery Act funding is for water infrastructure needs. Another 30% is for other construction projects across the bureaus and offices. Fifteen percent is for approximately 1,500 deferred maintenance and energy retrofit projects. Another 9% is for over 600 road and bridge maintenance projects. As of 12/24/10, $1.7 billion had been paid out.

[1] Council of Economic Advisors, Strengthening the Rural Economy, April 2010.

BUREAU OF LAND MANAGEMENT

Bureau Role

The Bureau of Land Management's (BLM) mission is to sustain the health, diversity, and productivity of the public lands for the use and enjoyment of present and future generations. The BLM was established in 1946 through the consolidation of the General Land Office and the U.S. Grazing Service. The BLM carries out a variety of programs for the management and conservation of resources on 245 million surface acres and 700 million acres of onshore subsurface minerals. In addition, the BLM is responsible for performing cadastral surveys on all Federal and Indian lands, and it carries out the Secretary's mineral operations on 57 million acres of Indian trust lands. BLM's public lands make up about 13 percent of the total land surface of the United States and more than 40 percent of all land managed by the Federal government, making the BLM the nation's largest land manager.

Interior also administers the Payments in Lieu of Taxes (PILT) program, which is presented within BLM's impacts because BLM manages a significant amount of land subject to PILT. In FY 2010, current and permanent PILT payments totaled $358 million. PILT payments are used by States to fund education and other programs. In FY 2010, PILT payments supported an estimated 6,458 jobs and $704 million in economic impacts.

BLM lands also encompass substantial opportunities for generating and transmitting renewable energy. As these resources are developed over time, considerable economic activity can be expected to occur.

Baseline Economic Information

BLM's management of Federal lands has an impact of over $122 billion on the national economy and supports over 550,000 American jobs.

Budget

2009 Enacted ($ millions)	2010 Enacted ($ millions)	2011 Request ($ millions)
1,039	1,134	1,142

Payroll (FY 2010)

Total Annual Payroll ($ millions)	Estimated Annual Payroll Impact ($ millions)	Estimated Additional Job Impacts from Payroll (jobs)
733	1,370	9,430

Major Economic Contributions

	Visitors	Value ($ millions)	Estimated Economic Impact ($ millions)	Estimated Jobs Impact (jobs)
Recreation	58,643,712	2,856	7,426	58,947
Oil, Gas, & Coal		30,444	99,172	420,207
Hardrock Minerals		3,757	9,580	42,265
Non-Metallic Minerals		1,928	4,216	18,445
Timber		35	814	3,748
Grazing		254	540	4,181
Geothermal		136	334	2,016
Wind Energy*			27	206
Total		39,411	122,110	550,016

* In FY 2010, wind energy turbines on BLM lands had an operating capacity of 389 MW (Arizona (30 MW), California (296 MW), Utah (42 MW), and Wyoming (21 MW)). An additional 49 MW of capacity was under construction on BLM lands in Utah. The employment and output shown here is related to the construction and operation of wind towers on BLM lands and does not include impacts related to the production of electricity.

Grants and Payments*

	2010 Enacted ($ thousands)	Estimated 2010 Economic Impact ($ thousands)	Estimated 2010 Total Jobs (jobs)
General Fund Payment to Counties and Native Corporations	80,384	158,055	1,447
Payments to States and Counties from Shared Receipts including SNPLMA Payments	20,052	39,427	361
Total Grants and Payments	100,436	197,482	1,808

* At the time of this report, all mineral revenues were collected by BOEMRE. As in the Budget in Brief, both onshore and offshore sources of mineral revenues are reported in the BOEMRE Grants and Payments table in this chapter.

NATIONAL PARK SERVICE

Bureau Role

In 1872, the Congress designated Yellowstone National Park as the nation's first "public park or pleasuring ground for the benefit and enjoyment of the people." The subsequent establishment of the National Park Service (NPS) on August 25, 1916, reflected a national consensus that natural and cultural resources must be set aside for public enjoyment and preserved for future generations. As stated in the original authorizing legislation, the NPS's mission is to "preserve unimpaired the natural and cultural resources and values of the National Park System for the enjoyment, education, and inspiration of this and future generations."

The National Park System comprises 394 areas covering more than 84 million acres in every State (except Delaware), the District of Columbia, American Samoa, Guam, Puerto Rico, and the U.S. Virgin Islands. In its entirety, the National Park system represents, interprets, and preserves both natural and cultural sites that are testaments to the nation's history, and offer an array of opportunities for much needed respite, reflection, and outdoor recreation to the American public.

Baseline Economic Information

NPS has a profound impact on the national economy, generating $30.4 billion recreation-related economic impacts and supporting nearly 247,000 American jobs.

Budget

2009 Enacted ($ millions)	2010 Enacted ($ millions)	2011 Request ($ millions)
2,526	2,744	2,729

Payroll (FY 2010)

Total Annual Payroll ($ millions)	Estimated Annual Payroll Impact ($ millions)	Estimated Additional Jobs Impact from Payroll (jobs)
1,440	2,693	18,540

Major Economic Contributions

Recreation Visits	Estimated Value ($ millions)	Estimated Recreation Impact ($ millions)	Estimated Jobs Impact (jobs)
285,279,021	11,893	30,391	246,956

Grants and Payments

	2010 Enacted ($ thousands)	Estimated 2010 Economic Impact ($ thousands)	Estimated 2010 Total Jobs (jobs)
American Battlefield Sites Matching Grants	9,000	17,696	162
Challenge Cost Share	2,344	4,609	42
Chesapeake Bay Gateway Grants	1,000	1,966	18
Heritage Partnership Program	16,805	33,043	302
Historic Preservation Fund	43,327	121,338	908
Japanese-American Confinement Site Grants	3,000	5,899	54
LWCF State Grants w/ GOMESA	37,288	101,984	724
Native American Graves Protection Act Grants	2,331	4,583	42
Park Partnership Grants	15,000	29,494	270
Preserve America	4,199	8,257	76
Save America's Treasures	14,109	34,474	277
Total Grants and Payments Impacts	148,403	363,342	2,876

U.S. FISH AND WILDLIFE SERVICE

Bureau Role

The U.S. Fish and Wildlife Service's (FWS) major responsibilities are to protect and conserve migratory birds, threatened and endangered species, certain marine mammals, and inter-jurisdictional fish. To accomplish its mission, FWS seeks opportunities to partner with farmers and ranchers, State and local governments, Federal agencies, tribes, citizen volunteers, corporations, and conservation groups.

In carrying out its mission, FWS has three primary conservation objectives:

1. Assist in the development and application of an environmental stewardship ethic for our society, based on ecological principles, scientific knowledge of fish and wildlife, and a sense of moral responsibility;
2. Guide the conservation, development, and management of the nation's fish and wildlife resources; and
3. Administer a national program to provide the public opportunities to understand, appreciate, and wisely use fish and wildlife resources.

Some examples of the ways FWS tries to achieve its mission include:

- Enforcing Federal wildlife laws,
- Protecting endangered species,
- Managing migratory birds,
- Restoring nationally significant fisheries,
- Conserving and restoring wildlife habitat such as wetlands,
- Assisting foreign governments with their international conservation efforts, and
- Distributing hundreds of millions of dollars, through our Wildlife Sport Fish and Restoration program, in excise taxes on fishing and hunting equipment to State fish and wildlife agencies.

FWS manages the 150 million-acre National Wildlife Refuge System with more than 551 National Wildlife Refuges and thousands of small wetlands and other special management areas. Under the Fisheries program, FWS also operates 70 National Fish Hatcheries, 65 fishery resource offices and 86 ecological services field stations.

The vast majority of fish and wildlife habitat is on non-Federal lands. The Partners for Fish and Wildlife, Partners in Flight, Sport Fishing and Boating Partnership Council, and other FWS partnership activities foster aquatic conservation and assist in voluntary habitat conservation and restoration.

Baseline Economic Information

FWS's refuge lands attract millions of visitors and contribute over $3.9 billion in annual economic impact and over 32,000 jobs.

Budget

2009 Enacted ($ millions)	2010 Enacted ($ millions)	2011 Request ($ millions)
1,440	1,647	1,642

Payroll (FY 2010)

Total Annual Payroll ($ millions)	Estimated Annual Payroll Impact ($ millions)	Estimated Additional Job Impacts from Payroll (jobs)
681	1,273	8,762

Major Economic Contributions

	Refuge Visitors	Estimated Value ($ millions)	Estimated Economic Impact ($ millions)	Estimated Jobs Impact (jobs)
Recreation	44,849,524	1,496	3,983	32,564

Grants and Payments

	2010 Enacted ($ thousands)	Estimated 2010 Economic Impact ($ thousands)	Estimated 2010 Total Jobs (jobs)
Boating Infrastructure Grants	13,061	25,681	235
Clean Vessel Act Grants	13,061	25,681	235
Coastal Wetlands Conservation	36,242	71,261	652
Cooperative Endangered Species Conservation Funds	71,560	140,705	1,291
Federal Aid in Wildlife Restoration, Payments to States	467,494	932,285	8,393
Fish and Wildlife Foundation	7,537	14,820	136
Fish Commission and Boating Council	1,200	2,359	22
Hunter Education and Safety Grant Program	8,000	15,730	144

Multi-State Conservation Grant Program	3,000	5,899	54
Multinational Species Conservation Fund	11,500	22,612	207
National Wildlife Refuge Fund (current and permanent)	18,931	37,223	341
Neotropical Migratory Bird Conservation	5,000	9,831	90
North American Wetlands Conservation Fund	53,481	105,157	963
Sport Fish Restoration, Apportionment to States	380,472	776,915	6,912
State and Tribal Wildlife Grants	75,319	148,096	1,359
Total Grant and Payment Impacts	1,178,919	2,359,935	21,269

BUREAU OF RECLAMATION

Bureau Role

The Bureau of Reclamation's (Reclamation) mission is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public. Reclamation is the largest supplier and manager of water in the 17 western States west of the Mississippi, excluding Alaska and Hawaii. It maintains 476 dams and 348 reservoirs with the capacity to store 245 million acre-feet of water. These facilities deliver water to one in every five western farmers to irrigate about ten million acres of land, and provide water to over 31 million people for municipal and industrial (M&I) uses as well as other non-agricultural uses. Reclamation is also the nation's second largest producer of hydroelectric power, generating 40 billion kilowatt hours of energy each year from 58 power plants. In addition, Reclamation's facilities provide substantial benefits to recreation and fish and wildlife habitats.

In addition to the economic effects of Reclamation activities identified above, Reclamation facilities reduce the amount of flood damages occurring to property located in the flood plain below these facilities. Although the economic effects of providing protection from flooding are not estimated using expenditure data as are the above activities, Reclamation facilities provide a positive effect to the economy by allowing funds to be spent on alternative activities rather than rebuilding or replacing property damaged or destroyed by flood events. Flood damage reduction values of $1.2 million per year are estimated on an annual basis for each region based on estimates obtained from the Corps of Engineers. Because flood damage reduction values vary widely from year to year depending on runoff levels, the values are averaged over a number of years to obtain an annual estimate. Further examination of the data collection methodology and uniformity could ensure a greater measure of confidence in the accuracy of the data.

Baseline Economic Information

Reclamation's management and recreation activities result in $55 billion in economic impact, and support about 416,000 jobs.

Budget

2009 Enacted ($ millions)	2010 Enacted ($ millions)	2011 Request ($ millions)
1,118	1,130	1,107

(Figures include Central Utah Project Completion Act Funding)

Payroll (FY 2010)

Total Annual Payroll ($ millions)	Estimated Annual Payroll Impact ($ millions)	Estimated Additional Job Impacts from Payroll (jobs)
383	716	4,928

Major Economic Contributions

	Value ($ millions)	Estimated Economic Impact ($ millions)	Estimated Jobs Impact (jobs)
Hydropower	2,506	5,113	19,851
Irrigation	12,652	38,876	267,988
M&I Water	2,200	5,346	78,479
Recreation	2,281	6,074	49,660
Total	19,639	55,409	415,978

Grants and Payments

	2010 Enacted ($ thousands)	Estimated 2010 Economic Impact ($ thousands)	Estimated 2010 Total Jobs (jobs)
Boulder Canyon Project Payments to AZ, NV	600	1,180	11
Water Reclamation and Reuse Program	13,595	26,731	245
Water SMART Grants	18,000	35,392	324
Total Grants and Payments	32,195	63,303	580

BUREAU OF INDIAN AFFAIRS, BUREAU OF INDIAN EDUCATION, AND THE OFFICE OF INDIAN ENERGY AND ECONOMIC DEVELOPMENT

Bureau Role

The mission of the Bureau of Indian Affairs (BIA) is to fulfill the Secretary's trust responsibilities and promote self-determination on behalf of Federally recognized Indian tribes. The Office of Indian Energy and Economic Development (IEED), within the Office of the Secretary, provides high-level support for the Department's goal of serving tribal communities by providing access to energy resources and helping tribes stimulate job creation and economic development. The mission of the Bureau of Indian Education (BIE) is to provide quality education opportunities in American Indian communities.

IEED engages with tribes in numerous activities that have direct and indirect impacts on the nation's GDP and employment. Many of these activities are managed directly by tribes through P.L. 93-638 tribal agreements, which support the policy of self-determination, enabling tribes to administer projects independently.

The BIA and BIE provide services directly or through contracts, grants, or compacts to a service population of 1.7 million American Indians and Alaska Natives who are members of 565 Federally recognized Indian tribes. The role of BIA and BIE has changed significantly in the last three decades, reflecting a greater emphasis on Indian self-determination. Programs are funded and operated in a highly decentralized manner, with about 90 percent of all appropriations expended at the local level, and at least 50 percent of appropriations provided directly to tribes and tribal organizations through grants, contracts, and compacts for tribes to operate government programs and schools.

Programs with economic impacts include energy, minerals, forestry, and irrigation, as well as employment and training programs, regional economic development incubators, loan guaranties to native-owned businesses, and trust land resource management.

Indian Affairs is working with more than 30 tribes on almost 50 projects that encompass a broad spectrum of both renewable and conventional energy. Highlights include a utility sized geothermal energy project at Pyramid Lake (NV), a Waste to Energy (WTE) facility at Oneida (WI), a hydro-electric project at Cherokee (OK), a woody biomass project at Fond du Lac (MN) and a solar project at Hualapai (AZ). Cumulatively, these five projects have the potential to generate more than 100Mw of clean electricity and create approximately 250 construction jobs and approximately 150 full time jobs when the projects are completed.

Baseline Economic Information

BIA and IEED currently empower American Indians by providing resources to tribes across the country. BIA and IEED's efforts generate over $14 billion in economic impact and over 136,000 jobs, many of them on Indian lands. Sufficient information to develop detailed estimates for this report was not available for a number of ongoing activities generating economic and employment

impacts. Other activities include construction, irrigation, job training, support for the development of mineral materials activities, and hydropower production.

Loan guarantee programs, while not involving direct expenditures, can create jobs and have economic impacts. The Indian Guaranteed Loan Program guarantees up to ninety percent of loans for Indian-owned enterprises. These enterprises contribute to the economies of Federally recognized tribal reservations or service areas. In FY 2010, about $90 million in loans were guaranteed that otherwise would not have been made to Native borrowers, according to lenders' written statements in the loan guaranty application. This program requirement ensures that loan guarantees enable economic activity for Indian businesses that would otherwise not take place. Loans guaranteed by the full faith and credit of the U.S. Government do not count against legal lending limits, thus this guaranty program may increase the total credit available to be loaned. These loan guarantees are estimated to contribute about $231 million in economic activity and support about 2,000 jobs.

A large part of BIA mineral production value comes from construction aggregate, including crushed rock, as well as sand and gravel. BIA generally issues business permits for sand and gravel scenarios. Mineral data from the Office of Natural Resources Revenue (ONRR) are limited to those "sand and gravel" operations where a lease was issued. ONRR does not have information for permits.

Budget

2009 Enacted ($ millions)	2010 Enacted ($ millions)	2011 Request ($ millions)
2,376	2,620	2,566

Payroll (FY 2010)

Total Annual Payroll ($ millions)	Estimated Annual Payroll Impact ($ millions)	Estimated Additional Job Impacts from Payroll (jobs)
542	1,014	6,979

Major Economic Contributions

	Value ($ millions)	Estimated Economic Impact ($ millions)	Estimated Jobs Impact (jobs)
Oil, Gas, and Coal	2,483	10,473	89,363
Irrigation	471	1,330	12,448
Other minerals *(e.g., construction aggregate)*	635	1,836	31,580
Timber[6]	41	714	2,637
Grazing[5]	54	95	733
Other activities *(e.g., job training, hydropower, etc.)*	These activities are associated with substantial economic and employment impacts on reservations. Additional information is needed to develop economic impact and employment impacts for these activities.		
Total	3,683	14,449	136,761

Support for Tribal Governments

	2010 Enacted ($ thousands)	Estimated 2010 Economic Contribution ($ thousands)	Estimated 2010 Total Jobs Supported (jobs)
Loan guarantees	89,780	230,770	1,984
Self-governance Compacts	415,000	815,992	7,470
Contract Support	166,000	326,397	2,988
Aid to Tribal Governments	33,195	65,270	598
Total	703,975	1,438,429	13,040

[6] For contributions related to Timber and Grazing we relied on a national multiplier, as tribal economies are not always closely integrated with given State economies. Contributions related to Timber were derived assuming that all harvested timber was processed in the Northwest Region of USDA's FEAST model. This gives a relatively conservative estimate of jobs supported.

BUREAU OF OCEAN ENERGY MANAGEMENT, REGULATION AND ENFORCEMENT

Bureau Role

The Bureau of Ocean Energy Management, Regulation and Enforcement (BOEMRE) manages energy and mineral resources, including renewable energy resources, on the nation's outer continental shelf (OCS) in an environmentally sound and safe manner.

The BOEMRE manages access to the OCS mineral resources to help meet the energy demands and other needs of the Nation while balancing such access with the protection of the human, marine, and coastal environments. Currently, BOEMRE administers about 7,300 active mineral leases on 37 million OCS acres, and oversees production from nearly 3,400 facilities on the OCS. Production from these leases generates billions of dollars in revenue for the Federal Treasury and State governments while supporting thousands of jobs. The BOEMRE oversees production of about 11 percent of the natural gas and 30 percent of the oil produced domestically, and facilitates the development of offshore energy resources. The BOEMRE is also developing a renewable energy program that will complement development of traditional energy sources and help begin the transition to a low-carbon economy. In 2010, the BOEMRE issued its first lease for commercial wind energy development on the OCS for approximately 46 square miles offshore Massachusetts.

In 2010, a Secretarial Order formed BOEMRE to replace the Minerals Management Service (MMS). The MMS, created in 1982, was responsible for mineral revenue collection efforts and the management of its OCS offshore areas. The revenue collection, distribution, accounting, and auditing functions of MMS were split off from BOEMRE on October 1, 2010, and are now part of the Office of Natural Resource Revenue (ONRR).

In January 2011 plans were laid out to restructure BOEMRE into two bureaus that will separately house: 1) the resource development and energy management functions of BOEMRE, and 2) the safety and enforcement functions of BOEMRE. The new Bureau of Ocean Energy Management (BOEM) will be responsible for managing development of the nation's offshore resources in an environmentally and economically responsible way. Functions will include: Leasing, Plan Administration, Environmental Studies, National Environmental Policy Act (NEPA) Analysis, Resource Evaluation, Economic Analysis and the Renewable Energy Program. The new Bureau of Safety and Environmental Enforcement (BSEE) will enforce safety and environmental regulations. Functions will include: All field operations including Permitting and Research, Inspections, Offshore Regulatory Programs, Oil Spill Response, and newly formed Training and Environmental Compliance functions. The two, separate bureaus will begin operating on October 1, 2011.

Baseline Economic Information

Energy and minerals production from offshore areas contributed over $115 billion in economic impacts and supported over 642,000 American jobs.

Budget

2009 Enacted ($ millions)	2010 Enacted ($ millions)	2011 Request ($ millions)
164	182	190

Payroll (FY 2010)

Total Annual Payroll ($ millions)	Estimated Annual Payroll Impact ($ millions)	Estimated Additional Job Impacts from Payroll (jobs)
156	291	2006

Major Economic Contributions

	Value* ($ millions)	Estimated Economic Impact ($ millions)	Estimated Jobs Impact (jobs)
OCS Oil and Gas	49,085	115,736	642,309

* This value is less than the Sales Value because of the portions of profits from OCS operations that leave the U.S.

Category	Sales Value ($ millions)
Oil	46,870
Gas	7,452
NGL	2,390
Total	56,712

Source: ONRR

Grants and Payments*

	2010 Enacted ($ thousands)	Estimated 2010 Economic Impact ($ thousands)	Estimated 2010 Total Jobs (jobs)
Cooperative and Delegated Audits of Oil and Gas Operations	10,000	19,662	180
Mineral Revenue Payments** (includes 8(g) payments to States)	1,825,814	3,589,999	32,936
Coastal Impact Assistance Program	123,213	242,268	2,223
Total BOEMRE Grants and Payments	1,959,027	3,851,930	35,338

* GOMESA funding is included in the LWCF figures included in the NPS grants and payments table.

** Mineral Revenue Payments include both offshore and onshore revenues. At the time of this report, both sources of revenue were collected by BOEMRE. As in the Budget in Brief, both sources of revenue are reported under BOEMRE.

OFFICE OF SURFACE MINING RECLAMATION AND ENFORCEMENT

Bureau Role

The Office of Surface Mining Reclamation and Enforcement (OSM) was established by mandate of the Surface Mining Control and Reclamation Act of 1977 to address environmental and public safety concerns associated with surface coal mining. Coal has played a central role in the history of the Nation's industrial and economic development. The OSM mission is to ensure that, through a nationwide regulatory program, coal mining is conducted in a manner that protects citizens and the environment during mining, and restores the land to beneficial use following mining.

One of the objectives of the Surface Mining Control and Reclamation Act is to mitigate the effects of past mining by aggressively pursuing reclamation of abandoned coal mines. OSM collaborates with States and Indian tribes to develop Abandoned Mine Lands (AML) programs, and also provides funding, technical assistance, and oversight to ensure that qualified lands are reclaimed. While OSM has made significant progress in reclaiming abandoned mine land, there are over 200,000 acres on coal-related abandoned mine sites that have yet to be fully reclaimed. These areas constitute an estimated $3.9 billion worth of health and safety problems across the lands of 23 States and three Indian tribes.

Baseline Economic Information

Budget

2009 Actual ($ millions)	2010 Actual ($ millions)	2011 Request ($ millions)
165	163	146

Payroll (FY 2010)

Total Annual Payroll ($ millions)	Estimated Annual Payroll Impact ($ millions)	Estimated Additional Job Impacts from Payroll (jobs)
47	87	602

Grants and Payments

	2010 Enacted ($ thousands)	Estimated 2010 Economic Impact ($ thousands)	Estimated 2010 Total Jobs (jobs)
Abandoned Mine Reclamation State	369,086	1,061,294	8,578

Grants			
State and Tribal Regulatory Grants	71,314	140,221	1,284
Total OSM Grants and Payments	440,400	1,201,515	9,862

US GEOLOGICAL SURVEY

Bureau Role

USGS scientific information informs societal decisions across almost all sectors of the economy. The information reduces uncertainty and provides input to water, mineral, energy, and biological resource management as well as mitigation and adaptation to climate change and natural hazards. USGS scientific information has public good characteristics, and as such, is not usually valued in market settings. However, because of its public good nature, the information's value is dependent on it being openly and widely available to the public. For instance, delivery of Landsat data increased exponentially to over a million scenes in fiscal year 2009, after the implementation of free web-based distribution. The large geographic and cyclical coverage of Landsat data makes it well-suited for monitoring and assessing land and resource changes important for land and ecosystem management as well as for responding to disasters and climate change. Integrated assessments that link natural, social, and economic science information are important to increasing the accessibility and use of USGS scientific information. For example, research on understanding the production, quantity, and value of ecosystem services can inform Interior managers on the impacts of land and resource decisions and the tradeoffs from alternative uses of these lands and resources. USGS programs consist of the following four primary disciplines: geography, geology, hydrology, and biology.

Geography: Geography programs integrate important environmental and societal processes to facilitate our understanding of how human well-being and environmental quality can be improved and maintained. These programs also identify the spatial variation in these characteristics and qualities and facilitate a more "place-specific" solution to environmental problems, including reduction of risk and options for greater adaptation to an uncertain future, such as those related to global climate change. For example, the Geographic Research, Investigations, and Remote Sensing program provides information about land surface change including change due to wildfire, agricultural production, urbanization, forest logging, climate change and other factors operating at broad regional scales.

Geology: Geologic programs at USGS provide important information to the public that helps protect life and property and are vital for exploring, developing, and preserving mineral, energy, and water resources; and evaluating and planning for land management and environmental protection. These programs help reduce losses from natural hazards, including earthquakes, volcanoes, landslides, and other ground failures and mitigate effects of coastal and stream erosion. The products can be used by a broadly based user community, including Federal, State, and local governments and the private sector.

Hydrology: Several USGS programs deliver important hydrological information, which provides a foundation for informed decision making by resource managers, regulators, industry, farmers, and the public. The programs provide information about groundwater availability in the Nation's major

aquifer systems; explain the occurrence, behavior, and effects of toxic substances in the Nation's hydrologic environments; and provide valuable streamflow and water quality information.

Biology: Biological research develops new methods and techniques to identify, monitor, and manage fish and wildlife, including invasive species, and their habitats. USGS biological research programs provide information about how ecosystems are structured, function and provide "ecosystem services."; the effects of environmental contaminants in the Nation's biotic resources with emphasis on resources managed by the DOI; the distribution, abundance, and condition of wildlife populations and communities; and information needed to prevent, detect, control, and eradicate invasive species and to restore impaired ecosystems.

Baseline Economic Information

Budget

2009 Enacted ($ millions)	2010 Enacted ($ millions)	2011 Request ($ millions)
1,046	1,113	1,134

Payroll (FY 2010)

Total Annual Payroll ($ millions)	Estimated Annual Payroll Impact ($ millions)	Estimated Total Job Impacts from Payroll (jobs)
717	1,340	9,227

Value of information Research

The USGS has taken the lead in developing value of information (VOI) research for Interior with studies of the National Map, geological maps, moderate resolution land imagery, water quality information, earthquake hazard mapping, and earth science information. The underlying method used in USGS VOI research is to compare the condition with the information to the condition without the information. The difference between the two conditions provides an estimate of the VOI. Examples of studies that have estimated the VOI include the following:

- A study of the total value of the National Map was conducted by modeling diffusion of technological applications of the mapping information (USGS Circular 1271). The net present value of the total VOI of the National Map was estimated to be $2.9 billion for the stream of benefits over a 30 year time horizon. This VOI greatly exceeds the $417 million net present value cost of developing and maintaining the National Map.

- A study conducted in the 1990's assessed the value of a new geological map for environmental decision making in a case study of landfill siting and road construction in Loudoun County Virginia. The new map was estimated to provide a benefit of $4.07 to $7.77 million for the applications considered compared to the cost of mapping the county of $1.94 million. [7]

- Bernknopf *et al.* (2006) studied the expected earthquake losses in Watsonville, CA, under a range of mitigation options. The geographic information was estimated to provide a net value of between $59.7 million and $67.4 million.

- In a cooperative investigation with the Geologic Survey of Canada, the USGS has explored the value of bedrock geological maps to mining enterprises (USGS Professional Paper 1721) in both a mature mining region (the Flin Flon Belt) and a potential frontier mining region (Southern Baffin Island.) The bedrock maps are used to identify domains most likely to contain commercially valuable metal sulfide deposits. By reducing uncertainty about the location of potential mines, an expectation of positive return on mine exploration investment is possible for more ventures. In South Baffin Island it was estimated that the new map would stimulate $18.0 million in exploration activity compared to a cost of $2.2 million for the new map. The exploration investment is equivalent to the risk adjusted net present value of the extracted minerals.

- Efficient prevention of groundwater contamination by nonpoint source insecticides and herbicides is a valuable use of information that was analyzed in a case study of agricultural land use in the Pearl Harbor Basin on the Island of Oahu, Hawaii (USGS Professional Paper 1645). The analysis estimated a net present value of $319 million if the most efficient alternative identified is used to optimize benefits net of wellhead treatment costs.

The applied value of scientific information has been and is under continuing investigation in analyses of potential and actual uses of DOI information products.

[7] All prices are expressed at the 2010 price level.

OFFICE OF INSULAR AFFAIRS

Office Role

The Office of Insular Affairs (OIA) carries out the Secretary's responsibilities for U.S. affiliated insular areas, including the Territories of Guam, American Samoa, the U.S. Virgin Islands, and the Commonwealth of the Northern Mariana Islands, as well as the three Freely Associated States: the Federated States of Micronesia, the Republic of the Marshall Islands, and the Republic of Palau. The OIA assists the insular areas in developing more efficient and effective governments by providing financial and technical assistance, and helps manage the Federal government's relationships with insular areas by promoting appropriate Federal policies. The OIA works to improve the financial management practices of insular governments, maximize economic development opportunities, and increase Federal responsiveness to the unique needs of island communities.

The standard of living in the insular areas is lower than for the United States as a whole: U.S. per capita GDP in 2009 was about $46,000, more than double the $20,000 average for the four U.S. territories. In one of the territories, per capita GDP is less than a quarter of the national per capita figure. Infrastructure in the insular areas, including school buildings, government offices, roads and airports, is typically not up to national norms. Refurbishing this infrastructure would result in much-needed improvements and generate a significant level of economic value for the communities concerned.

Accurate socioeconomic data is an important component of decision making. The four territories are not included in the Nation's GDP, the Bureau of the Census's American Community Survey and the Bureau of Labor Statistics' employment and labor force data. Lack of current data on crucial aspects of the territories deprives both territorial and Federal leaders from the detail and insight they need to make informed and critical policy decisions. OIA has an agreement with the Department of Commerce, Bureau of Economic Analysis to produce GDP data for the four territories. The first GDP estimates, for 2002-2007, were released by the BEA in May 2010. Estimates for 2008-2009 will be available this spring and summer.

In order to obtain additional information on their economic impact in the insular areas, the OIA contracted with RTI International in April 2010 to prepare a report estimating the economic impact of OIA grants and payments to insular areas. The report was completed in May 2010, and presented estimates of the impact of grants and payments on employment, employee compensation, and gross domestic product (GDP) for each of the insular areas. Economic Base Analysis (EBA) was used to estimate the indirect and induced effects of OIA funding in insular areas because no publicly available input-output models exist for the insular areas. This method differs from that used in the other bureau-level analysis in this chapter, but provides a similar estimate of economic impacts that includes direct, indirect, and induced effects.

Baseline Economic Information

Budget ($ millions)

2009 Enacted ($ millions)	2010 Enacted ($ millions)	2011 Request ($ millions)
84	103	87

Payroll

Economic effects for OIA employees are included in the estimates for the Other Interior Offices in Table 2-1 OIA's 41 employees represent about 1 percent of the "Other Interior Offices" labor force.[8] The impacts associated with these employees were estimated assuming that OIA's impacts represent a similar share of the total impacts of the Other Interior Offices.

Total Annual Payroll ($ millions)	Estimated Annual Payroll Impact ($ millions)	Estimated Additional Jobs Impact from Payroll (jobs)
5.2	9.7	67

Grants and Payments

OIA's FY 2010 technical assistance, grants, and payments funding of $479.6 million[9] was spent directly in the insular areas. Estimates of the amount of GDP supported by OIA payments are presented in the table below. Based on an analysis of the economics of each insular area, it was determined that for every $1 of GDP directly supported by OIA payments, approximately $2.28 of GDP was supported elsewhere in the insular economy on average. As a result, a significant portion of national GDP is directly and indirectly supported by OIA payments in many insular areas. For example, approximately 54% of total GDP in Micronesia is either directly or indirectly supported by OIA payments.

GDP Impact for FY2010 OIA Payments, by Insular Area

	Direct GDP Impact ($ thousands; 2009$)	**Indirect/Induced GDP Impact** ($ thousands; 2009$)	**Total GDP Impact** ($ thousands; 2009$)	**National GDP Supported by OIA Payments** (%)
American Samoa	24,825	26,197	51,022	9%

[8] Most of these 41 OIA employees had a duty station of Washington, DC; the rest were located outside of the Continental United States.

[9] This total, from the report "Economic Impacts Attributable to Federal Grants and Payments to Seven Insular Areas", is approximately the enacted budget authority for OIA in 2010.

Guam	96,069	209,110	305,179	7%
Northern Mariana Islands	12,510	12,004	24,514	2%
U.S. Virgin Islands	228,627	632,333	860,960	18%
Micronesia	51,722	89,000	140,722	54%
Marshall Islands	28,419	39,788	68,208	44%
Palau	6,831	14,363	21,194	12%
Total	**449,003**	**1,022,795**	**1,471,798**	**13%**

Source: Economic Impacts Attributable to Federal Grants and Payments to Seven Insular Areas, Final Report, Prepared for Office of Insular Affairs U.S. Department of the Interior. Research Triangle Institute, May 2010.

