THE DEPARTMENT OF THE INTERIOR'S ECONOMIC CONTRIBUTIONS

FISCAL YEAR 2011

JULY 9, 2012

EXECUTIVE SUMMARY

The Department of the Interior plays a substantial role in the U.S. economy, supporting over two million jobs and approximately $385 billion in economic activity for 2011. 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 2011 include:

- Recreation and Tourism: Americans and foreign visitors made nearly 435 million visits to Interior-managed lands. These visits supported over 403,000 jobs and contributed around $48.7 billion in economic activity. This economic output represents about 6.5% of the direct output of tourism-related personal consumption expenditures for the United States for 2011 and about 7.6% of the direct tourism related employment.
- Energy and Minerals: Exploitation of oil, gas, coal, hydropower and other minerals on Federal lands supported 1.5 million jobs and $275 billion in economic activity.
- Water, Timber and Forage: Use of water, timber and other resources produced from Federal lands supported about 290,000 jobs and nearly $41 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. $4.2 billion in grants and payments (including support to tribal governments) supported about 83,000 jobs and $10 billion worth of economic contributions.
- Interior's support for tribal governments is an important mechanism for advancing nation-to-nation relationships, improving Indian education, and improving the safety of Indian communities. In FY 2011, this funding contributed about $1.2 billion to economic output and supported about 9,500 jobs.
- Through both bureau programs and organizational partnerships, more than 21,000 employment opportunities were provided to people ages 15 to 25 on public lands in FY 2011. NPS and its organizational partners employed the largest number, with 9,089 youth employed.
- The physical infrastructure managed by Interior supports a wide variety of resource management and recreation activities. In FY 2011, investments in construction and maintenance totaled about $2.6 billion. This funding contributed about $7.2 billion in economic activity and supported about 49,000 jobs.
- Land acquisitions are a key component to ensuring that the ecosystem services provided by Interior-managed lands can be preserved and enhanced. The $144 million spent on land acquisitions in FY 2011 is estimated to contribute about $141 million in economic activity and support about 1,000 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 landscapes.

Please cite this report as: The Department of the Interior's Economic Contributions, FY 2011.I

(This page is intentionally left blank)

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF BOXES

(This page is intentionally left blank)

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 for FY 2011. This report, prepared at the direction of the Secretary of the Interior, contains information on economic contributions as well as economic information on other key issues that impact Interior's broad land, water, and resource management responsibilities.[1]

In a nutshell

- The Department of the Interior plays a substantial role in the U.S. economy, supporting nearly 2.4 million jobs and approximately $385 billion in economic activity for 2011.
- Interior's economic contributions are underpinned by substantial investments in facilities, lands, information, and institutional capacity made in past years.
- While it is straightforward to quantify and value outputs bought and sold in markets (such as oil, gas, and coal), Interior's lands and managed resources also produce or support a wide range of valuable ecosystem services, including agriculture, drinking water, energy, flood and disease control, carbon sequestration, recreation, and cultural resources.

The Department of the Interior plays a substantial role in the U.S. economy, supporting nearly 2.4 million jobs and approximately $385 billion in economic activity for 2011. Interior's economic contributions are underpinned by substantial investments in facilities, lands, information, and institutional capacity 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 allows 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 enhancements to the capacity to evaluate and process applications for renewable energy technology on public lands and to the capacity to provide for safe and efficient offshore energy development.

These investments have resulted in a substantial number of permits for renewable energy development being issued in FY 2011, 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, municipal, and industrial water supplies, and providing valuable information to mineral markets. Many of Interior's activities, such as the leasing of mineral rights,

[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.

significantly affect the national economy because they enable private industry to create wealth and jobs. Other Interior activities, which do not directly produce revenues, also support significant economic contributions. These include the provision of scientific information and technology transfer, support and capacity building for tribes, and a suite of conservation activities supported by various grants and payments. Table 1-1 provides a summary of values for the activities where the economic contributions can be quantified. However, these values only represent the gross economic value of Interior's activities. The net benefits associated with providing these contributions are substantially more difficult to quantify and value. While it is straightforward to quantify and value outputs bought and sold in markets (such as oil, gas, and coal), Interior's lands and managed resources produce or support a wide range of valuable ecosystem services, including agriculture, drinking water, energy, flood and disease control, carbon sequestration, recreation, and cultural resources. Additional empirical research that helps managers to better understand and quantify the value of these services can result in better land management decisions.

This report highlights the current economic contribution of Interior's existing programs and activities, and provides information on the Department's contribution on a state-by-state basis.[2] The report also addresses a set of topics where Interior has significant management responsibilities and where market transactions do not fully reflect net economic values. In general, comparing DOI economic contributions from FY 2010 and FY 2011, the value of all commodities and other inputs to production associated with Interior's activities increased by 6% in nominal terms from $136 billion to $144 billion. The change in value for individual inputs varied significantly across commodities. This difference can largely be attributed to commodity price changes and changes in the quantity of inputs produced.

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. Chapter 3 addresses the economics of conservation; Chapter 4 addresses ecosystem restoration; Chapter 5 focuses on rural communities and conservation lands; Chapter 6 discusses the value of information and technology transfer; and Chapter 7 explores the concept of full cost accounting. Additional details on Interior's economic contributions at the state level, the bureau level, contributions by sector, as well as the methodology used to evaluate economic contributions are provided in Appendices to this report. Taken as a whole, the Department of the Interior's market and non-market based economic values represent a substantial contribution to the national economy. This report provides context and supporting data to illustrate this important role.

[2] This report is the third in a series of ongoing annual reports initiated with a preliminary report released by Interior in December 2009. While the reports rely on generally similar methodological approaches, the results are not directly comparable because a number of factors may change from year to year, including prices, quantities, and changes in some of the underlying modeling. Appendix 8 and Appendix 9 provide additional information on changes in approach, methods, and data compared to previous reports. As in the FY 2010 report, the FY 2011 report does not include the impact of funding provided by the one-time American Recovery and Reinvestment Act of 2009 (ARRA), although some projects funded by ARRA are discussed.

Table 1-1. Summary of Values and Outputs for DOI

	Inputs (DOI Activity)	Outputs Resulting from DOI Activity		
Category	**Value (billions, $2011)**	**Est. Value of DOI Inputs as % of National Sector**	**Total Economic Contribution (billions, $2011)**	**Total Domestic Jobs Supported (jobs)**
DOI Payroll (~81,000 employees in 2011)	5.13		8.30	58,471*
Grants & Payments to Non-Federal Entities (excludes payments via U.S. Treasury)	4.22		10.14	83,638
Support for Tribal Governments	0.48		1.17	9,504
Public Resources as Inputs to Production				
Recreation and Tourism	19.47	3%	48.65	403,482
Energy				
Oil, gas and coal	88.02	33%	250.20	1,389,556
Hydropower	1.08	19%	1.59	4,981
Wind Power	0.00	1%	0.10	688
Geothermal	0.16	36%	0.61	3,029
Solar	0.00		1.37	6,747
Non-fuel Minerals	8.74		21.22	122,928
Other Production				
Irrigation water	14.02	12%	33.34	231,977
M&I water	2.30	19%	5.35	32,296
Grazing	0.56	1%	1.49	18,324
Timber	0.07	1%	1.22	7,489
Total	144.25		384.75	2,373,111

* In 2011, DOI's payroll supported about 81,000 employees (direct jobs), as well as 58,471 indirect and induced jobs throughout the Nation. For more information, please see Page 197.

OVERVIEW OF INTERIOR'S ECONOMIC CONTRIBUTIONS

Economic contribution analysis: The economic contribution analysis presented in this chapter and in Chapter 2 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 analysis is best characterized as a *contribution analysis* in comparison to other measures of economic activity, such as an analysis of net economic benefits.[3] Net 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.[4] The distinction between economic benefits, economic impacts, and economic contributions is discussed in Appendix 7.

In FY 2011, investments in construction and maintenance totaled about $2.6 billion. The physical infrastructure makes it possible to use, enjoy, and benefit from Interior managed resources. This funding contributed about $7.2 billion in economic activity and supported almost 49,000 jobs.

Investing in Conservation: Conservation of landscapes and ecosystems help support numerous activities, such as tourism, outdoor recreation, cultural observances, and working landscapes, all making significant contributions to the well-being of the nation and local communities. Investments in conservation provide benefits to society in the form of species and habitat protection, maintenance of working landscapes, and the provision of ecosystem services (such as clean water, timber, fisheries habitat, and carbon sequestration). Chapter 3 discusses several economic issues related to land conservation including measuring the value of conservation, evaluating conservation investments, targeting investments, the relationship between land values and conservation, and options for land acquisition.

Investments in land conservation can include land acquisition as well as scientific research and other conservation management activities. The measurement of net benefits from conservation investments (which are often inappropriately valued using economic contribution or economic impact information) can provide important information to policymakers for future decisions. Economic techniques allow the benefits and costs of conservation investments to be represented in monetary terms, enabling comparison across locations or projects in a common metric. Absent the ability to quantify benefits in monetary terms, physical measures of benefits (e.g., number of species conserved) can be substituted, where either measure of benefit can be used to calculate a return on

The DOI FY 2011 budget included $144 million for Land acquisition. These acquisitions support $141 million in economic activity and support over 1,000 jobs. These long-term investments expand and protect ecosystem services, including recreation, ecotourism, cultural heritage, water filtration, habitat, and flood control.

[3] This analysis also does not evaluate the impacts of ceasing activities on DOI lands or the impacts of alternative management approaches.

[4] 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.

investment. Such calculations can provide valuable information to evaluate, target and prioritize land acquisition decisions or other conservation activities.

Ecosystem restoration: Ecosystem restoration is an important component of Interior's activities. It can be difficult, though, to quantify the economic value of restoration. Although the jobs and economic contributions from restoration are substantial and important, they do not represent the full economic value of ecosystem restoration, because they do not capture the net economic benefits associated with environmental goods and services not bought and sold in markets. Chapter 4 includes a number of case studies that highlight the economic contributions of a wide range of restoration projects supported by DOI bureaus and partners. The economic contributions associated with these case studies are summarized in Table 4-1. The magnitude of these contributions varies with the amount of spending on the restoration project, the duration of the project, and the mix of capital and labor used during the restoration. The largest restoration project analyzed, the Truckee River restoration, involved spending $19 million over five years, supporting an average of 37 jobs per year. Additional information on restoration activities is presented in Appendix 3.

Rural economies: Publically owned conservation lands can play a major role in rural areas through the provision of natural amenities that facilitate engagement in numerous outdoor recreation activities, such as fishing, hunting, bird-watching, hiking, and boating. Chapter 5 explores how the conservation of public lands in rural areas can also serve as an attractant to households specifically looking for access to the natural amenities they offer and their contribution to overall quality of life. As the largest federal land management agency in the United States, Interior has the ability to play a role in shaping the economic and demographic profile of many rural communities through the diverse collection of conservation lands managed by its bureaus. Visitation to Interior sites supports a significant number of rural jobs in many states, including Utah (14,973 jobs); Wyoming (14,445 jobs); Colorado (9,173 jobs); and Arizona (8,249 jobs).

Innovation, Information and Technology Transfer: As used in this report "information," includes both scientific and technical information, and is a critical input that helps support private markets, the production processes of private entities, and many public sector decisions. For example, oil, gas, and mineral markets are underpinned by scientific and technical information on resource availability; water use and allocation decisions rely on precipitation and runoff predictions; and preparedness for natural hazards relies on information about the locations and probability of such events occurring. The information supplied in these examples has an economic value that is at least partly incorporated in the market prices of traded goods and services. The ability to transfer information to nonfederal entities can enhance the value of the information and provide benefits to the public. Chapter 6 discusses some of the different types of information produced by DOI, a short discussion of the economics of information, and provides examples where technology developed by Interior has been transferred to the private sector.

Full cost accounting: Interior resources provide energy, minerals, forage, water, habitat, and timber that are subsequently used throughout the economy to generate electricity, provide fuel for transportation, and provide raw materials used as inputs in a number of industries. Yet, in many cases the benefits provided by the raw materials and products that flow from DOI managed lands, as well as the production, distribution and use of these products, also may cause adverse effects on the environment, economy, or society. Economists typically characterize these adverse effects as "negative externalities." Conversely,

some of Interior's activities (e.g., restoration of habitat, historic buildings) have external benefits called "positive externalities." Chapter 7 provides an introduction to the concept of externalities, discusses the application of these concepts in the context of several Interior related examples, and highlights the importance of moving toward full cost accounting of DOI land management activities. Specifically, engaging in full cost accounting of all energy sources—fossil fuels, wind, solar, and other forms of non-fossil fuel power generation—would help promote more cost-effective investments on public lands.

SECTOR HIGHLIGHTS

Highlights of Interior's economic contributions to key economic sectors in 2011 include:

- Recreation and Tourism: Americans and foreign visitors made nearly 435 million visits to Interior-managed lands. These visits supported about 403,000 jobs and contributed $48.7 billion in economic activity. This economic output represents about 6.5% of the direct output of tourism-related personal consumption expenditures for the United States for 2011 and about 7.6% of the direct tourism related employment.
- Energy and Minerals: Oil, gas, coal, hydropower, wind power, geothermal power, solar power, and other mineral activities on Federal lands supported over 1.5 million jobs and around $275 billion in economic activity.
- Water, Timber and Forage: Use of water, timber, and forage produced from Federal lands supported nearly 290,000 jobs and nearly $41 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 $4.2 billion supported about 83,000 jobs and $10 billion worth of economic contributions.
- Interior's support for tribal governments represents an important mechanism to advance nation-to-nation relationships, facilitate economic development, improve Indian education, and improve the safety of Indian communities. In FY 2011, this funding contributed about $1.2 billion to economic output and supported about 9,500 jobs.
- Youth employment at Interior totaled 14,011 in FY 2011; 15,051 in FY 2010; and 13,578 in FY 2009. The NPS and organizational partners employed the largest number in FY 2011, with 9,089 youth employed. Interior's partnerships with other organizations employed an additional 7,073 people ages 15-25 in FY 2011 (Box 1-1 provides additional information on youth employment).[5]

[5] A large body of literature has studied the effectiveness of a variety of career-focused education and training policies and programs. While conducting such analyses is difficult, findings from recent experimental evaluations of programs operated by states and nonprofit organizations, and careful studies of community colleges suggest that employment-focused programs, often developed in cooperation and collaboration with employer or industry partners, have been successful, producing returns for workers that exceed the social cost of the programs. The most successful training programs appear to either coordinate directly with employers and industry partners to ensure that their participants receive training in skills that are in demand, or include career-oriented counseling that steers trainees to the most valuable coursework. See, for example, Greenstone, M. and Looney, A. 2011. *Building America's Job Skills with Effective Workforce Programs: A Training Strategy to Raise Wages and Increase Work Opportunities. Strategy Paper*. The Brookings Institution.

Box 1-1. DOI Youth Employment and Service Activities

Youth Jobs at Interior: *Through both bureau programs and organizational partnerships, more than 21,084 employment opportunities were provided to young people between the ages of 15 and 25 on public lands in FY 2011. There is an economic benefit associated with these activities and Interior bureaus are able to attract and retain qualified employees. Participating youth gain valuable work experience that serves to strengthen their skills and increase future wage rates. In addition, youth hires often convert to permanent positions, are promoted to a new position, or receive new job assignments. In FY 2011, about 16% (2,293) of Interior's youth hires converted to permanent positions, were promoted into a new position, or received a new job assignment.*

The Youth Conservation Corps (YCC), a summer work youth program, is an integral component of Secretary Salazar's Youth in the Great Outdoors Initiative. For example, NPS annually accomplishes a minimum of $4.0 million in work performed by YCC employees and FWS has worked with the YCC to introduce young Americans to conservation opportunities. Interior also participates in a variety of programs focused on youth employment and service, including:

- *Student Temporary Employment Program (STEP): The STEP program offers part-time paid positions to students in high school, college, vocational school or graduate school in order to gain experience in new fields. OSM, for example, annually hires through STEP for a variety of projects.*
- *Student Career Experience Program (SCEP): BLM annually employs approximately 200 students in SCEP nationwide and spends approximately $12,000 per student or $2.4 million total for training expenses, salaries, tuition assistance, and travel. BLM provides these students with a housing stipend of $1,500 per year to offset the costs of temporary housing at the work site. It has also encouraged the participation of economically disadvantaged youth.*
- *AmeriCorps Volunteers in Service to America (VISTA): OSM partners with the VISTA program to bring environmental and economic improvement to communities affected by coal-polluted watersheds. OSM also supported VISTAs involved in its reforestation projects and in regulatory projects with States. The reforestation program has resulted in substantial environmental, cultural, and economic benefits to areas that were forested before mining.*
- *Non-Profits: The Student Conservation Association (SCA), the Southwest Conservation Corps, the Greening Youth Foundation, and other organizations provide opportunities to, college and high school students to protect and restore DOI lands across the country. In FY 2011, the partnership agreements between Reclamation and SCA and The Corps Network were planned to be used to assist on-the-ground conservation projects and internships.*

In accordance with Executive Order 13562, signed December 27th 2010 (http://www.whitehouse.gov/the-press-office/2010/12/27/executive-order-recruiting-and-hiring-students-and-recent-graduates), the Pathways program eliminates the current student hiring authorities and establishes three new programs including the Internship Program, the Recent Graduates Program, and a reinvigorated Presidential Management Fellows (PMF) Program. For more information on each program please go to: http://www.opm.gov/HiringReform/Pathways/index.aspx. OPM issued final regulations on the new Pathways program on 5/11/12.

BUREAU HIGHLIGHTS

Highlights of Interior's economic contributions by bureau in 2011 include:

- The Bureau of Land Management (BLM) oversees 248 million acres of Federal lands (and 700 million subsurface acres of mineral estate) and contributed about $151 billion to the national economy and supported over 756,000 American jobs.
- As of March 2012, the Bureau of Ocean Energy Management (BOEM) and the Bureau of Safety and Environmental Enforcement (BSEE) administered 6,607 active mineral leases on 36 million offshore acres; energy and minerals production from offshore areas accounted for about $121 billion in economic contributions and supported around 734,500 American jobs.
- The Bureau of Reclamation maintains 476 dams and 348 reservoirs, provides water that irrigates about 10 million acres of land, provides municipal and industrial water to over 31 million people, generates about 48 million megawatt hours of electricity, and provides recreation opportunities. These activities are estimated to contribute approximately $46 billion in economic output, and support nearly 312,000 jobs.
- The National Park Service (NPS) maintains 84 million acres on 397 sites in 49 states, providing a recreation-related economic contribution of about $31 billion, and supporting over 258,000 American jobs.
- The Bureau of Indian Affairs (BIA), the 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 566 tribes, contributing around $12 billion in economic output and supporting nearly 126,000 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 about $1.2 billion in economic output and supports around 9,500 additional jobs.
- The U.S. Fish and Wildlife Service (FWS) manages the 150 million-acre National Wildlife Refuge System of 555 National Wildlife Refuges and thousands of small wetlands and other special management areas, providing an economic contribution of over $4.2 billion and supporting about 34,500 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 preparation for 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. OIA provided $429 million in grants and payments directly to the insular areas during FY 2011. This assistance played an important role in the economies of each of these areas by providing financial and technical assistance to promote economic growth, education, public health, and the development of more efficient and effective government. Grants, payments, and technical assistance from OIA supported about 31,000 jobs and around $1.5 billion in economic activity in these areas. OIA has also strengthened its ability to provide accurate and current socioeconomic data by establishing a technical assistance agreement with the Bureau of Economic Analysis to calculate GDP of the territories.

- 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. OSM grants are estimated to contribute about $1.2 billion in economic activity and support about 7,800 jobs.

STATE HIGHLIGHTS

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. Figure 1-1 and Figure 1-2 show the state-level economic output and jobs resulting from DOI activities. Additional state-level information is provided in Appendix 2. Some of the highlights of economic contributions associated with a variety of activities including recreation, minerals, timber, and forage on a state-by-state basis include the following:

- **Recreation**: The economic contribution of recreation activities differs considerably across states.
    - Recreation on Interior-managed lands was estimated to support about 35,000 jobs in California, 21,000 jobs in Utah, 23,000 jobs in Arizona, and 12,000 jobs in the District of Columbia.
    - Recreational visits to Interior-managed lands supported economic activity exceeding $1 billion in several states: Arizona, California, Colorado, the District of Columbia, Florida, Nevada, Oregon, Utah, and Wyoming.
    - Visitation to national parks and national wildlife refuges contributes to local economies in many coastal states. Estimated economic contributions from coastal recreation to NPS sites were significant in many states, with $895 million in economic output in California, $764 million in Florida, $515 million in New York, and $398 million in Massachusetts. Visitation to coastal parks supported thousands of jobs in many states, including over 8,500 jobs in Florida, over 7,900 jobs in California, over 4,300 jobs in New York, and over 4,100 jobs in Massachusetts. Visitors to National Wildlife Refuges in coastal areas also contributed to economic output in many states, with contributions in Oregon, Florida, Alaska, and North Carolina of over $100 million each. These expenditures also support jobs in coastal communities, with over 2,800 jobs supported in Oregon, over 2,500 in Florida, over 2,300 in Alaska, and over 1,100 in North Carolina.
- **Onshore Minerals**: The economic impact of onshore minerals activities also varies widely.
    - In 2011, oil, gas, coal, and non-metallic mineral activities in New Mexico supported over 92,000 jobs and $16.3 billion in economic output.
    - In Wyoming, oil, gas, coal, and non-metallic mineral activities supported over 130,000 jobs and $30.9 billion in economic output.
    - In California, oil, gas, coal, and non-metallic mineral activities supported over 21,000 jobs and $4.4 billion in economic output.