Estimates of local employment supported by OIA payments are presented the table below. Based on analysis of the economic structure of each insular area, it was determined that for every job directly supported by OIA payments, approximately 1.90 jobs were supported elsewhere in each insular economy, on average. Base employment multiplier estimates ranged from 1.96 in the Northern Mariana Islands to 3.77 in the U.S. Virgin Islands.

Employment Impact for FY2010 OIA Payments, by Insular Area

	Direct Employment Impact (jobs)	**Indirect/Induced Employment Impact** (jobs)	**Total Employment Impact** (jobs)	**National Employment Supported by OIA Payments (%)**
American Samoa	766	809	1,575	9%
Guam	1,294	2,816	4,109	6%
Northern Mariana Islands	326	313	640	2%
U.S. Virgin Islands	2,327	6,436	8,763	18%
Micronesia	3,150	5,420	8,570	54%
Marshall Islands	1,879	2,631	4,510	44%
Palau	480	1,009	1,490	12%
Total	**10,222**	**19,434**	**29,656**	**15%**

Source: Economic Impacts Attributable to Federal Grants and Payments to Seven Insular Areas, Final Report, Prepared for Office of Insular Affairs U.S. Department of the Interior. Research Triangle Institute, May 2010.

In the cases of the Marshall Islands and Micronesia, a significant portion of national employment is directly and indirectly supported by OIA payments. Approximately 54% of total recorded employment in Micronesia was either directly or indirectly supported by OIA payments. These data do not include subsistence agriculture or fishing.

Estimates of the amount of employee compensation supported by OIA payments are presented in the table below. Based on an analysis of the economic structure of each insular area, it was determined that for every $1 of employee compensation directly supported by OIA payments, approximately $2.26 of employee compensation was supported elsewhere in the insular economy,

on average. Base employee compensation multiplier estimates ranged from 1.95 in the Marshall Islands to 3.87 in the U.S. Virgin Islands.

Employee Compensation Impact for FY2010 OIA Payments by Insular Area

	Direct Employee Compensation Impact ($ thousands; 2009)	**Indirect/Induced Employee Compensation Impact** ($ thousands; 2009)	**Total Employee Compensation Impact** ($ thousands; 2009)	**National Employee Compensation Supported by OIA Payments (%)**
American Samoa	11,260	15,249	26,510	14%
Guam	26,951	64,125	91,076	7%
Northern Mariana Islands	3,967	5,718	9,685	3%
U.S. Virgin Islands	73,986	212,068	286,054	19%
Micronesia	16,213	30,655	46,868	69%
Marshall Islands	20,019	19,102	39,121	39%
Palau	5,790	11,131	16,921	17%
Total	**158,186**	**358,049**	**516,235**	**14%**

Source: Economic Impacts Attributable to Federal Grants and Payments to Seven Insular Areas, Final Report, Prepared for Office of Insular Affairs U.S. Department of the Interior. Research Triangle Institute, May 2010.

In the cases of the Marshall Islands and Micronesia, a significant portion of national employee compensation is directly and indirectly supported by OIA payments. For example approximately 69% of total estimated recorded employee compensation in the Federated States of Micronesia is either directly or indirectly supported by OIA payments.

Chapter 3 ECOSYSTEM SERVICES

INTRODUCTION

Conservation is at the core of Interior's mission to protect America's natural resources and heritage, honor cultures and tribal communities, and supply energy to power the future. This chapter highlights how ecosystem service concepts can integrate conservation with human well-being. Evaluating and taking into consideration the services provided through human production as well as through conserved ecosystems can result in new stakeholders, broader landscapes, expanded revenue sources, and enhanced conservation. This chapter is not intended to be a comprehensive survey of the ecosystem services literature, but to present the relevant concepts and discuss how they apply to Interior.

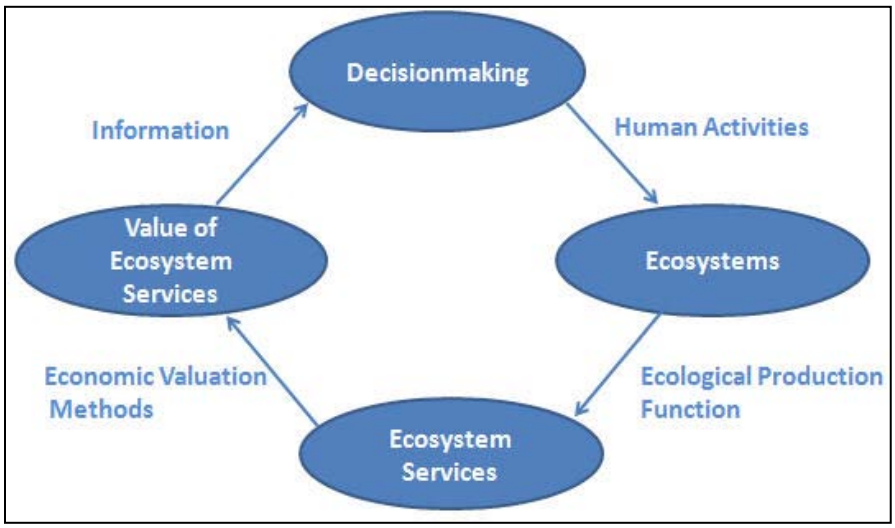
The Department of the Interior's lands and managed resources produce a wide range of valuable ecosystem services, including food, drinking water, energy, flood and disease control, carbon sequestration, recreation, and culture. Understanding the value of these services can result in better land management decisions. Although there is currently not a total quantification, nor valuation, of ecosystem services from Interior lands and managed resources, this chapter provides three case studies to illustrate sources of some ecosystem services values, including:

1. Preserved land cover through BLM's Community Assistance and Hazardous Fuel Programs (HFP), which is estimated to maintain an ecosystem service value of $2.9 billion ($2004) in select California, BLM-dominated counties;
2. DOI-managed wetlands in the Mississippi Alluvial Valley, which are estimated to generate over $450 million ($2008) in ecosystem service values; and
3. FWS management of Wildlife Protection Areas (WPAs) in the Prairie Potholes, which are estimated to generate $8.4 Million ($2004) in ecosystem service values from waterfowl hunted nationwide.

Although the fields of ecology and economics do not have a standard definition and measurement of ecosystem services, they are generally understood to be the benefits of nature to individuals, communities, and economies. For some services, determining value is relatively straightforward, such as for minerals or grazing lands, which are traded in established markets. Other services are being valued in emerging markets, such as carbon sequestration and alternative energy, which are expected to become better defined in coming years. However, few markets exist for experiencing a day of hiking or fishing, maintaining and interpreting our cultural resources, enhancing the health of wetlands and rangelands, or preserving habitat for endangered species. These ecosystem services from DOI lands and managed resources are important, can change, and are less well understood than marketed services and values.

As depicted in Figure 3-1, all human activities affect ecosystems. The scientific community is critical in understanding ecosystems and the production of services affected by human uses. The economic community translates the scientific metrics into economic values that generate the information needed by managers to make the most informed and effective decisions.

Figure 3-1. Decision-making on Managing Ecosystem Services



Source: Steve Polasky, 2006, p. 6.

Ecosystem services mapping and quantification remain a major challenge. Good decision-making requires an understanding of the types, locations, and conditions of ecosystems. According to the USGS,

> "ecosystems are a practical landscape unit that can promote an understanding of the ecosystem services upon which our society depends. The United States lacks a standardized coast-to-coast ecosystem map at an appropriate scale for local on-the-ground management of ecosystems. To address this need, the USGS ecosystem mapping program is synthesizing abiotic and biotic data layers, landforms, surficial geology, bioclimatic zones and vegetation to delineate ecosystem units at 30-meter resolution (see Figure 3-2 for a representation of the various layers). In addition to the final map product and a better understanding of ecosystem structure, the program will also make available, for the first time, the individual abiotic map products, e.g. Digital Landform, Surficial Geology, and Bioclimatic Zone Products for the Conterminous United States."
>
> USGS, National Ecosystem Mapping

Figure 3-2. Ecosystem Layers for Mapping and Quantification

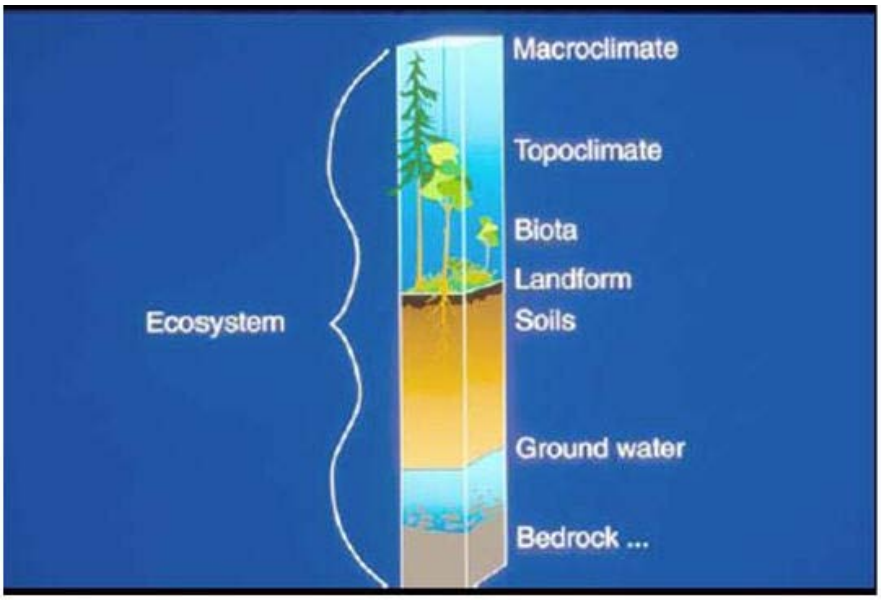


Image courtesy of Robert Bailey, USFS.

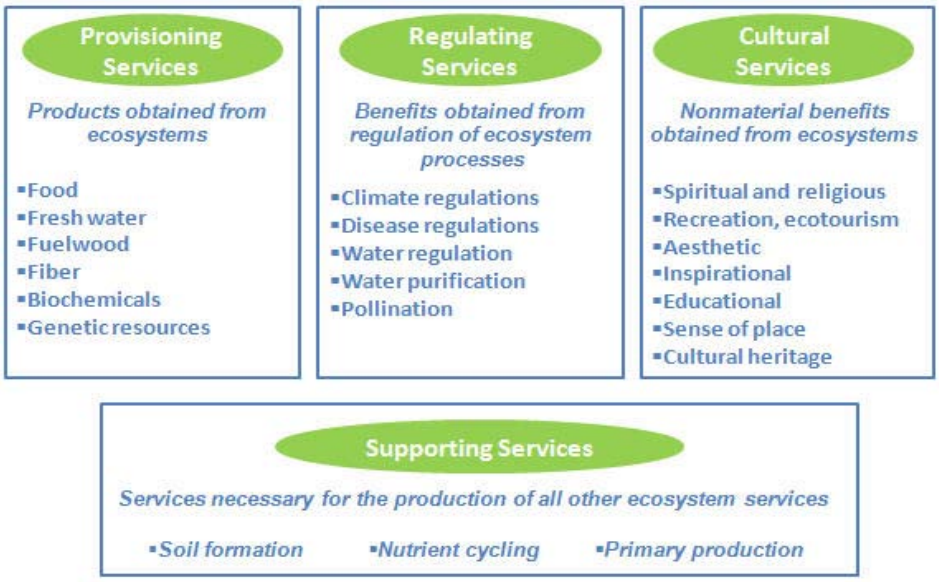
Source: USGS, National Ecosystem Mapping, http://geography.wr.usgs.gov/science/ecosystem.html

The Relationship between Ecosystem Services, Uses and Economic Values

Ecologists currently classify ecosystem services into four categories, as shown in Figure 3-3:

1. **Provisioning services** goods produced such as food, timber, fuel, and water (i.e., commodities);
2. **Regulating services** such as flood and disease control;
3. **Cultural services** such as spiritual, recreational, and cultural benefits; and
4. **Supporting services** such as nutrient cycling that maintain the biophysical conditions for life on Earth.

Figure 3-3. Ecosystem Service Categories



Source: Millennium Ecosystem Assessment, 2005, p. 57.

Some ecologists classify recreation as a provisioning service instead of a cultural service; however, the interface with economics is cleaner if provisioning services only include commodities (goods bought and sold on the market at a market price).

Ecosystem services are organized for valuation by economists into the following two main categories—use and non-use values—and several subcategories:

Use value

- **Direct use** involves human physical involvement with natural resources (e.g., logging, fishing, recreation, and tourism).
- **Consumptive use** relates to activities that consume natural resources (e.g., logging, fishing).
- **Non-consumptive use** does not deplete the resources (e.g., recreation, tourism).
- **Indirect use** refers to the category of resources that support humans or what humans directly use, including climate regulation, flood control, animal and fish refugia, pollination and waste assimilation from wetlands.

Economists Differ on Definitions of Use and Non-Use Values

Public lands provide valuable functions and services. There is variation among experts, though, as to how these functions and services are defined. In general, economists divide economic values into two main categories: use and non-use. Existence value is sometimes considered a non-use, but is more recently understood by some resource economists as a non-consumptive (passive) use, particularly in the sense of cultural values. Examples include spiritual and cultural connections between Native Americans and natural resources. Non-use values do not involve physical interaction. These include bequest (based on perceived value to future generations) and option values (values from preserving the opportunity of future use). There is no consensus among economists as to whether option value, which by ensures the possibility of (future) use of the resources is use or non-use value. It is traditionally identified as a non-use value because it is not related to any current use of the good.

Non-use values

Non-use values are associated with the benefit or pleasure derived from the knowledge that an environmental good or amentity exists without using it. Types of non-use values include: existence values, bequest values (values based on perceived value to future generations), and option value (values from preserving the opportunity of future use).

Finally, there are three primary economic approaches used to estimate the various types of values from ecosystem services: These include:

- **Economic value**, which is generally measured in terms of market values or what people are willing to pay for the set of resources and services produced on public lands. Economic value also includes "non use" values.

- **Economic impacts** or economic contributions are measured in terms of the sales, jobs, tax revenues and income that result from activities on public lands. Economic contributions of Interior's activities are discussed in other chapters of this report. See Chapter 2 and Appendices 1 through 5.

- **Expenditure analysis** is the total spending on natural resource use, which does not equal the economic value or economic impact. However, given incomplete information, total spending can be used to illustrate minimum benefits related to use. See the Recreation section of Appendix 2.

The "Birth" of Ecosystem Services and Their Economic Value

The concept of ecosystem services may go back as far as Plato (Daily, 1997), but ecosystem services as the concept is discussed today likely started in 1997 with the publication of *Nature's Services: Societal Dependence on Natural Ecosystems.* The book's editor, ecologist Gretchen Daily, wrote in the preface*:*

A small group [of Pew Fellows] gathered informally to lament the near total lack of public appreciation of societal dependence upon natural ecosystems… [L]ack of understanding of the character and value of natural ecosystems traces ultimately to a failure of the scientific community to generate, synthesize, and effectively convey the necessary information to the public. A collective strategy to address this problem emerged from the group's discussion, the first phase of which consisted of producing a rigorous, detailed synthesis of our current understanding of a suite of ecosystem services and a preliminary assessment of their economic value.

The resulting book was written by many of the nation's leading scientists and economists that, for the very first time, took on the tasks of characterizing the ways in which Earth's natural ecosystems confer benefits on humans and then making a preliminary assessment of their value.

See: Ruhl and Salzman (2007: 2); Daily (1997).

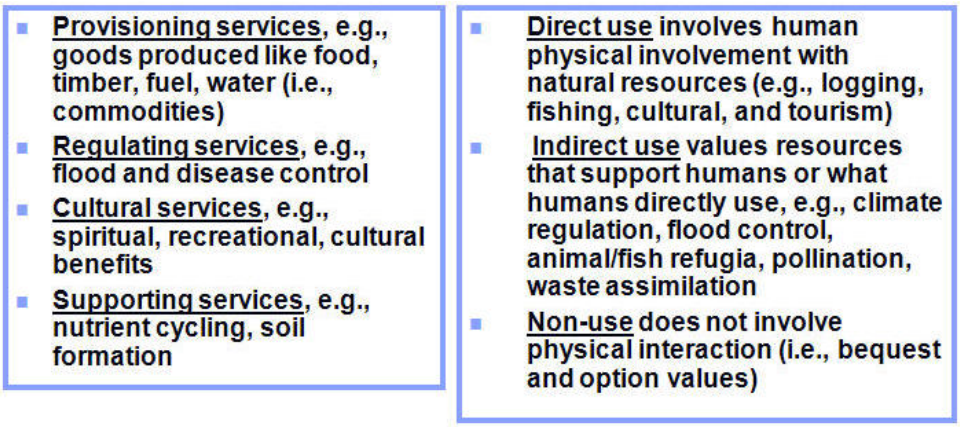
ECONOMIC METHODS FOR VALUING ECOSYSTEM SERVICES

Economic valuation methods help decision makers understand how the provision of services from public lands and managed resources contributes to human well-being, taking into account the location of beneficiaries relative to production of services. Estimates of economic impacts should not be considered as estimates of the net worth or *value* of activities occurring on public lands. This is because the estimated output impacts relate to gross sales revenues, not profit which defines the value of the activities that accrues to businesses. Moreover, the estimated output impacts do not account for the economic value of the activities that accrues to individuals themselves, which is known as *consumer surplus.* Consumer surplus or net economic value is the difference between the maximum that a person is willing to pay for the good

or service rather than do without it, and what he/she actually spends (total benefits minus total spending).

The concept of total economic value in natural resource and environmental economics refers to a sum of use and non-use values. Amenity values are a subset of total economic value, which includes non-consumptive use, indirect use, and non-use values. Consumer surplus is captured in the calculation of amenity values. The most important point to note is that while there may not be a universally accepted definition of ecosystem services across disciplines, ecologists' general classification aligns with economic concepts of use and non-use, as shown in Figure 3-4. This alignment allows for the various types of economic valuation to assist in effective decision-making, as described further below.

Figure 3-4. Ecologist's General Classification Aligns with Economic Concepts



Economic evaluation involves the identification, measurement, valuation, and comparison of the benefits (outcomes) and/or costs (inputs) of a policy, program, project, activity or event, often with two or more alternatives. Options for incorporating ecosystem service values into economic evaluations include:

- **Benefit-cost analysis**, which is used to evaluate the desirability of an action by weighing the total benefits against the total costs;
- **Environmental impact assessment**, which is used to analyze the natural, social and economic effects of an action on a given area;
- **Cost-effectiveness analysis**, which helps identify the least-cost option given a specific policy or program management goal with multiple approaches; and
- **Damage assessment**, which is the process of evaluating potential or actual hazardous impacts on people and resources (e.g., fire, hurricanes, chemical releases) and the potential benefits from risk mitigation, land-use planning and/or restoration, among other activities.

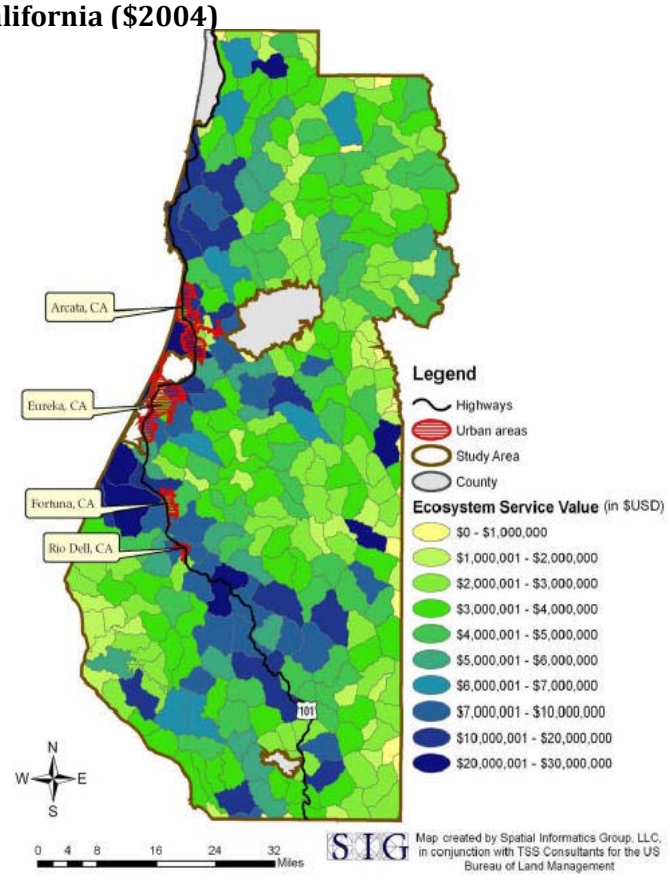
Because many ecosystem services are non-market goods, it can become challenging to acquire good data for use in decision-making. Of the three approaches for estimating ecosystem service values, economic impact analysis and expenditure analysis are addressed elsewhere in this report. Estimation using an economic valuation study is described in more detail below.

Box 3-1. Preserved Land Cover Maintains an Estimated Ecosystem Service Value of $2.9 billion ($2004) in Select California, BLM-dominated Counties

Wildfire management helps protect structures, as well as natural resources that provide valuable goods and services.

BLM's Community Assistance and Hazardous Fuel Programs (HFP) are implemented to negate the destruction caused from wildfires. While not all fire is harmful from an ecological standpoint, there are wildfires that can ultimately be damaging to both manmade and natural capital. Many researchers have tried to study the costs and benefits associated with fire hazard mitigation, yet few have accounted for the ecosystem service value of protected natural assets. Examples include the hydrologic regulation functions of standing forests, water purification and flood abatement services of wetlands, and the scenic and recreational values of natural landscapes. Ganz et al. (2007) attempt to highlight these values associated with HFP within three counties in California: Napa, Humboldt, and San Bernardino. Each county was selected for its diverse number of land cover types, hazardous fuel treatments, development patterns, and the significant amount of BLM lands within their boundaries.

Figure 3-5. Estimated Ecosystem Service Values by Watershed for Humboldt County Study Area, California ($2004)



The authors use a full suite of ecosystem valuation techniques to yield baseline values for 19 land cover types. Once these values are derived for each specific land use, they are multiplied by the respective acres of each cover type to aggregate up to the county level. The model estimates ecosystem values of $1.2 billion, $276 million, $1.4 billion, for Humboldt, Napa, and San Bernardino counties, respectively ($2004). Humboldt's values accrue largely from its forests (almost 80 percent), while Napa and San Bernardino's rely primarily on a makeup of forests, freshwater systems, and agricultural lands/vineyards. The authors provide a significant management conclusion from two community case studies: "[f]ire treatments appear to be cost effective. When both the nonmarket and market-based values of protected structures, goods, and services…are taken into consideration, there appears to be a net economic benefit for each community" (Ganz *et al.*: 603).

ECONOMIC VALUATION METHODS AND EXAMPLE STUDIES

For valuing ecosystem services and associated amenities, there are three classes of economic studies—revealed, imputed and expressed willingness to pay—that encompass seven applicable methods: (1) hedonic pricing, (2) travel cost, (3) damage cost avoided, (4) replacement cost, (5) substitute cost, (6) contingent valuation, and (7) conjoint analysis. Each of the methods is described briefly below.

1. **Revealed Willingness to Pay—Market Prices.** Some environmental amenities, like scenic views and recreational experiences may not be di rectly bought and sold in markets. However, the prices people are willing to pay in markets for related goods can be used to estimate their values. For example, people often pay a higher price for a home with a view of the ocean, or will take the time to travel to a special spot for fishing or bird watching. These kinds of expenditures can be used to place a lower bound on the value of the view or the recreational experience.

    - **Hedonic pricing** is used to estimate values for environmental amenities that directly affect market prices. It is most commonly applied to variations in housing prices that reflect the value of local environmental attributes like nearby public lands. The basic premise of this method is that the price of a marketed good is related to its characteristics, or the services it provides.
    - **Travel cost** is the method used to estimate recreational use values. The method can be used to estimate the economic benefits or costs resulting from changes in access costs for a recreational site, elimination of an existing recreational site, addition of a new recreational site, changes in environmental quality at a recreational site. The premise is that the time and travel cost expenses that people incur to visit a site represent the "price" of access to the site. Thus, their willingness to pay to visit the site can be estimated based on the number of trips that they make at different travel costs.

2. **Imputed Willingness to Pay—Cost Methods.** The value of some ecosystem services can be measured by estimating the cost of actions people are willing to take to avoid the adverse effects that would occur if the services were lost, or to replace the lost services. For example, wetlands often provide protection from floodwaters. The amount that people pay to avoid flood damage in areas similar to those protected by the wetlands can be used to estimate willingness to pay for the flood protection services of the wetland. The three methods used are called: Damage Cost Avoided, Replacement Cost, and Substitute Cost.
3. **Willingness to Pay Surveys**. Many ecosystem services are not traded in markets, and are not closely related to any marketed goods. Thus, people cannot "reveal" what they are willing to pay for them through their market purchases or actions. In these cases, surveys can be used to ask people directly what they are willing to pay based on a hypothetical scenario (contingent valuation or CV). Alternatively, people can be asked to make tradeoffs among different alternatives, from which their willingness to pay can be estimated (conjoint analysis). These are called stated preference methods. Although there has been controversy in the past about the results and costs of CV studies, in particular, the method improved substantially after the Exxon Valdez disaster, when NOAA assembled a panel of leading economists to assess

contingent valuation as a reliable method for natural resource damage assessment. The panel identified parameters of "good" CV studies.

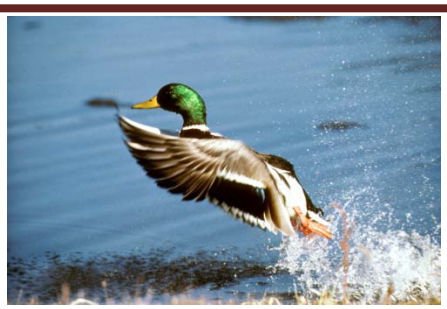
DOI has experience in conducting stated preference studies, including:

- **Glen Canyon Dam.** Reclamation used a CV survey to estimate the benefits of protecting downstream resources.
- **Yellowstone National Park.** NPS conducted a conjoint study to support a rulemaking on winter use management.
- **America the Beautiful Pass**. NPS, FWS, BLM, and the USDA Forest Service coordinated on a study that used a combined revealed and stated approach to help determine the price of the new recreation pass.
- **Elwha River.** The NPS, Reclamation and Indian Tribes coordinated on a CV study of the public's WTP to remove old dams that block salmon migration.
- **Exxon Valdez.** CV was used to measure the recreation and passive use values lost due to the oil spill.

The results of these types of valuation studies can provide reliable estimates of the total value of ecosystem services, which may be incorporated into benefit-cost analyses, environmental impact assessments, policy decisions, and damage assessments. These types of studies provide decision makers with a rich set of information and allow consideration of net benefits (total benefits minus total costs) associated with various options for resource management.

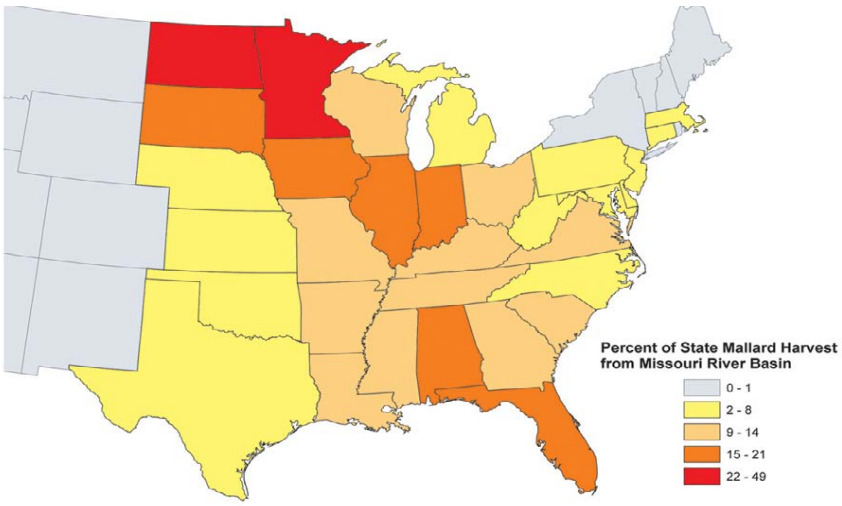
Box 3-2. Prairie Potholes Estimated to Generate $8.4 Million ($2004) in Ecosystem Service Values from Waterfowl Hunted Nationwide

DOI's US Fish & Wildlife Service (FWS) manages Waterfowl Production Areas (WPAs) to provide nesting habitat for North American waterfowl. Nearly 3,000 WPAs in 10 states preserve more than 735,000 acres of federally owned wetland habitat. An additional 2.2 million acres are managed under easement or leased to FWS. Federally-owned WPAs are open for public recreation, including hunting, fishing, and hiking. WPAs provide recreational opportunities to their neighbors, as well as increasing nationwide waterfowl populations. Laughland (2005) measured the value of the waterfowl production services of WPAs and the benefits received by visitors to WPAs in the highly productive Prairie Pothole Region of Minnesota and the Dakotas. Although there is no charge for using WPA lands, studies at other sites have shown that visitors would be willing to pay for the kinds of recreational services they receive there. Laughland estimated that visitors to five WPAs in Minnesota would have been willing to pay $9.9 million ($2004) for the experience. One way WPA wetland ecosystems generate value is through the hunting of species that rely on them. Nationwide, 1.8 million people enjoy waterfowl hunting annually. Laughland estimated that they derive $770 million ($2004) in net economic value from the sport. Biologists use leg bands and other tools to understand waterfowl migrations. These source data were used to assign some of the value that hunters gain in distant states back to the ecosystems where the birds were hatched. Analyzing life tables and migration patterns, the study established that ducks spend about 53 percent of their lifetime on or near the breeding grounds. This led to an appropriate distribution of the hunters' net economic value to the breeding grounds and the WPAs. Laughland estimated that $8.4 million ($2004) of the waterfowl hunters' net economic value can be attributed to WPAs managed by the FWS.



Waterfowl Production Areas contribute to duck populations nationwide.

Figure 3-6. State Duck Harvest Proportion from Missouri River Basin Region



Source: Munro and Kimball. 1982.

Using alternative estimates for some of the model parameters gave a range of results between $3.8 million and $9.9 million. North Dakota has the greatest area under WPA management and so accounts for $6.5 million of the estimate. Minnesota and South Dakota contribute $0.1 million and $1.8 million, respectively.

Box 3-3. DOI-Managed Wetlands in the Mississippi Alluvial Valley Estimated to Generate Over $450 Million ($2008) in Ecosystem Service Values

As the largest floodplain in the US, the Mississippi Alluvial Valley (MAV) is a particularly rich ecosystem that has undergone massive change from hydrological alteration and agricultural expansion over the last 100 years. Located below the confluence of the Mississippi and Ohio Rivers in the states of Arkansas, Mississippi, and Louisiana**,** the MAV produces a myriad of ecosystem goods and services and has been a target for restoration through the Wetland Reserve Program (WRP). The WRP provides easement payments and cost-sharing to private landowners to protect, restore and enhance their wetlands.

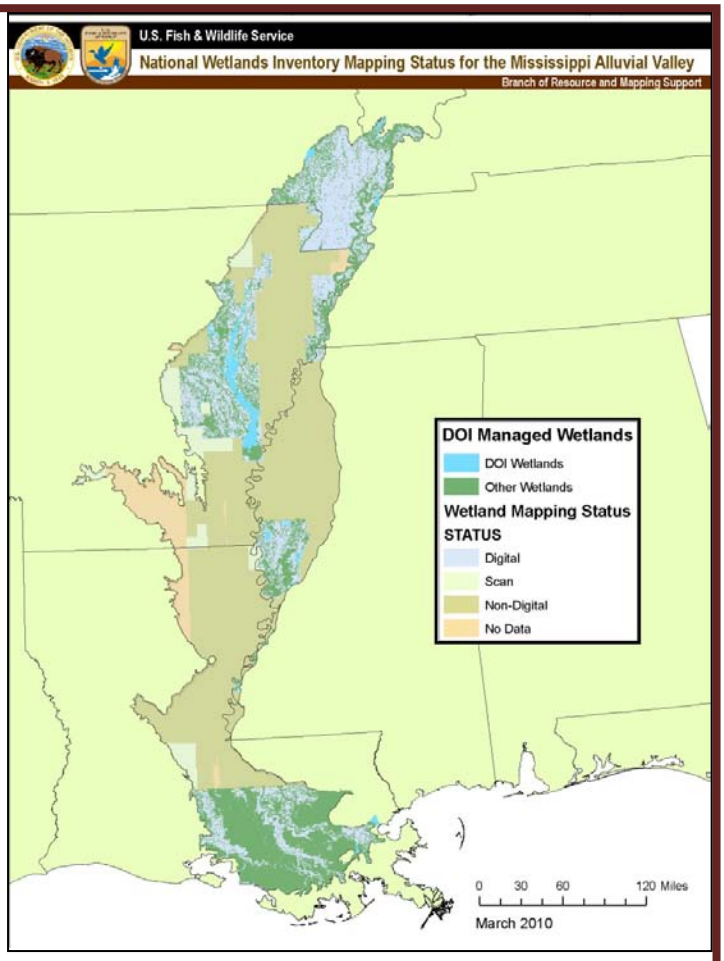


Figure 3-7. Map of Mississippi Alluvial Valley

Jenkins et al. (2010), working in conjunction with a USDA Conservation Effects Assessment Project (CEAP), compared estimated ecosystem service values to the cost of wetland restoration through the WRP. The authors focused on three ecosystem services: greenhouse gas (GHG) mitigation, nitrogen mitigation, and increased waterfowl recreation from enhanced habitat. In contrast to landscape-level approaches, the authors designed a bottom-up integration of ecosystem service function measurements, environmental modeling and economic valuation, combining both field and secondary data.