- **Offshore Minerals:** Offshore minerals activities supported a total of about 734,500 jobs across the country in 2011 (this does not include jobs supported by offshore revenues directed toward grant programs). For example: around 157,500 jobs were supported in Texas, around 107,400 jobs were supported in Louisiana, about 65,000 jobs were supported in Florida, and around 46,000 jobs were supported in California.

- **Timber and grazing**: BLM timber activities are concentrated in Oregon, supporting about 2,800 jobs and about $537 million in economic activity. BLM forage in Idaho supported about 2,900 jobs and about $275 million in economic activity in 2011.

- **Grants and Payments to non-Federal Entities**: Payments to states and counties represent an important source of income to these jurisdictions. In 2011, grants and payments were estimated to support over 17,100 jobs in Wyoming, over 8,400 jobs in New Mexico, over 3,900 jobs in Utah, and over 3,300 jobs in Colorado. Grants and payments were estimated to support over 31,000 jobs in the Insular Areas.

- **Support for tribal governments**: Grants and payments to tribal governments supported about 9,500 jobs and $1.2 billion in economic activity.

Figure 1-1. Economic Output Supported by DOI Activities, by State

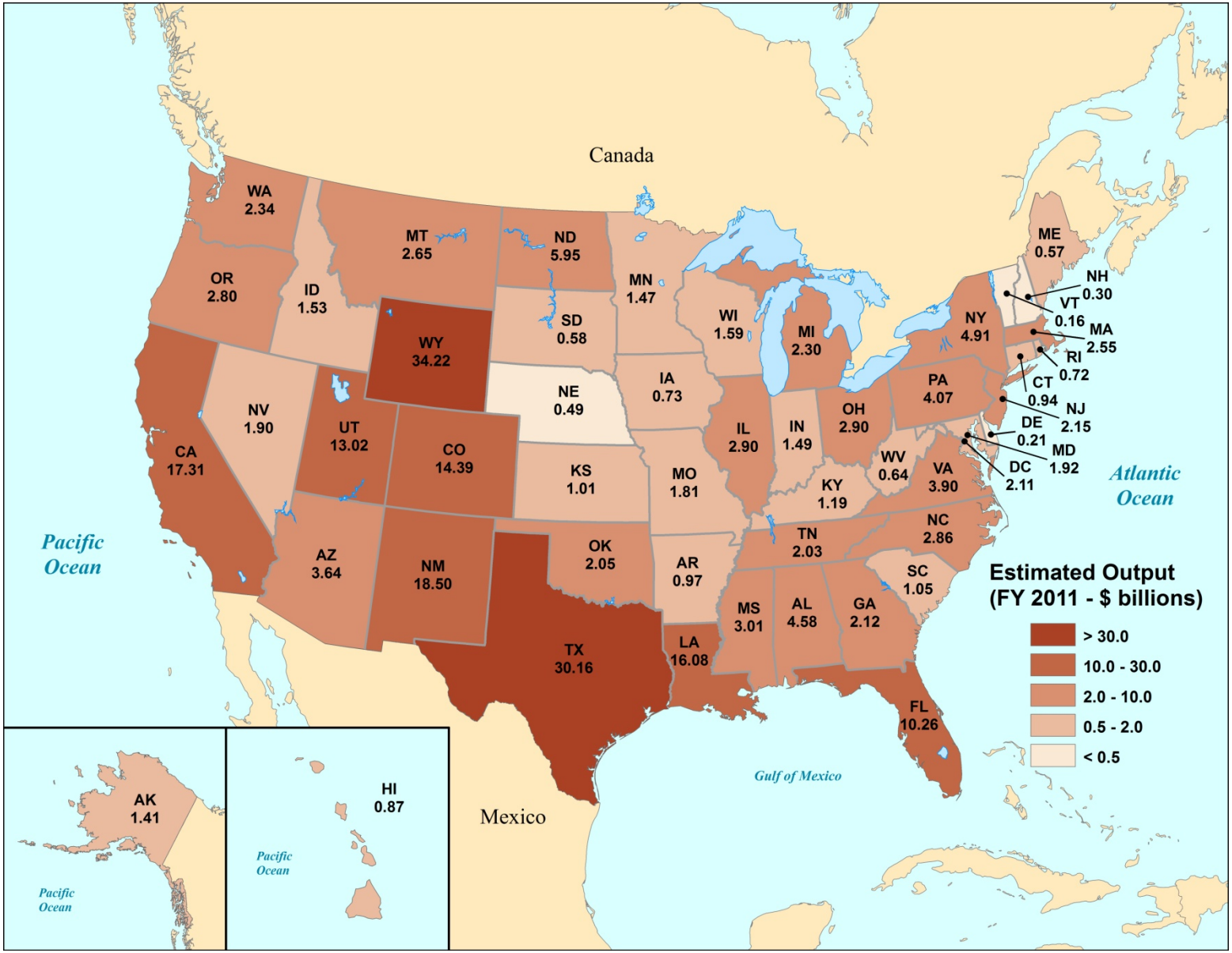
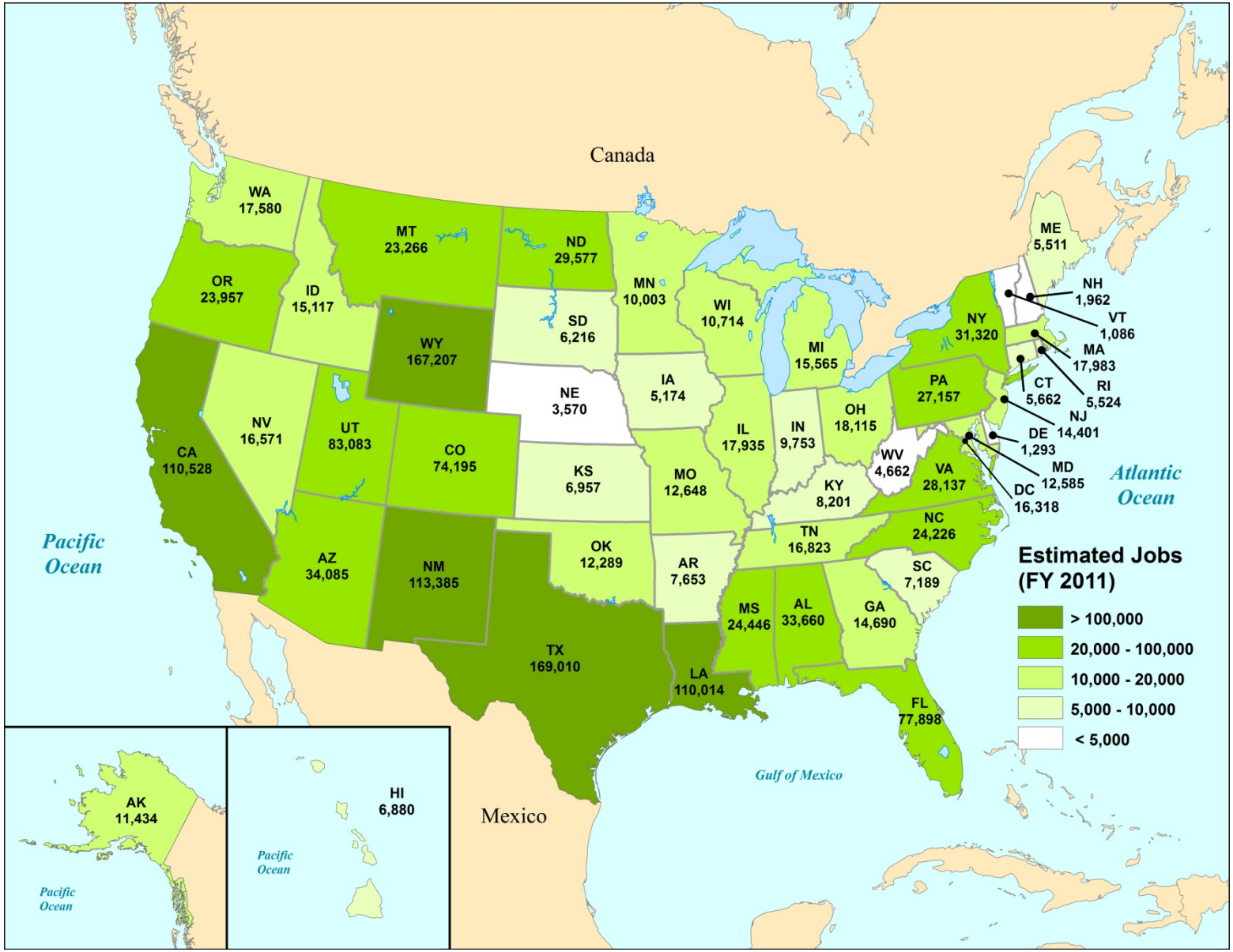


Figure 1-2. Estimated Jobs Supported by DOI Activities, by State



Chapter 2 BUREAU-LEVEL ECONOMIC CONTRIBUTIONS

In a nutshell

- Table 2 1 provides a bureau-level summary of economic contributions. More detailed information on economic contributions by each bureau follows the table.
- These sectors do not represent the entire suite of Interior's influence: bureaus affect other sectors through additional programs and activities, e.g., land acquisition, construction, road building, education, law enforcement, and conservation activities.

Each bureau within the Department adds to Interior's overall economic contributions. The Bureau of Land Management's multiple-use mission allows it to have an effect 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, the Bureau of Safety and Environmental 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 effect 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 preparation for natural hazards. Finally, The Bureau of Indian Affairs, the Bureau of Indian Education, 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 contribution of Interior's programs and activities on major economic sectors, which in this report include recreation, energy and minerals, timber, grazing, and water. These sectors do not represent the entire suite of Interior's influence: bureaus affect 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 effect on the economy. If all of Interior's activities were included in the analysis, the contributions may be considerably higher. Efforts will continue to be made to expand the scope of Interior activities presented in future economic reports.

Table 2-1 provides a bureau-level summary of economic contributions. More detailed information on economic contributions by each bureau follows the table. Additional assumptions and the methods for deriving these estimates can be found in Appendices 7 and 8.

Table 2-1. Summary Economic Contributions by Bureau

	Budgeted Amount (billions, $2011)	Total Economic Contribution (billions, $2011)	Total Domestic Jobs Supported (jobs)
Payroll			
National Park Service	1.49	2.41	16,984
Fish and Wildlife Service	0.71	1.14	8,050
Bureau of Land Management	0.73	1.19	8,351
Bureau of Reclamation	0.39	0.63	4,449
Bureau of Ocean Energy Management, Regulation & Enforcement	0.10	0.17	1,190
Indian Affairs	0.53	0.87	6,096
US Geological Survey	0.71	1.16	8,148
Office of Surface Mining	0.05	0.07	522
Other Interior Offices	0.41	0.66	4,680
Subtotal DOI Payroll (~81,000 employees in 2011)	5.13	8.30	58,471*

* In 2011, DOI's payroll supported about 81,000 employees (direct jobs), as well as 58,471 indirect and induced jobs throughout the Nation. For more information, please see Page 197.

Grants, Payments, and Tribal Support			
Grants and Payments to non-Federal Entities[1]	4.22	10.14	83,638
Support for Tribal Governments	0.48	1.17	9,504
Subtotal Grants, Payments and Tribal Support	4.70	11.30	93,143

[1] Grants & Payments to States, excluding payments via U.S. Treasury

Production Inputs			
	Inputs (DOI Activity)	**Outputs Resulting from DOI Activity**	
Bureau	**Sales Value (billions, $2011)**	**Total Economic Contribution (billions, $2011)**	**Total Domestic Jobs Supported (jobs)**
National Park Service Recreation[1]	12.13	31.08	258,416
Fish and Wildlife Service Recreation	1.59	4.22	34,529
Bureau of Indian Affairs Oil, gas and coal	3.31	9.63	96,080

	Inputs (DOI Activity)	Outputs Resulting from DOI Activity	
Bureau	**Sales Value (billions, $2011)**	**Total Economic Contribution (billions, $2011)**	**Total Domestic Jobs Supported (jobs)**
Irrigation water	0.39	0.95	8,791
Grazing	0.04	0.08	1,370
Timber	0.04	0.56	4,069
Other minerals	0.30	0.86	15,434
Bureau of Land Management			
Oil, gas and coal	32.34	119.57	558,976
Geothermal	0.16	0.61	3,029
Hardrock/Other Locatable Minerals	6.41	15.57	82,040
Other Minerals	2.02	4.79	25,453
Grazing	0.52	1.41	16,954
Timber	0.02	0.66	3,420
Recreation	3.38	7.04	58,942
Wind		0.10	688
Solar		1.37	6,747
Bureau of Reclamation			
Hydropower	1.08	1.59	4,981
Irrigation water	13.63	32.40	223,186
M&I water	2.30	5.35	32,296
Recreation	2.37	6.31	51,596
Bureau of Ocean Energy Management, Regulation & Enforcement	52.36	121.00	734,500
Subtotal Bureau Production Contributions	134.42	365.15	2,221,498
Total	144.24	384.72	2,372,927

[1] Source for NPS data: Stynes, Daniel J., 2011. "Economic Benefits to Local Communities from National Park Visitation and Payroll, 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 248 million surface acres and 700 million subsurface acres of mineral estate. 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 56 million acres of Indian trust lands. BLM's public lands make up about 16 percent of the total land surface of the United States and almost 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 contributions because BLM manages a significant amount of land subject to PILT. In FY 2011, current and permanent PILT payments totaled $375 million. PILT payments are used by states to fund education and other programs. In FY 2011, PILT payments supported an estimated 7,615 jobs and contributed to nearly $894 million in economic output.

BLM lands also provide 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 contributed about $151 billion in economic output to the national economy and supported over 756,000 American jobs.

Budget ($ billions)

2010 Actual	2011 Actual	2012 Enacted
1.17	1.15	1.13

Payroll (FY 2011)

Total Annual Payroll (billions, $2011)	Estimated Annual Contribution from Payroll (billions, $2011)	Estimated Additional Jobs Supported from Payroll (jobs)
0.73	1.19	8,351

Major Economic Contributions

	Visitors	Value (billions, $2011)	Estimated Economic Contribution (billions, $2011)	Estimated Number of Jobs Supported (jobs)
Recreation	57,783,168	3.38	7.04	58,942
Oil, Gas, & Coal		32.34	119.57	558,976
Hardrock/Other Locatable Minerals		6.41	15.57	82,040
Other Minerals		2.02	4.79	25,453
Timber		0.02	0.66	3,420
Grazing		0.52	1.41	16,954
Geothermal		0.16	0.61	3,029
Wind Energy			0.10	688
Solar Energy (site construction only)			1.37	6,747
Total	57,783,168	44.87	151.12	756,250

Grants and Payments

	2011 Enacted (billions, $2011)	Estimated 2011 Economic Contribution (billions, $2011)	Estimated 2011 Total Jobs Supported (jobs)
General Fund Payment to Counties and Native Corporations	0.08	0.18	1,524
Payments to States and Counties from Shared Receipts including SNPLMA Payments	0.01	0.03	287
Total Grants and Payments	0.09	0.21	1,811

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 "conserve the scenery and the natural and historic objects and the wild life therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations" (16 U.S.C. 1).

The National Park system comprises 397 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 provides an important contribution to the national economy, contributing $31.1 billion in recreation-related economic output and supporting over 258,000 American jobs.

Budget ($ billions)

2010 Actual	2011 Actual	2012 Enacted
2.76	2.61	2.58

Payroll

Total Annual Payroll	Estimated Annual Contribution from Payroll	Estimated Additional Jobs Supported from Payroll
(billions, $2011)	(billions, $2011)	(jobs)
1.49	2.41	16,984

Major Economic Contributions[1]

	Visitors	Value	Estimated Economic Contribution	Estimated Number of Jobs Supported
		(billions, $2010)	(billions, $2010)	(jobs)
Recreation[2]	281,303,769	12.13	31.08	258,416

[1] The estimates presented for NPS are from Stynes, Daniel J., "Economic Benefits to Local Communities from National Park Visitation and Payroll, 2010." 2010 was the most recent year available.
[2] Recreation includes visitation at NPS units in American Samoa, Guam, Puerto Rico, and U.S. Virgin Islands.

Grants and Payments

	2011 Enacted	Estimated 2011 Economic Contribution	Estimated 2011 Total Jobs Supported
	(billions, $2011)	(billions, $2011)	(jobs)
Heritage Partnership Program	0.02	0.04	333
Historic Preservation Fund[1]	0.05	0.14	994
LWCF State Grants w/ GOMESA	0.05	0.12	803
Other NPS Grants[2]	0.01	0.01	100
Total Grants and Payments	0.12	0.31	2,230

[1] The FY 2011 total for the Historic Preservation Fund was $54.4 million. This included $8.0 million for Indian Tribes, and $46.4 million for states and territories. This report did not estimate the contributions for the $3.1 that went to territories.
[2] Other NPS Grants include American Battlefield Sites Matching Grants, Japanese-American Confinement Site Grants, Native American Graves Protection Act Grants, Challenge Cost Share, and Chesapeake Bay Gateway Grants.

U.S. FISH AND WILDLIFE SERVICE

Bureau Role

The U.S. Fish and Wildlife Service is the government agency dedicated to the conservation, protection, and enhancement of fish, wildlife and plants, and their habitats. It is the only agency in the Federal Government whose primary responsibility is management of these important natural resources for the American public. The Service also helps ensure a healthy environment for people through its work benefiting wildlife, and by providing opportunities for Americans to enjoy the outdoors and our shared natural heritage.

The Service is responsible for implementing and enforcing some of our Nation's most important environmental laws, such as the Endangered Species Act, Migratory Bird Treaty Act, Marine Mammal Protection Act, North American Wetlands Conservation Act, and Lacey Act. The Service fulfills these and other statutory responsibilities through a diverse array of programs, activities, and offices that function to:

- Protect and recover threatened and endangered species
- Monitor and manage migratory birds
- Restore nationally significant fisheries
- Enforce federal wildlife laws and regulate international wildlife trade
- Conserve and restore wildlife habitat such as wetlands
- Help foreign governments conserve wildlife through international conservation efforts
- Distribute hundreds of millions of dollars to states, territories and tribes for fish and wildlife conservation projects

The Service also manages the 150 million acre National Wildlife Refuge System, the world's preeminent system of public lands devoted to protection and conservation of fish and wildlife and their habitats. The 555 units of the Refuge System receive over 40 million visitors each year who participate in hunting, fishing, wildlife observation and photography, environmental education and interpretation, and other outdoor recreation activities. Within the Fisheries program, the Service operates 70 National Fish Hatcheries, which in conjunction with Fish Health Centers and Fish Technology Centers restore native aquatic populations, mitigate for fisheries lost as a result of federal water projects, and support recreational fisheries throughout the United States.

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 were estimated to contribute over $4.2 billion in annual economic output and over 34,000 jobs from recreation-related spending.