Table 3-1. Ecosystem Services Measured By USGS National Wetlands Center and Ducks Unlimited

Ecosystem Service	Definition/Metric	Spatial Resolution
Wildlife habitat – amphibians	Species richness (number/ha)	Site
Wildlife habitat – breeding birds	Species richness (number/ha)	Region
Wildlife habitat – waterfowl	Duck energy days/acre	Region
Nutrient retention	Denitrification potential (kg NO_3-N/ha/yr)	Site
Erosion reduction	Sediment (Mt/ha/yr)	Site
Carbon sequestration	Mg CO_2e/ha/yr	Site

Source: Murray, Jenkins, Kramer, Faulkner, 2009, p. 16.

Box 3- 3, continued from previous page.

Scientists at USGS' National Wetlands Research Center carried out the field data collection. Relying on benefit transfer methodology, which involves appropriately transferring results from studies completed in another location and/or context, the authors applied representative economic values to the estimated changes in services that result from restoring cropland to forested wetland. Their initial ecosystem service valuation provides estimates of social welfare values, which is considered the appropriate measure for gauging public programs such as WRP. They also estimated the potential value from emerging ecosystem service markets. As shown below, the social value of wetlands in the MAV is approximately 20 times higher than the market value of $74 per hectare per year ($2008/ha/yr).

Table 3-2. Range of Ecosystem Service Values for MAV Wetlands

Ecosystem service	Social Value ($2008/ha/yr)	Current Market Value ($2008/ha/yr)	Potential Market Value ($2008/ha/yr)
GHG mitigation	**$171 - $222**	**$59**	**$419**
Nitrogen mitigation	**$1,248**	**$0**	**$634**
Waterfowl recreation	**$16**	**$15**	**$15**
Total	**$1,435 - $1,486**	**$74**	**$1,068**

Source: Adapted from Jenkins *et al.*, 2010.

According to FWS' National Standards and Support Team, the MAV region is over 30.8 million acres, of which over 12.8 million acres (41.6%) has digital wetland mapping completed. Within that mapped area there are approximately 4.6 million acres of wetlands (36% of the land area). Of the approximately 1.2 million acres of National Park Service and National Wildlife Refuge lands within the MAV region (4.12%), 313,983 acres are mapped as wetlands. Applying the ecosystem service value estimates from Jenkins *et al*. (2010) for functioning forested wetlands, the 313,983 acres of DOI-managed wetlands in the MAV are estimated to provide $450.6 to $466.6 million ($2008) in ecosystem service value (assumes all DOI wetlands in the MAV are forested wetlands). The potential market value is estimated at $335.3 million ($2008). The authors consider these wetland values to be a lower bound because ecosystem services like floodwater storage, sediment retention, and wildlife habitat services are not included.

MARKETS FOR ECOSYSTEM SERVICES RELEVANT TO DOI RESOURCES

Interior has long-term experience with conservation banking and already considers ecosystem services in some of its resource management decisions. There are opportunities and challenges for the Department from new and evolving ecosystem services markets. Examples of evolving markets include carbon credit trading on voluntary markets for greenhouse gas credits[10] and payments for ecosystem services for biodiversity conservation. In addition, opportunities exist to improve the efficiency of existing markets, but care must be taken not to disrupt existing markets that appear to be functioning reasonably well. A good example is wetland mitigation banks, which generate aquatic resource credits to offset resources lost from various construction projects. The U.S. EPA and the Army Corps of Engineers revised the regulatory framework covering mitigation banking in 2008.[11] Markets for water, which are typically administered by State water authorities, are also well established in a number of locations.

Conservation banks are institutions designed to secure natural assets, similar to the way financial banks protect monetary assets. Lands are conserved and permanently managed to support target species, offsetting the adverse impacts of development that occurred elsewhere (off-site mitigation) within the designated service area. Degraded areas can be restored to generate credits, and commercial areas (grazing lands, timberlands) can be managed for multiple uses. Since the early 1990s, FWS has approved over 100 conservation banks (mostly in California). Federal guidance for mitigation banking dates to 1995 (60 FR 58605-58614), and FWS guidance on banks for target species dates to 2003. Opportunities exist for Interior to expand and improve the use of conservation banking, through both new and existing arrangements. For example, larger-scale banks can offer benefits over disaggregated on-site mitigation projects, in terms of ecological function and administration costs.

Ongoing DOI Research on Valuing Ecosystem Services

Research on the valuation of ecosystem services is being conducted by several Interior bureaus in cooperation with other Federal and university partners on local, regional, and national scales. The following are examples of research projects that are currently underway to provide information for DOI's decision makers,.

FWS National Wildlife Refuges. FWS' Division of Economics and the University of Georgia are partnering on research entitled, "Valuing Ecosystem Goods and Services Provided by U.S. National Wildlife Refuges." This joint study between university and Federal government economists, biologists and ecologists is being conducted with the primary purpose of identifying and estimating a more comprehensive set of public benefits derived from National Wildlife Refuges beyond recreational use.

[10] The Chicago Climate Exchange (CCX) was North America's only such voluntary market to-date, trading emission allowances for six greenhouse gases from 2003 to 2010.
[11] 33 CFR Parts 325 and 332.

The specific study objectives are to:

1. Develop theory and techniques for valuing ecosystem goods and service supported by National Wildlife Refuges, which can be applied to individual refuges across the National Wildlife Refuge System;
2. Apply theory and techniques to estimate economic values for selected ecosystem goods and services for several case-study refuges;
3. Aggregate estimates of ecosystem good and service values to obtain an estimate of the total economic value of each case-study refuge; and
4. Determine feasibility of scaling-up ecosystem service values estimated for case-study refuges to estimate regional and national estimates of Refuge ecosystem values.

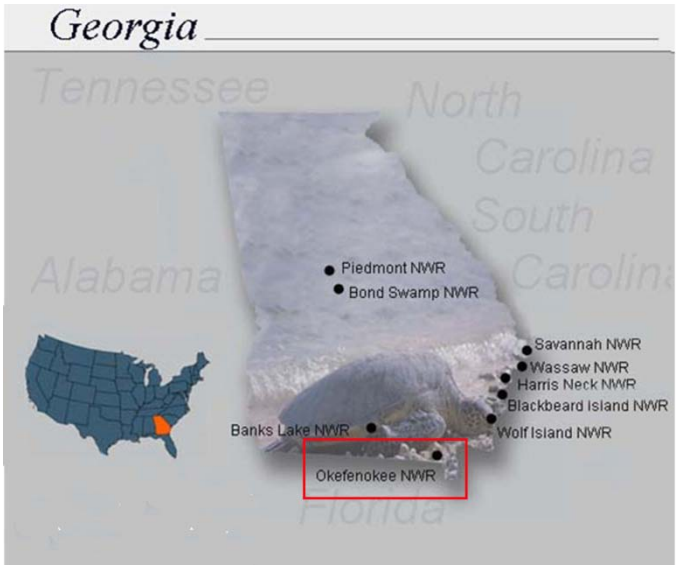
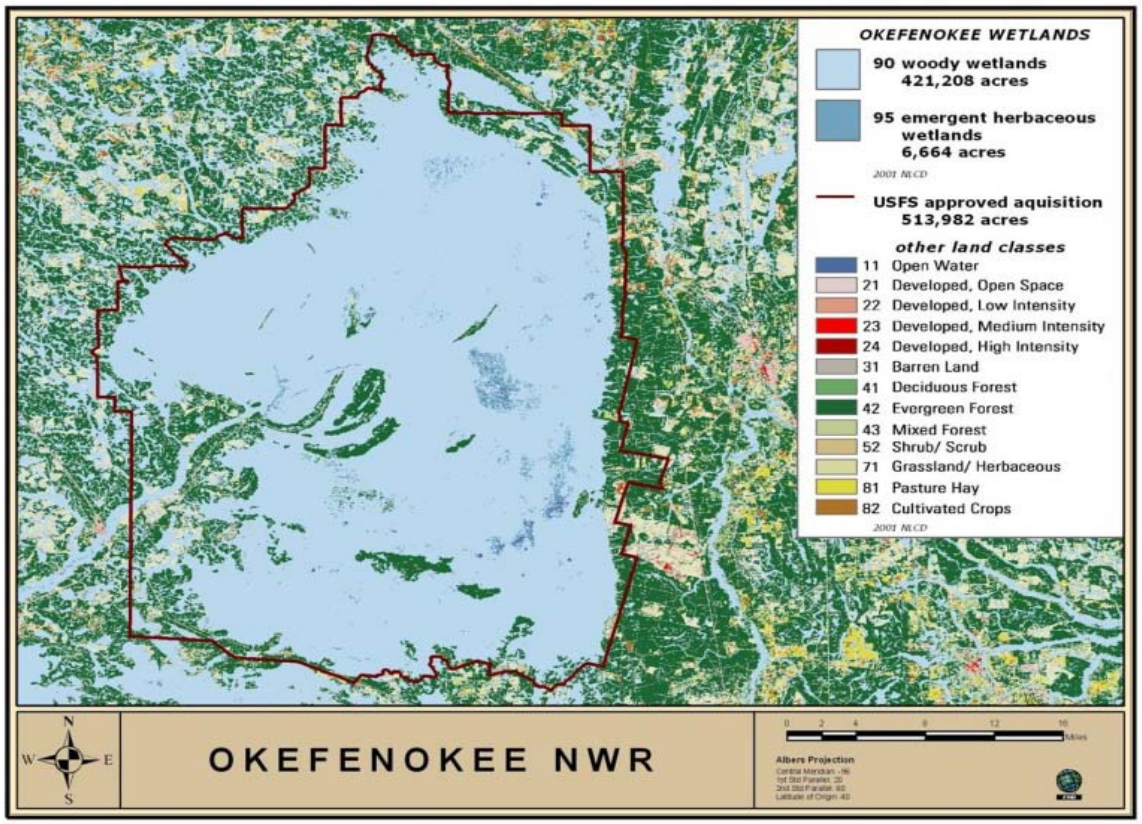


Figure 3-8. Location of Okefenokee NWR

Figure 3-9. Map of Okefenokee NWR



Based on the study team's knowledge of past and ongoing field ecologic research and policy/management needs expressed by the FWS (including geographic representation), their case-study sites include: (1) Okeefenokee National Wildlife Refuge (southeastern coastal region); (2) Sevilleta National Wildlife Refuge (Rocky Mountain region); (3) Blackwater National Wildlife Refuge (mid-Atlantic estuary site); and (4) a Prairie-Pothole site (Midwestern region).

The study team's preliminary review of the literature suggests that available data will support estimation of ecosystem values supported by the following ecosystem functions, goods and services provide by wetlands in National Wildlife Refuges:

- Recreational fishing and hunting;
- Wildlife observation;
- Commercial Fishing;
- Carbon sequestration;
- Nutrient cycling (waste assimilation, water quality); and
- Storm and sea-level rise protection.

BLM Ecosystem Services Valuation Pilot. BLM and USGS are collaborating on a pilot project to assess the usefulness of ecosystem services valuation to BLM's resource management decisions, with assistance from scientists at USDA's Agricultural Research Service, other agencies, and universities. The project will examine services and stressors within the San Pedro watershed in southeast Arizona. The project goals include determining which methods for valuing ecosystems are ready for operational use at BLM, and exploring the usefulness of an ecosystem services valuation framework in BLM's land use decision-making.

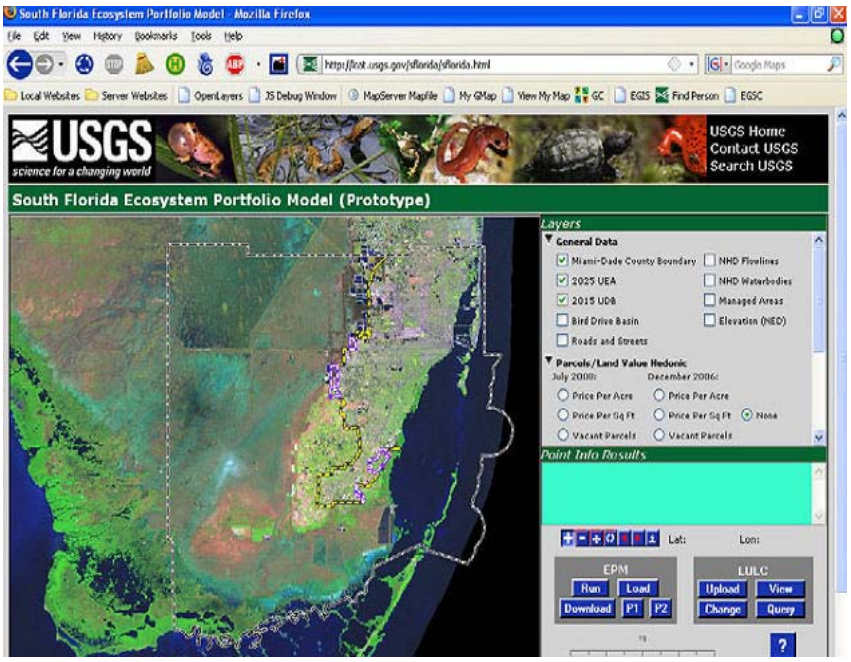
National Parks in the Colorado River Basin. There are many services provided by National Park System resources along the Colorado River, including cultural, historical, recreational, and ecological. NPS and Reclamation are estimating comprehensive economic values (including ecosystem services) for water-related activities. These economic values are needed to better understand how water allocation decisions affect the integrity of the resources and values of National Park System units along the Colorado River. These decisions also affect the visiting public and surrounding local economies.
(See http://www.usbr.gov/uc/rm/amp/twg/mtgs/09jun22/NH_WhitePaper.pdf)

US Geological Survey.

- To meet obligations from Congress under the *Energy Independence and Security Act of 2007* and enhance DOI's decision-making capabilities, USGS is also conducting research and development to quantify the Nation's carbon storage and carbon sequestration capacities. This effort includes an assessment of the fluxes of three greenhouse gases (carbon dioxide (CO2), methane (Ch4), and nitrous oxide (N2O)) and their associated impacts on ecosystem services.
- USGS is developing a computer tool to quantify accounting metrics for ecological values, quality of life indicators, and land prices in a model structured for stakeholder deliberations of the provision of ecosystem services. The USGS Ecosystem Portfolio Model (EPM) is a web-based tool designed to assist in land use planning that was originally developed for

South Florida. Plans are being made for application in the Southwest (in cooperation with EPA) and Puget Sound.

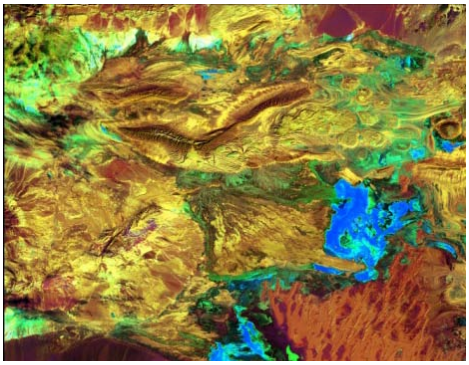
Figure 3-10. USGS, Ecosystem Portfolio Model



Prairie Pothole Integrated Landscape Monitoring (PPILM). This USGS pilot project is being conducted in partnership with FWS, USDA (Farm Service Agency, Natural Resources Conservation Service, Agricultural Research Service), Audubon Society, and the Nature Conservancy. The group is developing tools and protocols to observe, understand, and predict changes in ecosystem services under alternate land-use and climate futures. Ecosystem services being analyzed include pollination, carbon sequestration, biodiversity, and water storage. Ultimately, the PPILM will enable Federal and State researchers and managers to measure and quantify the effects of landscape practices and programs on ecosystem services. (See http://biology.usgs.gov/ecosystems/prairie_potholes.html)

Assessment of Goods and Valuation of Ecosystem Services (AGAVES) Project. USDA, DOI, EPA, University of Arizona, University of New Mexico, and others are developing a science plan to guide the evaluation of the consequences of natural and human-induced environmental change in the semi-arid Southwest. The program is building on current valuation efforts of the riparian and hydrologic ecosystem services in the San Pedro and Rio Grande. The initial focus is on the San Pedro and Santa Cruz River Basins. The plan focuses on program-level science and resource management issues and strategies, and will be modified to incorporate major changes in research needs or direction (see http://rmgsc.cr.usgs.gov/agaves).

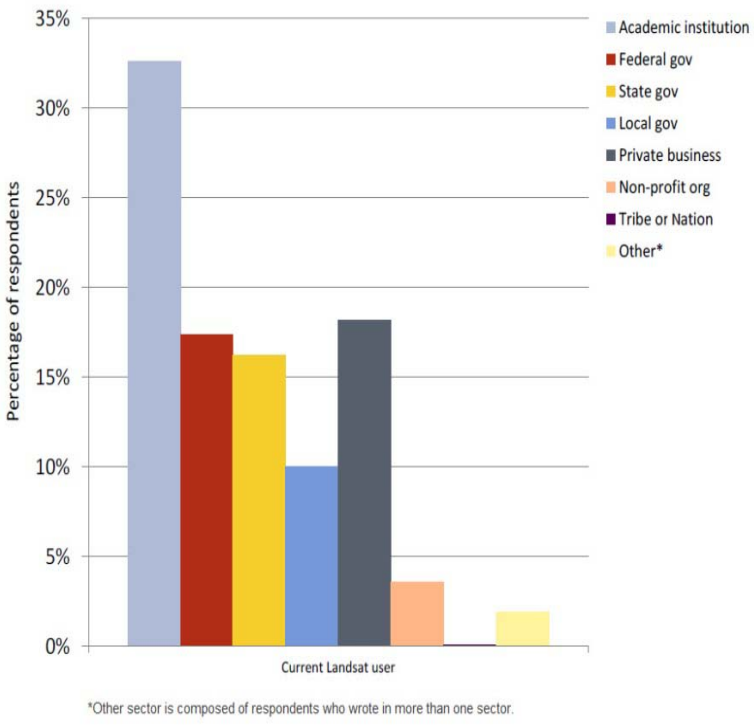
Box 3-4. **Value of Information: Landsat Satellite Imagery**
USGS study shows imagery is important and valuable to users



Credit: Landsat 7 "Earth as Art" image of Dasht-e Kavir in Iran.

The Landsat satellites operated by the USGS provide high-quality, multi-spectral, moderate-resolution satellite imagery (MRI) of urban, rural, and remote lands for all areas of the world. Landsat imagery is unique among the variety of MRI available today for three main reasons. First, the archive of imagery extends back to 1972, allowing for broad-area analyses over several decades. Second, the imagery is and has been collected globally on a regular basis, providing repeat coverage of remote areas that other satellites do not offer. Third, the imagery is currently available at no cost and with no user restrictions to those requesting images from USGS. The entire archive of Landsat imagery, including all new acquisitions, became available at no cost at the beginning of 2009. The result was a 50-fold annual increase in the number of scenes downloaded from USGS, with more than four million scenes downloaded before the end of 2010. Landsat imagery provides unique spatial information for use by many people both within and outside of the United States. However, the value of the information provided by the imagery to users is, to a large extent, unknown.

Figure 3-11. Sectors of Current Landsat Users



Source: Miller *et al.*, 2011, p. 8.

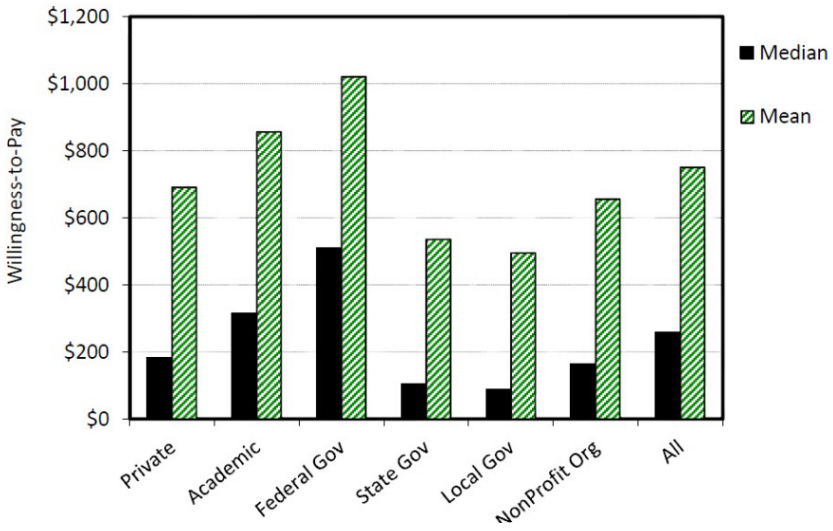
In economic terms, the value of information is equal to what individuals would pay for that information (Macauley, 2006). The value depends on the uncertainty of the situation in which the information will be used, the importance of the outcome of the situation, the cost of using the information, and the cost of an appropriate substitute. The comprehensive value of Landsat imagery may always be elusive, especially given the widespread use of the imagery in applications like Google Earth and the difficulty in identifying all direct and indirect users of the imagery. However, a more complete understanding of the value of information provided by Landsat imagery can be achieved.

Box 3-4, continued from previous page.

Using multiple measurements, social scientists at the USGS Fort Collins Science Center Policy Analysis and Science Assistance branch found a high value for Landsat imagery, as described below. Using a non-probability sample of almost 1,400 Landsat users, USGS applied four approaches to estimate the value of Landsat imagery to those users:

1. Determining the importance of Landsat imagery to respondents, as well as their satisfaction with attributes of the imagery;
2. Identifying the environmental and societal benefits, including impacts on decisionmaking, from projects that used Landsat;
3. Establishing what respondents would do if Landsat imagery was no longer available and how it would impact their work; and
4. Applying the contingent valuation method to determine respondents' willingness to pay for imagery equivalent to Landsat if there is a gap in imagery provision in the future.

Figure 3-12. Estimated Willingness to Pay for Imagery to Replace Landsat Imagery Among Current Landsat Users



Source: Miller *et al.*, 2011, p. 30.

The results showed a high value for Landsat imagery among all respondents, particularly academics. In general, the imagery was important to respondents for their work, and they were very satisfied with the attributes provided by Landsat. The respondents found the imagery particularly beneficial for improving decisionmaking and preventing harm to the environment and humans. The value of Landsat imagery to the respondents was also revealed by the substantial amount of work that would be discontinued or require a substitute source of data in the event of a data gap. Over half of the respondents would discontinue some of their work if Landsat were no longer available, and more than three-quarters would use substitute information for their work. Finally, the value was demonstrated by respondents' willingness to pay for the imagery. On average, these respondents were willing to pay $760 per scene, which is greater than the previous administratively set price for Landsat imagery. These results should be considered a minimum value of Landsat within the Landsat user community.

Future Efforts

While tremendous progress has been made in both the scientific understanding and economic valuation of ecosystem services, additional economic work is needed to more fully understand and value the benefits of cultural uses, particularly by Native peoples; the benefits from investment in public lands like refuges and national parks; returns from public investment in private lands through acquisition, grants, and conservation easement programs; the benefits from indirect uses like climate regulation, flood control, pollination and waste assimilation; and uses by future generations.

Given Interior's experience and wide-ranging resource management responsibilities, the Department is well positioned to help develop new ecosystem services markets and improve the efficiency of existing ones. An efficient market needs many "buyers" and "sellers" with well-defined property rights, clear trading rules, low transactions costs for participation, and sufficient monitoring and enforcement. The "buyers" need to be confident that their purchases meet regulatory requirements. For ecosystem services that are not typically bought and sold in markets (e.g., biodiversity), the first challenge is the development of appropriate metrics to evaluate tradeoffs. These metrics probably would not be monetary. Metrics do not have to be "perfect," but they do need to be science-based, transparent, and be understandable to potential market participants. To achieve a credible framework, future efforts should focus on market development or the development of processes that would assist in revealing the values individuals place on these services rather than on establishing values.

Chapter 4 THE ECONOMICS OF INVASIVE SPECIES AND DOI RESOURCES

INTRODUCTION

Approximately 50,000 non-indigenous plants, animals and microbes have been introduced in the United States (Pimentel, et al. 2005). Many of these species have been intentionally introduced for beneficial uses such as food production or landscape restoration, while others have been introduced accidentally. Some non-indigenous species are beneficial or have no adverse impacts on the environment, while others cause environmental and economic damage. Such species are commonly referred to as *invasive species*, alien (non-native) species "whose introduction does or is likely to cause economic or environmental harm or harm to human health".[12] Invasive species are a growing problem in the United States, costing the nation billions of dollars per year in prevention and control costs, lost productivity, and damages to infrastructure, industry, ecosystems, and outdoor recreation.

> "**Invasive species** means an alien species whose introduction does or is likely to cause economic or environmental harm or harm to human health."
>
> Executive Order 13112

Invasive species that affect land and water resources include weeds, trees, insects, amphibians, reptiles, microbes, fungi, mammals, fish, and mollusks. Once established, invasive species can inflict significant environmental and economic damage, including habitat destruction, loss of biodiversity, and loss of ecosystem services. Impacts to ecosystem services[13] include a loss of provisioning services, such as food, fiber, fuel, and medicine provided by native species, and a loss of benefiting services such as pollination, water filtration, climate and pest control, and protection from erosion, wildfires, and other natural hazards. Invasive species can directly affect human uses as well, including outdoor recreation, electric generation, water supply, and agriculture, and can negatively affect human health.

The cross-boundary nature of invasive species has led to efforts to coordinate management across government agencies. The National Invasive Species Council (NISC) was established in 1999 to facilitate planning and coordination of Federal invasive species programs. The NISC is co-chaired by the Secretaries of the Interior (Interior or DOI), Agriculture, and Commerce, and its membership includes the Secretaries of Transportation, State, Defense, Homeland Security, Treasury, and Health and Human Services, the Administrators of the Environmental Protection Agency and the National Aeronautics and Space Administration, the Director of the U.S. Agency for International Development, and the U.S. Trade Representative. The Invasive Species Advisory Committee (ISAC) was also established by the Secretary of the Interior, and includes 30 non-Federal members that advise the NISC on invasive species issues.

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[12] See ISAC (2006) for additional clarification and guidance on the definition of invasive species. Available at: http://www.invasivespeciesinfo.gov/docs/council/isacdef.pdf

[13] See Chapter 3 for more information on ecosystem services.

Invasive species issues affect DOI at many levels. In addition to coordination of the interdepartmental NISC and administration of the non-Federal ISAC within the Office of the Secretary, invasive species are also prominent in the missions of many of the bureaus. DOI's Bureau of Reclamation (Reclamation), National Park Service (NPS), U.S. Fish and Wildlife Service (FWS), and Bureau of Land Management (BLM) all implement programs to address the control of invasive species in areas they manage. The United States Geological Survey (USGS) conducts research that assists in invasive species management. The Division of Economics, USFWS, provides analytic and research support for a variety of USFWS programs, including those which deal with invasive species. Current and recent projects have addressed the current and potential impacts of Gambian Pouch Rat infestations in Florida; Asian Carp in the Great Lakes; Black, Silver and Bighead Carp in the Mississippi River; and large constrictor snakes in Florida.

Although science-based approaches have dominated invasive species policy, economic input has become more important in recent years, as the rate of invasive species introduction and spread has increased (Evans 2003). A 2002 General Accounting Office (GAO) report emphasized the importance of economic analysis of invasive species to better inform decision making (GAO 2002). Since that time, many studies related to the economics of invasive species have been conducted, including several funded through the U.S. Department of Agriculture's Program of Research on the Economics of Invasive Species Management.

Economics has a role in many areas of invasive species policy including the economic consequences of invasive species introduction, cost-benefit analysis of different management options, the allocation of scarce resources and funding for invasive species management, and the implications of trade and sanitary and phytosanitary (SPS) policies. This chapter focuses on areas that are most relevant to Interior, including management issues, such as the optimal allocation of resources for prevention, control, and eradication of invasive species, and the valuation of invasive species impacts on ecological and human uses of DOI resources (including non-market impacts).

ECONOMICS OF INVASIVE SPECIES MANAGEMENT ON DOI LANDS

Invasive species have significant impacts on DOI land and water resources. These species affect human uses such as recreation, hydropower, water supplies, agriculture, and ranching, as well as ecosystem functions including pollination, water filtration, climate, pest control, and protection from erosion, wildfires, and other natural hazards. Invasive species, particularly terrestrial weeds, pose a serious threat to land resources managed by Interior bureaus. Over 6,500 non-native invasive species have been documented on NPS lands, 70% of which are plant species. Approximately 5% of NPS lands are dominated by invasive species. Estimates from the year 2000 indicate that 20% of BLM lands in western States (35 million acres) were affected by invasive species. It is expected that an updated inventory during 2010 may indicate that affected acreage is 2 to 3 times greater than the year 2000 assessment. Aquatic nuisance species also affect DOI resources. Invasive mussels are present in 12 Reclamation water sources in western States. Aquatic invasive species also threaten water resources managed by NPS and BLM. FWS addresses effects on other fish and wildlife species proactively through its authority to add invasive wildlife,

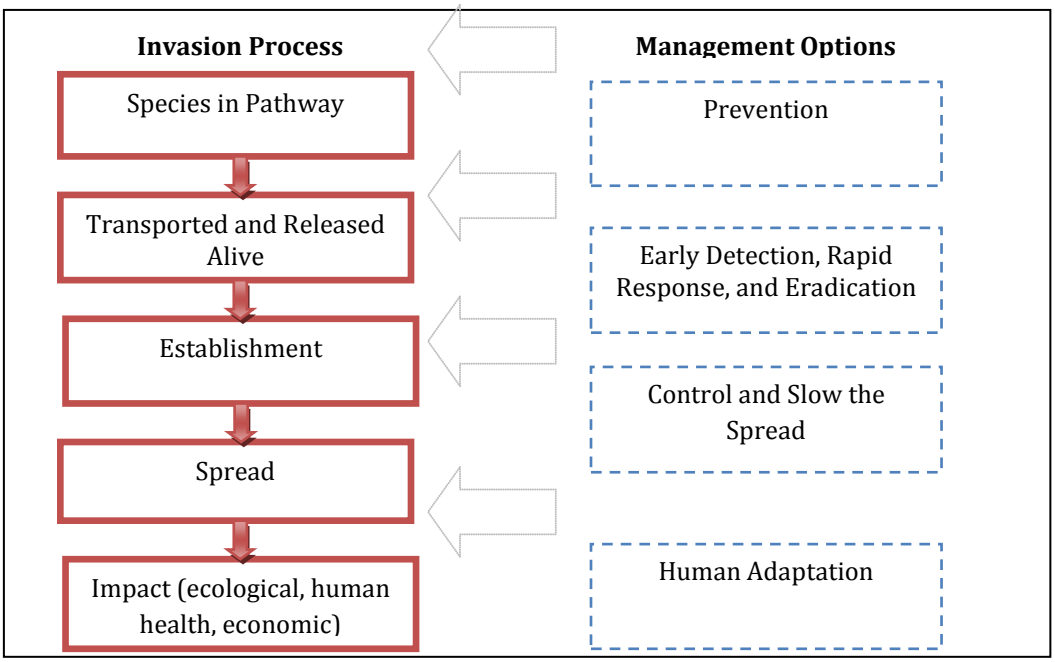
plant, and fish species to the list of injurious species under the Lacey Act, which regulates the trade of illegal species, as well as through Section 7 consultations for species listed under the Endangered Species Act (ESA), which are often affected by invasive species. USGS also plays a large role in developing risk assessments, conducting research, and providing information on the effect and extent of invasive species through the National Biological Information Infrastructure.

Terrestrial invasive species, such as forest pests, mammals, reptiles, weeds, and shrubs, can affect aesthetic values and wildlife habitat. These effects can decrease the quality of many different types of recreational experiences including hunting, wildlife viewing, and hiking. Aquatic nuisance species, such as weeds, mussels, and fish, can also have significant effects on recreation. These species can affect recreational fishing, boating, and swimming by altering aquatic ecosystems and creating hazards for recreationists. Management of aquatic species can also affect the welfare of recreationists. For example, some policies may limit access or close fisheries or recreation areas, resulting in losses to recreationists. Invasive species can also cause a loss of regulating and supporting ecosystem services such as pollination, water and nutrient cycling, climate and pest control, and protection from natural disturbances (such as erosion, flooding, and wildfires). Other resulting ecological effects include impacts on biodiversity, threatened and endangered species, and production of food, fiber and other goods.