Budget ($ billions)

2010 Actual	2011 Actual	2012 Enacted
1.65	1.51	1.48

Payroll

Total Annual Payroll (billions, $2011)	Estimated Annual Contribution from Payroll (billions, $2011)	Estimated Additional Jobs Supported from Payroll (jobs)
0.71	1.14	8,050

Major Economic Contributions

	Visitors	Value (billions, $2011)	Estimated Economic Contribution (billions, $2011)	Estimated Number of Jobs Supported (jobs)
Recreation	45,360,579	1.59	4.22	34,529

Grants and Payments

	2011 Enacted (billions, $2011)	Estimated 2011 Economic Contribution (billions, $2011)	Estimated 2011 Total Jobs Supported (jobs)
Boating Infrastructure Grants	0.01	0.03	258
Clean Vessel Act Grants	0.01	0.03	258
Coastal Wetlands Conservation	0.04	0.08	717
Cooperative Endangered Species Conservation Funds	0.07	0.17	1,415
Federal Aid in Wildlife Restoration, Payments to States	0.38	0.91	7,602
Multinational Species Conservation Fund	0.01	0.02	203

Grants and Payments

	2011 Enacted (billions, $2011)	Estimated 2011 Economic Contribution (billions, $2011)	Estimated 2011 Total Jobs Supported (jobs)
National Outreach Program	0.01	0.03	258
National Wildlife Refuge Fund (current and permanent)	0.02	0.04	322
North American Wetlands Conservation Fund	0.04	0.09	774
Sport Fish Restoration, Apportionment to States	0.36	0.86	7,159
State and Tribal Wildlife Grants	0.05	0.11	934
Coastal Impact Assistance Program	0.09	0.22	1,881
Other[1]	0.03	0.06	543
Total Grants and Payments	1.11	2.66	22,322

[1] Other Grants and Payments include: Fish and Wildlife Foundation, Fish Commission and Boating Council, Hunter Education and Safety Grant Program, Multi-State Conservation Grant Program, and Neotropical Migratory Bird Conservation.

BUREAU OF RECLAMATION

Bureau Role

The Bureau of Reclamation (Reclamation) has a 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 damage 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 U.S. Army 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.

Secretarial Order 3297, issued in February 2010, established the WaterSMART Program calling for coordination across agencies, to integrate energy and water policies, and to ensure the availability of sound science and information to support decisions on sustainable water supplies. The WaterSMART Program includes funding for cost-shared grants for water and energy management improvement projects, basin-wide efforts to evaluate current and future water supplies and demands, Title XVI Water Reclamation and Reuse projects, the establishment and expansion of collaborative watershed groups, and smaller-scale water conservation activities through the Water Conservation Field Services Program. Reclamation also supports the WaterSMART Clearinghouse website as a resource to provide leadership and assistance in coordinating with states, Indian Tribes, and local entities to integrate water conservation and sustainable water strategies.

Baseline Economic Information

Reclamation's management and recreation activities contribute $46 billion in economic output, and support about 312,000 jobs.[6]

[6] The jobs figure reported for the Bureau of Reclamation in the previous report (FY 2010) was erroneously reported as 415,978 jobs. This figure should have been 357,069 jobs. The source of the errors were in the employment

Budget ($ billions)

2010 Actual	2011 Actual	2012 Enacted
1.10	1.06	1.05

Payroll

Total Annual Payroll (billions, $2011)	Estimated Annual Contribution from Payroll (billions, $2011)	Estimated Additional Jobs Supported from Payroll (jobs)
0.39	0.63	4,449

Major Economic Contributions

	Visitors	Value (billions, $2011)	Estimated Economic Contribution (billions, $2011)	Estimated Number of Jobs Supported (jobs)
Recreation	50,090,170	2.37	6.31	51,596
Hydropower		1.08	1.59	4,981
Irrigation		13.63	32.40	223,186
M&I Water		2.30	5.35	32,296
Total	50,090,170	19.39	45.64	312,059

Grants and Payments

	2011 Enacted (billions, $2011)	Estimated 2011 Economic Contribution (billions, $2011)	Estimated 2011 Total Jobs Supported (jobs)
Boulder Canyon Project Payments to AZ, NV	0.001	0.001	12
Water Reclamation and Reuse Program	0.022	0.052	439
Water SMART Grants	0.033	0.078	667
Total Grants and Payments	0.055	0.131	1,119

estimates for M&I water, listed as 78,479 jobs, which should have been 32,296 jobs and in the employment estimates for hydropower which were listed as 19,581 and should have been 7,126.

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

Bureau Role

Indian Affairs (IA) bureaus and offices in the U.S. Department of the Interior are under the direction of the DOI Assistant Secretary-Indian Affairs. Their general mission is to uphold and strengthen the United States government's unique legal and political relationship with the Nation's Federally recognized American Indian and Alaska Native tribes. This relationship has been specified, throughout the history of the United States, by the Constitution of the United States, treaties, court decisions, and Federal statutes. Through this government-to-government relationship, Indian Affairs provides services to 566 Federally recognized tribes, either directly or through contracts, grants, or compacts.

IA's greatest challenge and most important goal is to address the severe economic problems that exist in Indian Country, where American Indians and Alaska Natives, among all measured demographic groups within the United States, continue to have the lowest living standards and the highest rates of poverty and unemployment. To address this situation and related socio-economic problems in Indian Country, IA provides critical services to Native American communities while also supporting a wide variety of programs that are committed to enhancing the economic growth of tribes and the financial success of Native American businesses.

BIA Tribal Management/Development Program: This program supports the Native American Fish and Wildlife Society, an organization of tribal biologists and conservation officers that provides needed conservation officer training, technical services to Tribes, and youth programs to introduce Indian youth to careers in the natural resource field.

The two bureaus under the Assistant Secretary-Indian Affairs are the Bureau of Indian Affairs (BIA) and the Bureau of Indian Education (BIE). The BIA's mission is to fulfill the Secretary's trust responsibilities and promote self-determination on behalf of Federally recognized Indian tribes. The BIE's mission is to provide quality education opportunities in American Indian communities. Through these missions, BIA and BIE contribute substantially to economic growth in tribal areas through advances in infrastructure, strategic planning, improved practices of governance, and the development of human capital. In addition, several other IA offices exist within the Office of the Assistant Secretary (AS-IA), though not within the BIA or BIE. These other offices include administrative offices, such as the Office of the Chief Financial Officer and the Office of Human Capital Management, and also include the program-based offices of: Federal Acknowledgement, Homeland Security and Emergency Management, Indian Energy and Economic Development (IEED), Indian Gaming, Regulatory Affairs and Collaborative Action, and Self-Governance. Within IEED five divisions support economic growth in Indian Country—the Divisions of: Energy and Mineral Development, Economic Development, Capital Investment, Workforce Development, and Energy Policy Development. Other program offices within the AS-IA, such as the Office of Indian Gaming and Office of Self-Governance, play important roles as well in promoting the economic development of tribes.

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 566 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.

Indian Affairs is working with more than 59 tribes on almost 69 projects involving both renewable and conventional energy production. Highlights include 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),a hydro-electric project at Flathead (MT), a wind project at Campo (CA), a solar project at Hualapai (AZ), and a utility sized geothermal energy project at Pyramid Lake (NV). Cumulatively, these seven projects have the potential to generate more than 440Mw of clean electricity and create approximately 450 construction jobs and approximately 175 full time jobs when the projects are completed.

Economic contributions are measured for the following programs energy, minerals, forestry, and irrigation, as well as employment and training programs, regional economic development incubators, loan guarantees to native-owned businesses, and trust land resource management.

Baseline Economic Information

Indian Affairs empowers Native Americans by providing resources to tribes across the country. IA's efforts contribute over $12 billion in economic activity and support nearly 126,000 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 contributions. Other activities include construction (schools, roads, and other facilities), 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 2011, the Department guaranteed $78 million in loans that were issued by banks for a variety of economic development activities. These are loans that the private sector otherwise would not have 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 $214 million in economic activity and support about 1,400 jobs.

A large part of the mineral production supported by Indian Affairs comes from construction aggregate, including crushed rock, as well as sand and gravel, with BIA issuing business permits for sand and gravel production. 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 ($ billions)

2010 Actual	2011 Actual	2012 Enacted
2.61	2.59	2.53

Payroll

Total Annual Payroll (billions, $2011)	Estimated Annual Contribution from Payroll (billions, $2011)	Estimated Additional Jobs Supported from Payroll (jobs)
0.53	0.87	6,096

Major Economic Contributions

	Value (billions, $2011)	Estimated Economic Contribution (billions, $2011)	Estimated Number of Jobs Supported (jobs)
Oil, Gas, and Coal	3.31	9.63	96,080
Other minerals (e.g., construction aggregate)	0.30	0.86	15,434
Irrigation	0.39	0.95	8,791
Timber	0.04	0.56	4,069
Grazing	0.04	0.08	1,370
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	4.09	12.08	125,744

Support for Tribal Governments

	2011 Enacted (billions, $2011)	Estimated 2011 Economic Contribution (billions, $2011)	Estimated 2011 Total Jobs Supported (jobs)
Loan guarantees	0.08	0.21	1,376
Self-governance Compacts	0.15	0.35	3,024
Contract Support	0.22	0.52	4,457
Aid to Tribal Governments	0.03	0.08	647
Total	0.48	1.17	9,504

BUREAU OF OCEAN ENERGY MANAGEMENT, REGULATION AND ENFORCEMENT

In response to the Deepwater Horizon explosion and resulting oil spill in the Gulf of Mexico, the Obama administration implemented the most aggressive and comprehensive reforms to offshore oil and gas regulation and oversight in U.S. history. These reforms included a reorganization of the former Minerals Management Service (MMS) into two new agencies and one new office: the Bureau of Ocean Energy Management (BOEM), the Bureau of Safety and Environmental Enforcement (BSEE), and the Office of Natural Resources Revenue (ONRR). ONRR is dedicated to the function of revenue collection, and reports to the Assistant Secretary for Policy, Management, and Budget, keeping this function insulated from the safety and resource management functions. The reorganization process was completed on October 1, 2011 with the establishment of BOEM and BSEE. For an interim period during the re-organization, the Bureau of Ocean Energy Management, Regulation and Enforcement (BOEMRE) handled the functions for which BOEM and BSEE are now responsible. As these organizations together composed BOEMRE during fiscal year 2011, we provide a brief description of their separate missions below, and report their economic contributions and budget together.

BUREAU OF OCEAN ENERGY MANAGEMENT

The BOEM seeks to balance economic development, energy independence, and environmental projection through OCS oil and gas leasing, renewable energy development, and environmental reviews and studies. The bureau is responsible for developing the Five-Year OCS Oil and Natural Gas Leasing Program, leasing OCS oil and gas blocks, and OCS plan approval for exploration and development operations. The BOEM is also responsible for renewable energy leasing and permitting of offshore wind, current, and hydrokenetic energy projects.

BUREAU OF SAFETY AND ENVIRONMENTAL ENFORCEMENT

The BSEE protects the environment, and promotes safety and conservation of offshore resources through its regulatory oversight and enforcement of OCS oil and gas drilling, production and inspection operations. The BSEE is also responsible for oil spill response, including standards for offshore operators' spill response plans and conducting oil spill drills and equipment inspections, as well as technical research and decommissioning. To secure proper training and up to date knowledge for its offshore inspectors, the BSEE operates the National Offshore Training and Learning Center.

Baseline Economic Information

Together the BOEM and the BSEE manage access and development of OCS mineral resources to help meet the nation's energy needs while balancing the protection of the human, marine, and coastal environments. Currently (as of March 2012), the two agencies administer 6,607 active mineral leases on 36 million OCS acres, and oversee production from nearly 3,200 OCS facilities. The Federal OCS contributes about 10 percent of the natural gas and 30 percent of the crude oil produced domestically. Production from OCS leases generates billions of dollars in revenue for the Federal Treasury and state governments. Energy and minerals production from offshore areas in 2011 was estimated to contribute around $121 billion in economic output and supported about 734,500 American jobs.

Budget ($ billions)*

2010 Actual	2011 Actual	2012 Enacted
0.19	0.22	0.14

*Combined BOEM and BSEE budget totals.

Payroll

Total Annual Payroll (billions, $2011)	Estimated Annual Contribution from Payroll (billions, $2011)	Estimated Additional Jobs Supported from Payroll (jobs)
0.10	0.17	1,190

Major Economic Contributions

	Value* (billions, $2011)	Estimated Economic Contribution (billions, $2011)	Estimated Number of Jobs Supported (jobs)
OCS Oil and Gas	52.36	121.00	734,500

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

These budget figures are for general fund appropriates for BOEMRE (formerly MMS, currently BOEM and BSEE) and exclude appropriated offsetting collections from rental revenues, cost recovery fees and inspection fees.

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 ($ billions)

2010 Actual	2011 Actual	2012 Enacted
0.16	0.16	0.15

Payroll

Total Annual Payroll	Estimated Annual Contribution from Payroll	Estimated Additional Jobs Supported from Payroll
(billions, $2011)	(billions, $2011)	(jobs)
0.05	0.07	522

Grants and Payments

	2011 Enacted	Estimated 2011 Economic Contribution	Estimated 2011 Total Jobs Supported
	(billions, $2011)	(billions, $2011)	(jobs)
Abandoned Mine Reclamation State Grants	0.40	0.98	6,408
State and Tribal Regulatory Grants	0.07	0.16	1,395
Total OSM Grants and Payments	0.46	1.15	7,803

U.S. 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 decisions as well as mitigation and adaptation to climate change and preparation for 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 scenes increased from 1.14 million in FY 2009 to 2.45 million in FY 2010 to 2.92 million in FY 2011, 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 are organized within six mission areas: climate and land use change, core science systems, ecosystems, energy, minerals, and environmental health, natural hazards, and water.

USGS has a rich culture of mentoring, engaging, employing, and educating youth in the geosciences. Efforts include hiring interns through the National Association of Geoscience Teachers (NAGT) summer cooperative and through the USGS Youth Program using local partnerships between science centers and schools, recruitment at schools in urban areas, and career development programs with colleges and universities. The Native American Relations program provided 24 students an opportunity to participate in USGS research directly related to tribal lands.

Climate and Land Use Change: The USGS undertakes scientific research, monitoring, remote sensing, modeling, synthesis, and forecasting to address the effects of climate and land use change on the Nation's resources. The resulting research and products are provided as the scientific foundation upon which policymakers, natural resource managers, and the public make informed decisions about the management of natural resources on which they and others depend.

Core Science Systems: Data about Earth and its resources are only useful if available in a format that is understandable and accessible. The USGS provides the Nation with ready access to natural science information that supports smart decisions about how to prepare for and respond to natural risks and manage natural resources.

Ecosystems: Ecosystems are integrated systems of organisms interacting with their physical environments, constituting the Earth's biosphere and supporting human existence. Resilient functioning ecosystems support food webs, build soil, enhance crop pollination, purify water, cycle nutrients, detoxify waste, and regulate the atmosphere. The USGS conducts research and monitoring to develop and convey a fundamental understanding of ecosystem function and distributions, physical and biological components

and trophic dynamics for freshwater, terrestrial, and marine ecosystems and the human and fish and wildlife communities they support.

Energy and Minerals, and Environmental Health: The Energy and Minerals, and Environmental Health Activity conducts research and assessments on the location, quantity, and quality of mineral and energy resources, including the economic and environmental effects of resource extraction and use; and conducts research on the environmental impacts of human activities that introduce chemical and pathogenic contaminants into the environment and threaten human, animal (fish and wildlife), and ecological health.

Natural Hazards: Every year in the United States, natural hazards cost lives and billions of dollars in damage. The USGS provides policymakers and the public with a clear understanding of natural hazards and their potential threats to society, and assists with developing smart, cost-effective strategies for achieving preparedness and resilience.

Water: Society depends on fresh and reliable water supplies, as do diverse and fragile ecosystems. To understand the Nation's water resources, the USGS collects hydrologic and water-quality information and provides access to water data, publications, and maps, as well as to recent water projects and events.

Economics as a part of the USGS research portfolio

The USGS is examining ways that economics can be incorporated more effectively into its research portfolio. A workshop was held in June 2011 at the USGS National Center to examine the role of economics at the USGS and to evaluate future directions. Over 70 economists, other scientists, and managers participated in the workshop from all USGS mission areas and from across the Department of the Interior. Participants also included economists and other scientists from other federal agencies, NGOs, and universities.

Secretary Salazar welcomed participants to the workshop in a letter outlining the importance of economics to USGS research and to Interior's efforts to make informed resource management decisions. The discussion made clear the importance of partnerships to USGS economics. Economics adds value to USGS science by serving as a bridge between research and resource management decisions. It translates scientific results that are commonly expressed in biophysical terms into monetary or other valuation metrics that can be used to compare alternative scenarios that cut across market and non-market settings.

USGS Economic Studies

USGS economics can be grouped into four fundamental categories:

1. Valuation studies in which natural resources including ecosystem services are examined so that their value to the Nation can be considered in resource management decisions even if they do not have values determined by traditional markets.
2. Value of scientific information studies that provide insight into how USGS scientific information is used to inform decisions. These studies can help prioritize the use of scarce funding resources in research investments.

3. Benefit-cost analyses that incorporate USGS science to examine the consequences of alternative scenarios and provide resource managers with information on potential tradeoffs.
4. Natural resource (mineral, energy, and other ecosystem services) evaluations examining extraction costs, spatial flows, and consumption patterns.

The studies described in these four categories require the use of scientific information in economic analyses. USGS economics is not envisioned to be a stand-alone activity that is conducted separately from other USGS research. It is seen as an integral part of USGS science in which economics builds on and is integrated with traditional USGS biophysical science. USGS economic studies also rely on partnerships, to provide connections between USGS science and external stakeholders (including Interior resource managers) and to provide access to specialized skills and capacity.

Baseline Economic Information

Budget ($ billions)

2010 Actual	2011 Actual	2012 Enacted
1.11	1.08	1.07

Payroll

Total Annual Payroll (billions, $2011)	Estimated Annual Contribution from Payroll (billions, $2011)	Estimated Additional Jobs Supported from Payroll (jobs)
0.71	1.16	8,148

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 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 government 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, improve quality and quantity of economic data and increase Federal responsiveness to the unique needs of island communities.

The standards of living in the insular areas are generally lower than in the United States as a whole; U.S. per capita GDP in 2009 was about $46,500, double the $23,515 average for the four U.S. territories. In one territory, per capita GDP is just over 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 and jobs for the communities concerned.

Accurate and current socioeconomic data are a critical component of informed decision making. To help the territories upgrade their economic data systems, the OIA established a technical assistance agreement with the Bureau of Economic Analysis (BEA) in 2009 to calculate GDP of the territories in the manner it does so for the United States, the 50 states and the District of Columbia (DC). The first set of GDP data for the territories which covered 2002-2007 was released by the BEA in May 2010 and estimates for 2008 and 2009 were released in the summer of 2011. (Estimates for 2010 will be available this summer; the 2002-2009 GDP data for the four territories are posted on the BEA's web site.) The four territories are also included in the County Business Patterns and the Economic Census which the Bureau of the Census carries out. Despite significant progress in improving the quality and quantity of data on the territories in the last few years, much remains to be done. The territories are not included in the Census Bureau's American Community Survey and the Bureau of Labor Statistics' employment and labor force data. Under present arrangements, there is no current information on population, demography and some aspects of income on the territories between the decennial censuses. 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.

In an effort to obtain information on the economic contribution of the OIA's grants and programs in the insular areas, the OIA contracted with Research Triangle Institute (RTI) International in October 2011 to update its 2010 findings. The RTI report[7] presents estimates of the impact of grants and payments on employment, employee compensation, and 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

[7] *Economic Impacts Attributable to FY 2011 Federal Grants and Payments to Seven Insular Areas*, Final Report, RTI International, December 2011. This report is available on-line at www.doi.gov/oia/reports/PDF/OIA_Econ_Impact_2011%28RTI_Dec2011%29.pdf

current 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.

OIA provided $429 million in grants and payments directly to the insular areas during FY 2011. This assistance played an important role in the economies of each of these areas by providing financial and technical assistance to promote economic growth, education, public health, and the development of more efficient and effective government. An additional $22.3 million was spent outside the Insular Areas.

Baseline Economic Information

Budget ($ billions)

2010 Actual	2011 Actual	2012 Enacted
0.10	0.10	0.10

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 contributions associated with these employees were estimated assuming that OIA's contributions represent a similar share of the total contributions of the Other Interior Offices.

Payroll

Total Annual Payroll (billions, $2011)	Estimated Annual Contribution from Payroll (billions, $2011)	Estimated Additional Jobs Supported from Payroll (jobs)
0.004	0.01	48

Grants and Payments

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 $3.00 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 55% of total GDP in Micronesia is either directly or indirectly supported by OIA payments.

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

GDP Contribution for FY2011 OIA Payments, by Insular Area

	Direct GDP Contribution (billions, $2010)	Indirect/Induced GDP Contribution (billions, $2010)	Total GDP Contribution (billions, $2010)	National GDP Supported by OIA Payments (%)
American Samoa	0.04	0.04	0.08	11%
Guam	0.10	0.22	0.33	7%
Northern Mariana Islands	0.01	0.03	0.04	5%
U.S. Virgin Islands	0.24	0.62	0.86	20%
Micronesia	0.05	0.09	0.15	55%
Marshall Islands	0.03	0.04	0.06	41%
Palau	0.01	0.02	0.02	14%
Total	0.48	1.05	1.53	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, December 2011.