Management options for dealing with invasive species can be directly linked to the stages of the invasion process, with fewer management options available as an invasion progresses (Figure 4-1). The first step in this process involves the introduction of a species into a pathway from which it can spread. After the species is introduced into the pathway, it must be transported and released alive into a new environment. If the new environment provides suitable habitat for reproduction, the species may become established. Once established, the species can then spread to other locations, inflicting ecological, economic, and human health effects. Management efforts early in this process are focused on prevention, or stopping the invasion before the species is transported to a new location and released alive. Following the transportation and release of a live species in a new location, efforts are focused on early detection and rapid response, which hopefully lead to eradication of the pest. If early efforts fail and the species becomes established in the new environment, management focuses on controlling and slowing the spread of the population. Finally, if the species is able to spread throughout the new location, efforts are made to mitigate any impacts that it may have on ecological resources, the economy, or human health. Management options in each of these steps impose different costs and vary from species to species.

Many of the contributions of economic research to invasive species management relate to the estimation of benefits and costs of different management alternatives. Researchers have developed sophisticated bioeconomic models that combine biological and economic data to help determine the optimal strategies for minimizing expected damages and costs of prevention and control. Economics can help inform decision-makers as they choose among eradication, control, and prevention options for invasive species management. Other economic research addresses the effects of private land management decisions on public lands, and informs the development of appropriate incentives to encourage private land owners to implement invasive species management strategies.

Figure 4-1. Invasion Process and Management Options



Source: Adapted from Lodge et al. (2006)

Invasive species have a significant impact on DOI resources throughout the United States, requiring significant funding and staff resources of several DOI bureaus. Table 4-1 presents information on DOI expenditures on invasive species. In FY 2009, expenditures totaled about $94 million. Table 4-2 presents information on how these expenditures were distributed among categories of activities. About 61 percent of the total was devoted to control and management efforts, 13 percent to research, and 11 percent to restoration.

Table 4-1. DOI Expenditures on Invasive Species Management, FY 2009

Bureau	**Invasive Species Expenditures (2009)** ($ thousands)
Bureau of Indian Affairs	1,021
Bureau of Land Management	11,721
Bureau of Reclamation	4,357
National Park Service	38,676
U.S. Fish and Wildlife Service	24,470
U.S. Geological Survey	11,250
Office of Insular Affairs	2,631
DOI Total	94,126
Source: DOI data.	

Table 4-2. Invasive Species Expenditures by Category, FY 2009

Summary by Category	Invasive Species Expenditures 2009 ($ thousands)
Prevention	5,909
Early Detection/Rapid Response	7,298
Control and Management	57,459
Restoration	10,009
Research	12,103
Education and Public Awareness	462
Leadership/International Cooperation	886
Total, Department of the Interior	94,126
Source: DOI data.	

COSTS AND BENEFITS OF INVASIVE SPECIES MANAGEMENT

Based on the limited resources available for invasive species management and the increasing number of species that are affecting resources on DOI lands, one of the most important contributions of economics is in helping to determine cost-effective management strategies. Most economic studies on the management of invasive species can be categorized as either cost-effectiveness analyses or benefit-cost analyses. Cost-effectiveness analyses are often conducted after an invasion has occurred and focus on determining the control strategy that minimizes management costs. Benefit-cost analyses are usually conducted before an invasion occurs and compare a range of different management options, including prevention. While benefit-cost analyses are more comprehensive than cost-effectiveness analyses, the difficulty in measuring all the benefits associated with a given action has made them less common in practice. It is important to consider a range of benefits, including direct, indirect, and non-use values, in benefit-cost analysis. The estimation of many of these values requires the use of non-market valuation techniques that have been developed over the past several decades.

Analytical Tools

Cost-effectiveness analysis: Compares the costs of alternative policies or approaches for achieving a certain goal.

Cost-benefit analysis: Compares the costs and benefits of an action and is used to determine which alternative maximizes net benefits.

Non-market valuation: Methods that estimate the value of goods and services that are not commonly bought and sold in markets.

One issue that often arises once an invasive species has become established is the choice between eradication and control programs. While eradication programs are often undertaken, in many cases they have proven to be ineffective. The choice between management options often depends on the specific characteristics of the species and location of concern (see Box 4-1 for a case study of saltcedar eradication and control).

Economic analysis is also used in determining the cost-effectiveness of prevention programs in areas where a species has yet to be introduced. Prevention strategies are often pursued in the case of island and isolated water resources (particularly lakes). Island ecosystems are especially sensitive to species invasions. These ecosystems are often less diverse and may be easily overcome by invaders; furthermore, native island species are often vulnerable and are easy prey for invasive predators (Stachowicz and Tilman, 2005). Islands tend to have high levels of imports, which provide vectors of transport for invasive introductions. Aquatic ecosystems have similar vulnerabilities and face a large number of introductions via trade and recreational boating. Prevention is often optimal for island and aquatic resources given the potentially high economic and ecological costs of introductions. Furthermore, prevention is often more effective in these cases since sources of introduction can be addressed more directly than in the case of many terrestrial invasive species such as forest insect pests or invasive grasses.

Box 4-1. Saltcedar (Tamarix spp.)

Saltcedar (or tamarisk) is a woody plant with a dominant presence in riparian landscapes of the western United States. It was intentionally introduced in the 19th century as an ornamental and was widely planted for erosion control and as windbreaks. It has since naturalized and become abundant along riverbanks throughout the western States (Nagler et al. 2010a; Friedman et al. 2005).

Saltcedar (and similar plants such as Russian olive) is associated with streamflow depletion, replacement of native vegetation, provision of inferior wildlife habitat, stream channel narrowing, and increased risks of flood and riparian forest fires; however, there is scientific debate regarding the extent to which it is the cause of these negative impacts (Shafroth et al. 2005). Saltcedar can also have positive effects on ecosystems; it prevents the erosion of river banks and can provide habitat where vegetation would otherwise not grow. Since the 1960s, its eradication and control has been a priority for western land and water managers, with the primary objectives being water salvage and habitat restoration. The success of eradication programs in meeting these objectives has been varied. It has long been held that saltcedar uses more water than native vegetation and that removing it will lead to higher stream flows and more water availability in the arid West. However, increased water yields have been lower than originally expected and recent studies suggest that native trees use similar quantities of water as their non-native counterparts (Nagler et al. 2010b; Shafroth et al. 2005).

Saltcedar control (*Source: Colorado State University Natural Resource Ecology Laboratory. Photo by Paul Evangelista.)*

Control strategies for eradicating saltcedar are chosen based on stand density, site accessibility, and other management objectives, and can vary widely in cost and success rate (O'Meara, et al. 2009). In many cases, the complete eradication of stands may be unrealistic, prohibitively expensive, or even undesirable (Shafroth et al. 2005). These factors make analysis of the costs and benefits of control an important step in managing local riparian areas. Two studies with contrasting results highlight how local ecosystem dynamics and assumed project outcomes can affect cost-benefit analysis. Zavaleta (2000) considers the nationwide costs and benefits of regaining lost ecosystem services through saltcedar control, estimating that the tree will cost $127-291 million annually in lost ecosystem services in the western United States, including municipal and agricultural water losses, lost hydropower generation, and reduced flood control. The study finds that the benefits of saltcedar control outweigh the costs within a 30-year horizon. Barz et al. (2007) consider the costs and benefits of saltcedar control along the Middle Pecos River in New Mexico. They assume that water salvage is the primary benefit of control in the study region and find that previous eradication efforts along the river had little to no impact on stream flow, resulting in small benefit estimates. The study finds that the direct and indirect costs of removing saltcedar from the Middle Pecos River far exceed the benefits of salvaged water.

The contrasting results of these studies emphasize the need for comprehensive, localized analyses of the net effects of saltcedar on local riparian ecosystems. The potential for water savings and habitat restoration vary across landscapes, as do the costs of control. Furthermore, saltcedar may provide benefits in some landscapes that would make its removal undesirable. Integrated ecological and economic analyses can provide valuable information for resource managers to prospectively and retrospectively assess the success of control and eradication programs and guide future projects.

The brown tree snake provides one example of invasive species in an island environment. This species has led to significant economic, health and environmental impacts on Guam, spurring Hawaii to adopt prevention programs (see Box 4-2. Brown Treesnake (Boiga irregularis) for additional details). Although there is currently no brown tree snake infestation in Hawaii, economic estimates based on damages in Guam indicate that prevention programs are an effective management strategy.

Cost avoidance through prevention has also been a key management strategy in the case of zebra and quagga mussels in U.S. lakes. These species can reduce productivity of electric generation and water supply facilities by clogging pipes, affect recreation activities, and affect the provision of ecosystem services. While many lakes throughout the United States have already been infested, campaigns for cleaning recreational boating equipment have protected some lakes where the mussels have not been introduced. Economic research indicates that prevention is warranted in many cases. For example, Leung et al. (2002) develop a hypothetical model to show that prevention expenditures of up to $324,000 per year associated with one power plant (with 2.4 million MWh annual production) on a single lake would be beneficial compared to treatment at the plant after an infestation has occurred. In the case of a Florida lake used for water supply, recreation, and other ecosystem services, Lee et al. (2007) conclude that a management plan of prevention and early eradication would yield the greatest net benefits. Their results suggest that the benefits of preventative management far outweigh the costs, with an expenditure of $2.5 million on prevention over a 20-year horizon resulting in over $170 million in benefits.

Bioeconomic models are a new advance in the economic and biological research on invasive species. These models combine information on population dynamics with economic data on the costs and benefits of different management options and can inform decision makers on optimal choices between prevention and control expenditures. Bioeconomic models are complex and require the interdisciplinary efforts of biologists, ecologists, economists, and mathematicians; however, forecasts developed by bioeconomic models can provide valuable information beyond what is provided by biological or economic models alone.

Several current studies demonstrate how a bioeconomic framework can be used *ex ante* to predict possible damages from biological invasions and inform optimal control policies. Buhle et al. (2005) develop a model that shows how the consideration of biological data along with economic issues in a cost-effectiveness analysis can result in a shift in optimal control strategies. Their results show that, although population biology indicates that control strategies focused on the removal of adults are only effective if adult survival is naturally high, these strategies can be effective with lower levels of adult survival if the marginal cost of lowering fecundity is high. The studies by Leung et al. (2002) and Lee et al. (2007) mentioned above incorporate biological and economic data into simulation models to determine optimal management strategies for zebra mussels. Keller et al. (2008) develop a simulation model to predict the spread of rusty crayfish (*Orconectes rusticus*) through lakes in Vilas County, Wisconsin. They build their model based on data available in 1975, the initial year of the rusty crayfish invasion, and simulate the costs and benefits that varying levels of preventive management would have had. They find that, for the 30-year period between 1975

and 2005, an optimally targeted preventative management program could have saved $37 million in lost fishing value at a cost of $4.3 million.

Box 4-2. Brown Treesnake (Boiga irregularis)

Brown Treesnake (*Source: USGS. Photo by Gordon Rodda.)*

Sometime in the years following World War II, brown treesnakes arrived in Guam from their native range of Papua New Guinea as stowaways in military cargo (Rodda et al. 1992). The damage that brown treesnakes have caused in Guam is unprecedented. The birds, lizards, and bats of Guam evolved in the absence of snake predators and lacked protective behaviors to guard themselves against predation; this led to the extinction of many species and the endangerment of others. Presently, Guam has lost all breeding populations of seabirds, 11 of 13 species of native forest birds, 2 of 3 bats, and 6 of 10 to 12 species of native lizards, with most of the remaining species endangered (Fritts & Leasman-Tanner 2001). The loss of the island's birds, bats, and lizards has further resulted in the loss of ecosystem services including insect predation, seed dispersal, and pollination, and has left the island vulnerable to increased damages to agricultural crops, increased public health issues from insects, and a loss of forest diversity (Fritts & Leasman-Tanner 2001). Brown treesnakes are also responsible for frequent power outages on the island. Snake-caused power outages happen approximately every third day, and cost Guam an estimated $4.5 million per year in direct damages and lost productivity (Fritts 2002). Brown treesnakes are mildly venomous, may bite when provoked, and are prone to taking refuge in homes; these attributes have led to human health concerns surrounding snakebites, and may have damaged Guam's tourist industry (Shwiff et al. 2010).

The snakes on Guam represent the only confirmed population of brown treesnakes outside of their native range. Guam is centrally located in the Pacific Islands and is a major transportation center for military and civilian goods. The heavy flow of cargo through Guam, combined with the brown treesnake's propensity to take refuge in man-made materials (such as cargo crates and airplane wheel wells) makes the transport of snakes from Guam to other Pacific ports very likely. Hawaii and the islands of Micronesia are at the greatest risk of invasion by the brown treesnake, based on the climatic tolerances of the snake, trade flows, and similar ecosystems, which include prey that lack coevolutionary experience with snake predators (Fritts and Rodda 1998). A substantial portion of the southern United States mainland is also climatically suitable for brown treesnakes (Rodda et al. 2007).

The potentially high costs of an invasion combined with the high probability of invasion place Hawaii's economy and environment at great risk. For locations like Hawaii, that are at risk of invasion, economic research on the potential damage costs of an invasion can provide useful information to policy makers who must determine how much to budget towards snake prevention efforts. Shwiff et al. (2010) estimate that annual damages to Hawaii from a brown treesnake invasion could range between $593 million and $2.14 billion in lost productivity from frequent electrical outages, economic impacts of reduced tourism, and medical costs from snakebites. Economic optimal control models can help policy makers determine optimal expenditures on prevention and control. The Federal government currently spends about $2.6 million per year to prevent the spread of brown treesnakes to the Hawaiian Islands. Burnett et al. (2008) conclude that it could be optimal to increase prevention expenditures to as much as $3.2 million per year to further decrease the probability that snakes reach the Hawaiian Islands.

IMPACTS OF INVASIVE SPECIES ON DOI LANDS

Economic research on invasive species helps to quantify the impacts of invasive species on Interior resources in monetary terms using non-market valuation methods. Accurate information on the economic value of damages caused by invasive species is important for benefit-cost analysis of different management options, as well as for prioritizing projects competing for limited funding. Values that are derived for invasive species damages can be categorized as direct use values (including consumptive and non-consumptive values), indirect use values, and non-use values. Direct uses are related to human physical involvement with natural resources; indirect uses support human activities or the resources being used; and non-use values are related to the existence of the resource but are not associated with any service that it provides. Direct use values affected by invasive species include consumptive uses such as agriculture, water supply, and electric generation, as well as non-consumptive uses such as recreation. Consumptive use values are often derived from market data, while non-consumptive use values are usually obtained via non-market valuation methods. Indirect use values that can be diminished by invasive species damage include water storage, wildfire prevention, and greenhouse gas sequestration. Non-use values for natural resources are based on existence of the resource, regardless of any direct or indirect use. One example is the knowledge that a person's grandchild will be able to enjoy a resource in the future. (See Chapter 3 for more information on valuation methods.)

Most valuation research on damages caused by invasive species has focused on direct and indirect use values. The effects of invasive species assessed in these studies are generally negative, such as decreased catch for recreational fishing or increased risk of wildfires. However, in some cases positive effects may also be experienced, such as the introduction of a fish species with recreational fishing value or an introduced plant species with medicinal value. Some studies have also assessed the impacts of management strategies for dealing with invasive species, such as the effect of recreational closures on anglers or boaters. Previous research has provided useful estimates for policy analysis in some cases, but also points to challenges in deriving these values and important areas for future research. The following sections provide a review of several studies that estimate the effects of invasive species on human and ecological uses and give implications for policy analysis.

Human use

Some studies have attempted to estimate the economic impact of terrestrial invasive species in terms of decreased recreational expenditures. Leitch et al. (1994) estimate the change in wildlife-related recreation due to leafy spurge infestation in the upper Great Plains based on recreation expenditures, the percentage of infested area, and a wildland coefficient that relates the relative importance of a particular land use to support of wildlife species. They estimate annual direct impacts of $2.4 million from wildlife-associated recreation and another $1 million from reduced soil and water conservation. Eiswerth et al. (2005) estimate the economic impact of invasive weeds on recreation in Nevada, and show the importance of data availability in this type of assessment. They were able to use limited data in an input-output model to estimate damages of $30 to $40 million over a five-year time horizon.

Box 4-3. Zebra Mussels (Dreissena polymorpha) and Quagga Mussels (Dreissena bugensis)

Zebra and quagga mussels are invasive mollusks native to Russia that are estimated to cost the United States $1 billion per year in damage and control costs (Pimentel et al. 2005). Following their introduction to the Great Lakes in the late 1980s, zebra and quagga mussels spread rapidly through the connected waters of the Mississippi River Basin and the northeastern United States, and have recently expanded their range to the western States (see Figure 2). Zebra and quagga mussel infestations have occurred in BOR waters at a number of locations, and NPS and FWS are involved in activities to prevent the spread of mussels to other locations. Adult mussels attach to all types of structures and form dense mats up to one foot thick; this attribute makes them prone to clogging water intake pipes. Water storage and delivery infrastructure, hydropower and fossil fuel generated power plants, municipal water treatment facilities, private industries, and irrigators can all incur large costs either from removing mussels from their systems or from lost output. Dreissena also affect natural ecosystems through their feeding behavior; they are filter feeders and process up to one gallon of water per mussel per day, thus drastically altering the food web and negatively affecting fisheries and biodiversity.

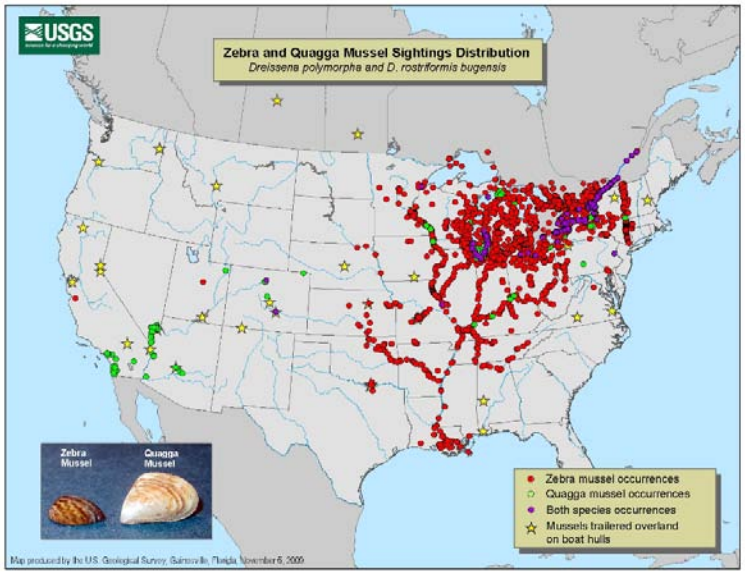


Figure 4-2: North American range of the zebra and quagga mussel (*Source: USGS, 2009)*

The ecological effects caused by mussel invasions directly affect human enjoyment and recreational activities. Specifically, the decline of some species of fish may result in lost value for anglers who target those species, and beach recreators and lakeside homeowners may suffer welfare losses due to sharp shells and odors from dead mussels that wash to shore.

Human activities are directly related to the dreissenid invasion. Commerce played a key role in the initial invasion, with mussels first arriving in North America through discharged ballast water from commercial freighters. The more recent invasion of the western States has resulted from the overland transport of mussels on recreational boats. Preventive management policies, such as ballast water regulations and recreational boat inspection programs, reduce the probability that aquatic invaders are introduced and spread. These policies are a valuable option for dealing with irreversible invasions that have the potential to cause severe ecological and economic damages; however, the costs of proactively preventing or slowing an invasion can be large. A number of research efforts have been undertaken to examine the optimal allocation of prevention and control strategies (Leung et al. 2002, Finnoff et al. 2005, Lee et al. 2007). This research suggests that prevention is often a cost-effective strategy, but the optimal level of prevention is highly influenced by the risk of invasion.

Other studies have estimated the impact of management policies for aquatic invasive species on recreation. Davis and Moeltner (2010) use non-market valuation techniques to assess the potential losses to recreational anglers from alternative invasive species management strategies. Their

research shows projected losses to recreational anglers of $10 to $30 million per year resulting from different policies (including closures and size/lure/bag restrictions) to control the spread of the New Zealand Mud Snail in northern Nevada. Lupi et al. (2003) estimate the benefits of different sea lamprey control programs to recreational anglers. They link estimated changes in lake trout population resulting from different control programs and recreational fishing benefits from a non-market valuation model, calculating annual angler benefits of $2.6 to $4.7 million.

Invasive species can also affect other human uses of natural resources, such as public utilities, including electricity generation and water supply. These estimates of direct effects often consider lost productivity and/or the management costs incurred from dealing with invasive species. For example, Shwiff et al. (2010) use available information about the brown treesnake invasion on Guam to estimate the potential costs of an invasion on Hawaii. Based on damage cost data from Guam, Shwiff et al. (2010) estimate that a brown treesnake infestation in Hawaii could result in power-related economic damages ranging from $456 million to $761 million per year. Lee et al. (2007) use expenditure information from other sites, and find that a zebra mussel infestation of Lake Okeechobee in Florida could cost water users $3.37 million annually if intake pipes are untreated. Zebra mussels have also been found to affect hydropower generation facilities. Using expenditure data from infested hydropower plants, Phillips et al. (2005) estimate that installation costs for control systems at hydropower plants in the Columbia River basin could range from hundreds of thousands to over a million dollars per plant.

Ecological impacts

While the effects of invasive species on ecosystem services can be significant, these losses are difficult to value and thus have not often been quantified in benefit-cost analysis. However, several recent studies have begun to use non-market valuation methods to quantify the loss of these services, especially when indirect uses form the majority of the impacts. Accurate information about the impact of an invasive species on a given ecosystem service is crucial in estimating these values. Cooperation between ecologists and economists helps to provide the necessary link for modeling these impacts. In some cases, when researchers are unable to collect primary data related to a specific ecosystem, results from previous studies may provide values for a particular ecosystem service.

Invasive plant species can affect water cycling and related ecosystem functions. For example, *Miconia calvescens*, an invasive woody shrub, has affected the water balance on Oahu, Hawaii. Evidence has shown that the tree can lead to increased runoff and a resulting decrease in groundwater recharge. Annual losses on Oahu due to damages from reduced groundwater recharge and increased sedimentation are estimated to be $4.5 million per million gallons per day (Burnett et al. 2007). Tamarisk shrubs have been found to affect water cycles in the western United States, and some previous studies have attempted to quantify the loss of these ecosystem services in economic terms (Zavaleta 2000, Barz et al. 2007). However, benefit estimates vary with local conditions and modeling assumptions (see Box 4-1 for more details).

Box 4-4. Cheatgrass (Bromus tectorum)

Cheatgrass, or downy brome, is an invasive weed that was introduced into the United States in the 1800s. Since that time, it has spread to many areas throughout the United States including western rangelands. Cheatgrass has been a particular problem in the grasslands of the Great Basin, that includes BLM-managed lands. The weed thrives in areas that have been disturbed by fire, construction, flood, poorly managed grazing and intense recreation. Once established in an area, cheatgrass displaces native plants, impacting wildlife habitat. In addition to these ecosystem effects, cheatgrass can also significantly increase fire hazards. Since it grows in dense stands and is highly flammable, fires in cheatgrass areas are more frequent and more intense than rangelands with native vegetation. Furthermore, since the weed grows well in disturbed environments, the burned areas often see an increase in cheatgrass populations.

These ecosystem changes result in negative economic effects in areas of cheatgrass invasions. In addition to the welfare losses from habitat loss, increased frequency and intensity of wildfires can result in risk of property damage, human health effects from smoke inhalation, costs of fire suppression services, and the release of sequestered carbon. Since these external costs are not generally borne by private land users, such as ranchers, economic analysis estimating these values can be useful information for policy making. Some research has begun to estimate the value of preserving the native sagebrush ecosystems, or the cost of allowing invasive species such as cheatgrass to overtake the landscape. Estimating values for preservation and restoration efforts can help to allocate scarce resources among different management programs. Using non-market valuation methods, Evans and Rollins (2008) estimate that individuals in the Great Basin are willing to pay at least $71 annually for a land management program to protect against ecosystem losses due to wildfire and invasive weeds. Waigner et al. (2008) use benefit indicators for four different ecosystem services (recreational antelope hunting, forage production for commercial ranching, property protection, and sage grouse habitat) to identify optimal cheatgrass management options. While they were unable to provide quantitative estimates of benefits, they show how information on relative benefits can be used to rank different management options when quantitative information is unavailable.

Cheatgrass Fire *(Source: USGS)*

Introduction of invasive species can result in changes to disturbance regimes[14] that can have serious ecosystem impacts and resulting economic costs. For example, the introduction of species that increase fire frequency (such as cheatgrass) can increase fire suppression costs and health effects, as well as decrease property values. Evans and Rollins (2008) used non-market valuation methods to show that individuals are willing to pay to avoid such ecosystem damages in the Great Basin (see Box 4-4. Cheatgrass (Bromus tectorum)for more details). Invasive mammals such as feral pigs can often alter ecosystems by rooting in soil, disturbing native vegetation and increasing erosion. Some plant species, such as saltcedar, have been found to alter flooding regimes by increasing sedimentation in the waterway, leading to channel narrowing. Zavaleta (2000) estimates annual flood damages due to saltcedar to be around $52 million in the United States.

[14] Disturbance regime is a term used in ecology to describe the pattern of natural disturbances (such as fire, erosion, and flooding) that shape an ecosystem over time.

The effects of invasive species on ecosystem services can alter wildlife habitat, resulting in loss of biodiversity, and impacting threatened and endangered species. Wilcove et al. (1998) have estimated that 49% of threatened and endangered species in the United States are threatened by invasive species. The Burnett et al. (2006) study cited above used the average value of endangered bird species from previous studies to estimate the potential economic cost of losses of endangered native birds due to *Miconia* and brown treesnake infestations.

SUMMARY

Invasive species affect DOI lands and water resources and require significant financial and human resources for their management. Economic analysis can provide useful information for decision-making in terms of choosing the most cost-effective technique for dealing with an invasive species, or conducting benefit-cost analysis of different management strategies. This chapter is not intended to be an exhaustive review of all economic research on invasive species; it instead focuses on those areas that are most relevant for Interior agencies and natural resource management.

Many of the methods and results discussed here could prove useful for DOI bureaus in completing economic analyses for regulations or benefit-cost or cost-effectiveness analyses for management purposes. Although economic analyses of invasive species issues have been limited at DOI thus far, future work could utilize previous studies of individual species and advancements in economic tools for estimating impacts and assessing management strategies. Collaboration between economists and natural scientists working on invasive species issues at DOI bureaus is also central to providing useful and accurate policy recommendations. Partnerships with other government agencies that have conducted or funded studies on the economics of invasive species would also be helpful in furthering this type of analysis at Interior.

Chapter 5 CONCLUSIONS

The Department of the Interior's lands and managed resources produce a wide range of valuable ecosystem services, including food, drinking water, energy, flood and disease control, carbon sequestration, recreation, and culture. Understanding the economic contributions and values of these goods and services can result in better land management decisions.

This report has presented information on the FY 2010 economic contributions of the programs and activities of DOI. The information in the report has highlighted the current economic impact of Interior's existing programs and activities. The report also addressed economic issues related to the value of information, ecosystem services, and invasive species.

The Department of the Interior has a substantial impact on the national economy, supporting over two million jobs while infusing billions of dollars into the economy which in turn support many jobs across the Nation. In 2010, Interior supported approximately $346 billion in economic activity. Most of this contribution was associated with revenues produced by Interior's management of natural resources on Federal lands, including leasing mineral rights, providing irrigation water, providing recreational opportunities, protecting unique natural resources, and providing valuable information to the mineral markets. Many of Interior's activities, such as the leasing of mineral rights, significantly impact the national economy because they enable private industry to create wealth and jobs.

Interior uses ecosystem service concepts to integrate conservation with human well-being, with conservation being at the core of Interior's mission to protect America's natural resources and heritage, honor cultures and tribal communities, and supply energy to power the future. Evaluating and taking into consideration the services provided both through human production as well as through conserved ecosystems can result in new stakeholders, broader landscapes, expanded revenue sources, and enhanced conservation.

Although there is currently not a total quantification, nor valuation, of ecosystem services from Interior lands and managed resources, this report provided three case studies to illustrate sources of some ecosystem services values.

Invasive species are a growing problem in the United States, costing the nation billions of dollars per year in prevention and control costs, lost productivity, and damages to infrastructure, industry, ecosystems, and outdoor recreation. Although science-based approaches have dominated invasive species policy, economic input has become more important in recent years, as the rate of invasive species introduction and spread has increased. Invasive species have significant impacts on DOI land and water resources. These species affect human uses such as recreation, hydropower, water supplies, agriculture, and ranching, as well as ecosystem functions including pollination, water filtration, climate, pest control, and protection from erosion, wildfires, and other natural hazards. Interior is working to blend science and economics. Economic analysis provides useful information for decision-making in terms of choosing the most cost-effective technique for dealing with an invasive species, or conducting benefit-cost analysis of different management strategies. Many of

the methods and results discussed in this report could prove useful for DOI bureaus in completing economic analyses for regulations or benefit-cost or cost-effectiveness analyses for management purposes.

Appendix 1. BUREAU-LEVEL ECONOMIC IMPACTS BY STATE

STATE-LEVEL IMPACTS FOR BLM MINERALS

The BLM manages some 700 million acres of Federal onshore mineral estate, providing oil, natural gas, coal, hardrock minerals, and geothermal energy.

The following data provide estimated employment, income, and output resulting from BLM-managed minerals in 18 western States in 2010. BLM's Eastern States Office also manages very significant tracts of mineral estate and information from these lands is also included below. The economic contributions of BLM minerals production can be evaluated with information on direct employment, income, and output. Total employment, income, and output estimate direct effects plus the indirect and induced economic effects of that activity in the local economy, such as the activities of other oil and gas service companies required to support oil and gas field development and the local effects of spending the additional income derived from minerals activities. Employment is expressed in annual average full and part time private sector jobs. Total economic estimates are produced through the IMPLAN input-output model.

Table A1-1. State-Level Impacts for BLM Minerals

State	Sector	Employment (jobs)		Output ($ millions)	
		Direct	Total	Direct	Total
Alaska	Oil and Gas	175	633	123.2	206.0
	Coal Mining	0	0	0.0	0.0
	Other Minerals	0	0	0.0	0.0
	Geothermal Energy	0	0	0.0	0.0
	Wind Energy	0	0	0.0	0.0
Arizona	Oil and Gas	0	0	0.0	0.0
	Coal Mining	0	0	0.0	0.0
	Other Minerals	0	0	0.0	0.1
	Geothermal Energy	0	0	0.0	0.0
	Wind Energy	5	7	0.7	0.9
California	Oil and Gas	3,848	12,409	1,703.8	3,297.9
	Coal Mining	0	0	0.0	0.0
	Other Minerals	624	1,434	186.3	336.5
	Geothermal Energy	367	996	97.6	193.8
	Wind Energy	32	45	6.3	8.5
Colorado	Oil and Gas	5,655	17,213	2,930.9	4,856.1
	Coal Mining	2,573	5,611	782.7	1,263.2
	Other Minerals	30	88	17.6	26.7
	Geothermal Energy	0	0	0.0	0.0
	Wind Energy	0	0	0.0	0.0

State	Sector	Employment (jobs)		Output ($ millions)	
		Direct	Total	Direct	Total
Idaho	Oil and Gas	0	0	0.0	0.0
	Coal Mining	0	0	0.0	0.0
	Other Minerals	584	1,150	162.5	236.7
	Geothermal Energy	0	0	0.0	0.0
	Wind Energy	0	0	0.0	0.0
Kansas	Oil and Gas	226	394	51.2	74.5
	Coal Mining	0	0	0.0	0.0
	Other Minerals	0	0	0.0	0.0
	Geothermal Energy	0	0	0.0	0.0
	Wind Energy	0	0	0.0	0.0
Montana	Oil and Gas	1,341	2,805	394.5	582.9
	Coal Mining	1,282	2,596	361.6	526.1
	Other Minerals	0	0	0.0	0.0
	Geothermal Energy	0	0	0.0	0.0
	Wind Energy	0	0	0.0	0.0
Nebraska	Oil and Gas	104	179	23.4	34.9
	Coal Mining	0	0	0.0	0.0
	Other Minerals	0	0	0.0	0.0
	Geothermal Energy	0	0	0.0	0.0
	Wind Energy	0	0	0.0	0.0
Nevada	Oil and Gas	125	221	28.3	44.0
	Coal Mining	0	0	0.0	0.0
	Other Minerals	0	0	0.0	0.0
	Geothermal Energy	193	393	36.9	61.5
	Wind Energy	0	0	0.0	0.0
New Mexico	Oil and Gas	24,000	51,593	7,991.7	11,408.3
	Coal Mining	420	903	136.1	197.3
	Other Minerals	1,250	2,717	463.7	661.4
	Geothermal Energy	0	0	0.0	0.0
	Wind Energy	0	0	0.0	0.0
North Dakota	Oil and Gas	3,188	6,295	967.7	1,387.2
	Coal Mining	6	13	2.1	3.1
	Other Minerals	0	0	0.0	0.0
	Geothermal Energy	0	0	0.0	0.0
	Wind Energy	0	0	0.0	0.0
Oklahoma	Oil and Gas	417	962	135.0	211.1
	Coal Mining	89	198	26.7	42.0
	Other Minerals	0	0	0.0	0.0
	Geothermal Energy	0	0	0.0	0.0
	Wind Energy	0	0	0.0	0.0

State	Sector	Employment (jobs)		Output ($ millions)	
		Direct	Total	Direct	Total
Oregon	Oil and Gas	0	0	0.0	0.0
	Coal Mining	0	0	0.0	0.0
	Other Minerals	0	0	0.0	0.0
	Geothermal Energy	0	0	0.0	0.0
	Wind Energy	0	0	0.0	0.0
South Dakota	Oil and Gas	40	57	9.0	11.4
	Coal Mining	0	0	0.0	0.0
	Other Minerals	0	0	0.0	0.0
	Geothermal Energy	0	0	0.0	0.0
	Wind Energy	0	0	0.0	0.0
Texas	Oil and Gas	258	1,269	208.0	375.1
	Coal Mining	0	0	0.0	0.0
	Other Minerals	0	0	0.0	0.0
	Geothermal Energy	0	0	0.0	0.0
	Wind Energy	0	0	0.0	0.0
Utah	Oil and Gas	7,277	20,576	3,049.5	4,750.1
	Coal Mining	1,501	3,618	416.6	694.5
	Other Minerals	68	173	23.6	37.8
	Geothermal Energy	22	42	2.9	5.0
	Wind Energy	119	150	13.8	17.4
Washington	Oil and Gas	0	0	0.0	0.0
	Coal Mining	0	0	0.0	0.0
	Other Minerals	0	0	0.0	0.0
	Geothermal Energy	0	0	0.0	0.0
	Wind Energy	0	0	0.0	0.0
Wyoming	Oil and Gas	29,352	64,539	14,199.8	18,949.6
	Coal Mining	13,775	25,330	4,820.3	6,416.8
	Other Minerals	1,501	3,224	814.2	1,062.9
	Geothermal Energy	0	0	0.0	0.0
	Wind Energy	3	4	0.5	0.6
Eastern States	Oil and Gas	1,051	3,427	338.2	738.2
	Coal Mining	490	1,764	154.2	376.3
	Other Minerals	15	46	4.1	9.4
	Geothermal Energy	0	0	0.0	0.0
	Wind Energy	0	0	0.0	0.0

Source: BLM

STATE-LEVEL ECONOMIC IMPACTS FOR BLM GRAZING AND TIMBER (2010)

The Bureau of Land Management (BLM) manages livestock grazing on about 160 million acres of public lands. In addition, out of the 67 million acres of BLM-managed lands forests or woodlands, 11 million acres are commercial forestlands, generally used for traditional forest products such as lumber, plywood, and paper. For grazing, the BLM administers nearly 18,000 permits and leases held by ranchers who graze their livestock at least part of the year on more than 21,000 allotments under BLM management. In managing grazing and timber activities on public lands, the BLM's objectives are to ensure the long-term health and productivity of these lands, create multiple environmental benefits that result from healthy watersheds, and provide livestock and timber-based economic opportunities for rural communities.

The following data provide estimated employment, income, and output resulting from BLM-managed grazing and timber activities in 2010. The economic value of BLM forage is based on the total sale price of livestock times the proportion of animal-unit months grazed on BLM-managed lands to total animal-unit months. BLM grazing and timber operations have direct effects in terms of employment and income, as well as induced effects in the local economy, such as the activities of other businesses required to support ranching operations and the local effects of spending the additional income derived from public lands grazing. Employment is expressed in annual average full and part time private sector jobs. Total economic estimates are produced through the IMPLAN input-output model.

Table A1-2. State-Level Impacts for Grazing and Timber (2010)

	Grazing				Timber			
	Employment (jobs)		Output ($millions)		Employment (jobs)		Output ($millions)	
	Direct	Total	Direct	Total	Direct	Total	Direct	Total
Alaska	0	0	0	0	6	10	1.4	3.0
Arizona	100	191	14.3	27.4	1	1	0.1	0.3
California	34	71	5.1	11.9	110	281	20.9	53.7
Colorado	194	336	28.3	53.5	68	148	13.7	46.6
Idaho	212	402	35.8	61.8	86	206	18.5	35.9
Kansas	0	0	0	0	0	0	0	0
Montana	239	438	32.9	59.7	38	83	9.9	19.6
Nebraska	0	0	0	0	0	0	0	0
Nevada	200	352	34.6	58.1	22	47	4.1	7.5
New Mexico	486	842	70.1	117.3	13	26	3.2	9.4
North Dakota	1	2	0.3	0.4	0	0	0	0
Oklahoma	0	0	0	0	0	0	0	0
Oregon	216	388	17.5	36.4	889	2,736	245.9	595.1
South Dakota	17	28	3.2	5.0	9	16	1.4	2.5
Texas	0	0	0	0	0	0	0	0

	Grazing				Timber			
	Employment (jobs)		**Output** ($millions)		**Employment** (jobs)		**Output** ($millions)	
	Direct	Total	Direct	Total	Direct	Total	Direct	Total
Utah	360	476	22.0	36.1	32	73	5.6	15.3
Washington	21	33	1.5	3.2	24	63	6.6	15.5
Wyoming	426	623	44.7	69.5	35	56	5.7	9.7
Eastern States	0	0	0	0	0	0	0	0
Total (Sum across States)	**2,507**	**4,181**	**310.3**	**540.3**	**1,333**	**3,748**	**337.1**	**814.4**

Source: BLM

STATE-LEVEL IMPACTS FOR ABANDONED MINE LAND FUNDING (OSM AND BLM)

The information below represents the readily available information on State-level impacts of the Abandoned Mine Land (AML) program. Both OSM and BLM have Abandoned Mine Lands programs and activities, however BLM's funding is included in their appropriations and is not included here due to lack of state-level information. The goal of the OSM AML program is to promote the reclamation of mined areas left without adequate reclamation prior to the enactment of the Surface Mining Control and Reclamation Act (SMCRA) in 1977. OSM collaborates with States and tribes to develop their AML programs, and also provides funding, technical assistance, and oversight to ensure that qualified lands are reclaimed.

Table A1-3. AML Funding for FY 2010 (OSM)

State	2010 Funding ($ millions)	Estimated Jobs Impacts (jobs)
Alabama	7.0	131
Alaska	2.4	44
Arkansas	2.3	41
Colorado	7.4	128
Crow Tribe	1.8	42
Hopi Tribe	1.1	26
Illinois	16.1	278
Indiana	13.0	239
Iowa	2.4	46
Kansas	2.4	41
Kentucky	37.6	688
Louisiana	0.3	6
Maryland	2.6	46
Mississippi	0.2	5
Missouri	2.5	46
Montana	10.7	200
Navajo Nation	6.5	151
New Mexico	4.5	83
North Dakota	3.4	55
Ohio	11.6	235
Oklahoma	2.5	49
Pennsylvania	43.8	827
Tennessee	2.6	53
Texas	4.1	81
Utah	4.2	85
Virginia	8.7	158
West Virginia	49.9	878
Wyoming	117.4	1,930
Total	369.1	8,578

Source: OSM

While OSM has made significant progress in reclaiming AML land, there are over 200,000 acres on coal-related abandoned mine sites that have yet to be fully reclaimed, amounting to an estimated $3.9 billion worth of health and safety problems areas in 23 States and three tribes across the United States. Characteristics of these high priority problem areas include extreme danger and adverse effects to public health and safety.

Table A1-3 shows FY 2010 AML funding by State and the estimated jobs impacts. Job impacts range from 1,930 in Wyoming to 5 in Mississippi.

STATE-LEVEL IMPACTS FOR OFFSHORE MINERALS – BOEMRE

The BOEMRE program supports 642,309 jobs across the nation through Outer Continental Shelf (OCS) oil and gas operations. The jobs in exploration and production on the OCS pay higher than the average national salary. The distribution of jobs is based on the BOEMRE's own economic model (MAG-PLAN) as well as additional calculations to distribute the jobs that occur outside of the Gulf of Mexico region.

Effects of the spending of OCS revenues paid to the Federal Government (bonus bids, royalties, and rentals) and industry profits were also calculated and assigned to States. The methods used for these calculations are discussed in Appendix 5.

Table A1-4. Offshore Minerals – Estimated Job Impacts by State[15]

State	Estimated Total Jobs (jobs)
Alabama	8,130
Alaska	4,971
Arizona	4,313
Arkansas	3,714
California	29,329
Colorado	9,193
Connecticut	2,725
Delaware	553
DC	2,122
Florida	14,179
Georgia	6,508
Hawaii	1,137
Idaho	970
Illinois	9,678
Indiana	4,199
Iowa	2,081
Kansas	4,230
Kentucky	3,550
Louisiana	123,118
Maine	963
Maryland	5,213
Massachusetts	5,369
Michigan	7,233
Minnesota	4,014
Mississippi	16,711
Missouri	4,574
Montana	1,368
Nebraska	1,370
Nevada	1,444
New Hampshire	925
New Jersey	6,556
New Mexico	5,531
New York	13,676
North Carolina	5,915
North Dakota	1,727
Ohio	10,000
Oklahoma	14,960
Oregon	2,526
Pennsylvania	12,198
Rhode Island	741
South Carolina	2,914
South Dakota	688
Tennessee	4,372
Texas	247,836
Utah	3,183
Vermont	464
Virginia	8,401
Washington	4,987
West Virginia	2,722
Wisconsin	3,881
Wyoming	5,148
Total	642,309

Source: BOEMRE

[15] These impacts exclude any effects related to BOEMRE Grants and Payments.

Appendix 2. ECONOMIC IMPACT BY SECTOR

INTRODUCTION

The Department of the Interior's public resource management activities support over 2 million jobs, spread across a number of sectors including recreation and tourism, mineral-based energy production, agriculture, and forestry. Many of these sectors have the unique ability to reach rural communities where Interior has management activities. The following summaries provide some key impacts by sector. the percentage of total Interior employment impacts contributed by each sector.

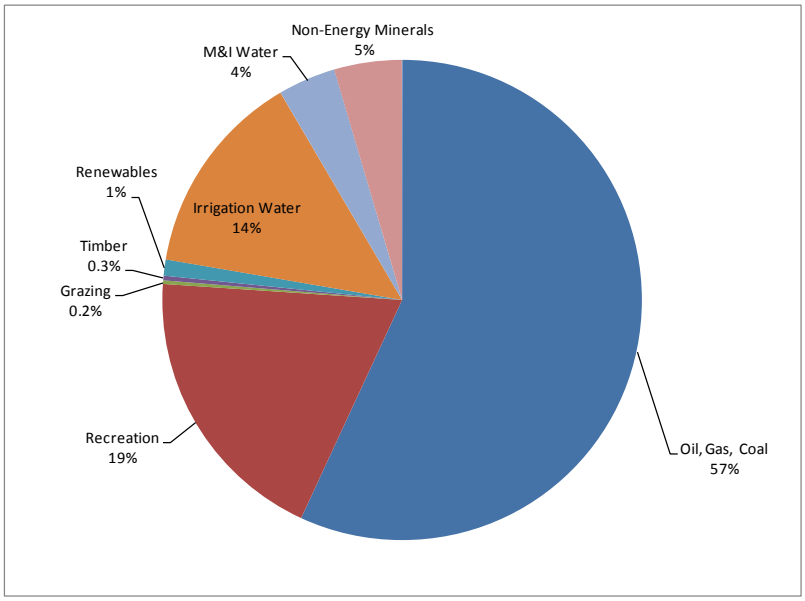


Figure A2-1. Percentage of DOI Employment Impacts by Management Activity (Total: 2 million jobs)

Public lands continue to be economically important to rural communities throughout the West, although the nature of the relationship is changing. While traditional land use activities remain important, continuing demographic changes in the West are likely to put additional pressures on public land use.

Traditional uses such as grazing, mining, and forestry remain key sources of rural jobs and income. At the same time, alternative uses of public lands such as outdoor recreation and conservation have gained in economic importance to rural communities. Selling recreation related goods and services such as lodging, guide services, and equipment to public land visitors has become a vital part of many rural economies. Similarly, some of the fastest growing areas in the West are rich in natural environmental amenities and are near public lands where the abundance of wildlife and open spaces attracts new residents.

The economic benefits of conservation, tourism, outdoor recreation, farming, ranching, mining, and forestry, and the ecosystems on which these activities depend, all make significant contributions to the well being of individuals, the nation, and local communities, even though the monetary value of these contributions is sometimes difficult to measure. However, few markets exist for experiencing a day of hiking or fishing, maintaining and interpreting our cultural heritage, enhancing the health of wetlands and rangelands, or preserving habitat for endangered species. These are a few of the many non-market ecosystem services provided by Federal, State, and private lands and resources.

RECREATION

Federal and State lands provide outdoor recreation opportunities in all 50 States, and expenditures by recreationists represent an important contribution to State and local economies. Recreation development involves more than just tourist-related businesses, such as hotels and restaurants; it encompasses all economic growth that results from people moving into the community to take advantage of its recreational amenities. This kind of development has the potential to transform a community by attracting retirees, entrepreneurs, and young workers, diversifying the economy, and improving the quality of life with a broader array of goods and services.

Recreation expenditures support a significant amount of economic activity. For example:[16]

- Wildlife associated expenditures ($122.3 billion; $2006) were 0.9% of US GDP ($13.3 trillion; $2006);
- Wildlife associated expenditures were 17.2% of Total Direct Tourism Output ($709.7 billion; $2006);
- Texas, Florida, California, Pennsylvania, and Michigan are the top five States in terms of total wildlife associated expenditures (in that order);
- Wyoming, Montana, Maine, Alaska, and Arkansas are the top five States in terms of total wildlife associated expenditures as a percent of total State GDP (in that order);
- Wildlife associated expenditures were 1.3% of Total Personal Consumption Expenditures ($9.3 trillion; $2006); and
- Wildlife associated expenditures were 8.0% of Personal Consumption Expenditures associated with Recreational goods and vehicles, Transportation services, Recreation services and Food services and accommodations ($1.5 trillion; $2006). While this is a very broad category, 8% represents a significant share.

Tourist expenditures create local demands for traded goods and services, thus creating jobs and income for local residents. In rural areas near large public land holdings, it is not uncommon for a large portion of the economic activity in these sectors to be caused by tourists and other visitors to the area. Given that recreation-based nonmetropolitan counties have experienced three times the rate of net migration as compared to nonmetropolitan areas as a whole, rural communities endowed with natural amenities will likely experience growing local demands on service and retail businesses.[17]

Recreation visits to Interior-managed lands in the contiguous United States, Hawaii, and Alaska in 2010 supported over 380,000 jobs and about $48 billion in economic contributions to the

[16] These comparisons were made using 2006 values because the 2006 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation is the most recent data available.

[17] English, Donald B.K., Marcouiller, David W., and Cordell, H. Ken. 2000. Tourism Dependence in Rural America: Estimates and Effects. Society and Natural Resources, Vol. 13, pp. 185-202.

communities and regions surrounding Interior-managed land. Recreation activities have an economic impact in both rural communities and major metropolitan areas.

- Recreation and tourism visits to National Parks, Refuges and other public lands support Interior jobs for nearly 7,200 park rangers, environmental interpreters, guides, and visitor use assistants.
- Employment in the recreation and tourism industry is characterized by low-skilled seasonal and part-time jobs; 40% of all workers have no formal education beyond high school.
- Youth employment at Interior totaled 16,149 and 21,874 in FY 2009, and FY 2010 respectively, mostly in seasonal and part-time positions developing skills and experience as interpreters, visitor assistants, and trail maintenance workers. The NPS employed the largest number in FY 2010, with 10,845 youth employed.
- In the rural State of Wyoming, recreation and tourism on Interior-managed lands result in an estimated 15,000 jobs, comprising 5% of the State's total workforce.
- More than 4,000 communities with a combined population of 22 million are just a half hour drive from BLM managed public lands. Almost 58 million visitor days were estimated for FY 2010, including almost 30 million camping and picnicking visits, over 2 million non-motorized boating trips, over 6 million interpretation and education visits.

Box A2-1. Recreational Equipment Expenditures

Expenditures by recreationists on public lands represent a sizeable contribution to State and local economies. In the 2006 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation (the most recent data available), FWS examined the economic impacts of equipment purchases related to wildlife-related recreation activities. Tents, fishing rods and reels, firearms, cameras, binoculars and related items are categorized as *trip-related equipment*. Equipment purchases create jobs and revenue for both local and non-local businesses and communities. Equipment type and demand vary widely between visitors, depending on the purpose of the visit, length of stay, and whether the visitor is local or traveled from outside the area.

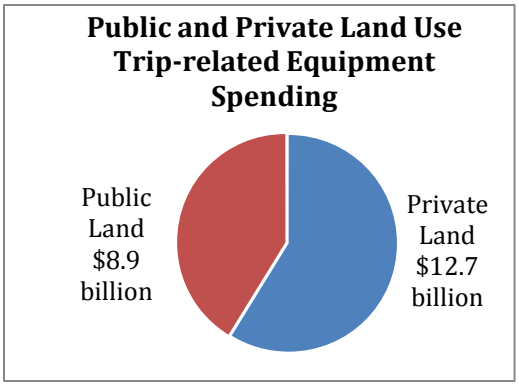


Figure A2-2. Public and Private Land Use Trip-related Equipment

A portion of these trip-related equipment expenditures can be attributed to visits to general public lands (Federal, State, and local). The 2006 Survey indicated that 41% of wildlife-related outdoor recreation occurred on all public lands. The portion of the trip-related equipment purchases ($21.9 billion in 2010 dollars) attributed to general public land use is about $9 billion. Big ticket items, such as boats and campers, are not included in trip-related equipment statistics.

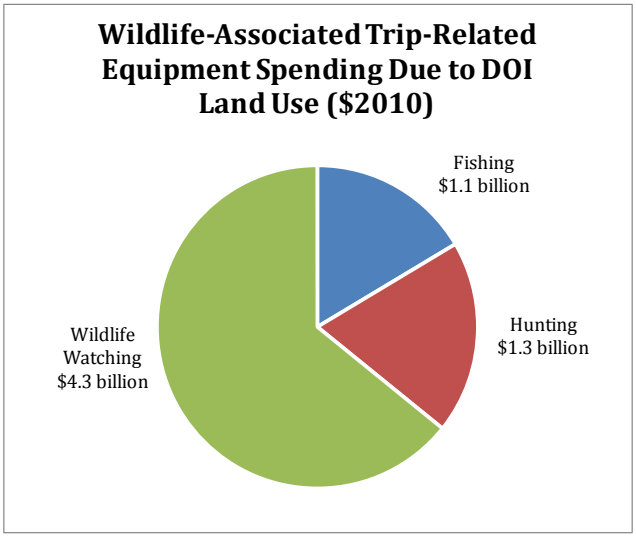


Figure A2-3. Wildlife-Associated Trip-Related Equipment Spending Due to DOI Land Use

In 2006, $6.0 billion ($6.6 billion in 2010 dollars) was spent for trip-related recreation equipment on DOI land. Sixty-five percent of total trip-related equipment expenditures were for wildlife watching items, 19% for hunting items, and 16% for fishing items. Expenditures per day of recreation on DOI land were $20 (in 2010 dollars) for trip-related equipment.

Natural resource amenities can also be attractive to retirees, which can have important implications for fueling local economies. While much of the retiree growth in recent decades has occurred in rural counties close to metropolitan areas and transportation corridors, it has occurred in rural counties endowed with natural amenities as well. Studies have indicated that warm and sunny climates, open lands, scenery, and water are important natural resource amenities to attract retirees. Policies that encourage nature-based recreational facilities, natural parks and wilderness areas, fishing spots, along with golf facilities and sporting events, can add to the amenity attractiveness of a locality for retirees. In particular, counties close to national parks and containing natural areas and recreation parks experienced a significant growth of retirees in recent decades, and that growth is likely to continue. However, further concentration of retirees, particularly in and around parks and other natural areas, may be problematic in that one of their unique aspects is that they are undeveloped. Too many people wishing to live near public lands may eventually become a threat.[18]

A subset of the tourism industry, "heritage tourism," is somewhat distinct from active outdoor recreation (although they may overlap) as the business or practice of attracting and accommodating visitors to a place or area based especially on the unique or special aspects of that locale's history, landscape, and culture. Heritage tourism helps promote the diversification of local economies and preservation of a community's unique character. Heritage tourism can be a powerful economic development tool because some studies have shown that heritage tourists stay longer and spend more than other tourists.

ENERGY & MINERALS (OIL, GAS, AND COAL)

Onshore oil, gas and coal activities on Interior-managed lands resulted in over 400,000 jobs and almost $100 billion in economic contributions, while offshore activities supported an additional 642,309 jobs and $116 billion in economic contributions. Direct jobs through energy and mineral activities on Interior-managed lands are generally high-paying jobs, including technical specialists employed by Interior bureaus and additional private sector jobs in the technical, labor, and maintenance fields.

- BOEMRE employs nearly 500 surveyors, engineers and scientists to assist in the safe management of offshore oil and gas management while BLM employs over 900 surveyors and engineers in the development of onshore resources.
- Oil and gas activities on public lands and offshore areas provide many high paying, private-sector jobs. The Bureau of Labor Statistics (BLS) reports that in 2009, U.S. oil and gas production worker earned an average of $28.09 an hour compared to the private industry average of $20.90 an hour for all job types.
- BLS predicts wage and salary employment in mining to decline by 2% through the year 2016. The Abandoned Mine Lands (AML) grant program administered by OSM can keep jobs in areas where mining is in decline, such as West Virginia and Kentucky. Based on

[18]Poudyala, Neelam C., Hodges, Donald G., and Cordell, H. Ken. 2008. The role of natural resource amenities in attracting retirees: Implications for economic growth policy. Ecological Economics. Vol. 68, pp. 240-248.

funding allocated, the AML program is estimated to create 1,566 jobs in these two States in 2010.

RENEWABLE ENERGY (HYDROPOWER, GEOTHERMAL, SOLAR, AND WIND)

Nearly 22,000 jobs and $5.5 billion in economic impacts are associated with hydropower, geothermal, and wind activities on Interior managed lands. Interior's long-standing role in hydropower production – as well as more recent activities in wind, solar, and geothermal renewable power – supports private industry jobs in a high-paying and growing industry.

- Reclamation directly employs over 1,000 high-paying technical workers as civil, electrical, and hydrological engineers with additional jobs being created in the emerging solar and wind industries.
    - Engineer = 54
    - Engineering tech = 204
    - Civil Engineer = 554
    - Mechanical Engineer = 74
    - Electrical Engineer = 210
    - Environmental Engineer = 12
    - Total Estimate = 1108
- The BLS predicts an overall decline in utility jobs sector-wide but a potential employment increase in the renewable energy sectors. Utility industry jobs pay well; lower-skilled maintenance and installation workers earn on average $20 per hour while highly trained civil and mechanical engineers earn $39-41per hour.
- Fourteen solar energy projects proposed on BLM land in California, Arizona, and Nevada were identified in 2009 as having made sufficient progress to formally start the environmental review and public participation process. These projects were advanced enough in the permitting process to potentially be cleared for approval by December 2010, thus making them eligible for economic stimulus funding under the American Recovery and Reinvestment Act of 2009. Of these, Records of Decision (RODs) have been signed for 9 projects associated with 3,697 MW of installed capacity. The projects with approved RODs are estimated to be associated with about 6,300 jobs during the construction period and about 850 permanent jobs."

LAND AND WATER RESOURCES (IRRIGATION, GRAZING, AND TIMBER)

Interior-managed public lands embody a multiple-use concept that allows for traditional jobs in the farming, ranching, and forestry industries while preserving open space and ecosystems for recreation and environmental benefits.

- Public lands and the adjacent private ranches in the West maintain open spaces, provide habitat for wildlife, offer recreational opportunities, and help preserve traditional livelihoods and family ranching.
- The BLM's range and timber activities support almost 8,000 jobs and nearly $1.4 billion in economic activity.

- Timber and grazing activities support small and family-owned businesses and enterprises. Self-employed workers make up 43% of the agriculture and forest industries that utilize Interior's land and water resources.
- The economic activity and employment supported by cattle and sheep using BLM rangeland represents a small, but important share of the total value of the sheep and cattle sector in the western States. The largest contribution to economic output and employment is in Nevada, where BLM rangeland supports about 15% of the total value of the economic output and employment in the cattle and sheep sector; in New Mexico, Oregon, Utah, and Wyoming BLM rangeland supports about 5% of the of the total value of the economic output in the cattle and sheep sector; and in other western States it supports less than 5%.

Timber Impacts in Rural Oregon

Interior's timber management activities have the potential to create jobs in rural communities with limited employment opportunities. In Oregon, a largely rural state that has seen a marked decline in traditional forestry jobs, BLM manages 2.4 million acres of forests and woodlands in the western part of the state, including 2.2 million acres of commercial forest and 200,000 acres of woodlands. BLM's forest management activities in Oregon support over 2,700 jobs and almost $600 million in economic activity.

Appendix 3. STATE-LEVEL ECONOMIC IMPACTS BY SECTOR

Through management activities conducted at the bureau-level, the Department of the Interior contributes to State and local economies in terms of jobs created and related spending impacts. This chapter provides additional State-by-State information on the economic impacts associated with a variety of activities including recreation, minerals, timber, and forage. Some highlights include the following:

- **Recreation**: The economic impacts of recreation activities differ considerably across States.
  - Recreation on Interior-managed lands is estimated to support about 34,700 jobs in California, 20,300 jobs in Utah, 21,400 jobs in Arizona, and 12,400 jobs in the District of Columbia.
  - Recreational visits to Interior-managed lands resulted in economic activity exceeding $1 billion in several States: Arizona, California, Colorado, the District of Columbia, Florida, Oregon, Utah, and Wyoming.
- **Onshore Minerals**: The economic impact of onshore minerals activities also varies widely.
  - In 2010, oil, gas, coal, and non-metallic mineral activities in New Mexico supported over 55,200 jobs and generated $12.3 billion.
  - In Wyoming, oil, gas, coal, and non-metallic mineral activities supported over 93,000 jobs and generated $26.4 billion.
  - In California, oil, gas, coal, and non-metallic mineral activities supported over 13,800 jobs and $3.6 billion.

- **Offshore Minerals:** Offshore minerals activities support a total of about 642,000 jobs across the country (this does not include jobs supported by offshore revenues directed toward grant programs). For example: over 247,800 jobs are supported in Texas, over 123,100 jobs are supported in Louisiana, and over 29,300 jobs are supported in California.

- **Timber**: BLM timber activities are concentrated in Oregon, supporting about 3,100 jobs and about $632 million in economic activity.

- **Grants and Payments to non-Federal Entities**: Payments to States and counties represent an important source of income to these jurisdictions. In 2010, grants and payments were estimated to support over 15,000 jobs in Wyoming, 6,700 jobs in New Mexico, 3,300 jobs in Utah, and 2,800 jobs in Colorado. Grants and payments are estimated to support almost 30,000 jobs in the Insular Areas.

More detailed State-level data is presented in the following figures and tables in this Appendix:

- Figure A3-1. Map of U.S. Jobs Supported by Department of the Interior Activities
- Figure A3-2. State-by-State Summary of Job Impacts

- Table A3-1. State-by-State breakdown of total jobs supported by Interior activities, by sector
- Figure A3-3. Map of U.S. Output Supported by Department of the Interior Activities
- Figure A3-4. Output Supported by DOI Activities
- Table A3-2. State-by-State breakdown of total output supported by Interior activities, by sector
- Table A3-3. State-level Employment and Output Impacts for Recreation Visits

Unless otherwise noted, each of the following economic impact summaries relies on State-level multipliers to develop output and employment impacts within each State's borders. A multiplier for one State does not account for "spillover" effects accruing in other States. Thus, the sum of effects across 50 States will be less than the overall nationwide impacts. In contrast, when a national-level multiplier is used, spillover effects among States are taken into account, providing better estimate of nationwide impacts.

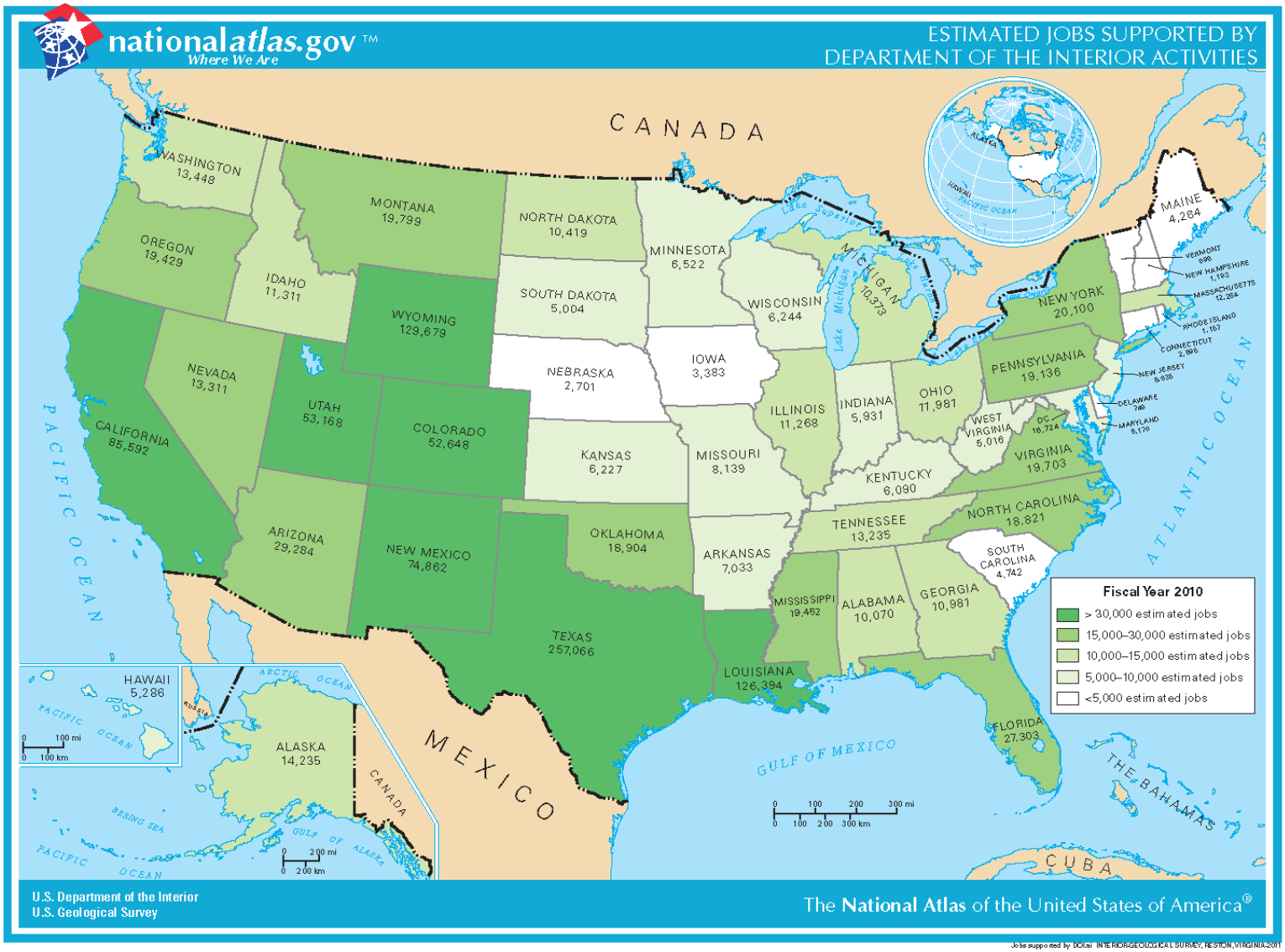


Figure A3-1. Map of U.S. Jobs Supported by Department of the Interior Activities

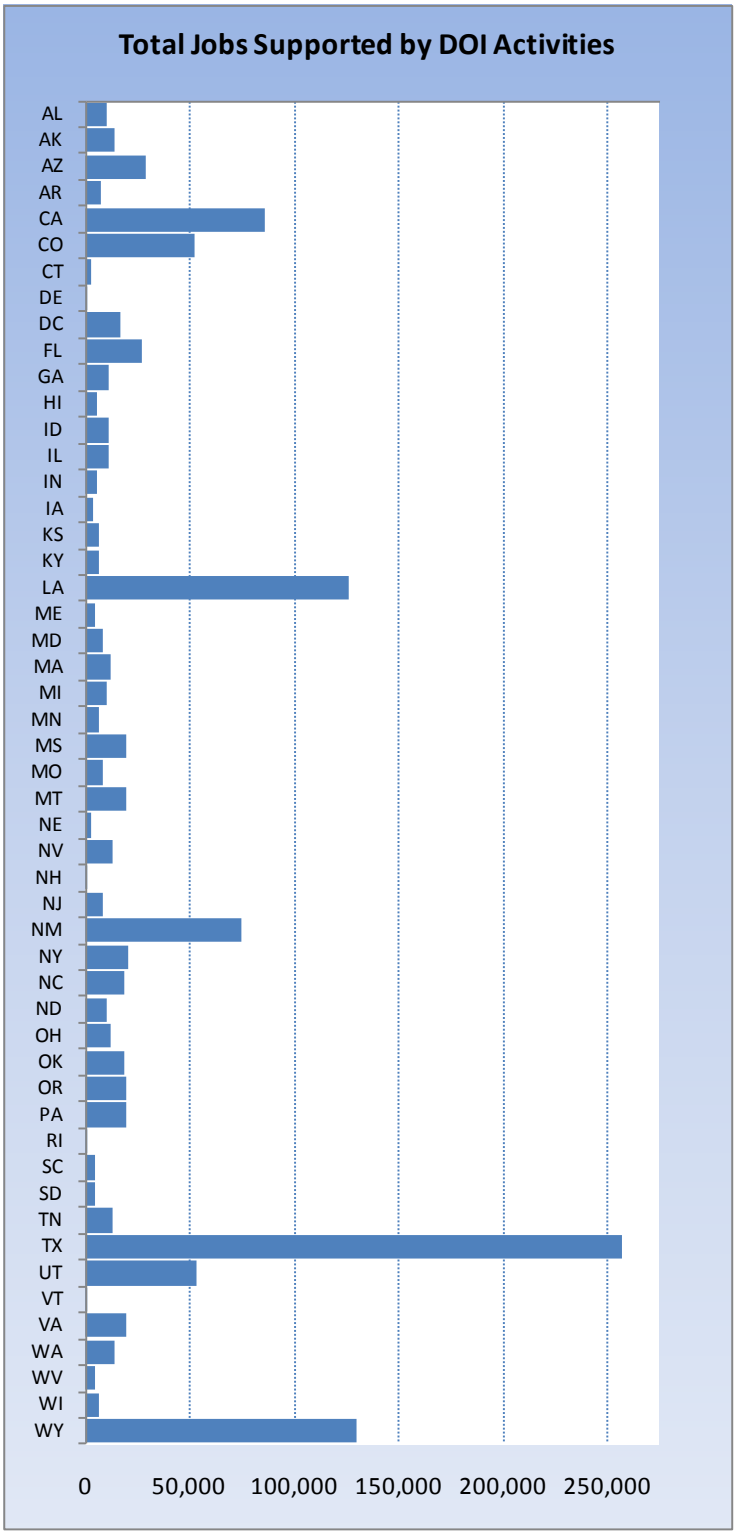


Figure A3-2. State-by-State Summary of Job Impacts

Note: The above figure presents jobs supported by recreation, energy, minerals, grazing, timber, salaries and grants and payments in each of the 50 States. The jobs reported in Table 1-1, were estimated using a national-level model that includes interstate "leakages" not captured in state by state-level models.