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 1.98 in American Samoa to 3.68 in the Northern Mariana Islands.

Employment Contribution for FY2011 OIA Payments, by Insular Area

	Direct Employment Contribution (jobs)	Indirect/Induced Employment Contribution (jobs)	Total Employment Contribution (jobs)	National Employment Supported by OIA Payments **(%)**
American Samoa	885	867	1,752	11%
Guam	1,550	3,368	4,918	7%
Northern Mariana Islands	372	997	1,369	5%
U.S. Virgin Islands	2,551	6,492	9,043	20%
Micronesia	3,050	5,433	8,483	55%
Marshall Islands	1,872	2,343	4,215	41%
Palau	523	1,061	1,584	14%
Total	10,803	20,561	31,364	16%

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, December 2011.

In the cases of the Marshall Islands and Micronesia, a significant portion of national employment is directly and indirectly supported by OIA payments. Approximately 55% 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 $2.87 of employee compensation was supported elsewhere in the insular economy, on average. Base employee compensation multiplier estimates ranged from 2.07 in the Marshall Islands to 4.13 in the Northern Mariana Islands.

Employee Compensation Contribution for FY2011 OIA Payments by Insular Area

	Direct Employee Compensation Contribution (billions, $2010)	**Indirect/Induced Employee Compensation Contribution** (billions, $2010)	**Total Employee Compensation Contribution** (billions, $2010)	**National Employee Compensation Supported by OIA Payments (%)**
American Samoa	0.011	0.012	0.023	13%
Guam	0.036	0.092	0.128	8%
Northern Mariana Islands	0.004	0.013	0.017	5%
U.S. Virgin Islands	0.081	0.182	0.263	18%
Micronesia	0.016	0.031	0.047	72%
Marshall Islands	0.021	0.023	0.044	44%
Palau	0.007	0.013	0.020	20%
Total	0.176	0.365	0.542	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, December 2011.

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 72% of total estimated recorded employee compensation in the Federated States of Micronesia is either directly or indirectly supported by OIA payments.

OFFICE OF NATURAL RESOURCES REVENUE

Office Role

The Office of Natural Resources Revenue (ONRR) was established within the Office of the Secretary under the Assistant Secretary for Policy, Management and Budget on October 1, 2010 pursuant to Secretarial Order No. 3306 as part of the reorganization of the former Minerals Management Service (MMS). ONRR performs functions formerly performed by the Bureau of Ocean Energy Management, Regulation, and Enforcement (BOEMRE). ONRR collects, accounts for, analyzes, audits, and disburse revenues from energy and mineral leases and other monies owed for the utilization of public resources on Outer Continental Shelf (OCS) and onshore Federal and American Indian lands. ONRR serves as a trustee of the royalty asset from Indian trust properties and as an advocate for the interests of Indian mineral owners, ensuring fulfillment of our Indian trust responsibility. The material below provides information on the major grant and payment programs administered by ONRR.

- Under the Mineral Leasing Act states receive 50 percent of the revenues resulting from the leasing of mineral resources on Federal public domain lands within their borders. Alaska is the exception, receiving a 90 percent share of receipts from Federal mineral leasing in that state (exclusive of the National Petroleum Reserve-Alaska).
- The Federal Oil and Gas Royalty Management Act of 1982 (FOGRMA), as amended, Sections 202 and 205, authorized the Secretary to develop cooperative and delegated agreements with states and tribes to carry out certain inspection, auditing, investigation, or enforcement activities for leases in their jurisdiction. Currently, ONRR has agreements with 10 states and 6 tribes.
- The Energy Policy Act of 2005 created the Coastal Impact Assistance Program (CIAP), which authorized the Secretary of the Interior to allocate $250 million annually to this program for FY 2007 through 2010. These funds are shared among six states (Alabama, Alaska, California, Louisiana, Mississippi, and Texas) and 67 eligible Coastal Political Subdivisions (CPSs) within those states, based upon allocation formulas prescribed in the Act. Funds are awarded from the CIAP account to the states and CPSs as grants for approved coastal impact assistance projects. Distributions into the CIAP account ended in FY 2010; however, program activities such as grant awards and monitoring will continue for several years.

Grants and Payments

	2011 Enacted (billions, $2011)	Estimated 2011 Economic Contribution (billions, $2011)	Estimated 2011 Total Jobs Supported (jobs)
Cooperative and Delegated Audits of Oil and Gas Operations	0.01	0.03	242
Mineral Revenue Payments (includes 8(g) payments to states)	1.99	4.75	40,497
Total Grants and Payments	2.01	4.78	40,739

Chapter 3 INVESTING IN CONSERVATION

INTRODUCTION

Investments toward the conservation of landscapes provide benefits to society in the form of species and habitat protection, maintenance of working landscapes, the provision of ecosystem services (such as clean water, timber, fisheries habitat, and carbon sequestration), and activities, such as tourism, outdoor recreation, and cultural observances. Economics can help measure the value of these benefits to humans, and prioritize investments in conservation to utilize constrained budgets to obtain the greatest value for society. This chapter discusses several economic issues related to land conservation including measuring the value of conservation, evaluating conservation investments, targeting investments, the relationship between land values and conservation, and options for land acquisition.

In a nutshell

- Conservation investments provide value to society in terms of species and habitat protection, maintenance of working landscapes, the provision of ecosystem services, and human use benefits.
- Economic techniques allow the benefits and costs of conservation investments to be represented in monetary terms, enabling comparison across locations or projects in a common metric.
- Such calculations can provide valuable information to evaluate, target and prioritize land acquisition decisions or other conservation activities.

CONSERVATION INVESTMENTS AT DOI

Governments and private organizations around the world invest in conservation efforts through the establishment of biological reserves and other protected lands. The Department of the Interior (DOI or Interior) supports conservation efforts through public land and water resources administered by the Fish and Wildlife Service (FWS), the National Park Service (NPS), the Bureau of Land Management (BLM), and the Bureau of Reclamation (Reclamation). These areas provide opportunities for recreation visitors and support conservation of natural resources and wildlife habitat.

The FWS administers Federal biological reserves in the United States, including the National Wildlife Refuge (NWR) system and Waterfowl Production Areas (WPA). These areas are intended to conserve fish, wildlife, and plant resources as well as their habitats; and are home to more than 700 species of birds, 220 species of mammals, 250 reptile and amphibian species and more than 200 species of fish. Many of these areas also support habitat for threatened and endangered (T&E) species, with 59 NWRs established with the primary purpose of conserving T&E species. Human uses are also

Mission of the National Wildlife Refuge System: *To administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans. The Refuge System is estimated to have received 45.4 million visits in 2011.*

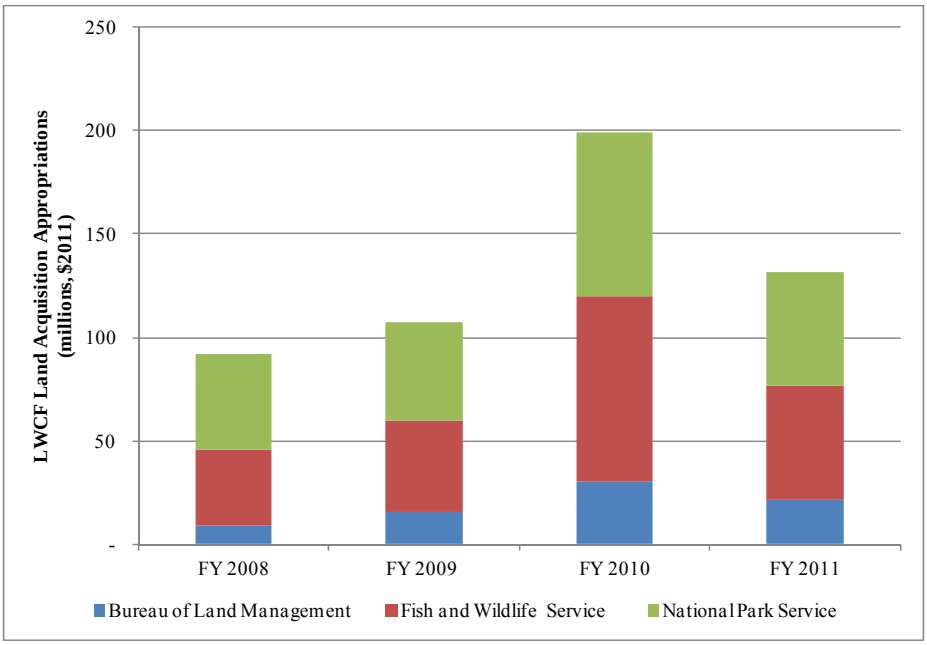
important to these areas, including hunting, fishing, wildlife observation, photography, environmental education, and interpretation. An estimated 45.4 million recreationists visited NWRs in 2011.

The BLM supports conservation efforts through its National Landscape Conservation System (NLCS), which designates certain areas of BLM lands to be specially managed to enhance conservation. The mission of the NLCS is to "conserve, protect, and restore nationally significant landscapes recognized for their outstanding cultural, ecological, and scientific values."

The NPS also supports conservation efforts with lands "which purpose is to conserve the scenery and the natural and historic objects and the wild life therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations."

One of the primary ways Federal land management agencies can expand conservation efforts is through additional land acquisition. The Land and Water Conservation Fund (LWCF) is the principal source of funding for federal public land acquisition. The LWCF Act of 1965 was established to help provide additional public lands that are accessible for outdoor recreation (Vincent 2010). Figure 3-1 shows Interior LWCF appropriations for land acquisition from FY2008 through FY2011 (all values have been converted to 2011 US$, totals do not include Forest Service funding or LWCF funds not used for land acquisition).

Figure 3-1. Interior LWCF Appropriations for Federal Land Acquisitions, FY 2008 - FY 2011



The Migratory Bird Conservation Fund (MBCF) provides funding for FWS land acquisition programs to purchase waterfowl habitat in major migratory bird conservation areas and WPAs. One of the major sources of funding for the MBCF is the sale of Federal Duck Stamps, which are required to hunt migratory waterfowl and can be used for admission to NWRs. In FY 2010, $27,085,599 of MBCF funding was disbursed for the acquisition of land and interests in land totaling 15,083 acres at major migratory bird conservation areas, and $23,857,203 for land and interests in land totaling 28,039 acres at WPAs.

DOI bureaus also provide funding for conservation efforts through a number of grant programs directed to states, territories, local governments, and individuals. For example, the FWS supports conservation though Coastal Wetlands Conservation grants, Cooperative Endangered Species Funds, the Multi-State Conservation Grant Program, and a number of other conservation grant programs. The NPS also provides grant funding for several natural and historical conservation programs.

The Department of the Interior and the U.S. Department of Agriculture have developed a land acquisition program that supports strategic interagency landscape-scale conservation projects while continuing to meet agency-specific programmatic needs. Under the Collaborative Landscape Planning (CLP) effort, Interior bureaus collaborate with the U.S. Forest Service to coordinate land acquisition planning with government and local community partners to achieve the highest priority shared conservation goals more effectively. The CLP process is designed to: use the LWCF to incentivize collaborative planning for measurable outcomes at the landscape scale; invest LWCF resources in some of the most ecologically important landscapes; and invest in projects that can reach shared goals grounded in science-based planning, are driven by and responsive to local community initiatives, and will make the most efficient use of federal funds.

DOI has made funding available for adaptive management efforts including Landscape Conservation Cooperatives (LCCs). Established in 2010 by Secretarial Order 3289, LCCs are a network of public-private partnerships that provide shared science to ensure the sustainability of America's land, water, wildlife and cultural resources. The 22 LCCs collectively formed a national network of land, water, wildlife, and cultural resource managers, scientists, and interested public and private organizations—within the U.S. and across international borders—to share a common need for scientific information and interest in conservation. FWS provides staff support for the majority of the LCCs, along with Reclamation, BLM, NPS, USGS, and the U.S. Forest Service (USFS). Other federal agency involvement includes the U.S. Environmental Protection Agency (EPA), Department of Defense, Natural Resources Conservation Service, and the National Oceanic and Atmospheric Administration (NOAA). The LCC Steering Committee is the principle leadership body for the LCCs, which are led or co-led by a wide variety of organizations, including state fish and wildlife or natural resources agencies, federal agencies, and Canadian provinces. States or territories are involved in all 22 LCCs.

Other DOI investments that support conservation efforts include science research, fish hatcheries, and conservation management activities. One recent effort is on-going climate research led by USGS which addresses carbon sequestration and other aspects of climate science. DOI conservation efforts also include activities involving ocean issues and invasive species. For example, Interior played an important role in the development of the recently released National Ocean Policy Implementation Plan, as a key member of the National Oceans Council.[9] The National Invasive Species Council (NISC) works to

[9] The draft implementation plan is available on-line at: http://www.whitehouse.gov/sites/default/files/microsites/ceq/national_ocean_policy_draft_implementation_plan_01-12-12.pdf.

ensure that that Federal programs and activities to prevent and control invasive species are coordinated, effective and efficient.[10]

ECONOMIC VALUE OF CONSERVATION

The benefits provided by conservation are often measured in terms of the values they have to humans. Although these benefits are often difficult to quantify, techniques exist to estimate their value in monetary terms. Benefits obtained from conservation include stocks of natural capital (materials that exist at one point in time) and flows (services that are provided from the natural capital stock over time). Stocks of natural capital include resources such as minerals that can be depleted permanently and trees that are replenished slowly over time. Natural capital also produces a flow of benefits over time including water, air and climate regulation; nutrient cycling; cultural uses; and recreation opportunities. The human use of natural capital can affect stocks and flows of benefits provided over time.

Conservation investments can also contribute to local economies by providing employment opportunities and additional economic output (though these measures are not metrics for economic value). These metrics can be very important to communities, particularly in a difficult economic climate. While economic contribution analysis can provide useful information on the distributional, employment and output impacts of a policy or program, investment decisions are typically made based on net economic benefits, i.e., estimates of *net returns* to capital invested, which contribution analysis ignores. Net economic value analyses can take the form of benefit-cost analysis, which measures both benefits and costs in monetary terms, or cost effectiveness analysis, which expresses costs in monetary terms and conservation benefits in biological or physical units. It should be noted that benefits from conservation investments can include not only environmental benefits, but also human use benefits including recreation and cultural benefits.

Conservation lands managed and acquired by DOI serve many important biological and ecological functions such as the production of plant and animal species, provision of clean water, carbon storage, and scenic amenities. Many studies have estimated values for ecosystem services at specific locations (see Box 3-1 for an example of grassland conservation in the Prairie Pothole region). Many factors can affect biological and ecological functions such as climate change, pollution, and changing land uses. These factors in turn can affect the conservation values and the net economic value of conserved lands. Additional research into the value of ecosystem services provided by conservation lands could provide much needed information to policymakers when considering future public land acquisitions.

The natural amenities supplied by conservation lands and open space also provide benefits to nearby landowners and residents. Previous studies have shown that natural amenities can lead to increased migration to surrounding localities (McGranahan 1999, McGranahan 2008, Deller et al., 2001). Natural areas have also been shown to increase the property values of surrounding home owners. For example, a recent study showed a significant impact on the value of homes located near National Wildlife Refuges in certain areas of the country (Box 3-5 for additional details).

[10] See Chapter 4 in the FY 2010 DOI Economic Contributions report for more information on the economics of invasive species that affect Interior resources.

Box 3-1. Economic Value of Grassland Conservation in the Prairie Pothole Region

The prairie pothole region (PPR), located in the north central United States and south central Canada, is a grassland ecosystem interspersed with wetlands that were created by receding glaciers during the last ice age. This unique ecosystem supports abundant wildlife, including a significant population of waterfowl, garnering it the nickname the "Duck Factory." However, agricultural uses in the area have led to wetland drainage throughout the region over the years. Conservation efforts have been undertaken by government and private interests in recent years in an attempt to maintain habitat for waterfowl production.

USGS researchers and collaborators recently developed estimates for the value of ecosystem services provided by the PPR in North and South Dakota (Gascoigne et al., 2011). The study used benefit transfer techniques to estimate values for three ecosystem services (carbon sequestration, reduced sedimentation, and waterfowl production), and compared these values across different scenarios of future land use change. Land use changes considered include different levels of native prairie conversion and enrollment in the Conservation Reserve Program (CRP) and Wetland Reserve Program (WRP), which provide financial assistance to farmers that voluntarily enroll to provide resource-conserving cover on cropland or maintain wetlands on their property.

The analysis considered four scenarios that simulate different levels of conservation, from aggressive conservation of native prairie to extensive conversion to cropland. The results showed that an aggressive conservation program with protection of native prairie and increased mitigation investment would lead to over $1 billion in net societal benefits over a 20 year period. Carbon sequestration would make up the largest part of this benefit, followed by waterfowl production. Other scenarios indicate that native prairie conversion to cropland would result in a net cost of around $3.4 billion over the 20 year period. These results show the net value that grassland conservation can provide to society from just a select set of ecosystem services. In addition, the analysis provides an example of how economic methods can be used to help decision makers compare different policy alternatives with respect to the net benefits they provide to society.

Northern Pintail Drake in the Prairie Pothole Region of South Dakota (USGS)

Conservation efforts also protect natural assets that support human uses of natural resources. Recreation use is significant at many conservation areas managed by DOI. In 2011, more than 434 million people visited DOI lands. Recreationists receive benefits from these activities beyond their expenditures to participate in the activity. However, recreation and other environmental amenities are not traded in markets, so the tools used to measure the value are referred to as non-market valuation methods. These methods use data from related markets (revealed preference methods) or information from surveys of the public (stated preference methods) to estimate values for environmental goods and services. Some revealed preference methods include travel cost models, hedonic pricing methods, and averting expenditures. Stated preference methods include contingent valuation and conjoint analysis. Benefit transfer techniques are also often used to apply estimates from previous studies to new situations when additional primary research is not feasible.

Methods used to value environmental goods and services

- *Travel cost:* Uses costs of travel and time to estimate values for environmental goods and services.
- *Hedonic pricing*: Imputes values by decomposing market prices into components encompassing environmental and other characteristics (often used for property values or wages).
- *Averting behavior*: Estimates the value of environmental attributes by analyzing expenditures to change behavior to avoid decreased environmental quality.
- *Contingent valuation*: Survey-based method that asks individuals how much they would be willing to pay for environmental goods based on hypothetical scenarios.
- *Conjoint analysis*: Survey-based method that asks individuals to make trade-offs between different alternatives, and uses these responses to value different attributes.
- *Benefit transfer*: Applies an existing value estimate to a new application that is different from the original one (either as a point estimate or a function).

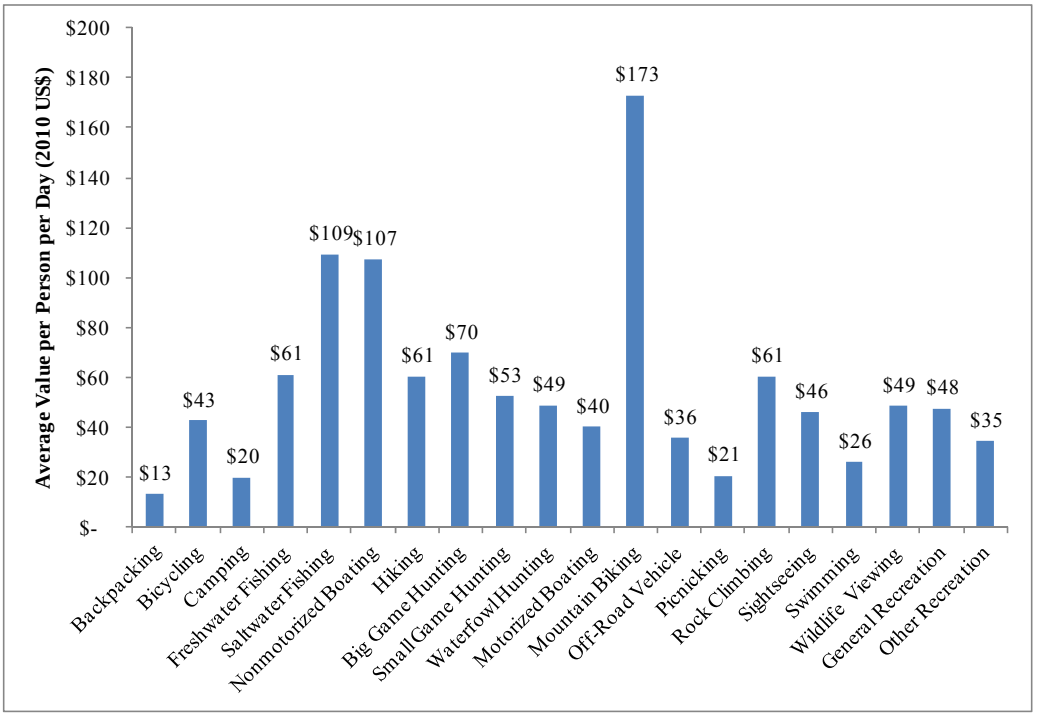
Several reviews of the recreation economic valuation literature have been completed over the years including an on-going effort at Oregon State University. In addition, a new NPS study is currently being finalized that estimates the net economic value of visitation to National Parks (see Box 3-2 for additional details). Figure 3-2 shows mean estimated "use" values for a variety of different recreation activities for studies completed in the United States and Canada between 1958 and 2006 (all values have been converted to 2010 US$). These values range from $13 per person per day for backpacking to $173 per person per day for mountain biking. These values differ from expenditures on recreation activities in that they represent values to individuals over and above expenditures. Many studies have also been conducted to estimate these values for specific recreation sites and recreation uses using a variety of economic analysis techniques (see Box 3-3 for an example related to coral reef recreation).