Table A3-1. State-by-State breakdown of total jobs supported by Interior activities, by sector

State	Recreation[1]	Energy & Minerals[2,3]	Grazing & Timber[4]	Major Grants & Payments[5]	DOI Salary[6]	Total[7]
			(jobs)			
Alabama	975	8,130		869	95	10,070
Alaska	5,782	5,604	10	1,756	1,083	14,235
Arizona	21,364	4,320	192	863	2,545	29,284
Arkansas	2,657	3,714		506	156	7,033
California	34,658	44,214	352	2,318	4,050	85,592
Colorado	13,216	32,105	484	2,801	4,043	52,648
Connecticut	19	2,725		127	25	2,895
Delaware	64	553		115	17	749
District of Columbia	12,414	2,122		57	2,131	16,724
Florida	11,634	14,179		583	907	27,303
Georgia	3,356	6,508		472	645	10,981
Hawaii	3,775	1,137		152	222	5,286
Idaho	6,659	2,120	608	776	1,147	11,311
Illinois	813	9,678		631	146	11,268
Indiana	1,027	4,199		552	153	5,931
Iowa	904	2,081		312	86	3,383
Kansas	1,028	4,625	0	370	204	6,227
Kentucky	1,353	3,550		997	190	6,090
Louisiana	691	123,118		1,972	614	126,394
Maine	2,980	963		188	133	4,264
Maryland	2,352	5,213		211	394	8,170
Massachusetts	6,155	5,369		169	571	12,264
Michigan	2,225	7,233		587	328	10,373
Minnesota	1,396	4,014		580	532	6,522
Mississippi	1,945	16,711		576	219	19,452
Missouri	2,485	4,574		610	470	8,139
Montana	9,451	6,769	521	1,842	1,216	19,799
Nebraska	596	1,549	0	283	272	2,701
Nevada	9,243	2,058	400	645	966	13,311
New Hampshire	50	925		165	53	1,193
New Jersey	1,761	6,556		161	157	8,635
New Mexico	4,189	60,744	868	6,716	2,345	74,862
New York	5,507	13,676		407	509	20,100
North Carolina	12,015	5,915		491	400	18,821
North Dakota	960	8,035	2	1,013	408	10,419
Ohio	1,177	10,000		613	191	11,981
Oklahoma	1,731	16,120	0	485	568	18,904
Oregon	11,223	2,526	3,124	578	1,979	19,429
Pennsylvania	4,870	12,198		1,367	700	19,136
Rhode Island	274	741		114	28	1,157
South Carolina	1,425	2,914		261	142	4,742
South Dakota	3,137	744	44	377	701	5,004
Tennessee	7,902	4,372		539	423	13,235
Texas	5,457	249,105	0	1,780	723	257,066
Utah	20,319	27,741	549	3,340	1,219	53,168
Vermont	49	464		145	39	698

State	Recreation[1]	Energy & Minerals[2,3]	Grazing & Timber[4]	Major Grants & Payments[5]	DOI Salary[6]	Total[7]
			(jobs)			
Virginia	8,472	8,401		490	2,340	19,703
Washington	6,349	4,987	96	742	1,273	13,448
West Virginia	802	2,722		1,113	381	5,016
Wisconsin	1,311	3,881		588	464	6,244
Wyoming	15,012	98,244	679	15,037	707	129,679

[1] Recreation jobs based on visitor spending at units managed by BLM, BOR, FWS and NPS

[2] Energy & Minerals jobs are based on activities related to onshore and offshore oil and gas, coal, non-metallic minerals, and geothermal and wind electricity generation

[3] BLM's Eastern States are not included in these totals due to lack of state-specific information

[4] Jobs based on value of timber and grazing forage managed by BLM

[5] Grants and Payments jobs include AML, PILT, Royalties and certain other grants (Sport Fish, Wildlife Restoration, State and Tribal Wildlife Grants, LWCF with GOMESA, Historic Preservation, CIAP, CESCF, Preserve America, Save America's Treasures, Refuge Revenue Sharing)

[6] DOI Salary jobs are those supported by DOI employees

[7] These totals represent jobs supported by recreation, energy, minerals, grazing, timber, salaries and grants and payments in each of the 50 States. The jobs reported in Table 1-1, were estimated using a national-level model that includes interstate "leakages" not captured in state by state-level models.

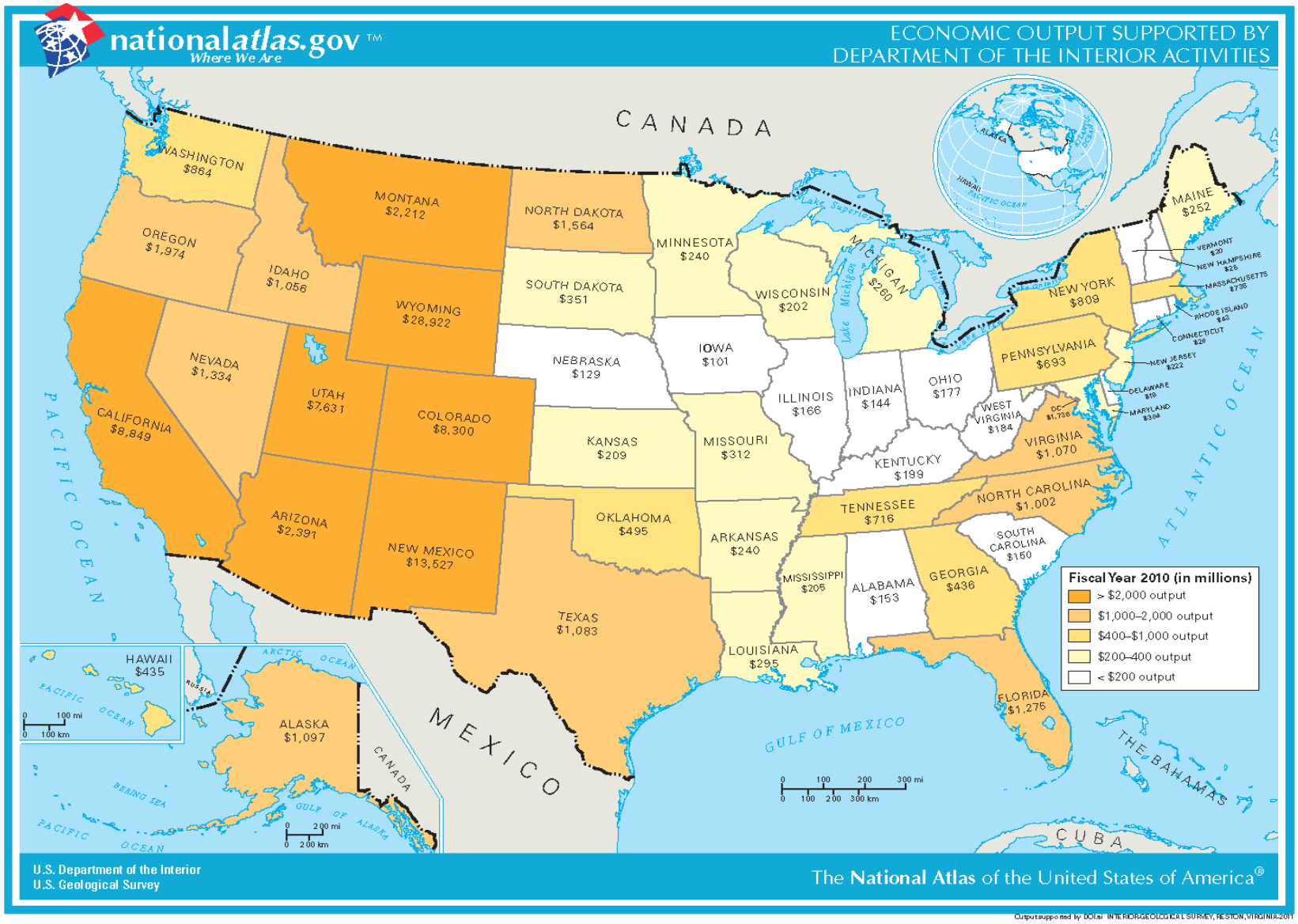


Figure A3-3. Map of U.S. Output Supported by Department of the Interior Activities

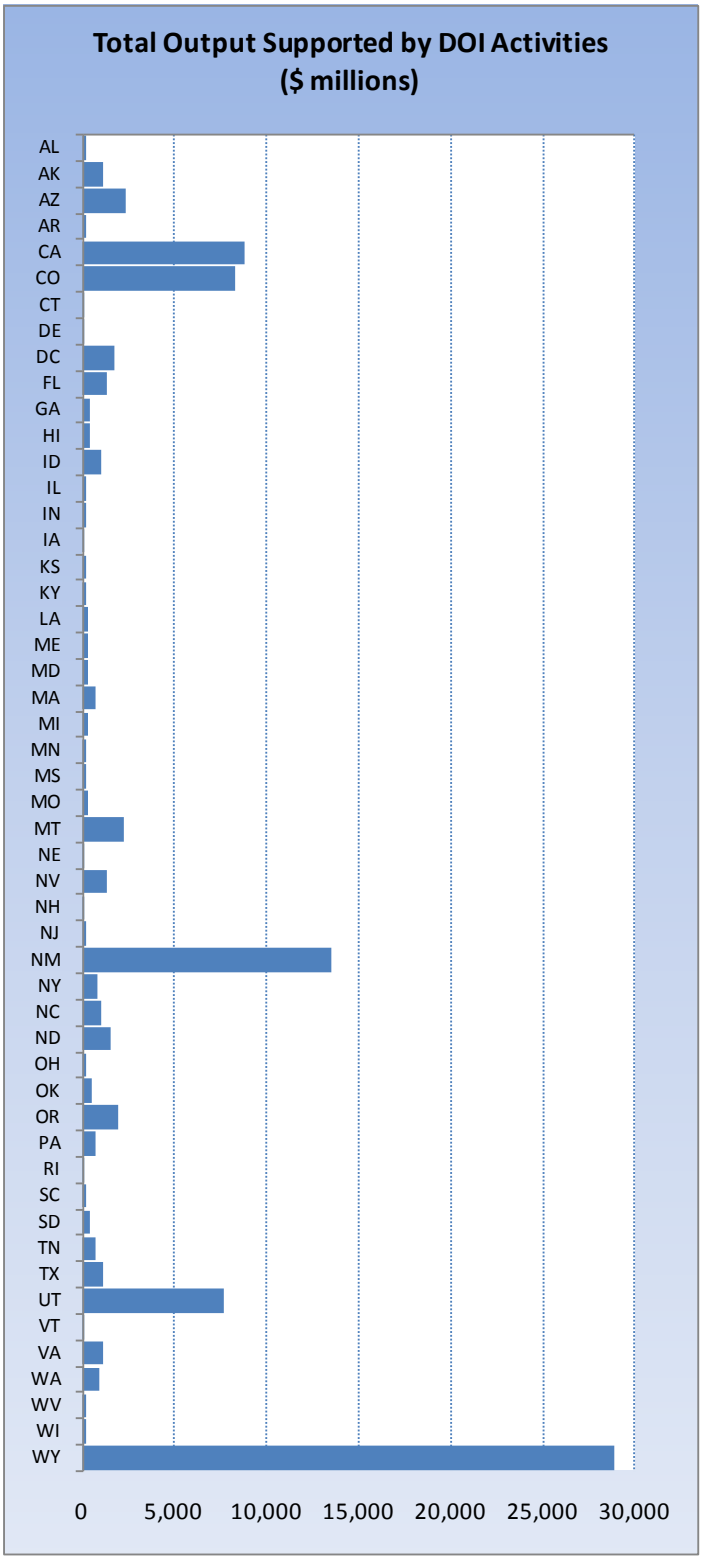


Figure A3-4. Output Supported by DOI Activities

Note: The above table presents output supported by recreation, energy, minerals, grazing, timber, salaries and grants and payments in each of the 50 States. The economic contributions reported in Table 1-1 were estimated using a national-level model that includes interstate "leakages" not captured in state by state-level models.

Table A3-2. State-by-State breakdown of total output supported by Interior activities, by sector

State	Recreation[1]	Energy & Minerals[2]	Grazing & Timber[3]	Major Grants & Payments[4]	DOI Salary[5]	Total[6]
			($ millions)			
Alabama	74.2			68.4	9.9	152.5
Alaska	576.1	206.0	3.0	173.6	138.3	1,097.0
Arizona	1,972.9	0.9	27.7	79.7	310.2	2,391.4
Arkansas	186.9			36.5	16.2	239.6
California	4,050.0	3,836.6	65.6	278.3	618.1	8,848.6
Colorado	1,279.3	6,146.0	100.1	256.7	517.8	8,299.9
Connecticut	2.2			14.4	3.6	20.2
Delaware	6.2			11.0	2.1	19.3
District of Columbia	1,426.3			6.5	303.3	1,736.1
Florida	1,106.1			59.3	109.3	1,274.7
Georgia	321.0			38.2	76.6	435.8
Hawaii	393.7			14.9	26.7	435.2
Idaho	552.7	236.7	97.8	57.1	111.9	1,056.2
Illinois	73.9			71.9	19.7	165.5
Indiana	79.0			48.5	16.5	144.0
Iowa	66.9			25.4	8.7	101.0
Kansas	84.6	74.5	0	28.4	21.9	209.4
Kentucky	92.8			85.7	20.2	198.7
Louisiana	65.7			162.5	66.9	295.1
Maine	222.2			15.6	14.2	252.0
Maryland	232.7			21.0	50.5	304.2
Massachusetts	636.3			18.7	81.4	736.4
Michigan	166.1			56.2	38.2	260.5
Minnesota	120.0			54.2	65.5	239.7
Mississippi	141.2			41.3	22.3	204.7
Missouri	207.8			49.8	54.3	311.9
Montana	771.5	1,109.0	79.3	135.0	116.8	2,211.7
Nebraska	43.4	34.9	0.0	21.7	28.7	128.7
Nevada	978.2	105.5	65.5	68.7	116.1	1,334.1
New Hampshire	4.5			14.5	6.3	25.3
New Jersey	180.9			18.4	23.0	222.2
New Mexico	346.1	12,267.0	126.7	542.8	244.5	13,527.1
New York	684.7			46.8	77.6	809.2
North Carolina	914.9			42.6	44.5	1,002.1
North Dakota	67.5	1,390.2	0.4	65.6	40.5	1,564.3
Ohio	98.8			56.0	21.8	176.6
Oklahoma	142.4	253.2	0	37.8	61.5	494.9
Oregon	1,062.0	0	631.6	52.8	227.9	1,974.3
Pennsylvania	471.4			134.9	86.6	692.8
Rhode Island	27.6			11.8	3.4	42.8
South Carolina	115.3			20.4	14.3	149.9
South Dakota	235.8	11.4	7.5	24.5	71.5	350.7
Tennessee	619.9			45.6	50.1	715.6

State	Recreation[1]	Energy & Minerals[2]	Grazing & Timber[3]	Major Grants & Payments[4]	DOI Salary[5]	Total[6]
			($ millions)			
Texas	451.9	375.1	0	163.4	93.0	1,083.3
Utah	1,672.5	5,504.9	51.5	272.5	129.9	7,631.2
Vermont	4.3			11.8	4.1	20.1
Virginia	729.4			46.4	294.2	1,070.0
Washington	600.6	0	18.7	73.3	171.3	863.8
West Virginia	54.7			92.0	37.5	184.2
Wisconsin	101.7			48.9	51.0	201.6
Wyoming	1,190.5	26,429.8	79.2	1,149.5	73.3	28,922.5

[1] Recreation output based on visitor spending at units managed by BLM, BOR, FWS and NPS

[2] Energy & Minerals output are based on activities related to onshore oil, gas, coal, non-fuel minerals, geothermal and wind electricity generation

[3] Grazing and timber output based on value of timber and grazing forage on lands managed by BLM

[4] Grants and Payments output include AML, PILT, Royalties and certain other grants (Sport Fish, Wildlife Restoration, State and Tribal Wildlife Grants, LWCF with GOMESA, Historic Preservation, CIAP, CESCF, Preserve America, Save America's Trasures, Refuge Revenue Sharing)

[5] DOI Salary output is that supported by DOI employees

[6] These totals represent output supported by recreation, energy, minerals, grazing, timber, salaries and grants and payments in each of the 50 States. The economic contributions reported in Table 1-1 were estimated using a national-level model that includes interstate "leakages" not captured in state by state-level models.

Table A3-3. State-level Employment and Output Impacts for Recreation Visits

	BLM			BOR			FWS			NPS			Total		
State	Visits	Jobs	Output ($ millions)	Visits	Jobs	Output ($ millions)	Visits	Jobs	Output ($ millions)	Visits	Jobs	Output ($millions)	Visits	Jobs	Output ($ millions)
AL	0	0	0	0	0	0	1,231,932	609	50	790,752	366	24	2,022,684	975	74
AK	612,570	441	46	0	0	0	1,437,338	2,296	228	2,278,474	3,045	302	4,328,382	5,782	576
AZ	5,581,948	4,656	489	7,153,910	6,960	702	519,843	506	51	10,713,122	9,242	731	23,968,823	21,364	1,973
AR	0	0	0	0	0	0	1,130,890	478	37	3,031,842	2,180	150	4,162,732	2,657	187
CA	10,233,635	7,634	983	12,363,434	7,968	1,042	4,557,022	2,937	384	35,023,586	16,120	1,640	62,177,677	34,658	4,050
CO	6,447,666	4,864	532	3,482,242	3,184	333	68,930	63	7	5,443,039	5,106	408	15,441,877	13,216	1,279
CT	0	0	0	0	0	0	25,000	5	1	19,386	13	2	44,386	19	2
DE	0	0	0	0	0	0	199,767	64	6	0	0	0	199,767	64	6
DC	0	0	0	0	0	0	0	0	0	35,695,833	12,414	1,426	35,695,833	12,414	1,426
FL	0	0	0	0	0	0	3,693,106	2,647	266	9,495,437	8,987	840	13,188,543	11,634	1,106
GA	0	0	0	0	0	0	305,971	122	12	6,475,874	3,233	309	6,781,845	3,356	321
GU	0	0	0	0	0	0	0	0	0	271,608	105	12	271,608	105	0
HI	0	0	0	0	0	0	554,178	649	72	4,312,818	3,126	322	4,866,996	3,775	394
ID	6,348,782	5,508	464	923,074	626	50	360,890	245	20	494,196	281	19	8,126,942	6,659	553
IL	0	0	0	0	0	0	1,275,688	435	45	464,074	379	28	1,739,762	813	74
IN	0	0	0	0	0	0	204,400	38	3	2,230,024	989	76	2,434,424	1,027	79
IA	0	0	0	0	0	0	1,908,462	696	53	241,063	208	14	2,149,525	904	67
KS	0	0	0	2,027,655	838	70	275,700	114	10	101,906	77	5	2,405,261	1,028	85
KY	0	0	0	0	0	0	40,000	15	1	1,630,944	1,338	92	1,670,944	1,353	93
LA	0	0	0	0	0	0	873,150	390	35	443,314	300	30	1,316,464	691	66
ME	0	0	0	0	0	0	375,500	184	16	2,227,698	2,796	206	2,603,198	2,980	222
MD	0	0	0	0	0	0	454,562	167	18	3,445,530	2,185	215	3,900,092	2,352	233
MA	0	0	0	0	0	0	1,306,728	466	55	9,772,738	5,689	582	11,079,466	6,155	636
MI	0	0	0	0	0	0	128,829	54	5	1,628,704	2,172	161	1,757,533	2,225	166
MN	0	0	0	0	0	0	1,678,608	920	85	650,156	475	35	2,328,764	1,396	120
MS	0	0	0	0	0	0	348,366	114	9	6,582,890	1,832	132	6,931,256	1,945	141

	BLM			BOR			FWS			NPS			Total		
State	Visits	Jobs	Output ($ millions)	Visits	Jobs	Output ($ millions)	Visits	Jobs	Output ($ millions)	Visits	Jobs	Output ($millions)	Visits	Jobs	Output ($ millions)
MO	0	0	0	0	0	0	415,731	147	13	3,933,043	2,338	195	4,348,774	2,485	208
MT	4,401,972	3,757	316	717,933	825	70	652,080	749	63	4,455,469	4,119	322	10,227,454	9,451	772
NE	0	0	0	835,223	330	26	212,890	84	7	273,444	182	11	1,321,557	596	43
NV	5,971,390	4,096	458	3,899,134	2,849	304	186,502	136	15	5,836,491	2,162	202	15,893,517	9,243	978
NH	0	0	0	0	0	0	66,185	30	3	34,558	20	2	100,743	50	5
NJ	0	0	0	0	0	0	597,100	284	33	5,828,477	1,477	148	6,425,577	1,761	181
NM	2,371,886	1,953	176	1,459,061	1,106	90	248,080	188	15	1,659,574	942	65	5,738,601	4,189	346
NY	0	0	0	0	0	0	674,968	314	37	17,327,234	5,193	648	18,002,202	5,507	685
NC	0	0	0	0	0	0	1,984,764	1,206	109	18,198,530	10,809	806	20,183,294	12,015	915
ND	20,758	18	1	202,818	146	11	403,453	289	22	631,459	507	32	1,258,488	960	68
OH	0	0	0	0	0	0	183,138	80	7	2,882,593	1,097	92	3,065,731	1,177	99
OK	0	0	0	1,740,753	686	58	2,150,448	847	72	1,249,011	198	13	5,140,212	1,731	142
OR	7,563,709	6,811	662	1,626,975	844	80	5,289,992	2,742	260	891,783	826	59	15,372,459	11,223	1,062
PA	0	0	0	0	0	0	155,669	46	5	8,885,894	4,825	467	9,041,563	4,870	471
PR	0	0	0	0	0	0	0	0	0	1,069,673	725	55	1,069,673	725	0
RI	0	0	0	0	0	0	426,423	224	23	50,397	49	5	476,820	274	28
SC	0	0	0	0	0	0	1,180,044	740	63	1,504,680	684	52	2,684,724	1,425	115
SD	51,805	42	4	362,768	383	30	389,200	411	32	4,134,663	2,300	170	4,938,436	3,137	236
TN	0	0	0	0	0	0	1,010,978	309	30	7,777,790	7,593	590	8,788,768	7,902	620
TX	0	0	0	1,074,925	694	70	1,125,576	727	73	6,938,238	4,037	309	9,138,739	5,457	452
UT	6,089,818	5,486	512	6,105,894	6,146	557	68,148	69	6	8,755,401	8,619	597	21,019,261	20,319	1,673
VT	0	0	0	0	0	0	80,000	28	2	31,129	21	2	111,129	49	4
VA	0	0	0	0	0	0	1,632,556	844	81	22,953,894	7,628	649	24,586,450	8,472	729
VI	0	0	0	0	0	0	0	0	0	577,931	971	66	577,931	971	0
WA	398,308	307	35	2,615,505	1,567	173	896,511	537	59	7,559,552	3,939	333	11,469,876	6,349	601
WV	0	0	0	0	0	0	72,013	27	2	1,803,552	775	53	1,875,565	802	55
WI	0	0	0	0	0	0	1,435,880	881	72	452,365	431	29	1,888,245	1,311	102
WY	2,451,949	1,823	158	3,498,866	4,163	345	356,335	424	35	6,117,188	8,601	652	12,424,338	15,012	1,191

	BLM			BOR			FWS			NPS			Total		
State	Visits	Jobs	Output ($ millions)	Visits	Jobs	Output ($ millions)	Visits	Jobs	Output ($ millions)	Visits	Jobs	Output ($millions)	Visits	Jobs	Output ($ millions)
Eastern States	97,516	93	11										97,516	93	11
Total for 50 States	58,643,712	47,489	4,847	50,090,170	39,314	4,012	44,849,524	26,576	2,610	285,279,021	163,726	14,382	438,862,427	277,105	25,719
Total Using National Multipliers	58,643,712	58,947	7,426	50,090,170	49,660	6,074	44,849,524	32,564	3,983	285,279,021	246,956	30,391	438,862,427	388,127	47,874

Notes for State-by-State Analysis

- The State summaries do not contain jobs associated with agricultural activities that receive Reclamation supplied irrigation water, as this information was not readily available at the State-level.
- Economic impacts associated with mineral activities in BLM's Eastern States Office are not included in the State-by-State analysis, as disaggregated data was not readily available.
- This analysis included only a subset of the total Grants and Payments, namely PILT; Mineral Leasing Revenue Payments to States; 8(g) Offshore Mineral Payments to States; LWCF State grants; Save America's Treasure's grants; AML; Sport Fish Restoration; Federal Aid in Wildlife Restoration; Refuge Revenue Sharing; Historic Preservation Grants, and State Wildlife Grants. In FY 2010 these grants represented about 80 percent of the total grants and payments.
- Calculations for offshore oil and gas employment include estimates for retained profits being spent in the state, which were not included in onshore employment estimates. Roughly 45% of total jobs related to offshore oil and gas activity were credited to Texas and 38% were credited to Louisiana (when combined with government revenue impacts and the spending of profits these shares decrease slightly, to 38 and 19%, respectively).

Appendix 4. URBAN-RURAL IMPACT ANALYSIS

Public lands, through recreation visits and natural resource management activities, support a stable work-force that is important to the economic health of the communities and regions where these activities take place. While it is difficult to quantify the many ways Interior contributes to local communities, evaluating the differences between rural and urban areas in terms of magnitude of employment impacts can illustrate the role Interior plays in many areas of the U.S. Information is presented below on jobs in rural areas supported by visitation to Interior recreation sites. A number of case studies are also presented that illustrate the role that the National Parks, National Wildlife Refuges, and BLM recreation sites play in both urban and rural communities throughout the country. These examples were selected because they represent a mix of urban and rural as well as a geographic distribution of locations.

Based on the Census classification of metropolitan (metro) and non-metropolitan (non-metro) areas in 2000, there are 2,052 non-metro counties, which contain 75 percent of the Nation's land, and are home to 17 percent (49 million) of the U.S. population. Here, we have used counties designated as metro as urban areas and non-metro countries as rural areas. In this classification scheme, rural areas comprise open country and settlements with fewer than 2,500 residents.

The employment and output impacts associated with visitors to DOI recreation sites vary considerably depending on whether the recreation site is located in an urban or rural area, a small number of Interior-supported jobs can have a major impact in isolated rural locations. Preliminary analysis indicates the following:

- Visitation to Interior sites supports thousands of jobs in rural areas of Utah (14,973 jobs), Wyoming (14,445 jobs), Tennessee (5,059 jobs), and Colorado (9,173 jobs).
- Visitation to Interior sites also supports a significant number of rural jobs in States where most counties are rural, including Montana (7,330 jobs); Nevada (4,478); Washington (3,507); and Idaho (4,562).
- Interior's sites support rural jobs in States where the majority of the population is rural[19]: Vermont (49); Maine (2,859); West Virginia (279); and Mississippi (1,197).
- Interior's sites support rural jobs in States with large rural populations[20]: Texas; (2,080); North Carolina (7,638); Pennsylvania (477); Michigan (2,201); New York (1,212); and Georgia (141).
- The majority of Abandoned Mine Land funding is targeted toward rural areas; in FY 2010, two-thirds of the funding went to four States: Wyoming, West Virginia, Pennsylvania, and Kentucky totaling $248.7 million and supporting an estimated 4,324 jobs.

[19] In the 2000 Census.
[20] Over two million rural residents in the 2000 Census.

Figure A4-1 shows the jobs supported by FY 2010 recreation and tourism in areas classified as rural, with the most recreation-related employment occurring in the rural areas of Wyoming, Utah, Tennessee and Colorado.

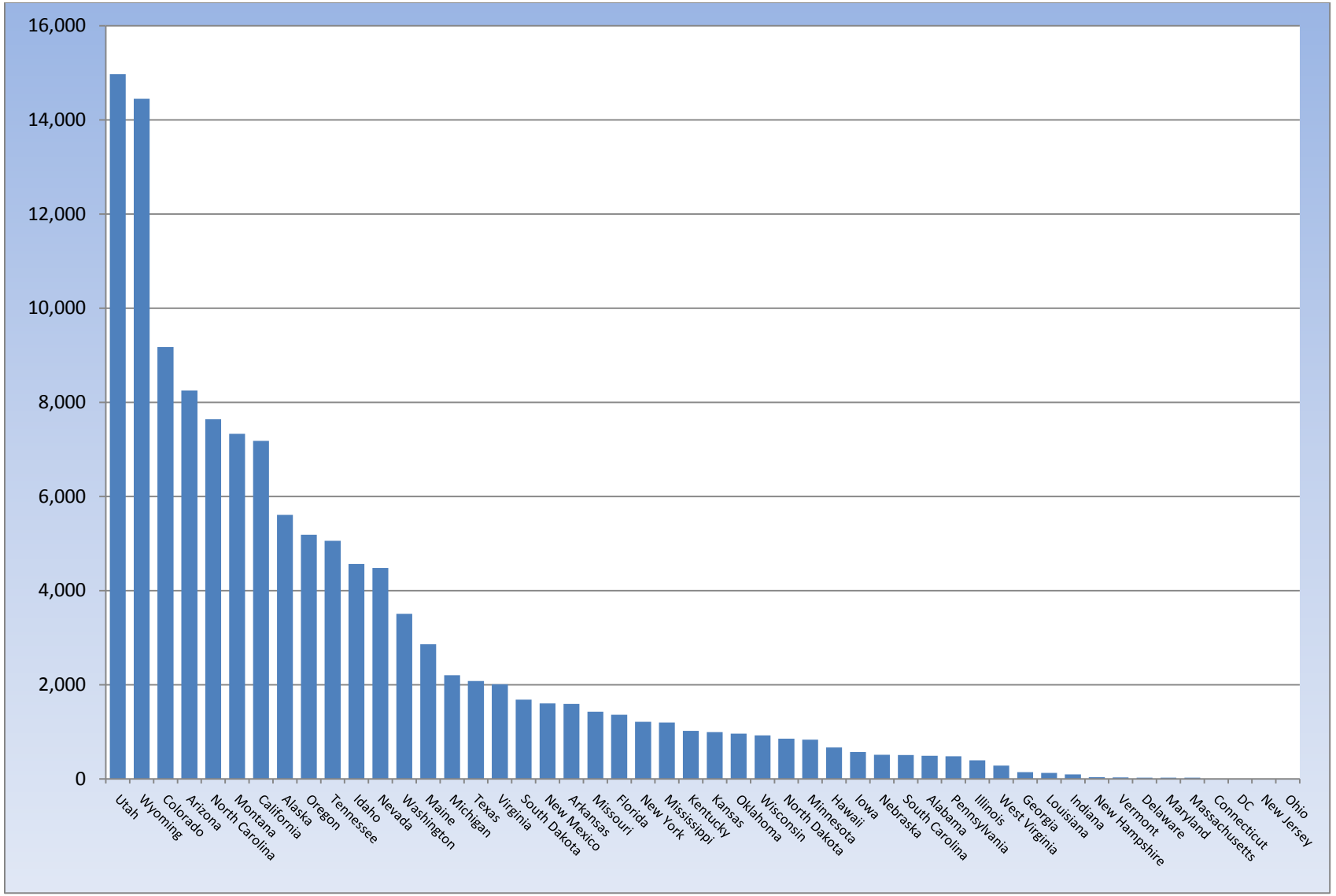


Figure A4-1. Jobs in Rural Areas, Supported by Visitors to DOI Recreation Sites (2010 data)

EXAMPLES OF LOCALIZED IMPACTS

Interior activities have a significant economic impact on local communities. In some particularly economically distressed rural areas where jobs are scarce, Interior-managed lands provide a steady source of jobs and income. Even in more prosperous metropolitan areas, Interior-managed lands bring in tourist money and create local jobs. The examples below summarize economic impacts associated with visitor spending in local areas for a total of five NPS and FWS units. These case studies demonstrate the differing levels of economic support that Interior activities provide to various communities. The following examples examine several factors, including local area population and labor force, and annual visits to Interior lands. Generally, NPS and FWS units provide the most economic support in areas with high levels of visitation and an overall small labor force.