Box 3-2. Economic Value of National Park Service Visitation

The National Park Service (NPS), together with researchers from the University of Montana, is currently finalizing a study that estimates the economic value of NPS visitation. The net economic value (NEV) of visitation is the monetary value of visitation that exceeds the costs that individuals incur to visit national parks, national monuments, national historic sites, and other units of the National Park system. This study uses data from NPS units where visitor surveys have been conducted to estimate site-specific NEV per visitor trip, and then extends these estimates through meta-analysis to most units of the System (359 of the 397 units currently in the System). These per trip values are then applied to annual visitation data to estimate the total NEV for each unit included in the analysis. A peer-reviewed report with detailed descriptions of the data, methods, and results is expected to be released in 2012.

Denali National Park (NPS)

Figure 3-2. Average Net Economic Value for Outdoor Recreation Uses (2010 $)



Source: Oregon State University, Recreation Use Values Database (http://recvaluation.forestry.oregonstate.edu)

Box 3-3. Coral Reef Conservation

Coral Reef at Palmyra Atoll National Wildlife Refuge (USFWS)

Some conservation efforts at DOI help to protect coral reefs in the Pacific, the Caribbean, and off the coast of Florida. In addition to the Department's role as the co-chair of the U.S. coral reef task force, which leads U.S. government efforts to preserve and protect coral reef ecosystems, several other bureaus are also involved in coral reef conservation activities. Among other activities, the U.S. Fish and Wildlife Service manages 16 National Wildlife Refuges that help to conserve coral reef ecosystems in the Pacific, Caribbean, and in the Florida Keys (USCRTF 2009). The Environmental Studies Program at the Bureau of Ocean Energy Management (formerly the Minerals Management Service) has conducted monitoring and research on coral reefs in the Floral Garden Banks National Marine Sanctuary, and on corals on man-made off-shore structures. The National Park Service is involved with monitoring, inventory and management of coral reef resources in ten National Park units with coral reef resources in Hawai'i, Guam, American Samoa, the U.S. Virgin Islands, and south Florida. The Office of Insular Affairs conducts a number of programs and administers grants related to coral reefs in U.S.-affiliated insular areas. The U.S. Geological Survey conducts a number of research efforts and mapping projects related to coral reefs (see the USGS Coral Science Plan for more information).

Coral reef resources provide economic value in terms of a number of different ecosystem services. A recent report by Conservation International summarized a number of studies estimating the economic value of several of the ecosystem services provided by coral reefs and related resources including tourism, fisheries, coastal protection, biodiversity, and carbon sequestration (Conservation International 2008). Some of the studies surveyed have attempted to measure the economic value of coral reefs in the United States and its affiliated areas.

Human uses can make up a large component of the economic value of coral reefs. Recreational activities such as snorkeling and SCUBA diving provide value to local users and visitors to the area. For example, one study in the Florida Keys used a travel cost approach to estimate the average per-person economic value for snorkeling trips at $481 (Park et al., 2002).

INVESTING IN CONSERVATION

Evaluating Investments

Given limited budgets for additional land acquisition, it is important to consider the best way to prioritize future investments. Determining the goals to be achieved in land acquisition is a key first step in the prioritization process. Economics can then be used to help inform these prioritization decisions to get the best return on investments.

Currently, many organizations set their priorities for conservation investments by solely assessing the expected benefits (Polasky 2008). However, in order to get the greatest return on investment, it is important to consider *both* benefits and costs of conservation efforts. A number of studies have shown that selecting sites based on return on investment (ROI) calculations can result in greater conservation benefits than when considering benefits or costs alone (Murdoch et al., 2010, Polasky et al., 2001, Ando et al., 1998).

ROI for conservation applications is generally defined as the increase in the conservation objective per unit cost of the conservation action (Murdoch et al., 2007). ROI is measured as the benefits obtained by an investment divided by the costs of the investment. As discussed above, benefits should be measured as the *value* of the investment, not the economic contributions the investment might provide to the community in terms of jobs or economic output. ROI estimates provide additional information beyond simple benefit-ranking systems, giving guidance on differential rates of investment in terms of benefits per dollar.

Identifying a clearly stated conservation objective that can be measured quantitatively is a key first step in evaluating the return on investment. It is possible to specify multiple objectives and devise a weighting system in cases where more than one objective is identified. However, as noted by Murdoch et al., (2007), specifying the objective is not a scientific matter and may be quite contentious. Absent a defined objective, it is impossible to determine the greatest return on investment for a given project.

The measurement of benefits obtained from the conservation actions is often difficult due to lack of appropriate data and monitoring. While traditional economic benefit-cost analysis measures both benefits and costs in monetary terms, several recent applications of conservation ROI analysis use physical measures of benefits (such as species conserved) in their ROI calculations (Murdoch et al., 2007, Newburn et al., 2005). Although the measurement of benefits in monetary terms allows for the comparison across different types of benefits (or multiple benefits), the use of physical measures can be appropriate if a single conservation objective is defined. ROI analysis using physical measures of benefits can be useful in situations where monetization of benefits is very difficult or prohibitively expensive.

Box 3-4. Conservation Banking

Conservation banking is a market-based approach to conservation of species and habitat used by FWS. A conservation bank is a parcel of land that has been restored or preserved as habitat for a specific species or suite of species and is then protected, managed, and monitored in perpetuity. The bank sponsor then sells their credits to those who need to mitigate or otherwise offset unavoidable impacts to the same species the bank protects. In some cases a bank sponsor reserves the credits for their own future projects rather than selling them to others; these banks are known as single user banks. Once credits are sold or otherwise traded, they are retired and when all credits are sold, the bank is closed and site remains as a perpetual preserve that is monitored and managed through funds from the endowment.

Conservation banking has proven to be a useful tool for accomplishing compensatory mitigation for impacts to federal and state protected species. Treating mitigation as a marketable good creates competition and takes advantage of economies of scale through aggregated offsets. FWS-certified banks are tracked in the Regulatory In-lieu Fee and Bank Information Tracking System (RIBITS) (http://geo.usace.army.mil/ribits/index.html).

On example of conservation banking is the Florida Panther Conservation Bank (FPCB), a privately owned 1,930-acre site located in Hendry County, Florida. The bank, established in 2008, is approximately 4.5 miles north of Big Cypress National Preserve and lies within Priority One (Primary Zone) Panther Habitat. The FWS uses a panther habitat suitability ranking system based in part on methods in publications by Swanson et al., (2005) and Kautz et al., (2006), adjusted by FWS to consolidate similar types of habitats and include the Comprehensive Everglades Restoration Plan water treatment and retention areas located in the panther's range. Through this methodology, FWS awarded FPCB 15,541.4 Florida panther conservation credits. During its first 4 years in operation FPCB sold about 74% of its credits (in 29 credit transactions) to state and local government agencies, developers and others in need of compensatory mitigation for the panther. Credits (Panther Habitat Units) currently sell sold for $750 to $1,500. FWS has approved a second bank and a third bank in the planning stages

Florida Panther (USFWS)

Incorporating costs into prioritization of conservation investments can result in significantly different decisions than if benefits are considered alone. For example, land costs can vary significantly from one area to another and may affect priority rankings. As noted by Polasky (2008), socioeconomic factors such as the rate of land conversion are also important in determining threats that affect expected benefits. Armsworth et al., (2006) also showed how land market dynamics can impact the effectiveness of conservation investments. Market feedbacks after conservation land purchases can lead to increased land prices in the surrounding area. When these high prices are a result of greater development demand, purchasers must make trade-offs between high cost/high threat parcels and low cost/low threat parcels. However, when prices vary based on changes in supply, conservation funds can be used to purchase lands in low cost/high threat locations, stretching limited budget dollars further. Conservation purchases can

also result in development being displaced into other local areas, potentially placing areas with higher conservation value in danger. Development can also increase in an area if the presence of conservation lands makes the area more attractive to other buyers seeking to capitalize on amenity values (Armsworth et al., 2006).

Targeting Investments

Conservation investments can be targeted to consider a number of different factors or to achieve different outcomes. The factors considered in targeting investments may depend on the objectives of the conservation program. Investments could be targeted based on conservation benefits achieved, such as environmental benefits or human use benefits. Categories of environmental benefits that are often considered in conservation projects include ecosystem services, natural amenities, and production of fish and wildlife. Targeting could also be focused on human uses. For example, prioritization of areas for land acquisition could take into account recreational or cultural uses. Location is another factor that could influence conservation investment. Certain areas could be targeted if current protected areas are fragmented by privately owned lands. Land prices in different locations could also influence land acquisition decisions for future conservation investments.

Targeted conservation investments in urban areas can provide high returns because of the large number of individuals that might value and use these areas. Box 3-6 provides information on conservation investments in the Anacostia watershed.

Options for Land Acquisition

As discussed earlier in this chapter, land acquisition is one of the primary ways that entities engage in conservation efforts. Therefore land acquisition costs are often the primary driver of the costs of conservation efforts. Management efforts that consider market factors that affect land prices, and consider different options for land acquisition during the planning process can help achieve conservation benefits at a lower overall cost.

The price of land can affect individuals' willingness to sell land or easements for conservation purposes. In the past, high land prices have placed pressure on owners of natural lands in many areas, creating a strong incentive for them to sell their land for development purposes. While relatively low land prices can create an opportunity to invest in land for conservation purposes, such investments must be balanced by the stream of anticipated benefits.

Market values of land can influence which areas are feasible for purchase and how many areas can be acquired in a given year based on funding levels. Land prices are generally determined by the current and potential future uses of the land. Market values of agricultural lands are linked to characteristics that affect productivity such as soil quality, slope, and access to water sources. In many areas, potential development prospects in the near-term can have a positive influence on land process. Distance from urban centers, uses of neighboring parcels, and development restrictions can all influence future land uses and land prices. These factors can vary across geographic areas.

Conservation easements are another way for private landholders, conservation organizations, and government agencies to maintain lands for conservation in perpetuity. Conservation easements are legally enforceable agreements between a landowner and a government or land trust that restrict

development and commercial and industrial uses on the property, while the landowner maintains ownership. The National Land Trust Census Report estimated that a total of 47 million acres were conserved by local, state and national land trusts in 2010 (Land Trust Alliance 2011). While the majority of Interior land acquisitions are fee simple (the government has full ownership of the property), some recent LWCF transactions have used conservation easements to protect land that remains private property. As of 2010, the FWS had 4.2 million acres under agreement, easement or lease (USFWS Division of Realty 2010).

A portion of the land held by FWS under conservation easements is managed as habitat conservation banks, which use the easements to protect habitat and realize conservation objectives. Conservation banks are a market-based approach to protect habitat for conservation purposes using conservation easements, and allowing for the transfer of credits to achieve mitigation or conservation goals while improving efficiency. Box 3-4 provides additional details about conservation banking efforts at FWS.

The consideration of market factors that affect land acquisition costs and different options for maintaining conservation lands can help managers to achieve the same conservation benefits at a lower cost. The use of this information along with estimates of the value of conservation benefits can help to prioritize future conservation investments.

Incentives may be able to help bring about land use patterns that achieve habitat objectives at lower cost. Incentives may also induce innovations in the production of habitat, in the techniques employed in managing land for commercial uses that allow habitat objectives to be met at lower cost, and in other measures that help protect and recover species. Land management techniques that make habitat conservation and other uses more compatible hold particular promise for reducing the costs of meeting conservation goals. Economists would typically focus on two principal objectives when considering the use of incentive mechanisms in the endangered species program: inducing private landowners to participate voluntarily in habitat conservation efforts, and reducing the economic costs of species and habitat conservation.

Box 3-5. Effect of National Wildlife Refuges on Home Values

Open space and natural areas provide amenities that are of value to nearby residents and visitors to the surrounding localities. One way these values are revealed is through increased property values of nearby homes.

Eastern Neck National Wildlife Refuge (USFWS)

A recent study examined how proximity to National Wildlife Refuges (NWRs) affects nearby home values (Taylor et al., 2011). Using confidential micro-level U.S. Census data, hedonic property valuation models were estimated to isolate the effect NWRs had on nearby home values, after controlling for other characteristics that affect the value of housing. The study's focus was on NWRs located in urban areas or the urban fringe within the continental United States because NWRs are more likely to have an effect if they are located in housing markets where open space is relatively scarce.

The analysis consistently found that properties within 0.5 miles of a NWR and 8 miles of an urban center were found to have a value differential of 4–5% in the Northeast, 7–9% in the Southeast, and 3–6% in the California/Nevada region. These impacts can also be represented in terms of "capitalized value," or the total impact on property values of the homes surrounding a NWR. Using the average impact for each region, the average capitalized value per NWR was estimated to be $8.7 million in the Northeast, $8.7 million in the Southeast, and $7.6 million in the California/Nevada region. The estimated capitalized values give an approximation of the enhanced property tax base that localities enjoy as a result of the NWRs. This is only one aspect of the value created through investments in conservation through the NWR system.

Box 3-6. Anacostia River Restoration

Washington, DC's Anacostia River—also known as the "forgotten river"— runs through some of the nation's poorest neighborhoods. The river was once a place where church members were baptized, children swam, and families picnicked. Over the years, it became a dumping ground for trash, toxics, and sewage, lined by highways and train tracks that cut off public access. A concerned citizen formed the Anacostia Watershed Society in 1989 to draw attention to the river. In the 1990s, this led to a growing partnership of local residents, interest groups, and multiple agencies, devoting millions of dollars, time, and technical expertise to restore and reclaim the watershed. In 2010, the U.S. Army Corps of Engineers and local partners released a restoration vision, identifying over 3,000 restoration projects to improve river health. In 2011, D.C. broke ground on one of the biggest investments yet—a $2.6 billion Clean Rivers Project that will eliminate nearly all combined sewer overflows to the Anacostia.

Last year, the Obama Administration identified the Anacostia River Watershed as a priority under the America's Great Outdoors initiative and the Urban Waters Federal Partnership. Both efforts seek to reconnect Americans to the outdoors and revitalize urban waterways in underserved communities. NPS is coordinating implementation by 11 federal agencies on over 50 projects, including installing rain gardens, restoring habitat, monitoring water quality, building trails, engaging youth, and cleaning up contaminants.

The NPS is largest federal landowner in the Anacostia watershed and the NPS has numerous projects underway to enhance the watershed. Last year, NPS hired roughly 300 youth and worked with 6,000 volunteers in the Anacostia East Park to rebuild eroded trails and to educate other youth about the local environment. NPS is also working with DC and Maryland to create the Anacostia Riverwalk Trail. When completed, 48 miles of trail will connect 16 waterfront neighborhoods to the park and the river. Residents and visitors will be able to walk and bike to the Fish Wharf, baseball stadium, Kingman Island, and National Arboretum, increasing visitation, jobs, and economic revitalization to local neighborhoods.

Other DOI bureaus are also active partners in revitalizing the Anacostia. USGS measures DC water quality, helping locate leaking sewers and observing and predicting tidal storm surges. They also created a geospatial mapping tool that includes data layers identifying each of the 50 federal projects, as well as demographic information to help guide future restoration efforts where the need is greatest. FWS tracks the impact of contaminants on fish in the river and helped transform one of the dirtiest urban streams in one of the poorest parts of D.C. The $2.7 million Watts Branch restoration project implemented by FWS and other partners now prevents 1,500 tons of sediment from entering the tidal river. By reducing erosion, partners are improving both water quality and habitat for eel, shad, and striped bass, along with herons, hawks, and owls.

Evaluating the economic benefits from restoring and enhancing urban habitat, greenspace, and river access is challenging—most environmental goods and services are not bought and sold in the market. However extensive research indicates that people value improvements to environmental quality and are willing to pay for such improvements, as may be reflected in increased property values (e.g., Lewis et al., 2008) or increased recreation use (e.g., Kinnell et al., 2006). Research also demonstrates that these environmental investments not only improve property values and boost local economies, but also improve public health (McInnis and Shinogle, 2009) and may provide an increased sense of community (EPA).

Before and after— 2011 FWS restoration on the Anacostia (FWS).

CONCLUSIONS

Land conservation plays an important role in DOI's mission. Investments in land conservation can include land acquisition as well as science research and other conservation management activities. These investments provide value to society in terms of species and habitat protection, maintenance of working landscapes, the provision of ecosystem services, and human use benefits.

The measurement of benefits from conservation investments can provide important information to policymakers for future decisions. Economic techniques allow the benefits and costs of conservation investments to be represented in monetary terms, enabling comparison across locations or projects in a common metric. Absent the ability to quantify benefits in monetary terms, physical measures of benefits (e.g., number of species conserved) can be substituted, where either measure of benefit can be used to calculate a return on investment. Such calculations can provide valuable information to evaluate, target and prioritize land acquisition decisions or other conservation activities.

Incentives, a key component of both development and conservation, are often best understood and evaluated through economics, which together with the other ecological and social sciences can improve our understanding of conservation implementation options.

REFERENCES

Ando, Amy, Jeffrey Camm, Stephen Polasky, and Andrew Solow. 1998. Species Distributions, Land Values, and Efficient Conservation. *Science*, 279: 2126-2128.

Armsworth, Paul R., Gretchen C. Daily, Peter Kareiva, and James N. Sanchirico. 2006. Land Market Feedbacks Can Undermine Biodiversity Conservation. *Proceedings of the National Academy of Sciences*, 103(14): 5403-5408.

Conservation International. 2008. Economic Values of Coral Reefs, Mangroves, and Seagrasses: A Global Compilation. Center for Applied Biodiversity Science, Conservation International, Arlington, VA, USA.

Deller, Steven C., Tsung-Hsiu (Sue) Tsai, David W. Marcouiller, and Donald B.K. English. 2001. The Role of Amenities and Quality of Life in Rural Economic Growth. *American Journal of Agricultural Economics*, 83(2): 352-365.

Gascoigne, William R., Dana Hoag, Lynne Koontz, Brian A. Tangen, Terry L. Shafer, and Robert A. Gleason. 2011. Valuing Ecosystem and Economic Services Across Land-Use Scenarios in the Prairie Pothole Region of the Dakotas, USA. *Ecological Economics*, 70(10): 1715-1725.

Kautz, R., Kawula, R., Hoctor, T., Comiskey, J., Jansen, D., Jennings, D., Kasbohm, J., Mazzotti, F., McBride, R., Richardson, L., Root, K. 2006. How much is enough? Landscape-scale conservation for the Florida panther. Biological Conservation 130: 118-133.

Land Trust Alliance. 2011. 2010 National Land Trust Census Report: A Look at Voluntary Land Conservation in America. Available at: http://www.landtrustalliance.org/land-trusts/land-trust-census/national-land-trust-census-2010/2010-final-report (Accessed on: December 23, 2011)

McGranahan, David A. 2008. Landscape Influence on Recent Rural Migration in the U.S. *Landscape and Urban Planning*, 85: 228-240.

McGranahan, David A. 1999. Natural Amenities Drive Rural Population Change. Economic Research Service, United States Department of Agriculture. Agricultural Economic Report No. 781.

Murdoch, William, Jai Raganathan, Stephen Polasky, and James Regetz. 2010. Using Return on Investment to Maximize Conservation Effectiveness in Argentine Grasslands. *of the National Academy of Sciences*, 107(49): 20855-20862.

Murdoch, William, Stephen Polasky, Kerrie A. Wilson, Hugh P. Possingham, Peter Kareiva, and Rebecca Shaw. 2007. Maximizing Return on Investment in Conservation. *Biological Conservation*, 139(3-4):375-388.

Newburn, David, Sarah Reed, Peter Berck, and Adina Merenlender. 2005. Economics and Land-Use Change in Prioritizing Private Land Conservation. *Conservation Biology*, 19(5): 1411-1420.

Oregon State University, College of Forestry. Recreation Use Values Database. Available at: http://recvaluation.forestry.oregonstate.edu/ (Accessed on: January 3, 2012)

Park, Timothy, J.M. Bowker, and Vernon R. Leeworthy. 2002. Valuing Snorkeling Visits to the Florida Keys with Stated and Revealed Preference Models. *Journal of Environmental Management*, 65: 301-312.

Polasky, Stephen. 2008. Why Conservation Planning Needs Socioeconomic Data. *Proceedings of the National Academy of Sciences*, 105(18): 6505-6506.

Polasky, Stephen, Jeffrey D. Camm, and Brian Garber-Yonts. 2001. Selecting Biological Reserves Cost-Effectively: An Application to Terrestrial Vertebrate Conservation in Oregon. *Land Economics*, 77(1): 68-78.

Swanson, K., Land, D., Kautz, R., Kawula, R. 2005. Use of least cost pathways to identify key highway segments for Florida panther conservation. In: Beausoleil, R.A. and Martorello D.A., (Eds.). Proceedings of the Eighth Mountain Lion Workshop, Olympia, Washington; pp. 191-200.

Taylor, Laura O., Xiangping Liu, and Timothy Hamilton. 2011. Amenity Values of Proximity to National Wildlife Refuges. Report to the U.S. Fish and Wildlife Service.

USCRTF (United States Coral Reef Task Force). 2009. U.S. Coral Reef Task Force Member Profiles. Available at: http://www.coralreef.gov/intro/coralpupdated.pdf (Accessed on: December 14, 2011)

USFWS (United States Fish and Wildlife Service), Division of Realty. 2010. Annual Report of Lands Under Control of the U.S. Fish and Wildlife Service as of September 30, 2010. Available at: http://www.fws.gov/refuges/realty/archives/pdf/2010_Annual_Report_of_Lands.pdf (Accessed on: January 31, 2012)

USGS (United States Geological Survey). 2007. Strategic Science for Coral Ecosystems 2007-2011. Available at: http://fl.biology.usgs.gov/coral_plan_final_April_2007.pdf (Accessed on December 14, 2011)

Vincent, Carol Hardy. 2010. Land and Water Conservation Fund: Overview, Funding History, and Issues. Congressional Research Service Report for Congress.

Chapter 4 ECOSYSTEM RESTORATION

INTRODUCTION

The Department of the Interior extensively supports—through its mission, policy, programs, and funding— the study, planning, implementation, and monitoring of ecosystem restoration. This commitment is reflected in the Department's FY2011-2016 Strategic Plan[11]:

> **Mission Area 1, Provide Natural and Cultural Resource Protection and Experiences, GOAL #1: Protect America's Landscapes.** We will ensure that America's natural endowment – America's Great Outdoors – is protected for the benefit and enjoyment of current and future generations. We will maintain the condition of lands and waters that are healthy, and we will restore the integrity of natural areas that have been damaged. We will strive to retain abundant and sustainable habitat for our diverse fish and wildlife resources, and we will reduce or eliminate threats to at-risk plant and animal species.

In a nutshell

- Restoration, rehabilitation, remediation, and reclamation activities play an important role in maintaining the health and vitality of DOI lands and managed resources.
- Ecosystem monitoring and adaptive management help ensure that lessons learned are integrated into ongoing and future decision making at Interior.
- Physical measures of restored stream-miles or acres are valuable indicators of restoration success, but they do not easily facilitate quality comparisons for future decisions. Interior's scientists and managers are actively working on the development of improved endpoints and more meaningful criteria for measuring restoration success.
- Jobs and economic contributions from restoration are important, though they do not represent the full economic value of ecosystem restoration. Developing values for the resources and associated services under Interior's trust would help ensure that the public's benefits are maximized from investment in DOI restoration activities.

[11] Available on-line at http://www.doi.gov/bpp/data/PPP/DOI_StrategicPlan.pdf

The described strategy includes a mandate to improve land and water health through maintenance and restoration of the wetlands, uplands, and riparian areas on DOI lands. Efforts include controlling invasive[12] plants and animals, restoring land to a condition that is self-sustaining, and ensuring that habitats support healthy fish and wildlife populations. Over 1.1 million acres of land and 879 riparian (stream/shoreline) miles are targeted to be restored to specifications in management plans between FY 2011 and FY 2016. The Office of Surface Mining Reclamation and Enforcement (OSM) has a target of 14,000 acres of federal, private, and tribal land and surface water acres to be reclaimed or mitigated from the effects of natural resource degradation from past coal mining. Almost 600,000 non-DOI acres are planned to be restored through partnerships with the U.S. Fish and Wildlife Service (FWS). Because the vast majority of fish and wildlife habitat managed by FWS is on non-federal lands, partners play a critical role in conserving and restoring lands to improve wildlife values.

America's rivers are the lifeblood of America's economy – from the water for farms that produce our food to the fish and wildlife that sustain our heritage. Today as we begin the restoration of this river system, we look to a bright future that recognizes rivers for their many contributions to our economy and environment. – Interior Secretary Salazar on the launch of the Elwha River restoration project, Washington, 9/17/11.

Ecosystem monitoring of restoration is critical for ensuring cost-effective implementation of today's restoration projects and those planned in the future. Monitoring can also inform adaptive management efforts to help ensure successful outcomes.[13] For example, where opportunities exist, the Bureau of Reclamation has begun adaptation actions in response to climate stresses, as well as land use, population growth, invasive species, and others. These activities include extending water supplies, water conservation, hydropower production, planning for future operations, and supporting rural water development. The adaptation actions span a wide array of Reclamation's mission responsibilities from water supply planning efforts and retrofitting of hydropower turbines to the restoration of rivers and ecosystems.

Restoration through Reclamation's WaterSMART Program

To implement the SECURE Water Act (P.L. 111-11), Secretary Salazar established the WaterSMART (Sustain and Manage America's Resources for Tomorrow) program in February 2010 (Secretarial Order 3297). Through WaterSMART, Interior works with states, tribes, local governments, and non-governmental organizations to secure and stretch water supplies for existing and future generations to benefit people, the economy, and the environment. Reclamation plays a key role in the WaterSMART program as DOI's main water management agency by administering grants, scientific studies, technical assistance, and scientific expertise. To date, the program has assisted communities in improving conservation, increasing water availability, restoring watersheds, resolving long-standing water conflicts, addressing the challenges of climate change, and implementing water rights settlements. The program has provided more than $85 million in funding to non-federal partners, including tribes, water districts, and universities, including $33 million in 2011 for 82 WaterSMART grant projects.

The FY 2011 budget reflected Secretary Salazar's ongoing commitment to ecosystem restoration,

[12] Controlling and preventing invasive species play a major role in restoration. More information on the issue of invasive species at Interior and the role of the National Invasive Species Council is provided in Chapter 4 of the FY 2010 DOI Economic Contributions Report (available on-line at http://www.doi.gov/ppa/upload/DOI-Econ-Report-6-21-2011.pdf).

[13] Information on adaptive management is available in the Departmental Manual, at 522 DM 1.

including major efforts to restore, protect, and preserve the California Bay-Delta (see the Sources of Funding section of Appendix 3), Everglades, Gulf Coast of Louisiana and Mississippi, and the Chesapeake Bay. The Department also actively coordinated with EPA on Great Lakes restoration efforts. As part of the commitment to understanding landscapes at the broader level and the potential effects of climate change, the number of Landscape Conservation Cooperatives (LCCs) was expanded from 9 to 22 by the end of 2011 (see Chapter 3 for more information on LCCs). LCCs are expected to play a significant role in FWS's ecosystem restoration efforts across the Nation. For example, in the Chesapeake Bay watershed, Service programs will coordinate efforts with the North Atlantic and Appalachian LCCs to meet the highest priority needs for achieving a healthy watershed and supporting sustainable populations of fish and wildlife. In the Everglades, landscape level partnerships will work to protect Florida panther habitat, sea turtles and other highly imperiled species in the Florida Keys. The California Bay Delta region will use the LCC and Strategic Habitat Conservation business model to work in this changing ecosystem, ensuring that FWS's actions are driven by good science, respect for partners, and a focus on outcomes.

Future Restoration Practitioners: *In addition to providing youth with work experience, DOI's bureaus are extensively involved in youth education. For example, Hands on the Land (HOL) is a national network of field classrooms sponsored by Partners in Resource Education, a collaboration of federal agencies (BLM, FWS and NPS for Interior; EPA; NOAA; and USDA), a non-profit foundation, schools, and other private sector partners. Through this network, federal agencies are providing a diverse array of hands-on learning opportunities for teachers and students. For example, a module on Great Sand Dunes National Park and Preserve allows youth in grades 4-9 to play an interactive web game as an ecologist tasked with the restoration of a fictitious ecosystem to learn about the adverse effects of invasive species. Students are also engaged in environmental monitoring programs. BLM's 258 million acres host a growing number of Hands on the Land sites, where education programs have been developed in conjunction with local schools. One example is the Blanca Wetlands case study analyzed in this chapter. More information about these sites is available on-line at http://www.blm.gov/wo/st/en/res/Education_in_BLM/Learning_Landscapes/For_Teachers/hol.html*

A February 2011 report to the President, "America's Great Outdoors: A Promise to Future Generations," defined an action plan for conservation, restoration, and recreation on public lands in the 21st century. The resulting blueprint for restoration of cultural and natural resources on public lands recognizes that spending taxpayer dollars needs to return positive net economic benefits (i.e., total benefits greater than total costs). It can be difficult, though, to quantify the value of restoration to help justify spending on restoration projects. Although the jobs and economic contributions from restoration are substantial and important, they do not represent the full economic value of ecosystem restoration, because they do not capture the net benefits associated with environmental goods and services not bought and sold in markets. Similarly, the physical measures of restored stream-miles or acres are valuable indicators of restoration success, but they do not easily facilitate quality comparisons for future decisions. Quantifying and valuing the new or additional ecosystem services from restoration continue to be a challenge.

The remainder of this chapter helps define restoration, describes some of the restoration efforts of Interior's bureaus and offices, reviews economic valuation methods, and presents a series of original case

studies developed by the USGS on the jobs and economic impacts from select DOI restorations. Appendix 3 provides additional information on the case studies and also describes sources of restoration funding for departmental restoration efforts.

Defining Restoration

At Interior, every bureau and several offices engage in some form of restoration, of physical structures as well as ecological and human use resources. Figure 4-1 illustrates that there are a number of activities that may be employed to help improve injured ecosystems. Terms like restoration, rehabilitation, remediation, and reclamation are often used interchangeably in practice, but their definitions vary by authorizing laws and implementing agencies. The red line in the figure illustrates the degradation of the original ecosystem to an impaired state. The degraded ecosystem exhibits a lower level of structure and function, compared to the original ecosystem. The degraded ecosystem can be returned to its original state using removal, cleanup, remediation and other restoration activities. Along the black arrow pointing toward "Reclamation," the figure shows reclamation activities improving the structure and function of the ecosystem. Restoration activities (shown as occurring along the dotted arrow) further improve the ecosystem structure and return the ecosystem to its original state. Off-site mitigation can be used alone or in combination with other approaches to return ecosystems (perhaps in a different location) to their original state.

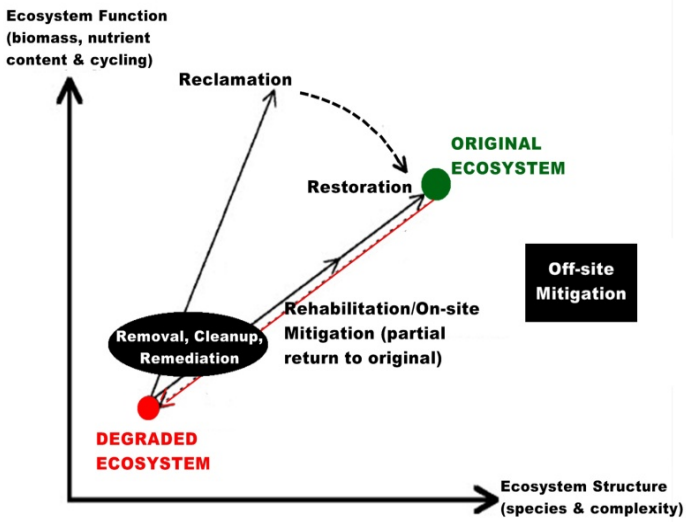


Figure 4-1. Restoration Relative to Other Efforts to Improve Degraded, Damaged or Destroyed Ecosystems

Source: Adapted from Bradshaw (1987).

For purposes of this chapter, ecosystem (or ecological) **restoration** is defined as an intentional activity that initiates or accelerates the recovery of a degraded, damaged, or destroyed ecosystem with respect to its health, integrity, services, and sustainability (Society for Ecological Restoration International 2004). Ecosystem health provides a useful metaphor for human health, and helps emphasize that most of DOI's lands and managed resources play an integral role in the welfare of many Americans and most of these resources have been altered by people. For example, chemicals or oil may be present and need to be addressed prior to restoration through **removal**, **cleanup,** or **remediation** of the land.[14]

Some ecosystems may have been changed so dramatically that a return to the original landscape is no longer possible and **rehabilitation** or **on-site mitigation**—a partial return to a previous state—could be the only option. **Reclamation** is the process of reconverting disturbed land to its former or other

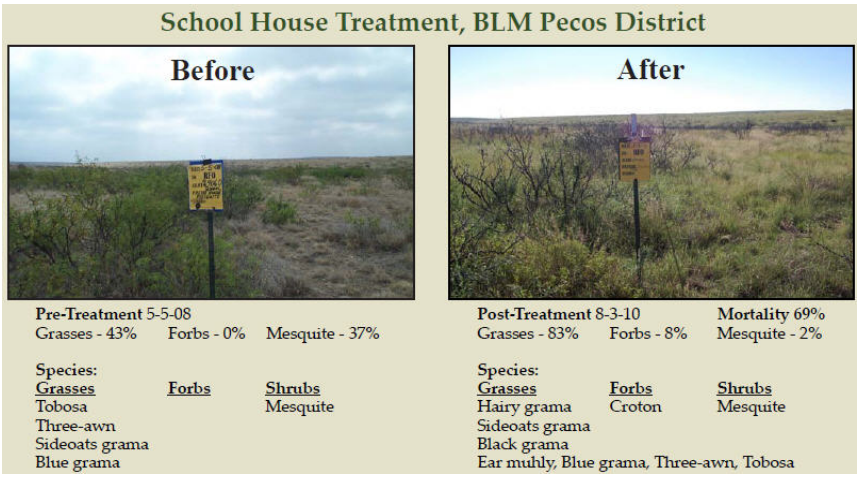
[14] The National Academy of Sciences suggested definitions for the terms restoration, reclamation, and rehabilitation (NAS, 1974). These definitions were carried forward in the seminal works on mined land reclamation, including Reclamation of Drastically Disturbed Lands (Schaller and Sutton, 1978), which was relied upon by Bradshaw (1987).

productive uses. It is commonly used in the context of mined lands. The main objectives of reclamation include the stabilization of the terrain, assurance of public safety, aesthetic improvement, and usually a return of the land to what, within the regional context, is considered to be a useful purpose. Reclamation projects that are more ecologically based can qualify as rehabilitation or even restoration.[15] **Off-site mitigation** is an action intended to compensate for environmental damage. Regardless of approach, monitoring is needed to ensure the desired goals are actually achieved.

[15] See Stahl, P.D. *et al.,* 2006, for more discussion on reclamation and ecosystem restoration.

Box 4-1. BLM's Restore New Mexico Program – High-Quality Science Generating Environmental and Economic Benefits from Restoration

Restore New Mexico is a partnership to restore grasslands, woodlands, and riparian areas to healthy and productive condition. The program began in 2005 and has treated more than 1.4 million acres of impaired federal, private, and state land, with millions more planned. With the $8 million in funding that has been received from Natural Resource Conservation Service and BLM, the program has been able to leverage over $7.1 million in funding from ranchers, the oil and gas industry, sportsman conservation groups, and others. This money was used for on-the-ground projects to restore habitat for threatened and endangered species, game species, and other wildlife adversely affected by historic overuse of the land. By improving the health of the land and incorporating best management practices, Restore has been able to help meet the local demands for energy, food and recreation, while also helping to improve the health of the land. BLM and its partners rely on high quality science to ensure the efforts of Restore New Mexico provide the greatest benefits to the land, resources, and wildlife.



Weaver Ranch, a 25,000-acre operation in New Mexico, is a special laboratory of innovation for vegetative treatments and scientific monitoring. Owner Jim Weaver and manager Willard Heck have been conducting scientific monitoring on their ranch for years, some of which has been funded by BLM. According to Heck, "In dry environments, once a landscape has been sufficiently altered, it will not return to its original state in a time frame relevant to humans without a management input. Just stepping back is not a fix to the problem, and simply removing the cows won't magically restore overgrazed land either… No doubt this is hard work, and landscape restoration treatments aren't cheap, but afterwards we had seven times more grasses, so it was like we had seven more ranches. This doesn't mean you can put seven times as many cows out there, but it does mean you can do a lot you couldn't do before...We hope to show [through monitoring] that we've created a more diverse, healthier environment that is more profitable to the rancher and benefits wildlife with proper management." More details on BLM's Restore New Mexico efforts, including the work at Weaver Ranch, are available on-line at http://www.blm.gov/nm/st/en/prog/restore_new_mexico.html.

Box 4-2. Restoration to Ensure a Refuge for the Future—Addressing Climate Change at the Alligator National Wildlife Refuge on the Shore of North Carolina

Natural resource managers face difficult decisions on whether to restore locations where climate change is projected to permanently shift ecological systems away from their historical status. It is an enormous challenge to determine how and what to restore to ensure that the expected long-term benefits exceed the costs given this future uncertainty. Using oyster reefs, water control structures, teams of students, and thousands of seedlings, land and resource managers at Alligator River National Wildlife Refuge on the coast of North Carolina are trying to address just this challenge.

A guided paddle tour at Alligator River National Wildlife Refuge (Cindy Heffley, FWS).

The Refuge lies in the Albemarle and Pamlico Sounds, North Carolina's most vulnerable region to sea level rise. Rising seas combined with storm surge could claim the entire Refuge within a lifetime. Threats from wildfire and invasive species could be worsened by climate change. This system has a wide range of ecological and human use values and is home to the rare pocosin wetlands and other habitats, including marshes, hardwood swamps, and Atlantic white cedar swamps. The Refuge is one of the last strongholds for black bears on the East Coast and is also inhabited by red wolves, alligators, ducks, geese, and river otters. This unique assemblage draws about 45,000 visitors each year, including many from overseas.

The Refuge has partnered with The Nature Conservancy, local residents, and others to protect and restore what can be sustained for the long run. Restoration work in combination with other strategies like building new reefs, removing invasive species, and plugging drainage ditches to prevent the influx of salt water, has multiple benefits for the Refuge, including providing habitat for species, preventing wildfire, and limiting the impact of floods. Restoration is playing an unusual role–buying time. Biologists are restoring bald cypress and black gum in areas that they expect will be inundated by estuarine waters in the not-so-distant future. These activities will buy time, providing crucial shelter and habitat for at-risk species, while conservationists protect upslope habitat to harbor the species in the future.

Black bears (Larry Wade, FWS).

In addition to sea level rise, many freshwater systems are projected to be warmer in the future (Kaushal et al., 2010), which could make habitat unsuitable for species and a questionable restoration investment. Forest systems are expected to shift to higher latitudes (Iverson et al., 2008), lowering the value of restoring them at lower latitudes. Removing non-native species may not make sense if those species are shifting their habitat in response to changing climate. As part of an overall protection and adaptation strategy, the Refuge and its partners have planted 20,000 saplings in areas that have been denuded of forest vegetation. To support these growing saplings, freshwater is being retained in areas that were previously drained. It is hoped that the favorable conditions will allow the forest to grow and sustain itself, at least for a while.

RESTORATION ACTIVITIES – INTERIOR'S BUREAUS AND OFFICES

The long-term missions, objectives, policies, and plans of DOI's bureaus and certain offices reflect a broad departmental commitment to restoration:

- **Bureau of Indian Affairs (BIA).** BIA's Tribal Management/Development Program includes funding for three restoration-related programs: 1) Inter-Tribal Bison Restoration and protection for restoration of bison on Indian homelands; 2) Wetlands/Waterfowl Management (Circle of Flight) of existing contracts to support tribal wetland rehabilitation, waterfowl enhancement and wild rice production projects on Indian lands in Minnesota, Wisconsin, and Michigan. This effort helps support tens of thousands of additional ducks and geese in spring and fall migrations, provides expanded hunting opportunities for tribal members and the general public, and offers enhanced wild rice gathering opportunities and economic development possibilities for tribes; and 3) Watershed Restoration, a joint fish habitat recovery project being carried out by the Northwest Indian Fisheries Commission, an intertribal organization representing 20 Western Washington treaty tribes since 1974, and the state of Washington.