Examples of Localized Impacts in Rural Locations

Crater Lake National Park (OR)

Crater Lake National Park is located in Klamath County, Oregon. This rural county has population of around 66,000 (Census, 2010), a labor force of 31,422 and an unemployment rate of 11.6 percent. In 2009, Crater Lake National Park attracted 446,516 visits. Visitors from out-of-town spent an estimated $31.9 million and supported 512 local jobs. The park directly employed 97 people, which contributed $7.2 million to the local economy and supported 21 additional local jobs. Through Crater Lake, the Department of the Interior is providing a much-needed stream of income to a rural area facing severe economic hardship.

Crater Lake Totals (2009)

Visits (2009)	**Area Unemployment Rate** (%, October 2010, BLS)	**Est. Non-local Visitor Spending** ($ millions)	**Est. Total Jobs Supported** (jobs)
446, 516	11.6	$31,880,000	630

Great Sand Dunes National Park and Preserve (CO)

Great Sand Dunes National Park and Preserve is located in south central Colorado within or adjacent to the rural counties of Alamosa, Custer, Huerfano, and Saguache. The combined population of the four counties is about 34,000 (Census, 2010), with a combined labor force of 17,540 and an average unemployment of 8 percent. The National Park and Preserve attracted nearly 290,000 visitors in 2009. Visitors from out-of-town spent an estimated $9.5 million, which supported 137 local jobs. The Monument also directly employed 32 people, which contributed $2.5 million to the local economy and supported an additional 6 local jobs. Great Sand Dunes is illustrative of Interior's impact on a small rural community. Though the area population is only 34,000, Interior lands provided an important source of jobs and revenue.

Great Sand Dunes Totals

Visits (2009)	**Area Unemployment Rate** (%, October 2010, BLS)	**Est. Non-local Visitor Spending** ($ millions)	**Est. Total Jobs Supported** (jobs)
289,995	8	9.5	175

Sheldon National Wildlife Refuge (Nevada, California, Oregon)

The Sheldon National Wildlife Refuge protects more than half a million acres of high desert habitat in the region where Nevada meets California to the west and Oregon to the north. The landscape is vast, rugged and punctuated with narrow gorges, springs and expansive tablelands of sagebrush and mountain mahogany. Visitors to the Refuge primarily participate in wildlife/wildlands observation and appreciation, hunting, fishing, hiking, camping, and rock hounding. The Refuge offers hunting for big game and upland birds as well as warm and cold-water fishing.

- The Refuge received about 17,000 visitors in 2008.
- An economic analysis indicated that that refuge wildlife watching visitors spent $3 million in 2008 accounting for $2.8 million in area output and 55 jobs. In addition, they garnered $895,000 in net economic value from the experience. Hunting and Fishing contribute $428,000 and $104,000, respectively, to regional output.
- The refuge supports local jobs and generates millions for a small rural area facing high unemployment.
- An estimated 1,440 feral horses and burros wandered freely year-round across the Refuge in 2007. The economic implications of having feral horses and burros on the Refuge are both positive and negative. On the benefits side, some members of the public may be willing to pay to view these animals or enjoy knowing that a population of these animals exists, even without any plans to view them. However, on the cost side, feral horses consume large volumes of forage that would otherwise be available to support native wildlife species; the Refuge currently devotes the majority of its budget to managing feral animals; and automobile collisions occur when they wander into roadways. The economic analysis helps to put these competing goals in perspective.

Sheldon NWR Totals (2008)

Visits (2008)	**Area Unemployment Rate** (%, October 2010, BLS)	**Visitor Spending** ($ millions)	**Estimated Total Jobs Supported** (jobs)
17,000	Washoe County – 12.8 Humboldt County - 9.2	3.0	55

Arches National Park and BLM Moab Field Office (UT)

DOI lands provide significant recreational opportunities and related economic benefits in and around Grand County, Utah. In 2009, Grand County had a population of around 9,660. The county had a labor force of 5,429 and an unemployment rate of 8 percent in October 2010. The BLM Moab Field Office manages 1.8 million acres. In 2010, BLM lands around Moab attracted 1,258,456 visits. Visitors from out-of-town spent an estimated $169.3 million and supported 2,447 local jobs. Arches National Park is located 5 miles north of Moab, Utah and encompasses 76,546 acres. Arches NP attracted 996,312 visitors in 2009, resulting in $99.9 million in spending and supporting 1,544 jobs. DOI directly employed an additional 223 people in Moab during 2010(72 in the BLM Field Office, 172 at Arches NP in 2010, and 24 USGS employees), which contributed an additional $5.5 million to the local economy and supported 53 additional local jobs.

Moab Area DOI Lands Totals (2009/2010*)

	Visits (2009/2010*)	**Area Unemployment Rate** (%, October 2010, BLS)	**Est. Non-local Visitor Spending** ($ millions)	**Est. Total Jobs Supported** (jobs)
BLM Moab Field Office	1,258,456	8.0	169.3	2,447
Arches National Park	996,312	8.0	99.9	1,544
DOI Total	2,254,768	8.0	269.2	3,991

* BLM visitation data is for 2010, NPS visitation data is for 2009.

Examples of Localized Impacts in Urban Locations

Golden Gate National Recreation Area (CA)

Golden Gate National Recreation Area is located in the San Francisco metropolitan area with land in Marin, San Francisco, and San Mateo Counties. The three urban counties have a combined population of around 1.8 million (Census, 2010), with an average unemployment rate across the three counties of 8.9 percent. In 2009, the National Recreation Area attracted over 15 million visitors. Visitors from out-of-town spent an estimated $113.3 million, which supported 1,479 local jobs. The Park directly employed 273 people, which supported 73 additional local jobs and contributed $29.4 million in additional local spending. Even in a large, metropolitan area like San Francisco, Interior's activities can have a significant impact on the economy and bring in important tourism dollars.

Golden Gate Totals (2009)

Visits (2009)	**Area Unemployment Rate** (%, October 2010, BLS)	**Non-local Visitor Spending** ($ millions)	**Estimated Total Jobs Supported** (jobs)
15,036,372	8.9	113.3	1,825

John Heinz at Tinicum National Wildlife Refuge (Pennsylvania)

The John Heinz at Tinicum NWR is located about 1 mile from Philadelphia International Airport in Pennsylvania. When acquisition is complete, it will consist of 1,200 acres of water, marsh, and upland habitats. More than 2 million people live in adjacent Delaware and Philadelphia counties where the October 2010 unemployment rate was 10.6 percent. In 2010, 136,000 visitors enjoyed watching wildlife at the refuge. Visitor spending of $2.2 million is estimated to have contributed $4.0 million to local output and 40 jobs. A national wildlife refuge like John Heinz at Tinicum NWR can provide a significant source of revenue for a metropolitan area, attracting many visitors and supporting local jobs.

John Heinz at Tinicum National Wildlife Refuge (2010)

Visits (2010)	**Area Unemployment Rate** (%, October 2010, BLS)	**Visitor Spending** (millions)	**Estimated Total Jobs Supported** (jobs)
136,000	10.6	2.2	40

BLM Examples of project Impacts

Mineral Bottom road rebuild. A flash flood in late summer 2010 destroyed a road essential to many private and commercial recreation activities in BLM's Moab Field Office in Utah. An economic analysis provided by the Moab Field Office demonstrated that the loss of the road would cost Grand County businesses nearly $5.0 million in lost revenues per year and 87 jobs. Grand County used this information to obtain $1.95 million in federal funding for repairs. The repair project itself was contracted to a local company, and will generate $2.57 million in direct and indirect economic benefits, including 29 jobs, for Grand County.

Ivanpah solar generating plant. The Ivanpah solar facility, located on BLM-managed lands in the Mojave Desert in San Bernardino County, California is a solar concentrating thermal power plant with 370 MW generating capacity. The project, which broke ground in fall 2010, will involve construction of three solar concentrating thermal power plants (power towers) surrounded by fields of heliostats (mirrors guided by a tracking system) to concentrate solar energy on the towers. Construction will involve an average employment of over 450 workers and peak employment of over 900 workers daily, with a total construction payroll of $197 million. Indirect employment effects are estimated at over 500 jobs during construction. Operation of the Ivanpah solar facility will generate approximately 100 jobs in total employment impacts.

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Appendix 5. Economic Contributions Associated with Land Acquisitions, Infrastructure, and Selective Ecosystem Restoration

Land Acquisition

Bureau	FY2010 Enacted ($ thousands)	Output ($ thousands)	Employment (Jobs)
National Park Service	86,266	177,708	1,199
U.S. Fish and Wildlife Service	86,340	177,860	1,200
Bureau of Land Management	29,650	61,079	412
Interior, Appraisal Services	12,136	25,000	169
Total	**214,392**	**441,648**	**2,980**

Multipliers: output – 2.06 per million; employment – 13.9 jobs per million.

Infrastructure

Bureau	Construction FY2010 Enacted ($ thousands)	Maintenance FY2010 Enacted FY10 Enacted ($ thousands)	Output ($ thousands)	Employment (Jobs)
National Park Service	239,769	721,713	2,552,237	19,758
U.S. Fish and Wildlife Service	37,432	161,742	522,289	4,081
Bureau of Land Management	8,626	86,111	243,614	1,932
Bureau of Reclamation				
Rural water projects	121,300		369,723	2,584
Replacement, additions and extraordinary maintenance	48,516		147,877	1,033
Dam safety	95,872		292,218	2,042
Facility maintenance	112,151		341,836	2,389
Indian Affairs	225,000	84,219	898,348	6,502
Wildland Fire Mgt		6,137	15,488	125
USGS - surveys, investigations, research		31,097	78,481	631
Central Utah Project				
Total	**888,666**	**1,091,019**	**5,462,112**	**41,076**

Construction multipliers: output – 3.01; employment 21.3.

Maintenance multipliers: output – 2.52; employment 20.3.

Selective Ecosystem Restoration Activities

Restoration Activity	FY2010 Enacted ($ thousands)	Output ($ thousands)	Employment (Jobs)
Chesapeake Bay Initiative	21,573	58,937	447
Great Lakes Restoration	66,404	181,416	1,375
Everglades Restoration	68,415	186,910	1,416
Total	**156,392**	**427,263**	**3,237**

Appendix 6. METHODS

ECONOMIC BENEFITS VS. ECONOMIC ACTIVITY

Economic benefits are a measure of the extent to which society is better (or worse) off because of a given policy or action, and includes both market and non-market benefits. Economic activity analysis measures expenditures from a policy, program or event and how those dollars cycle through the economy. This can include economic contribution analysis, which tracks the gross economic activity attributed to a policy or event in a regional economy, and economic impact analysis, which measures net changes in new economic activity in a regional economy resulting from a policy or event. Input-output techniques are commonly used for both types of economic activity analysis. The glossary of terms from Watson et al. (2007) is reprinted below.[21]

Term	Definition
Economic Activity	Dollars spent within region that are attributable to a given industry, event, or policy.
Economic Activity Analysis	An analysis that tracks the flow of dollars spent within a region (market values). Both economic impact and economic contribution analysis are types of economic activity analysis.
Economic Contribution	The gross change in economic activity associated with an industry, event, or policy in an existing regional economy.
Economic Impact	The net changes in new economic activity associated with an industry, event, or policy in an existing regional economy.
Economic Benefit	A net increase in total social welfare. Economic benefits include both market and nonmarket values.
Cost-Benefit Analysis	An economic efficiency analysis that measures net changes or levels in social welfare associated with an industry, event, or policy. This type of analysis includes both market and non-market values and accounts for opportunity costs.
Input-Output Model	A specific methodological framework that characterizes the financial linkages in a regional economy between industries, households, and institutions. Input-Output only measures economic activity and does not include any nonmarket values.

This report utilizes economic contribution analysis to track the economic contribution of Interior activities as those expenditures cycle through the economy. The following sections describe input-output models in more detail.

[21] For additional information on economic contribution and economic impact analysis see: Watson, P., J. Wilson, D. Thilmany, and S. Winter. 2007. Determining Economic Contributions and Impacts: What is the difference and why do we care? *The Journal of Regional Analysis and Policy*, 37(2): 140-146.

INPUT/OUTPUT MODELS

In general, input-output (I/O) models provide a snapshot of economic activity at a given point in time for a given region. Impact estimates produced by I-O models reflect the pattern and level of economic activity within a State or the Nation and indicate the significance of current regional economy. Estimated model results are analogous to a company's reports on gross sales revenue, rather than profits, the distinction being that profits typically define the value of an activity to businesses. It should also be noted that the estimated output impacts do not account for the value of changes in the quantity or quality of the environment amenities, as these amenities are not typically bought and sold in markets. Nor do these models account for external costs.

This analysis employs a widely used input-output (I/O) software and data system known as IMPLAN for estimating the output (sales), employment (jobs) and income effects arising from the interdependencies and interactions of economic sectors and consumers. IMPLAN draws upon data collected by the Minnesota IMPLAN Group from multiple Federal and State sources including the Bureau of Economic Analysis, Bureau of Labor Statistics, and the U.S. Census Bureau. IMPLAN contains 2009 data for up to 440 economic sectors and 9 income brackets.

Because of the way industries interact in an economy, activity in one industry affects activity levels in several other industries. For example, if more visitors come to an area, local businesses will purchase extra labor and supplies to meet the increase in demand for additional services. The income and employment resulting from visitor purchases from local businesses represent the *direct* effects of visitor spending within the economy. Direct effects measure the net amount of spending that stays in the local economy after the first round of spending; the amount that doesn't stay in the local economy is termed a leakage (Carver and Caudill, 2007). In order to increase supplies to local businesses, input suppliers must also increase their purchases of inputs from other industries. The income and employment resulting from these secondary purchases by input suppliers are the *indirect* effects of visitor spending within the economy. Employees of the directly affected businesses and indirectly affected input suppliers use their incomes to purchase goods and services. The resulting increased economic activity from new employee income is the *induced* effect of visitor spending. The indirect and induced effects are known as the secondary effects of visitor spending.

"Multipliers" (or "Response Coefficients") capture the size of the secondary effects, usually as a ratio of total effects to direct effects (Stynes and White, 1998). The sums of the direct and secondary effects describe the total economic impact of visitor spending in the local economy.

The economic effects and multipliers from the IMPLAN model are reported for the following categories:

Total Industry Output equals the value of all sales to intermediate (business to business) and final (consumers, exports) demand.

Employment (jobs) is defined as average annual employment.[22] It includes full and part time, temporary, and seasonal jobs as well as multiple jobs held by a single person. Jobs do NOT equal Full Time Equivalents. The employment data come from a series of surveys taken multiple times each year. The workers are counted regardless of status, thus jobs are permanent, part time, temporary and seasonal. The data from the surveys are summed and averaged to obtain an "average annual employment."

MULTIPLIERS

In general, I/O models rely on "multipliers" that mathematically represent the relationship between a change in one sector of the economy (e.g., expenditures by recreationists) and the effect of that change on economic output, income, or employment in other sectors of the economy (e.g., suppliers of goods and services to recreationists). Multipliers developed from I/O models vary by economic sector and the geographic area of analysis (i.e., they are not same if one is looking at the local, State, regional, or national level).

Unless otherwise noted, each of the following economic impact summaries relies on State-level multipliers to develop output and employment impacts within each State's borders. A multiplier for one State does not account for "spillover" effects accruing in other States. Thus, the sum of effects across 50 States will be less than the overall nationwide impacts. In contrast, when a national-level multiplier is used, spillover effects among States are taken into account, providing better estimate of nationwide impacts.

The IMPLAN modeling system was used to derive the multipliers that capture the secondary (indirect and induced) effects needed to determine the economic impacts of Interior activities.

Limitations

When using multipliers (or response coefficients), please keep in mind the following;

- IMPLAN is used to examine "marginal" changes: Estimated jobs and income coefficients are valid only for relatively small changes to a particular area's economy. Any stimulus large enough to change the underlying structure and trade relationships of the economy will necessarily change the relationships quantified in the coefficients and new models would need to be specified and run.
- Response coefficients (multipliers) are not generic: These coefficients reflect a unique underlying economic structure. They are not, therefore, generally applicable to issues and geographies different from those under which they were originally estimated.
- In reality, job and income effects would be "lumpy": Response coefficients which are generated for large geographic areas will normally contain well developed and complex economies. At a smaller scale, investments in rural, simple economies would necessarily have smaller response coefficients and thus a smaller job and income response.

[22] A job in IMPLAN is the annual average of monthly reports for that industry. This is the same definition used by CEA, BLS, and BEA nationally. One 12-month job is equivalent to two 6-month jobs.

Formulas for Calculating Impacts

Economic impacts are generally calculated using the following formulas:

(*Total expenditures on activity*) x (*expenditure multiplier*) = *Total Economic Output Impacts*

(*Total expenditures on activity*) x (*employment multiplier*) = *Total Employment Impacts*

Economic Impacts of Recreation – An Example Calculation

Recreation is an activity in which Interior plays a significant role. Spending associated with recreation activities on Interior-managed lands can generate a substantial amount of economic activity in local and regional economies. Recreationists spend money on a wide variety of goods and services and trip-related expenditures may include expenses for such items as food, lodging, equipment and transportation. Businesses and industries that supply the local retailers where the purchases are made also benefit from expenditures by recreationists. For example, a family may decide to purchase a set of fishing rods for an upcoming vacation. Part of the total purchase price will go to the local retailer, say a sporting goods store. The sporting goods store in turn pays a wholesaler who in turn pays the manufacturer of the rods. The manufacturer then spends a portion of this income to cover manufacturing expenses. In this way, each dollar of local retail expenditures can affect a variety of businesses at the local, regional and national level.

The income and employment resulting from visitor purchases from local businesses represent the *direct effects* of visitor spending within the economy. In order to increase supplies to local businesses, input suppliers must also increase their purchases of inputs from other industries. The income and employment resulting from these secondary purchases by input suppliers are the *indirect effects* of visitor spending within the local economy. The input supplier's new employees use their incomes to purchase goods and services. The resulting increased economic activity from new employee income is the *induced effect* of visitor spending. The indirect and induced effects are known as the secondary or multiplier effects of visitor spending. Multipliers capture the size of the secondary effects, usually as a ratio of total effects to direct effects. The sums of the direct and secondary effects describe the total economic impact of visitor spending in the local economy.

The examples below provide a general description of the underlying methodology used to calculate the economic impact estimates of recreation expenditures to Interior managed lands. Estimated values specific to visits to Bureau of Reclamation sites in Colorado present a numerical example.

Bureau of Reclamation Example:

1. <u>Estimate Total Recreation Expenditures</u>

(Number of visits to Interior recreation sites in State Y) × (Average spending per visit) = Total recreation expenditures associated with Interior recreation sites in State Y

Number of visits = 3,482,242
Average spending per visit = $53.38

(3,482,242 visits) × ($53.38 average spending per visit) = $185,882,078 in Total Expenditures

2. Estimate of Total Economic Impact
   (Total recreation expenditures associated with Interior recreation sites in State Y) × (Output multiplier for recreation expenditures) = Total Economic Impact for Interior recreation sites in State Y

   Output multiplier derived from IMPLAN = 2.28

   ($185,882,078) × (2.28) = $423,811,138 in Total Economic Impact

3. Estimate of Employment Effects
   (Total recreation expenditures associated with Interior recreation sites in State Y) × (Employment multiplier per $1,000,000 in recreation expenditures) = Total Employment effects

   Employment multiplier per $1M in recreation expenditures derived from IMPLAN = 14.48

   ($185,882,078 / 1,000,000) × (14.58) = 2,710 Total Jobs Supported

National Park Service Example - Great Sand Dunes NM

Recreation visits in 2008 = 273,903

Total recreation spending = $9,761,231 (average per visitor spending of $35.64)

Output multiplier derived from IMPLAN = 1.34

Estimate of percent of spending "captured" in local area based on survey data = 78%

$9,761,231 total recreation spending x 78% capture rate x 1.34 = $10,266,912 in Total Economic Impact

IMPLAN VERSION 2.0 VS. VERSION 3.0

A new version of IMPLAN (Version 3.0) was released in November 2009 to replace the previous version (Version 2.0) that was released over ten years prior. The new version incorporates a number of changes, with one of the most notable being an improvement in the method used for calculating Regional Purchase Coefficients (RPCs). IMPLAN Version 2.0 has been criticized for its use of non-survey based RPCs, which have been shown to produce higher estimates than survey-based data for the particular site under consideration. IMPLAN Version 3.0 attempts to deal with these criticisms through an improved method for estimating RPCs. The new method uses a gravity model that considers the size and proximity of alternative markets to give an improved estimation of imports and exports than the econometric-based estimates in Version 2.0. Koontz, Loomis, and Winter (2011) show that the differences in the Version 3.0 software can result in lower estimates of employment and income effects for tourism impacts.

The previous version of the DOI Economic Impact Report, released in December 2009, used IMPLAN Version 2.0 to calculate economic impacts of Interior bureaus and grant programs. Since this report uses IMPLAN Version 3.0, there may be some differences in economic impact estimates reported in the two reports because of the different methods used to calculate RPCs in the two versions of IMPLAN.

Appendix 7. DATA SOURCES AND NOTES

General

- Estimated DOI Inputs as a Percent of National Sector – DOI impacts as a percentage of the entire industry at the national level.
- Table 1-1 and Table 2-1 capture no output or employment impacts beyond payroll spending and natural resource production. Bureaus are engaged in various other activities funded by appropriations, e.g., land acquisition, BLM's mine land reclamation, construction, road building, education, etc.

OSM

- The majority of the Office of Surface Mining's activities related to reclamation of abandoned mine lands are encompassed by funding from the AML fund. The impact of these funds is captured in the entry for Grants and Programs reported earlier in the table.

Indian Affairs and BIA

- Sales volumes and values for BIA's oil, gas and coal activities are based on data from ONNR. Lacking multipliers specific to oil, gas and coal activities on Reservations, we used a multiplier based on BLM's onshore oil, gas and coal activities at the national level.
- A single entry is provided for BIA timber and grazing activities; to date, no grazing data were provided.
- BIA's economic contributions from oil, gas, and coal are assumed to be proportional to BLM's.
- "Other minerals" were assumed to be construction aggregate (sand and gravel; crushed stone). The value of output was estimated by assuming the 2010 royalty collections of $31 million were derived from a 5% royalty. This implies a commodity value of about $634 million. This estimated value represents about 3.7% of the total value of about $17 billion of construction aggregates produced in the US in 2009.
- The values reported for Irrigation represent the value of the crops produced using irrigation water supplied by BIA. This value overstates the actual production attributable to BIA, as some level of production would occur without the irrigation water delivered by BIA, and water is only one of many inputs into agricultural production.
- Economic contributions associated with contractual support provided to tribal governments was evaluated by applying State and local government multipliers.

BLM

- The method used by BLM to estimate the contributions from oil and gas activities is based on adjusting the sum of the value of the gross output plus drilling costs to remove interindustry sales to derive a final demand figure. A multiplier is then applied to final demand to derive the contribution estimates. The rationale for adding drilling costs to the gross output value (prior to making an adjustment to derive final demand) is that drilling costs are not accounted for in the IMPLAN production function for oil and gas extraction.

- Figures reported for hardrock minerals were developed by the Office of Policy Analysis, assuming a total value of U.S. hardrock mineral production at $57.1 billion (USGS Mineral Commodity Summary 2010) and 11.25 total jobs (direct, indirect and induced) per $1 million and an output multiplier of 2.55 from IMPLAN Sector 27 "Mining and quarrying other nonmetallic minerals". We assumed that 15.3 percent of this production value (and hence 15.3percent of the total jobs) is related to mining on Federal lands (15.3% is from DOI (1993) Economic Implications of a Royalty system for Hardrock Minerals" Table 3.2 p. 35).
- The prices used for determining the value of coal leased by BLM were as follows: Alabama – $61.72 per short-ton; Colorado -- $41.77 per short ton; Kentucky – $97.32 per short-ton; Montana -- $14.31 per short-ton; New Mexico – $45.27 per short-ton; North Dakota -- $12.51 per short-ton; Ohio -- $35 per short-ton; Utah -- $36.06 per short-ton; and Wyoming -- $12.26 per short-ton. These represent average values based on reported quantities and sales values for coal produced from Federal leases in these States.
- The prices used to determine the value of the oil produced from on shore Federal leases were: Alabama – $73.94/barrel; Alaska – $ 87.12/barrel; Arkansas – $73.64/barrel; California – $64.52/barrel; Colorado – $68.66/barrel; Illinois – $ 71.45/barrel; Indiana – $ 71.80/barrel; Kansas – $68.80/barrel; Kentucky – $68.89/barrel; Louisiana – $73.46/barrel; Michigan – $72.88/barrel; Mississippi – $ 72.62/barrel; Montana – $ 67.21/barrel; Nebraska – $65.53/barrel; Nevada – $60.87/barrel; New Mexico – $72.67/barrel; North Dakota – $66.10/barrel; Ohio – $69.79/barrel; Oklahoma – $72.67/barrel; Pennsylvania – $69.67/barrel; South Dakota – $71.21/barrel; Texas – $73.52/barrel; Utah – $63.53/barrel; Wyoming – $67.55/barrel.
- The prices used to determine the value of the natural gas produced from on shore Federal leases were: Alabama – $0.23/m cubic feet; Alaska – $5.84/m cubic feet; Arkansas – $4.38/m cubic feet; California – $3.89/m cubic feet; Colorado – $4.34/m cubic feet; Kansas – $4.37/m cubic feet; Kentucky – $3.83/m cubic feet; Louisiana – $11.03/m cubic feet; Michigan – $2.92/m cubic feet; Mississippi – $4.33/m cubic feet; Montana – $3.37/m cubic feet; Nebraska –$5.78/m cubic feet; New Mexico – $4.90/m cubic feet; New York – $4.84/m cubic feet; North Dakota – $4.60/m cubic feet; Ohio – $5.32/m cubic feet; Oklahoma –$4.90/m cubic feet; Pennsylvania – $5.45/m cubic feet; South Dakota – $3.65/m cubic feet; Texas – $4.17/m cubic feet; Utah – $4.34/m cubic feet; Virginia – $4.61/m cubic feet; West Virginia – $5.29/m cubic feet; Wyoming – $4.22/m cubic feet.

Reclamation

- FWS trip-related multipliers and average visitor expenditures were used to estimate impacts for Reclamation's recreation activities. The analysis relies on 1998 Reclamation visitation data (the most recent year available) and applies current expenditures per day, output multipliers, and employment multipliers from FWS.
- The values reported for Irrigation represent the value of the crops produced using irrigation water supplied by Reclamation. This value overstates the actual production attributable to Reclamation, as some level of production would occur without the irrigation water delivered by Reclamation, and water is only one of many inputs into agricultural production.

- The economic contribution delivering M&I water was estimated by using total 2005 M&I contract amounts in acre-feet and multiplying the total amounts by recent (2006) average market M&I water rates for major urban areas. At this time, actual water deliveries are not reported on a Reclamation-wide basis. The most recent year for which actual M&I deliveries were reported on a Reclamation-wide basis is 1992. Therefore, these values should also be treated as estimates.
- Hydroelectricity generated at Reclamation facilities was valued using regional retail prices adjusted by a factor of 28%, to reflect the fact that Reclamation functions more as a power wholesaler than a retailer. Wholesale values for the power markets supplied by Reclamation were not readily available. Of these markets, we were able to examine prices for California, where in 2009 the daily weighted-average wholesale price ranged from $21.50/MWh to $70.21/MWh, with an average for the year of $38.29/MWh. Over this same period, California retail prices ranged from $83.70/MWh (Transportation) to $148.90/MWh (Residential), with an average across all sectors of $134.80/MWh. The average wholesale price represented 28% of the average retail price. For each Reclamation project, we used EIA State-level price data to calculate a regional average price for the project's Power Market Administration. We then applied the factor of 28% to the regional retail price to estimate the wholesale value of the project's power.

BOEMRE

- The BOEMRE typically uses a socio-economic impact model, MAG-PLAN, to calculate employment and economic impacts from offshore oil and gas activity, e.g., wells drilled, platforms installed, etc. Outputs from the model are normally based on these expected OCS oil and gas activity levels. The costs of these activities are then used to estimate total spending and employment. Because revisions and updates being performed on the current version of Mag-Plan were incomplete at the time, the 2010 economic impact analysis is instead based on available Mag-Plan ratios and multipliers. These measures are applied to volumes and sales values of OCS oil and gas production, instead of using activity levels, to obtain measures of economic and employment impacts.
- In estimating the economic impact of OCS activities, BOEMRE used FY 2010 sales value data from the Office of Natural Resources Revenue. The sales value was divided between industry spending, government revenue, and profits to facilitate the calculation of individual State impacts. The ratios and multipliers used for industry spending and jobs are shown in the following table. Industry spending was divided between the States using Mag-Plan percentages and data from the Bureau of Labor Statistics.

	Direct	Indirect	Induced	Total
Spending Per Job	$ 178,470	$ 150,779	$ 101,411	
Spending Multiplier	1.00	0.46	0.57	2.03
Total Spending	$ 23,958,380,590	$ 11,123,794,878	$ 13,596,386,374	$ 48,678,561,842
Total Jobs	134,242.95	73,775.45	134,072.19	342,090.58

- Government OCS revenue originates from leasing revenue and taxes. A portion of OCS leasing revenue is allocated to grant and revenue sharing programs including state sharing in the 8(g)

zone, GOMESA, Coastal Impact Assistance Program (CIAP), Land and Water Conservation Fund (LWCF) and the Historic Preservation Fund (HPF). The remaining leasing revenue and tax revenue go into the Treasury General Fund. Government spending is converted to jobs using the IMPLAN ratio of 10.34 jobs per million dollars spent. Leasing and tax revenue are divided between states based on historical federal funds distributions.

- Industry after-tax profits are split between retained earnings and dividends. Using EIA percentages, a share of retained earnings is assumed to be spent for onshore development projects or spent on overseas projects. A portion of dividends was collected as taxes, whereas other dividends were assumed to be either reinvested, (added to retained earnings) or consumed. A portion of the consumed dividends was assumed to flow overseas. The portion of after tax profits that was estimated to flow oversees was excluded from the contribution analysis. ONNR reports total sales value and does not distrube sales values amongst any of these subcategories. Dividend tax revenue was combined with other tax revenue. Spending from the consumption of dividends is distributed to each state following data from the Census Bureau. The IMPLAN ratio of 10.34 jobs per million dollars spent was used to estimate employment impacts from this spending.
- Due to the deepwater drilling moratorium and the decline in approvals of drilling permits, 2010 was an atypical year for offshore drilling. Traditional drilling activities occurred for less than half of the year, so the job estimates in this analysis are likely higher than if employment estimates had been based purely on OCS activity rather than estimated using 2010 production values. This is the case because the multipliers used to estimate economic impacts are based on the typical levels of activity, e.g., drilling, associated with the 2010 level of production and revenues. Accordingly, the estimated economic impacts do not consider jobs that have been lost because of the drilling moratorium or slowing down in drilling permit approvals, or jobs that were created through oil spill clean-up of the BP Macondo blowout event.
- There have been numerous studies estimating the employment impacts from the moratorium in 2010 on the Gulf Coast Region. An interagency government report estimated that the job losses from the moratorium as 8,000 to 12,000.[23] Additional estimates range to 46,000 as estimated by the Louisiana Mid-Continent Oil and Gas Association (See table below). These estimates of job losses represent 2 to 7% of the BOEMRE estimates of total employment in the table above. Accordingly, this range of estimates can be taken to represent the potential size of the adjustment needed in BOEMRE's total employment measure to obtain a revised measure net of losses due to the moratorium.

[23] http://www.esa.doc.gov/Reports/estimating-economic-effects-deepwater-drilling-moratorium-gulf-coast-economy

	Total Jobs Potentially Impacted (thousand jobs)	**Percent of Total BOEMRE Jobs** (%)
Impacts Estimated for Louisiana		
Louisiana State University (Dismukes)	-10 to -16	1.6 to 2.5%
Louisiana State University (Richardson)	-17	2.6%
Louisiana Department of Economic Development	-10 to -20	1.6 to 3.1%
Impacts Estimated for Gulf Coast[24]		
Inter-Agency Report	-8 to -12	1.2 to 1.9%
BOEMRE	-23	3.6%
Louisiana State University (Dismukes)	-35	5.4%
Louisiana Mid-Continent Oil and Gas Association	-30 to -46	4.6 to 7.1%

- BOEMRE's estimate of lost spending as a result of the drilling moratorium is approximately 3% of total spending. Assuming companies did not spend money they would have spent drilling on other purchases, the total economic impact is approximately 3% less than estimated.

Additional Notes for Grants and Payments

- The total grants and payments reported in Table 1-1 and Table 2-1 represent all grants and payments for bureaus and Interior-wide programs in FY 2010, including current and permanent PILT payments and mineral revenue payments. State-level grants and payments data was obtained from the DOI Office of Budget for some categories (mineral revenue payments, PILT, Sport Fish, Wildlife Restoration, State and Tribal Wildlife Grants, LWCF State Grants w/ GOMESA, Historic Preservation Fund, BOEMRE Coastal Impact Assistance Program, CESCF Grants, AML, Preserve America, Save America's Treasures, and Refuge Revenue Sharing). Data for the remaining categories was obtained from the FY 2011 Interior Budget in Brief since State-level information was not available. The FY 2011 Budget in Brief identifies enacted FY 2010 grants and payments totaling $4.84 billion. Table 1-1 includes a total of $4.7 billion in grants and payments. Variances between the two figures can be attributed to the use of estimates for certain grant and payment totals at the time the Budget in Brief is printed, and exclusion of program administration costs in grant awards.
- The national-level analysis of grants and payments by bureau included in Chapter 2 uses national level multipliers for the appropriate sectors. The State-level analysis of employment impacts related to grants and payments included in Appendix 3 only includes those categories

[24] Besides studies that specifically estimate the impacts of the moratorium on Louisiana, these impacts are not available by state.

listed above for which State-level data was available. Including information on impacts of the full array of grant programs and payments would likely increase employment impacts. The State analysis uses State-level multipliers for the appropriate sectors for each grant category. Multipliers used in the grants analysis are shown in Table A6-6 and Table A6-7 at the end of this Appendix.

- Energy and mineral leasing revenues (bonuses, rents and royalties) disbursed to the U.S. Treasury are one of the Federal Government's greatest sources of non-tax receipts. These revenues help fund various government functions and programs through the General Fund of the U.S. Treasury. Royalty payments are divided into offshore and onshore categories. All employment and output impacts for offshore royalties were included in the category of Energy & Minerals for the national and State-level analyses. Existing BOEMRE models are not structured to allocate output impacts from energy and mineral activities between states.
- The $4.7 billion total of FY 2010 grants and payments (displayed in Table 1-1 and Table 2-1) does not include $11 billion in leasing revenues and corporate taxes that flow to the Treasury as a result of Interior's offshore mineral activities. These revenues are included in the BOEMRE totals.
- Federal law requires that all monies derived from mineral leasing and production activities on Federal and American Indian lands be collected, properly accounted for, and distributed. For Federal onshore lands, the revenues are generally shared between the States in which the Federal lands are located and the Federal government. In the case of American Indian lands, all monies collected from mineral production are returned to the Indian Tribes or individual Indian mineral lease owners. Revenues associated with Federal offshore lands are distributed to several accounts of the U.S. Treasury and certain coastal States with special Federal offshore tracts adjacent to their seaward boundaries.
- States receive nearly 50 percent of the revenues associated with mineral production on Federal public lands within their borders. Alaska is the one exception, which receives a 90 percent share. Coastal States, with certain Federal offshore 8(g) tracts adjacent to their seaward boundaries, receive 27 percent of the revenues.
- Mineral revenue payments include receipts for sales in the National Petroleum Reserve – Alaska, Mineral Leasing Associated Payments, National Forest Fund Payments to States, and Payments to States from Lands Acquired for Flood Control, Navigation, and Allied Purposes.
- The Grants and Payments category in Table 1-1 and Table 2-1 includes mineral revenue payments to States associated with onshore production, and grant programs funded by offshore leasing and other sources of revenues.
- The State-level analysis includes a preliminary estimation of the impacts of Federal offshore royalty payments (to States via Treasury). Additional details on these calculations are included in the section "Additional Notes for the Contributions of Interior's Offshore BOEMRE Managed Energy Activities" below.

Additional Notes for Payroll Impacts

- Total domestic jobs supported by Interior in Table 1-1 and Table 2-1 represent additional jobs above and beyond Interior employees.

- For Table 1-1 and Table 2-1, 2010 payroll data was obtained from Department of the Interior Human Resources data systems. The payroll data include salary data based on the duty-station of all Interior employees through September 25, 2010.
- The number of employees in each bureau as of September 2010 is as follows: BLM = 12,065; Indian Affairs = 9,445; BOEMRE = 1,783; Reclamation = 5,364; FWS = 10,193; NPS = 26,783; OSM = 536; USGS = 9,309; Other DOI Offices = 3,857.
- The calculation of the economic impacts associated with DOI payroll adjusts the total value of payroll for each State to account for taxes and savings rates using State-level data. These disposable income values (payroll – savings and taxes) are then used to calculate the economic impacts. This differs from the method used in last year's report, in which disposable income was assumed to be 66% of the payroll values for all States.
- For total and bureau-level payroll impacts Shown in Table 1-1 and Table 2-1, a national multiplier was used to estimate the employment impacts of Interior payroll, equaling 12.9 jobs per $1 million.
- For State-level salary impacts shown in Table A3-1, 2010 payroll data and State-level multipliers were used. Since State multipliers do not capture leakages, the total of State salary impacts will not equal the national-level salary employment impacts.
- The total salary paid and number of employees for each Bureau does not necessarily reflect FTE data typically reported in budget documents. This data was used to estimate total salary impacts rather than data on total FTE's, which would not have been a complete estimate of total salary impacts of DOI employees.
- The category "Other Interior Offices" shown in Table 2-1 includes the Office of the Secretary, the Office of the Solicitor, and the Office of the Inspector General. Insular Affairs is included in the Office of the Secretary.

Additional Notes for Recreation

- In Table 1-1, the value of the national sector was taken to be $728.8 billion, the 2009 direct output of the travel and tourism industry, as measured by the output of goods and services sold directly to visitors (source: Bureau of Economic Analysis).
- Total recreation economic and employment impacts are national estimates calculated using national level multipliers, which include "leakages" between States that are not captured in State-by-State models.
- U.S. territories and other areas in which the U.S. maintains land, including parks, monuments, and refuges are not included in this analysis. NPS and FWS do maintain visitation data for sites outside of the continental United States, Hawaii, and Alaska, and future analysis could include these areas.
- Visitation and expenditure data sources included the following: FWS Fishing, Hunting, and Wildlife-Associated Recreation Survey; NPS visitor surveys and the MGM 2009 report; for BLM sites, Forest Service expenditure data were used; Reclamation expenditures were also based on the FWS Fishing, Hunting, and Wildlife-Associated Recreation survey. The spending profiles associated with these data sources were used to develop estimates of average expenditures. For BLM, Table A6-1 shows the assumptions that were used (based on *Spending Profiles of National Forest Visitors, NVUM Four Year Report* by Stynes and White, 1998).

- Reclamation does not have current visitation information readily available. In most cases, project recreation sites are managed by Reclamation partners, including both Federal and non-Federal entities. The most recent comprehensive effort to collect visitation data and estimate benefits was in 1992. Therefore, the best available visitation data for recreation are from 1992. The estimates presented in this report should be considered as approximate. Reclamation has been developing a database for Recreation sites managed by Federal and non-Federal partners that may begin to yield better data on visitation in the future.

Table A7-1. BLM Spending Profiles

National Average Visitor Shares

Segment	Non-local Day	Non-local OVN-NF	Non-local OVN	Local Day	Local OVN-NF	Local OVN	Non-Primary
Share	11%	9%	17%	44%	3%	1%	15%
Visitor Spending/Party Trip	$61.87	$218.48	$542.26	$32.48	$163.02	$210.61	Not Available
Visitor Spending/Party Trip	$65.07	$229.77	$570.28	$34.16	$171.44	$221.49	Not Available
Number Persons/vehicle	2.6	2.8	2.7	2.2	2.9	2.5	Not Available

- Calculations for NPS relied on a similar approach to what was used for as BLM, but visitor segment, average persons per party, and spending profiles were derived from NPS data sources. In addition the MGM2 generic multipliers were used instead of IMPLAN State-specific multipliers (2008 NPS MGM2 Report, http://web4.msue.msu.edu/mgm2/default.htm).
- The FWS National Survey of Hunting, Fishing, and Wildlife Associated Recreation State-level data was used to determine the average recreationist's trip spending per day.
- Table A6-2 presents a State-by-State summary of the employment and total economic impacts of recreation visits for NPS, FWS, BLM, and Reclamation.

Table A7-1. FWS Recreation Multipliers

State	Refuge Visitor Days	Average per Day Trip-Related Expenditures	Output Multiplier	Jobs/$1M
Alabama	950,128	$ 33.26	1.59	19.26
Alaska	1,108,547	$ 130.62	1.58	15.86
Arizona	400,929	$ 70.85	1.80	17.80
Arkansas	872,199	$ 27.05	1.55	20.25
California	3,514,603	$ 54.96	1.99	15.20
Colorado	53,162	$ 67.34	1.84	17.60
Connecticut	19,281	$ 19.52	1.72	13.90
Delaware	154,070	$ 25.03	1.61	16.52
Florida	2,848,308	$ 49.16	1.90	18.91
Georgia	235,980	$ 27.58	1.83	18.80
Hawaii	427,410	$ 97.18	1.72	15.62
Idaho	278,336	$ 43.83	1.61	20.05
Illinois	983,874	$ 24.54	1.88	18.00
Indiana	157,644	$ 12.70	1.59	19.20
Iowa	1,471,901	$ 23.58	1.52	20.05
Kansas	212,634	$ 28.32	1.58	18.92
Kentucky	30,850	$ 25.22	1.57	19.30
Louisiana	673,417	$ 32.20	1.62	18.01
Maine	289,604	$ 32.55	1.69	19.52
Maryland	350,581	$ 30.25	1.69	15.70
Massachusetts	1,007,814	$ 30.02	1.80	15.40
Michigan	99,359	$ 27.52	1.81	19.72
Minnesota	1,294,626	$ 36.20	1.82	19.64
Mississippi	268,677	$ 22.25	1.50	19.04
Missouri	320,633	$ 24.13	1.71	19.00
Montana	502,917	$ 77.95	1.62	19.12
Nebraska	164,191	$ 25.10	1.60	20.42
Nevada	143,840	$ 63.56	1.59	14.90
New Hampshire	51,045	$ 33.67	1.69	17.40
New Jersey	460,513	$ 41.07	1.76	15.00
New Mexico	191,332	$ 52.55	1.52	18.70
New York	520,569	$ 39.36	1.81	15.30
North Carolina	1,530,749	$ 41.46	1.72	19.00
North Dakota	311,163	$ 49.37	1.46	18.84
Ohio	141,245	$ 28.56	1.75	19.80
Oklahoma	1,658,533	$ 26.73	1.62	19.10
Oregon	4,079,906	$ 35.91	1.78	18.72
Pennsylvania	120,060	$ 20.82	1.81	18.30

State	Refuge Visitor Days	Average per Day Trip-Related Expenditures	Output Multiplier	Jobs/$1M
Rhode Island	328,879	$ 40.32	1.73	16.93
South Carolina	910,109	$ 42.80	1.63	19.00
South Dakota	300,171	$ 69.15	1.54	19.82
Tennessee	779,717	$ 21.73	1.75	18.21
Texas	868,100	$ 45.48	1.85	18.41
Utah	52,559	$ 66.24	1.79	19.70
Vermont	61,700	$ 24.82	1.62	18.16
Virginia	1,259,109	$ 37.66	1.70	17.80
Washington	691,434	$ 47.00	1.83	16.53
West Virginia	55,540	$ 27.02	1.42	18.00
Wisconsin	1,107,422	$ 38.23	1.71	20.80
Wyoming	274,823	$ 91.74	1.39	16.82
United States	34,590,195		2.66	21.77

Source: FWS

Table A7-2 NPS Recreation Multipliers

State	Average Spending per Visit (Non-Local)	Jobs/$1M	Output Multiplier
Alabama	$ 23.75	15.50	1.01
Alaska	$ 94.90	14.05	1.39
Arizona	$ 61.53	13.45	1.06
Arkansas	$ 42.71	15.60	1.08
California	$ 30.12	12.52	1.27
Colorado	$ 61.91	14.45	1.15
Connecticut	$ 58.29	11.04	1.31
District of Columbia	$ 27.07	11.65	1.34
Florida	$ 58.22	14.50	1.35
Georgia	$ 30.73	13.54	1.29
Hawaii	$ 51.51	13.19	1.36
Idaho	$ 36.33	14.91	1.03
Illinois	$ 49.92	16.05	1.21
Indiana	$ 22.97	14.41	1.10
Iowa	$ 47.68	17.03	1.17
Kansas	$ 42.56	16.91	1.12
Kentucky	$ 46.96	16.36	1.12
Louisiana	$ 44.82	14.08	1.43
Maine	$ 71.42	17.32	1.28
Maryland	$ 45.15	13.00	1.28
Massachusetts	$ 39.39	13.15	1.34
Michigan	$ 76.22	17.08	1.27
Minnesota	$ 43.05	16.09	1.18
Mississippi	$ 11.58	13.68	0.99
Missouri	$ 36.28	14.53	1.21
Montana	$ 60.49	14.93	1.17
Nebraska	$ 32.05	18.68	1.11
Nevada	$ 29.67	10.65	0.99
New Hampshire	$ 34.03	15.64	1.27
New Jersey	$ 16.24	11.84	1.18
New Mexico	$ 37.64	14.50	0.99
New York	$ 19.63	11.20	1.40
North Carolina	$ 38.86	14.50	1.08
North Dakota	$ 43.62	17.51	1.12
Ohio	$ 19.68	15.18	1.27
Oklahoma	$ 10.14	12.21	0.78
Oregon	$ 57.61	15.44	1.10
Pennsylvania	$ 33.27	14.48	1.40
Rhode Island	$ 58.26	15.59	1.48

State	Average Spending per Visit (Non-Local)	Jobs/$1M	Output Multiplier
South Carolina	$ 26.76	15.38	1.16
South Dakota	$ 34.31	15.45	1.15
Tennessee	$ 64.45	14.39	1.12
Texas	$ 35.61	14.78	1.13
Utah	$ 64.60	15.10	1.05
Vermont	$ 44.81	14.27	1.20
Virginia	$ 21.48	13.57	1.15
Washington	$ 32.78	14.62	1.24
West Virginia	$ 32.04	12.30	0.83
Wisconsin	$ 55.36	16.33	1.12
Wyoming	$ 93.26	14.91	1.13
United States	$ 37.65	20.97	2.58

Source: NPS

Table A7-3 BLM Multipliers

	Recreation		Grazing		Timber		Minerals		Wind & Geothermal	
State	Jobs/$1M	Output Multiplier	Jobs/$1M	Output Multiplier	Jobs/$1M	Output Multiplier	Jobs/$1M	Output Multiplier	Jobs/$1M	Output Multiplier
AK	15.38	1.59			7.27	2.11	5.14	1.67		
AZ	17.53	1.84	13.31	1.91	13.47	2.97	6.64	1.62	9.72	1.24
CA	15.80	2.03	14.05	2.35	13.46	2.58	7.32	1.92	10.02	1.95
CO	15.98	1.75	11.85	1.89	10.83	3.40	6.14	1.65		
ID	18.24	1.53	11.24	1.73	11.14	1.94	7.08	1.46		
KS							7.70	1.46		
MT	18.12	1.53	13.30	1.81	8.30	1.97	7.14	1.47		
ND	18.58	1.51	7.29	1.73			6.50	1.43		
NE							7.62	1.49		
NM	17.33	1.56	12.01	1.67	8.11	2.91	6.43	1.43		
NV	14.44	1.61	10.17	1.68	11.55	1.83	7.82	1.55	10.64	1.67
OK							7.17	1.57		
OR	19.08	1.86	22.23	2.09	11.13	2.42				
SD	17.42	1.44	8.69	1.55	11.39	1.78	6.30	1.27		
TX							6.10	1.80		
UT	18.93	1.77	21.64	1.64	13.00	2.73	6.98	1.57	11.55	1.35
WA	16.30	1.84	21.67	2.11	9.56	2.35				
WY	15.76	1.37	13.95	1.56	9.72	1.70	4.69	1.33	8.00	1.18
Eastern States	19.98	2.38					10.55	2.26		

Source: BLM

Grant Program State Multipliers

These tables show the output and jobs multipliers that were applied for different categories of grants and payments.

Table A7-4. Grants and Payments Output Multipliers

State	Mineral Revenue Payments	PILT	Sport Fish	Wildlife Restoration	State & Tribal Wildlife Grants	LWCF State Grants w/ GOMESA	Historic Preservation Fund	BOEMRE Coastal Impact Assistance	CESCF Grants	AML	Preserve America	Save America's Treasures	Refuge Revenue Sharing
AL	1.27	1.27	1.31	1.29	1.27	1.56	1.67	1.27	1.27	1.68	1.27	1.63	1.27
AK	1.25	1.25	1.28	1.26	1.25	1.52	1.62	1.25	1.25	1.65	1.25	1.60	1.25
AZ	1.44	1.44	1.49	1.46	1.44	1.77	1.88	1.44	1.44	1.90	1.44	1.87	1.44
AR	1.18	1.18	1.22	1.20	1.18	1.42	1.54	1.18	1.18	1.55	1.18	1.51	1.18
CA	1.53	1.53	1.59	1.55	1.53	1.98	2.08	1.53	1.53	2.11	1.53	1.98	1.53
CO	1.32	1.32	1.37	1.35	1.32	1.63	1.74	1.32	1.32	1.76	1.32	1.77	1.32
CT	1.33	1.33	1.38	1.35	1.33	1.60	1.73	1.33	1.33	1.75	1.33	1.77	1.33
DE	1.23	1.23	1.27	1.25	1.23	1.53	1.63	1.23	1.23	1.66	1.23	1.56	1.23
DC	1.33	1.33	1.38	1.35	1.33	1.60	1.73	1.33	1.33	1.75	1.33	1.77	1.33
FL	1.52	1.52	1.58	1.55	1.52	1.91	2.02	1.52	1.52	2.05	1.52	1.97	1.52
GA	1.43	1.43	1.48	1.46	1.43	1.75	1.88	1.43	1.43	1.89	1.43	1.88	1.43
HI	1.19	1.19	1.23	1.21	1.19	1.42	1.54	1.19	1.19	1.55	1.19	1.58	1.19
ID	1.18	1.18	1.22	1.20	1.18	1.44	1.55	1.18	1.18	1.56	1.18	1.50	1.18
IL	1.50	1.50	1.55	1.53	1.50	1.87	1.99	1.50	1.50	2.01	1.50	1.93	1.50
IN	1.34	1.34	1.38	1.36	1.34	1.62	1.74	1.34	1.34	1.75	1.34	1.66	1.34
IA	1.25	1.25	1.29	1.28	1.25	1.48	1.60	1.25	1.25	1.61	1.25	1.57	1.25

State	Mineral Revenue Payments	PILT	Sport Fish	Wildlife Restoration	State & Tribal Wildlife Grants	LWCF State Grants w/ GOMESA	Historic Preservation Fund	BOEMRE Coastal Impact Assistance	CESCF Grants	AML	Preserve America	Save America's Treasures	Refuge Revenue Sharing
KS	1.24	1.24	1.28	1.26	1.24	1.49	1.60	1.24	1.24	1.62	1.24	1.61	1.24
KY	1.25	1.25	1.29	1.27	1.25	1.51	1.63	1.25	1.25	1.64	1.25	1.57	1.25
LA	1.30	1.30	1.34	1.31	1.30	1.62	1.71	1.30	1.30	1.75	1.30	1.58	1.30
ME	1.27	1.27	1.31	1.29	1.27	1.57	1.68	1.27	1.27	1.70	1.27	1.62	1.27
MD	1.32	1.32	1.36	1.34	1.32	1.59	1.73	1.32	1.32	1.74	1.32	1.78	1.32
MA	1.41	1.41	1.46	1.43	1.41	1.71	1.84	1.41	1.41	1.86	1.41	1.85	1.41
MI	1.45	1.45	1.50	1.47	1.45	1.81	1.92	1.45	1.45	1.93	1.45	1.91	1.45
MN	1.45	1.45	1.50	1.47	1.45	1.81	1.92	1.45	1.45	1.94	1.45	1.85	1.45
MS	1.22	1.22	1.25	1.23	1.22	1.47	1.57	1.22	1.22	1.60	1.22	1.50	1.22
MO	1.36	1.36	1.41	1.39	1.36	1.68	1.79	1.36	1.36	1.81	1.36	1.73	1.36
MT	1.18	1.18	1.22	1.20	1.18	1.44	1.55	1.18	1.18	1.56	1.18	1.58	1.18
NE	1.26	1.26	1.29	1.28	1.26	1.51	1.62	1.26	1.26	1.63	1.26	1.61	1.26
NV	1.26	1.26	1.30	1.28	1.26	1.53	1.64	1.26	1.26	1.65	1.26	1.65	1.26
NH	1.34	1.34	1.39	1.37	1.34	1.63	1.75	1.34	1.34	1.76	1.34	1.78	1.34
NJ	1.34	1.34	1.39	1.37	1.34	1.69	1.82	1.34	1.34	1.85	1.34	1.81	1.34
NM	1.23	1.23	1.27	1.25	1.23	1.46	1.58	1.23	1.23	1.58	1.23	1.57	1.23
NY	1.43	1.43	1.48	1.45	1.43	1.73	1.86	1.43	1.43	1.88	1.43	1.86	1.43
NC	1.35	1.35	1.40	1.37	1.35	1.63	1.75	1.35	1.35	1.77	1.35	1.74	1.35
ND	1.13	1.13	1.16	1.15	1.13	1.35	1.46	1.13	1.13	1.47	1.13	1.47	1.13

State	Mineral Revenue Payments	PILT	Sport Fish	Wildlife Restoration	State & Tribal Wildlife Grants	LWCF State Grants w/ GOMESA	Historic Preservation Fund	BOEMRE Coastal Impact Assistance	CESCF Grants	AML	Preserve America	Save America's Treasures	Refuge Revenue Sharing
OH	1.37	1.37	1.42	1.39	1.37	1.72	1.83	1.37	1.37	1.85	1.37	1.73	1.37
OK	1.26	1.26	1.30	1.28	1.26	1.55	1.66	1.26	1.26	1.68	1.26	1.60	1.26
OR	1.40	1.40	1.44	1.41	1.40	1.79	1.89	1.40	1.40	1.92	1.40	1.81	1.40
PA	1.44	1.44	1.49	1.46	1.44	1.80	1.91	1.44	1.44	1.93	1.44	1.82	1.44
RI	1.32	1.32	1.36	1.34	1.32	1.57	1.69	1.32	1.32	1.70	1.32	1.67	1.32
SC	1.31	1.31	1.35	1.33	1.31	1.59	1.70	1.31	1.31	1.71	1.31	1.70	1.31
SD	1.12	1.12	1.15	1.14	1.12	1.32	1.43	1.12	1.12	1.44	1.12	1.41	1.12
TN	1.42	1.42	1.47	1.44	1.42	1.75	1.85	1.42	1.42	1.87	1.42	1.81	1.42
TX	1.52	1.52	1.57	1.54	1.52	1.97	2.05	1.52	1.52	2.09	1.52	1.96	1.52
UT	1.36	1.36	1.40	1.38	1.36	1.70	1.80	1.36	1.36	1.82	1.36	1.79	1.36
VT	1.21	1.21	1.25	1.23	1.21	1.42	1.56	1.21	1.21	1.57	1.21	1.59	1.21
VA	1.32	1.32	1.36	1.34	1.32	1.61	1.73	1.32	1.32	1.74	1.32	1.77	1.32
WA	1.40	1.40	1.45	1.42	1.40	1.80	1.89	1.40	1.40	1.92	1.40	1.82	1.40
WV	1.17	1.17	1.20	1.18	1.17	1.35	1.47	1.17	1.17	1.48	1.17	1.44	1.17
WI	1.38	1.38	1.43	1.41	1.38	1.70	1.80	1.38	1.38	1.82	1.38	1.73	1.38
WY	1.07	1.07	1.10	1.08	1.07	1.25	1.37	1.07	1.07	1.37	1.07	1.39	1.07
US	1.97	1.97	2.04	1.99	1.97	2.74	2.80	1.97	1.97	2.88	1.97	2.44	1.97

Table A7-5. Grants and Payments Jobs/$1M

State	Mineral Revenue Payments	PILT	Sport Fish	Wildlife Restoration	State & Tribal Wildlife Grants	LWCF State Grants w/ GOMESA	Historic Preservation Fund	BOEMRE Coastal Impact Assistance	CESCF Grants	AML	Preserve America	Save America's Treasures	Refuge Revenue Sharing
AL	16.9	16.9	16.7	16.7	16.9	15.1	16.9	16.9	16.9	18.9	16.9	19.0	16.9
AK	12.7	12.7	12.7	12.6	12.7	10.8	12.2	12.7	12.7	18.3	12.7	13.4	12.7
AZ	16.0	16.0	15.9	15.8	16.0	14.8	16.5	16.0	16.0	18.5	16.0	17.6	16.0
AR	17.3	17.3	17.0	17.0	17.3	14.3	16.6	17.3	17.3	17.7	17.3	15.1	17.3
CA	12.9	12.9	13.1	12.8	12.9	13.4	14.9	12.9	12.9	16.8	12.9	14.6	12.9
CO	14.6	14.6	14.5	14.5	14.6	13.3	14.9	14.6	14.6	17.4	14.6	16.1	14.6
CT	12.3	12.3	12.3	12.2	12.3	12.0	13.8	12.3	12.3	17.6	12.3	15.8	12.3
DE	13.7	13.7	13.5	13.5	13.7	12.6	14.0	13.7	13.7	16.9	13.7	14.8	13.7
DC	12.3	12.3	12.3	12.2	12.3	12.0	13.8	12.3	12.3	17.6	12.3	15.8	12.3
FL	15.3	15.3	15.5	15.3	15.3	16.5	18.4	15.3	15.3	20.7	15.3	18.2	15.3
GA	18.7	18.7	18.4	18.4	18.7	15.8	17.8	18.7	18.7	19.9	18.7	17.4	18.7
HI	12.7	12.7	12.7	12.6	12.7	10.8	12.5	12.7	12.7	16.7	12.7	15.2	12.7
ID	16.4	16.4	16.2	16.2	16.4	14.8	17.0	16.4	16.4	18.9	16.4	17.3	16.4
IL	14.1	14.1	14.1	14.0	14.1	14.0	15.5	14.1	14.1	17.2	14.1	15.9	14.1
IN	17.6	17.6	17.4	17.4	17.6	14.7	16.7	17.6	17.6	18.3	17.6	16.7	17.6
IA	16.3	16.3	16.3	16.1	16.3	14.3	16.3	16.3	16.3	18.7	16.3	18.0	16.3
KS	17.7	17.7	17.3	17.4	17.7	13.8	15.5	17.7	17.7	16.9	17.7	20.2	17.7
KY	16.7	16.7	16.5	16.5	16.7	14.4	16.5	16.7	16.7	18.3	16.7	17.3	16.7
LA	15.9	15.9	15.7	15.7	15.9	13.9	15.4	15.9	15.9	17.8	15.9	16.6	15.9
ME	15.9	15.9	15.9	15.8	15.9	15.6	18.0	15.9	15.9	21.3	15.9	16.4	15.9
MD	14.2	14.2	14.1	14.0	14.2	12.5	14.1	14.2	14.2	17.4	14.2	16.9	14.2
MA	13.6	13.6	13.5	13.5	13.6	12.8	14.3	13.6	13.6	15.7	13.6	15.7	13.6
MI	15.6	15.6	15.7	15.5	15.6	15.6	17.3	15.6	15.6	20.4	15.6	20.1	15.6
MN	16.1	16.1	16.1	16.0	16.1	15.0	16.8	16.1	16.1	19.0	16.1	17.4	16.1
MS	17.4	17.4	17.2	17.2	17.4	14.9	17.0	17.4	17.4	18.8	17.4	17.6	17.4

State	Mineral Revenue Payments	PILT	Sport Fish	Wildlife Restoration	State & Tribal Wildlife Grants	LWCF State Grants w/ GOMESA	Historic Preservation Fund	BOEMRE Coastal Impact Assistance	CESCF Grants	AML	Preserve America	Save America's Treasures	Refuge Revenue Sharing
MO	17.9	17.9	17.6	17.7	17.9	14.7	16.3	17.9	17.9	18.4	17.9	17.2	17.9
MT	16.6	16.6	16.5	16.4	16.6	14.8	17.0	16.6	16.6	18.8	16.6	19.8	16.6
NE	17.3	17.3	17.1	17.1	17.3	14.0	15.5	17.3	17.3	17.7	17.3	18.3	17.3
NV	11.9	11.9	12.1	11.8	11.9	11.9	13.5	11.9	11.9	16.9	11.9	16.0	11.9
NH	16.1	16.1	16.0	16.0	16.1	14.4	16.6	16.1	16.1	19.8	16.1	19.6	16.1
NJ	12.6	12.6	12.6	12.5	12.6	11.9	13.5	12.6	12.6	16.2	12.6	16.2	12.6
NM	15.3	15.3	15.2	15.1	15.3	13.9	15.8	15.3	15.3	18.4	15.3	16.2	15.3
NY	13.2	13.2	13.2	13.1	13.2	12.4	13.8	13.2	13.2	16.4	13.2	12.5	13.2
NC	16.1	16.1	16.1	15.9	16.1	15.5	17.8	16.1	16.1	19.3	16.1	18.6	16.1
ND	18.2	18.2	17.7	17.9	18.2	12.6	14.4	18.2	18.2	16.3	18.2	20.2	18.2
OH	15.8	15.8	15.8	15.6	15.8	15.2	17.1	15.8	15.8	20.2	15.8	17.0	15.8
OK	17.0	17.0	16.8	16.8	17.0	15.1	17.3	17.0	17.0	19.7	17.0	17.3	17.0
OR	15.6	15.6	15.7	15.5	15.6	15.5	17.4	15.6	15.6	19.4	15.6	18.7	15.6
PA	16.4	16.4	16.2	16.2	16.4	14.6	16.2	16.4	16.4	18.9	16.4	17.2	16.4
RI	13.2	13.2	13.3	13.1	13.2	13.4	15.3	13.2	13.2	20.0	13.2	17.3	13.2
SC	17.7	17.7	17.4	17.5	17.7	15.7	17.6	17.7	17.7	19.4	17.7	19.0	17.7
SD	18.0	18.0	17.6	17.8	18.0	13.4	15.5	18.0	18.0	17.1	18.0	15.7	18.0
TN	17.7	17.7	17.4	17.5	17.7	16.0	17.9	17.7	17.7	20.5	17.7	17.7	17.7
TX	17.2	17.2	17.0	17.0	17.2	15.6	17.2	17.2	17.2	19.6	17.2	17.8	17.2
UT	16.7	16.7	16.7	16.6	16.7	15.6	17.5	16.7	16.7	20.4	16.7	21.2	16.7
VT	15.6	15.6	15.6	15.5	15.6	14.5	17.2	15.6	15.6	19.9	15.6	17.4	15.6
VA	14.7	14.7	14.6	14.6	14.7	13.5	15.1	14.7	14.7	18.3	14.7	16.8	14.7
WA	14.5	14.5	14.4	14.3	14.5	13.4	15.0	14.5	14.5	16.9	14.5	16.2	14.5
WV	15.6	15.6	15.5	15.5	15.6	12.9	14.9	15.6	15.6	17.6	15.6	15.4	15.6
WI	17.3	17.3	17.2	17.2	17.3	15.1	17.0	17.3	17.3	19.6	17.3	19.4	17.3
WY	14.1	14.1	14.0	14.0	14.1	11.3	13.3	14.1	14.1	16.4	14.1	14.9	14.1
US	18.0	18.0	18.2	18.0	18.0	19.4	20.9	18.0	18.0	23.2	18.0	19.7	18.0

Appendix 8. COMPARISON TO INTERIOR'S DECEMBER 2009 PRELIMINARY ECONOMIC IMPACT REPORT

The report represents a follow-up to a preliminary report released by Interior in December 2009. This report relied on data from 2008. While both reports rely on generally similar methodological approaches, the results are not directly comparable due to changes in some of the underlying modeling.

- In general, the value of the commodities and other inputs to production associated with Interior's activities fell slightly in nominal terms from $174 billion to $136 billion. This change largely be attributed to commodity price changes and changes in the quantity of inputs produced.
- The number of jobs supported by Interior related activities changed from about 1.4 million to about 2.2 million This increase is largely due to several factors:
    - Improvements in the methodology used to model output and employment for oil and gas;
    - Use of a new version of IMPLAN, which incorporates a more sophisticated modeling approach for inter-regional trade flows;
    - Increases in the "value" of some activities, such as recreation. Estimated economic contributions by recreation visitors increased from $25 billion in the 2009 report to $48 billion in this report. This is at least partly due to the use of new "expenditure profiles" which reflect larger estimated per day visitor expenses. These larger expenditures are associated with a larger number of jobs supported.

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