- **Bureau of Land Management (BLM).** BLM plays a major role in restoration of its lands to improve the health of entire watersheds to sustain and enhance a variety of biological communities. For example, BLM manages 30 million acres of sagebrush habitat occupied by the greater sage-grouse in 11 states. This is about half of the remaining sagebrush habitat in the United States. The sage-grouse is a Candidate Species for listing under the Endangered Species Act (ESA), and BLM, FWS and others are working to maintain and restore sagebrush landscapes on public lands to conserve sage-grouse populations. As another example, BLM's Western Oregon Reforestation and Forest Development Program guides forest regeneration and restoration activities on commercial and non-commercial forest lands that result in the establishment of young stands, including habitat restoration activities in riparian and other reserve areas. In FY 2011, Secretary Salazar designated two pilot projects to demonstrate the ecological and economic merits of the landscape restoration strategy in the Roseburg and Medford, Oregon, districts. Other BLM programs with a focus on restoration include the Hazard Management and Resource Restoration Program (HMRRP), Abandoned Mine Lands (AML) Program, and the National Landscape Conservation System (NLCS) (135 DM 3). The HMRRP is an administrative program with the objective of maintaining public land health by remediating contaminated sites and restoring natural resources injured by releases of hazardous substances and oil. The AML Program addresses physical safety and environmental hazards associated with abandoned hardrock mines on public lands administered by BLM. As discussed in Chapter 3, the mission of the NLCS is to

Role of the National Environmental Policy Act (NEPA) in Restoration

NEPA plays a major role in DOI projects to improve damaged, degraded or destroyed ecosystems. Specifically, the NEPA process requires that DOI:

- *Assess the environmental impacts of federal projects, which include issuing permits, spending federal money, or actions on federal lands;*
- *Consider the environmental impacts in making decisions; and*
- *Disclose the environmental impacts to the public.*

NEPA is intended to help public officials make decisions based on an understanding of environmental consequences and identify actions that protect, restore, and enhance the environment. Public involvement is an integral part of complying with NEPA. Information on Interior's implementation of NEPA is available at 43 CFR Part 46.

conserve, protect, and restore nationally significant landscapes recognized for their outstanding cultural, ecological, and scientific values for the benefit of current and future generations.

- **Bureau of Ocean Energy Management (BOEM).** BOEM (formerly part of BOEMRE) is responsible for managing development of the nation's offshore resources in an environmentally and economically responsible way. A number of BOEM's programs support restoration goals. For example, BOEM's Environmental Studies Program (ESP) is focused on advancing applied research to ensure that programmatic decisions regarding energy and mineral development on the OCS are informed by the best scientific information available. BOEM relies on this and other information when completing its environmental reviews in support of programmatic decisions, consistent with the National Environmental Policy Act (NEPA). These analyses help BOEM to determine, among other things, what mitigation measures may be needed to protect resources and the environment.

- **Bureau of Reclamation.** Supporting the Department's priority on ecosystem restoration is a key underpinning of Reclamation's mission *to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public*. As a key water supplier in the West, restoration better positions Reclamation to address the ongoing challenges presented by drought, climate change adaptation, increasing populations, growing water demand associated with energy generation, and environmental needs. For example, the goal of Reclamation's Resource Management Plans (RMP) is to create a balance of resource development, recreation, and protection of natural and cultural resources for the lands and waters being managed. The plans outline for Reclamation, other managing agencies, and the public, resource management policies and actions that will be implemented over each plan's 10-year life. Reclamation's Ecosystem Restoration program involves a large number of activities, including its ESA recovery

National Ocean Policy and Restoration

Executive Order 13547 was issued in July 2010 and established a National Ocean Policy to protect, maintain, and restore the health and biological diversity of ocean, coastal, and Great Lakes ecosystems and resources. The National Ocean Council, which is charged with implementing this policy and includes Secretary Salazar, identified two ongoing restoration initiatives in its draft Implementation Plan (p. 48) that exemplify the principles of the National Ocean Policy: (1) the Great Lakes Restoration Initiative, and (2) the Gulf Coast Ecosystem Restoration Task Force. Both initiatives, which involve Interior bureaus, demonstrate how regional, State, and local entities can work together to address common goals for protecting and restoring natural resources in concert with building strong coastal economies and resilient communities. As a principal steward, Interior's resources include:

- *More than 35,000 miles of coastline;*
- *34 million acres in 84 marine and coastal national parks;*
- *180 marine and coastal refuges;*
- *Energy and mineral leasing and production on the 1.7 billion offshore acres of Outer Continental Shelf managed by BOEM and BSEE;*
- *More than 20,000 small islands, rocks, exposed reefs, and pinnacles between Mexico and Oregon comprising the BLM-managed California Coastal National Monument;*
- *Hundreds of thousands of square miles in FWS-managed marine national monuments; and*
- *Extensive ocean, coastal, and Great Lakes research and mapping by USGS and bureaus to predict, assess, and manage impacts on coastal and marine environments.*

programs.[16] In particular, Reclamation's Pacific Northwest Region is involved in a variety of fish and wildlife programs which include cooperative watershed planning and the design and installation of fish passage devices. Working with the Northwest Power Planning Council's "Strategy for Salmon," Reclamation is participating with state and local interests in water conservation demonstration projects and model watershed programs in Oregon, Washington, and Idaho. Reclamation's efforts to empower tribal nations range from endangered species restoration to rural water and implementation of water rights settlement actions.

- **Bureau of Safety and Environmental Enforcement (BSEE).** BSEE (formerly part of BOEMRE) is a major contributor in NEPA activities throughout the offshore leasing and exploratory planning processes. Under BSEE, the Environmental Enforcement Division (EED) is specifically tasked with ensuring NEPA compliance for all BSEE-issued permits, the decommissioning of offshore production platforms, and managing the Idle Iron and Rigs-to-Reefs programs. These restoration programs ensure that marine and coastal environments are protected, and either improved or returned to their "pre-resource development" condition at the end of oil and gas activities. Additionally, BSEE also reviews industry reports, conducts field verifications and evaluations, and coordinates with BOEM to adaptively manage both environmental mitigation measures to ensure their effectiveness and enforceability.

- **U.S. Fish and Wildlife Service (FWS).** The Service plays a major role in restoration as manager of the Refuge System, and by providing biological, ecological, and contaminant expertise on FWS-managed resources through a wide variety of programs. Discussed at greater length in Chapter 3, the mission of the Refuge System is *[t]o administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans* (601 FW 1). As the principal federal partner responsible for administering the ESA, the Endangered Species Program takes the lead in recovering and conserving the nation's imperiled species. Working with partners, FWS uses a range of conservation tools, including restoring and acquiring habitat, removing introduced animal predators or invasive plant species, conducting surveys, monitoring individual populations, and breeding species in captivity and releasing them into their historic range. For an example see Box 4-3.

  The Fisheries and Habitat Conservation Program promotes the protection, conservation, and restoration of the nation's fish and wildlife resources. This cooperative program provides partnership-based habitat restoration, protection and conservation projects in its effort to restore aquatic and terrestrial trust species, populations and habitats. When oil or chemicals enter the environment and injure FWS-managed resources, the Environmental Contaminants Program provides the expertise to assess and restore these resources. FWS reported that they provided over 5,200 landscape-related contaminant actions benefitting other federal, state and local agencies and/or partners in FY 2011. For example, in FWS Region 5 (New England, NY, mid-Atlantic), contaminants staff have been investigating endocrine disruption of smallmouth and largemouth

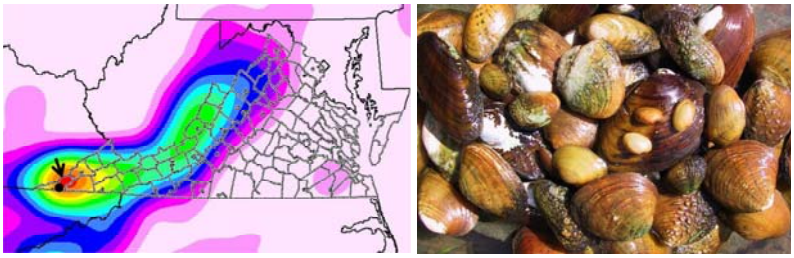
[16] Summary information on 16 different Reclamation river restoration or species recovery programs, along with questionnaire results from program managers on six potential institutional challenges, is available at http://www.usbr.gov/river/docs/RR_Prgrms_and_Inst_Chllngs_Smry120118.pdf .

bass, white-nose syndrome in bats, and the effects of wastewater from hydrofracturing of natural gas on mussels. These studies are critical for future restoration efforts, as they help land managers understand the effects on the affected species, and how to guide future restoration actions to best benefit the injured species. Analyses of jobs and economic impacts from restoration activities at Bandon Marsh National Wildlife Refuge in Oregon and the Glacial Ridge National Wildlife Refuge in Minnesota are provided in the case studies section.

- **National Park Service (NPS).** The Organic Act of August 25, 1916, other applicable laws, and the NPS strategic plan inform NPS' long-range objectives for protecting, restoring, and maintaining natural and cultural resources in good condition and managing them within their broader ecosystem and cultural contexts (145 DM 1). NPS' largest restoration implementation effort is in the Everglades, including Big Cypress National Preserve and Biscayne, Everglades, and Dry Tortugas national parks. Abandoned mining and oil and gas exploration and production sites represent a substantial portion of the disturbed lands requiring restoration in parks. In 2011, NPS reported managing an estimated 3,000 abandoned mineral land sites with more than 11,000 hazardous openings and over 33,000 acres of disturbed land.

Box 4-3. Lone Mountain Restoration

The Lone Mountain restoration was conducted to address natural resources injured when failure of a coal slurry impoundment resulted in a release of 6 million gallons of coal "fines" into the Powell River in western Virginia. This release injured 12 species of federally listed endangered mussels, supporting aquatic habitat, and designated critical habitat for two federally listed threatened fish species. FWS, with help from state, academic, and non-governmental partners, protected and restored over 500 acres of riparian habitat within a critical water recharge area of the upper Powell River watershed, released thousands of hatchery-reared juvenile mussels representing 15 species, released over 800 hatchery-reared yellowfin madtom fingerlings, and provided educational opportunities for students through the Lee County Public School Meaningful Watershed Educational Experience.



Powell River freshwater mussels spill and upstream habitat preservation locations. (Virginia Department of Game and Inland Fisheries)

Box 4-4. Restoration in a Rapidly Changing Arctic

The Arctic is facing significant and rapid impacts from climate change. The International Panel on Climate Change (IPCC) estimates that the Arctic is warming twice as fast as the rest of the world. As the manager of over 213 million acres of land and offshore areas in Alaska, Interior is responsible not just for understanding, protecting, managing these resources, but also responding to these changing conditions through adaptation and restoration activities. Two of the most urgent threats to public lands and resources in the Arctic are thawing permafrost and coastal erosion. Land subsidence (sinking) associated with thawing permafrost presents substantial challenges to infrastructure in Alaska, including roads, runways, water and sewer systems, and oil and gas activities. For example, the number of days per year in which travel on the tundra is allowed under Alaska Department of Natural Resources standards has dropped from more than 200 to about 100 days in the past 30 years, resulting in a 50% reduction in days that oil and gas exploration and extraction equipment can be used. This in turn has economic implications for local communities that benefit from petroleum activities on public lands.

NPS has recognized that restoration efforts are an important means for enhancing species' ability to cope with stresses and adapt to climatic and environmental changes. The NPS Climate Change Response Program is monitoring conditions across NPS Arctic units, where scientists are predicting that the average temperature may rise 10°F by 2080. Denali National Park contains some of the southernmost continuous permafrost in Alaska and recent measurements show that some of Denali's permafrost may be within a degree of thawing. With over 378,000 visitors in 2010, Denali is an important destination for visitors to Alaska, and restoration and adaptation efforts will help preserve the natural resources and recreational opportunities that are important to local economies.

Coastal erosion along the Alaskan Beaufort Sea.

Coastal erosion is also likely to have significant impacts on DOI resources. Shoreline erosion rates along parts of the Alaskan Beaufort Sea have increased significantly, from 28.5 ft per year (1979 to 2002) to 44.6 ft per year (2002 to 2007). Coastal erosion in this area has also threatened old exploratory wells drilled before BLM became manager of the National Petroleum Reserve-Alaska. A $16.8 million American Recovery and Reinvestment Act of 2009 (ARRA) project remediated health and safety threats to local communities by plugging the Drew Point Well, which was threatened by coastal erosion. The contract to remediate the well was awarded to a small native-owned company, providing employment opportunities to the communities of Nuiqsut, Barrow, and Atqusuk. In addition to plugging and abandoning the well, the contractors remediated the reserve of harmful contaminants, removing diesel fuel petroleum-contaminated mud from site. This project has prevented the release of harmful contaminants that would have impacted fisheries and marine mammals in the Beaufort Sea. Native Alaskans are dependent on these resources for a subsistence lifestyle.

(Sources of information: http://www.usgcrp.gov/usgcrp/nacc/education/alaska/ak-edu-3.htm; http://alaska.usgs.gov/science/geography/coastalerosion.html; http://recovery.doi.gov/press/wp-content/uploads/2009/04/alaska-drew-point.pdf).

As part of NPS's Disturbed Lands Restoration Program, the Abandoned Mineral Land Restoration Program encourages the full restoration of lands affected by mining activities, addresses environmental concerns (metals contamination, acid mine drainage), safety hazards (vertical mine openings, unstable slopes), and the sustainability of bat species, which may rely on mine shafts for habitat. The Park System Resource Protection Act (PSRPA) gives NPS authority to collect damages for injury to park resources. NPS' Environmental Response, Damage Assessment, and Restoration Branch provides support to parks in the prevention or minimizing of damage to park resources or their loss of use when incidents occur, including chemical releases, oil spills and physical destruction of property. The funds recovered are used to restore, replace, or acquire the equivalent of the resources that were lost or injured.

NPS' Restoration Activities: *Parks contain many examples of watersheds, landscapes, and marine resources disturbed by past human activity or other adverse influences that require:*

- *Restoring disturbed lands associated with abandoned roads and mines.*
- *Protecting wildlife habitat threatened by changes in water flow or quality such as prairies and wetlands.*
- *Controlling exotic plant species that impact native vegetation and wildlife habitat.*
- *Restoring fire effects to fire-dependent vegetation and wildlife habitat where natural fire regimes have been disrupted.*
- *Providing special protection of threatened and endangered plant and animal populations at risk.*
- *Perpetuating karst, cave, geologic processes and features by protecting groundwater quality.*
- *Managing marine fisheries to protect coral reefs and reef fish populations.*

- **Office of Surface Mining and Restoration (OSM).** The mission of OSM is to carry out the requirements of the Surface Mining Control and Reclamation Act (SMCRA) in cooperation with the states and tribes. Two of OSM's three primary objectives relate to restoration: (1) assure that the land is restored to beneficial use following mining, and (2) address the effects of past mining by aggressively pursuing reclamation of abandoned coal mines. Environmental problems associated with AMLs include surface and ground water pollution, entrances to open mines, water-filled pits, unreclaimed or inadequately reclaimed refuse piles and mine sites, sediment-clogged streams, damage from landslides, and fumes and surface instability resulting from mine fires and burning coal refuse. SMCRA authorized an AML Reclamation fee (see Appendix 1) based on coal production in order to hold the entire coal industry responsible for reclaiming coal mine lands left abandoned across the country. OSM's Environmental Restoration Program funds operations and projects for the AML Program. The Office of Technology Transfer provides information for surface mine design, evaluation, environmental protection, reclamation design, and bond release, and posts information about mining and reclamation conferences, forums, meetings, symposia and workshops.

Restoration Program Success: *In FY 2011, the Restoration Program restored, enhanced, and protected 87,709 acres and 401 stream/shoreline miles.*

- **Office of Restoration and Damage Assessment (ORDA) and the Restoration Program.** When hazardous substances or oil enter the environment, fish, wildlife, and other natural resources can be injured. Interior, along with state, tribal and other federal partners, acts as "trustee" for these resources on behalf of the public. The Department's trust resources include national parks, national wildlife refuges, lands managed by BLM, Indian lands, and natural resources held in trust by the federal government, waters managed by Reclamation, and

federally protected migratory birds and endangered and threatened plants and animals. Under the authorities of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (also known as CERCLA or "Superfund"), the Clean Water Act, and the Oil Pollution Act of 1990, trustees seek to identify and restore injured natural resources through the Natural Resource Damage Assessment and Restoration Program (NRDAR). The Restoration Program ensures the responsible parties, not taxpayers, bear the cost of restoring these injured resources to the quality and level of services provided had the event not occurred. Trustees assess the magnitude of injury during the response and cleanup or afterwards, and recover funds from responsible parties to carry out restoration activities. Trustees may also recover costs for the lost public use of the land or resources and for money spent by trustees to assess damages. A restoration plan is developed with public input that specifies the actions necessary to restore the injured resources. These actions can be carried out on the lands where injury occurred or at an alternate site which, when restored, provides a suitable replacement for the injured or lost resources. Trustees monitor the restoration actions to ensure long-term goals have been met. The Restoration Program is administered by ORDA and comprised of staff from BIA, BLM, FWS, NPS, Reclamation, Solicitor's Office, USGS, and the Office of Policy Analysis. ORDA's Restoration Support Unit (RSU) assists with all aspects of natural resource restoration planning, implementation, and monitoring. The Office manages the Department's Restoration Fund (see Appendix 3); develops guidance, policy and regulations to facilitate restoration; and works in partnership with other affected natural resource trustee agencies.

- **Office of Environmental Policy and Compliance (OEPC).** OEPC chairs a multi-bureau effort to clean up DOI sites through the Central Hazardous Materials Fund (CHF; see Appendix 3). This multi-bureau effort integrates the Department's interests in remediation and environmental restoration of the contaminated sites it manages by incorporating Interior's natural resource management concerns into CERCLA response actions. The CHF cost-effectively leverages DOI's legal, technical, and project management expertise to address the highest priority cleanup sites. The CHF focuses on the sites that pose the highest risks to employees, public health and welfare, and the environment; and typically, are so costly and complex to clean up that they cannot adequately be addressed using available bureau resources. Some of the larger sites include the Crab Orchard National Wildlife Refuge, Illinois; Valley Forge National Historic Park, Pennsylvania; Red Devil Mine, Alaska; Phosphate Mines, Idaho; and Orphan Mine, Grand Canyon National Park, Arizona. Since 1995, the Department has undertaken response actions at more than 65 sites and completed cleanup at 20 sites.

- **Office of Insular Affairs (OIA).** OIA is primarily involved in ecosystem restoration-related activities through control of the invasive Brown Treesnake (BTS), which was unintentionally introduced to the island of Guam following World War II. The BTS is directly responsible for the extinction or local extirpation of 10 of 13 native forest birds and three of 12 native lizards, which has caused a series of cascading impacts on the native forest structure and the entire terrestrial ecosystem of Guam. These snakes also currently cause nearly 200 outages per year, and their bite is responsible for approximately one in 1,200 emergency room visits on Guam. This program is a cooperative effort involving OIA (financial assistance and grants management), USGS (basic and applied research), FWS (Pacific and overall program coordination), the U.S. Department of Agriculture (USDA; control management), the Department of Defense (financial assistance and

control management on military facilities), and the governments of Hawaii, Guam, and the Commonwealth of the Northern Mariana Islands (restoration, control and management). The National Invasive Species Council (NISC) is an active member of the Brown Treesnake Technical Working Group and ensures that BTS concerns are incorporated into broader planning efforts on invasive species issues throughout Micronesia and Oceania.

USGS' Social Values for Ecosystem Services (SolVES): *To address some of the needs to quantify and map social values for use in ecosystem services assessments, USGS and Colorado State University developed a public domain tool, SolVES. This geographic information system (GIS) application is designed to use data from public attitude and preference surveys to assess, map, and quantify social values for ecosystem services. The recently released SolVES 2.0 enhances the opportunities for decision makers and researchers to weigh the tradeoffs among different ecosystem services in a variety of physical and social contexts, ranging from forest and rangeland to coastal and marine.*

- **U.S. Geological Survey (USGS).** USGS conducts research and monitoring to develop and a fundamental understanding of freshwater, terrestrial, and marine ecosystems. Examples of restoration-related research efforts include:
    - Cutting-edge work by USGS geneticists for use in making management decisions on fish and wildlife, including habitat and conservation.
    - Conducting a wide range of contaminant and restoration-related scientific expertise on CHF sites, NRDAR cases, and AMLs. For example, USGS scientists and mapping and digital data collection experts are collaborating to provide the scientific knowledge needed for effective cleanup of AMLs. In addition to providing scientific expertise on NRDAR cases, USGS has been working with ORDA on a restoration science initiative to develop protocols and metrics to better measure the ecological outcomes of restoration activities.
    - Informing the restoration efforts of the Great Lakes Restoration Initiative (GLRI), an interagency program that addresses the most significant environmental problems in the Great Lakes ecosystem. Results from USGS scientific studies and monitoring are helping guide restoration planning. For example, USGS is identifying the techniques and strategies that are most likely to succeed in restoring native fish. The goal is to accelerate the recovery of specific fish in Lake Ontario and to improve the resiliency and stability of Great Lakes fish communities by enhancing ecosystem function. See Appendix 3 for more information on the GLRI.

- **Wildland Fire Management Program.** The goal is to achieve both a cost-efficient and technically effective fire management program, which includes preparedness, suppression, hazardous fuels reduction, and restoration of ecosystems. Management activities are performed by BLM, FWS, NPS, and BIA. USGS provides fire science expertise and research. The Office of Wildland Fire Coordination coordinates the Department's efforts among the Interior bureaus and with other agencies. Multi-bureau operational programs are managed by the National Interagency Fire Center in Boise, Idaho. Interior's major partner in wildland fire management is the U.S. Forest Service (USFS).

Box 4-5. Sea Turtle Emergency Restoration, Texas

The Gulf Coast is home to one of the most ecologically complex regions in the country and site of a number of refuges, national parks, and national seashores. Following the April 2010 BP Deepwater Horizon drilling rig explosion and oil spill, the Deepwater Horizon Oil Spill Natural Resource Trustees identified three potential emergency restoration projects, including the Kemp's Ridley Sea Turtle Emergency Restoration Project. More Kemp's Ridley sea turtles were documented oiled as a result of the spill than any other sea turtle species, and the spill location overlapped the known distribution of important Kemp's Ridley foraging habitat.

NPS Padre Island National Seashore employee releasing recently hatched Kemp's Ridley sea turtles (Ray Kirkwood).

Emergency restoration actions are taken by trustees prior to the completion of the NRDAR planning process to prevent or reduce continuing natural resource injuries, and avoid potential irreversible loss of natural resources. Actions implemented for this project included enhanced support of Kemp's Ridley nest detection and protection activities on the Texas Gulf Coast, and construction of facilities to decrease response time and improve Kemp's Ridley nest detection and protection on Padre Island National Seashore. BP agreed to fund the project for the purpose of increasing nest detection and collection activities on Padre Island National Seashore, San Bernard National Wildlife Refuge, and state lands on the upper Texas coast. All located nests were transferred to existing egg incubation facilities at Padre Island National Seashore. Funds were used for enhanced nest detection surveys, field supplies, and construction of a temporary base camp and nesting corral at Padre Island National Seashore. This emergency restoration project helped reduce further injury to populations by protecting nests and increasing hatchling recruitment. The Kemp's Ridley Sea Turtle Emergency Restoration Project was completed in August 2011.

Economic Valuation of Restoration

As described throughout this report, the resources and activities of Interior enrich the nation in many ways. In some areas, determining value is relatively straightforward, such as for minerals or grazing lands, which are traded in established markets. Other areas may represent emerging markets, such as carbon sequestration and alternative energy, that are becoming better defined. However, few markets exist for experiencing a day of hiking or fishing, maintaining and interpreting cultural heritage, enhancing the health of wetlands and rangelands, or preserving habitat for endangered species. These are just some of the many non-marketed ecosystem services provided by Interior's resources.

As discussed in Chapter 3 of the FY 2010 DOI Economic Contributions Report (available on-line at http://www.doi.gov/ppa/upload/DOI-Econ-Report-6-21-2011.pdf), ecologists currently classify ecosystem services into four categories:

1. **Provisioning services** are goods 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.

Box 4-6. Great Lakes Legacy Act Funds Partnered with NRDAR Settlement in Indiana

Over many decades, steel mills, refineries, and manufacturing facilities have released hazardous substances and oil into the Grand Calumet River in northwestern Indiana, severely degrading the quality of water and sediments and causing injury to aquatic resources and migratory birds. Restoration efforts have been underway for over a decade, including dredging contaminated sediments from the riverbed, restoring in-stream habitat for fish and aquatic invertebrates, restoring migratory bird habitat within the riparian corridor, acquiring 139 acres of dune and swale habitat to become part of the National Park Service's Indiana Dunes National Lakeshore, and acquiring 77 acres of state-managed riparian habitat along nearby Salt Creek. More recently, FWS and the State of Indiana have partnered with EPA to clean up and restore the heavily polluted west branch of the Grand Calumet River by removing 71,000 cubic yards of contaminated material and capping a half mile of the river near Hammond, Indiana. This $33 million project was funded in part by the Great Lakes Legacy Act ($21.5 million) and in part by NRDAR settlement funds ($11.6 million). Along with sediment removal and capping, habitat restoration activities included planting native grasses, forbs, and woody vegetation along the riverbank and upland areas along this stretch of the river. The Great Lakes Water Quality Agreement calls for Remedial Action Plans to restore and protect 14 beneficial uses in Areas of Concern. Since the cleanup and restoration began in the west branch, two of the 14 "beneficial use impairments" have been delisted—the restriction on drinking water and added costs to agriculture—leading to tangible economic benefits to the area.

Placing sand cap and grading the north slope of Grand Calumet river bank (SulTRAC).

Interior's lands and managed resources produce a wide range of these valuable ecosystem services, including agriculture, drinking water, energy, flood and disease control, carbon sequestration, recreation, and cultural resources. Interior's ecosystem restoration activities play an important role in maintaining and enhancing the services from departmental lands and managed resources. Although the jobs and economic contributions from restoration are substantial and important, as described in the next section, they do not represent the full economic value of ecosystem restoration because they do not capture the net benefits associated with environmental goods and services not bought and sold in markets. Physical measures such as restored stream-miles or acres are also important for understanding and conveying restoration success, but they do not offer a complete measure of restoration benefits.

In economics, restoration benefits are valued in terms of the new or additional ecosystem services that are created as a result of the project. Economic value is defined as the amount society is willing to pay for the ecosystem service benefits created by the project. Net economic value is that willingness to pay less

the cost of the project (i.e., net benefits). Why does a complete measurement of restoration project benefits matter? A fundamental question for most decision makers is whether the total benefits exceed the total costs (i.e., generates positive net benefits). Restoration, reclamation, rehabilitation, remediation, and cleanup projects are often costly. While investment in these projects provides value to the public by restoring ecosystem function and structure to damaged, degraded, and destroyed ecosystems, they are often non-market benefits. If proper economic analysis is not conducted, an incomplete measure of these benefits could lead to under-investment in restoration or selection of a project option with lower actual net benefits than other alternatives.

Economic Approaches. Non-market valuation methods are one way to estimate values for changes in environmental quality such as those resulting from ecosystem restoration projects. These techniques can use data from related markets (such as the cost of traveling to a given site or property values) or data from questionnaires asking respondents their willingness to pay for a given change in quality to estimate these values. Some studies have used contingent valuation and choice experiment techniques to analyze survey data and estimate respondents' willingness to pay for restoration efforts related to wetlands or water resources (Loomis et al., 2000), wildlife habitat (Garber-Yontz et al., 2004), and forests (Adamowicz et al., 2000). Other studies have used data on travel costs (Bergstrom et al., 2004) or property values (Williamson et al., 2008) to develop statistical estimates of the economic value of restoration efforts.

Production function approaches are another method that can be used to value environmental quality provided by ecosystem restoration efforts. These methods estimate the value of ecosystem services as one input into productive economic activities. Some examples of production function approach applications include commercial and recreational fishing, agricultural systems, invasive species control, watershed protection, and damage cost avoidance (Barbier 2007).

Cost-based methods (also known as restoration-based) are used to estimate the value of ecosystem services by measuring the amount individuals would be willing to pay to avoid damages (i.e., avoided losses), the cost of restoring or replacing the lost services, or the cost of producing substitute services. Habitat equivalency analysis (HEA) and resource equivalency analysis (REA) are examples of cost-based methods that can be used to approximate the value of ecosystem goods provided by restoration projects, such as the cost of restoring habitat after an oil spill. These methods can give a rough indication of economic value, and the ease of analysis can be advantageous. However, their use requires the assumption that the public's value of the original resource is equivalent to that of the replaced or restored resource, which may not be the case. These methods are only as good as the quality of the inputs, which can be time-consuming and expensive to develop. Restoration projects are usually site-specific and costs can vary extensively by resource type, location, methods, and timing.

Challenges. There is clearly an extensive literature indicating that individuals value improvements in environmental quality and are willing to pay for such improvements, including restoration projects. However, estimating the economic value of ecosystem restoration as a change in environmental quality and the associated flow of ecosystem services presents several challenges. Notably, scientists identify that restoration research is still evolving for many resources. Baseline scientific data necessary to quantify changes in services may not exist. Site studies are often time-consuming and expensive to plan, implement, and monitor for success. Long-term monitoring of restoration projects provides a critical feedback loop to inform future restoration. However, priority-setting of funds can cut monitoring short,

effectively short-changing the quantity and quality of available restoration data. Similarly, economic valuation data collection and studies can be time-consuming and expensive. Valuation of cultural losses, such as resources with spiritual and religious uses, have been particularly challenging for economists. Many of the commonly used economic valuation methods described above are difficult to apply in the case of Native American communities, since many tribal members may feel the cultural losses are not commensurable with a dollar value (O'Neill 2009).

Case Studies of the Economic Contributions of Selected DOI Restoration Projects

As discussed above, federal investment in ecosystem restoration and monitoring protect federal trusts, ensure public health and safety, and preserve and enhance essential ecosystem services. These investments also provide economic contributions and jobs. Given constrained budgets and competing demands for investment, there is a need to better understand the connection between restoring the health and productivity of ecosystems, and the resulting economic benefits to local communities. This section includes nine case studies that highlight the economic contributions of a wide range of restoration projects supported by DOI bureaus and partners. The restoration projects were implemented on BLM, FWS, and NPS lands, and include river, riparian, forest, wetland, grassland, prairie, and coastal resources, as well as the demolition of a hazardous building.

Overview of Case Study Methods

Economic and employment contributions are estimated for each of the case study projects. Restored ecosystems are expected to benefit local communities beyond the completion of the restoration project. Thus, these projects will create additional future jobs and non-market benefits by providing increased opportunities for tourism, improving and sustaining fisheries and wildlife habitat, and reducing risk from flooding and other natural disasters. These future benefits are not accounted for in this analysis.

Job and income contributions for each case study were estimated using IMPLAN. IMPLAN is a widely used input-output software and data system for estimating the job and income effects resulting from the interdependencies and interactions of economic sectors and consumers (see Appendix 3 and Appendix 7 for more information on IMPLAN and how the restoration cases discussed in this chapter were modeled).

Restoration projects involve spending in a local economy on services such as construction and environmental consulting. The firms providing these services purchase materials such as rocks and riprap, monitoring equipment, and grass seed to accomplish their work. In many cases, materials for projects are purchased within the local economy. In order to meet the resultant increase in demand, input suppliers must also increase their purchases of inputs from other industries, thus creating additional economic activity. This economic activity supports jobs and generates income. Local firms and input suppliers need to maintain or hire additional employees to meet project demands. Subsequently, employees of directly affected businesses and input suppliers use their incomes to purchase goods and services in the local economy, generating further economic activity, and thus amplifying the ripple effect. Reported impacts reflect restoration expenditures external to DOI; the impacts do not include job and labor income impacts supported directly by DOI employees. Output and employment contributions for DOI employees are included in Chapter 2.

The case studies illustrate the substantial economic benefits that restoration projects provide for local communities, and the variation in impacts across projects emphasizes the need to take caution when transferring impact estimates from one project to another. Restoration type, costs and availability of inputs and labor, and modeling methods all play large roles in the final impact estimates. Each of these factors need to be considered when comparing or transferring impact estimates. See Appendix 3 for a detailed discussion.

Table 4-1 provides a summary of the case study results and presents value of industry output and employment contributions.

Table 4-1. Summary of Restoration Case Studies (2011$)

Project Name	Lead Bureau/ Partners	Location	Restoration Type	Total Expenditures ($2011)	Project Duration	Avg Expenditure/ yr	Local Job Impact (avg/yr)	Local Labor Income Impact* (avg/yr)	Local Economic Output (avg/yr)
Ex 1:Truckee River	BLM and TNC	Nevada	River Rechannel-ing	$18.9M	5 years	$3.8M	37	$2.7M	$5.7M
Ex 2:Gerber Stew	BLM	Oregon	Forest	$3M	8 years	$370,000	19	$870,000	Not calculated
Ex 3:Blanca Wetlands	BLM	Colorado	Wetlands	$75,000/year	ongoing	$75,000	< 1	$29,000	$103,000
Ex 4:Las Cienegas	BLM	New Mexico	Grassland/ Invasives Mitigation	$1.5M	2 years	$767 ,000	10	$600,000	Not calculated
Ex 5:Jaite Paper Mill Planning and implementa-tion	NPS	Ohio	Hazardous Building Demolition	Planning: $600,000 Implementation: $1.3M	Planning: 2.5 years Implementa -tion: 3 months	—	Planning: 4 Implement-ation 36	Planning: $214,000 Implementation: $755,000 (3 months)	$479,000
Ex 6:Glacial Ridge	FWS, TNC, NRCS	Minnesota	Prairie/ Wetland	$24M	11 years	$2.2M	15	$839,000	$1.9M
Ex 7:Ni-les'tun/Bando n Marsh	FWS and DU	Oregon	Tidal Marsh (restoration only)	$1.4M	2 years	$700,000	5	$453,000	$1.1M
Ex 8:CT Easement	FWS and TNC	Connecticut	Riparian/ Farm Preservation	$58,000	5 years	$12,000	< 1	$12,000	$23,000
Ex 9:RI Plover Nesting	FWS and TNC	Rhode Island	Public Education/ Habitat Manage-ment	$130,000	4 years	$32,000	< 1	$41,000	$58,000

*Labor income impacts include all salaries, wages, and benefits accruing to local workers, and are reported on an annual basis in 2011 dollars ($2011).

Case example 4-1. Partners Help Conserve, Enhance, and Restore Nevada's Lower Truckee River

Since 1974, the PLPT have managed fisheries designed to maintain the Kooeyooe and Lahontan cutthroat trout at desirable levels. The PLPT have called Pyramid Lake home for countless generations and are known as the Kooeyooetukadu or the "Kooeyooe Eaters."

The Lower Truckee River originates in the Sierra Nevada and flows through public, private, and tribally owned lands, including 31 miles of the Pyramid Lake Paiute Tribe (PLPT) reservation, terminating in Pyramid Lake within the reservation. Once remarkably productive, a century of man-made changes have heavily degraded the river system, leaving it inundated with invasive weeds. Significant damage occurred as part of a 1960s flood control project, including river downcutting, depression of the groundwater table, and lowering of Pyramid Lake by as much as 81 vertical feet. By the 1970s, the river had lost roughly 90% of its forest canopy, 40% of its resident bird species, and had no resident Kooeyooe (also spelled Cui-ui) or Lahontan cutthroat trout. Since then, many policies have been initiated to restore the lower river, including the purchase and dedication of water rights to improve flows, changes in reservoir operations to support cottonwood recruitment and Kooeyooe spawning, and the removal of some barriers to fish passage. BLM, Reclamation, and FWS have partnered with the PLPT, The Nature Conservancy (TNC), and at least 10 other federal, state, and local agencies on a wide variety of ambitious conservation, recovery, and restoration projects designed to achieve economic, cultural, environmental, and human health benefits in the Lower Truckee River.

In addition to their active fisheries recovery program, the PLPT is working to restore sections of the Lower Truckee within the reservation. The restoration work involves treating noxious weeds and replanting with native vegetation to help stabilize the river banks and reduce sediment loads. The selection of plant materials is done in consultation with tribal elders to ensure that plants with ethnobotanic values are accessible to all members of the tribe for traditional use and management. Some of this work has been funded by FWS, including a $200,000 grant announced in May 2011 for habitat restoration to promote reproductive success of the Kooeyooe below a nearby dam.

TNC wetland restoration at McCarran Ranch.

Further upstream, TNC is implementing a phased approach to restore natural channels and vegetation along the Lower Truckee River. The TNC Truckee River Project began with the purchase of the McCarran Ranch. Pilot work was implemented in 2003 and full restoration was started in 2006. With the success of the McCarran Ranch restoration, TNC began partnering with public land managers to restore additional stretches of the river. Work proceeded in 2008 with restoration at the Lockwood property owned by Washoe County. TNC also entered into an agreement with BLM in 2008 to allow TNC to restore approximately 408 acres of public land at the 102 Ranch and the Mustang Ranch. The premise of the restoration approach is that the biology of the river can recover only after the physical foundation-especially the channel geometry and groundwater elevation-has been returned to forms that approximate their original conditions. The supporting Environmental Assessment[17] describes the high restoration potential and habitat values of this effort, including benefits to several tribal interests from improved

According to BLM, conservation efforts along the Truckee River have made important strides in restoring degraded habitat, and serve as a model of what can be achieved when partners work together to achieve goals that would otherwise be unattainable if attempted alone.

[17] Available on-line at http://www.usbr.gov/mp/nepa/documentShow.cfm?Doc_ID=3485

water quality and quantity, fisheries, and availability of traditional native plant species.

Between 2006 and 2011, TNC reintroduced sinuosity into the river course, sloped the river banks, and planted the banks with native species. Monitoring of birds, fish, and vegetation is ongoing to help assure restoration success.

Economic Impacts of Restoration. The restoration work at Lockwood and on the McCarran, 102, and Mustang ranches includes nearly 9 river miles, 19 new wetlands, 13 new river meanders, 31 in-stream riffles, and 263 acres of revegetation. Restoration expenditures have so far totaled $18.9 million ($2011) over the combined projects' five year duration, averaging $3.8 million spent annually (2006-2010). Much of the projects' work - from initial design to major earthmoving to monitoring - was awarded to local contractors with TNC oversight. In addition to TNC, 12 firms worked on the Truckee River Project, nine of which were located within 60 miles of the river in Washoe, Storey, and Lyon Counties. Project expenditures directly accounted for 15 jobs in the local area each year and nearly $1.5 million annually in local labor income (salaries, wages, and benefits). Over 90% of the materials for the project were purchased from local suppliers, with over half of these expenditures going to purchase rocks and rip-rap from local mining and quarrying businesses and the remaining expenditures going toward construction supplies purchased at local retailers. More than 99% of all labor income went to employees living in the area who subsequently spent much of their income in local communities. The resulting spending by the suppliers and site workers accounted for an additional 22 jobs and an additional $1.2 million in local labor income per year. To date, the Truckee River Project has supported an average of over 37 jobs and $2.7 million in labor income to the local economy each year. These benefits will continue in future years, with projects being planned for two additional sites in the near future and other sites being evaluated for more restoration work.

Equipment-intensive construction on 102 Ranch project (Chris Sega, TNC, 2008).

102 Ranch in 2006, before restoration work, and after in 2009 (TNC).

Beyond these economic impacts, local communities are expected to benefit in the long-term from improved water quality as wetlands and native plants filter nutrients from the water; more flood attenuation as floodwaters spread out during high flows without doing damage elsewhere; added open space and recreation for kayakers, hikers, bikers, birdwatchers, and others; and enhanced educational opportunities for local students and recreational users.

Case example 4-2. Gerber Stew BLM Stewardship Contract in Southeast Oregon Aims to Improve Rangeland and Wildlife Habitat, Increase Forest Resiliency, and Reduce Hazardous Fuel Loads

BLM has the ability to enter into "Stewardship Contracts" to make forests and rangelands more resilient to natural disturbances. The contracts allow companies and communities to retain forest and rangeland products in exchange for services like thinning trees and brush or removing dead wood. Long-term contracts foster a public-private partnership to restore forest and rangeland health at a savings to taxpayers by allowing contractors to invest in equipment and infrastructure for making wood products or producing biomass energy.

Western Juniper trees used to make hardboard by a nearby mill.

Clearing juniper stands from riparian areas like Norcross Spring benefits the area's wildlife populations.

The Gerber Stew Stewardship Contract was awarded in September 2004 to a firm based in Bend, Oregon to implement restoration treatments and projects in BLM's Klamath Falls Resource Area. Western juniper is cut, burned and thinned to improve forest and rangeland health, and to reduce hazardous fuels as part of the National Fire Plan. Under the contract, forest-health projects generated timber that the contractor could use at local mills. The Gerber Stew Stewardship Contract provided an opportunity for BLM to meet restoration goals, while supporting timber utilization markets, reducing wildfire risk, and providing employment for local rural communities.

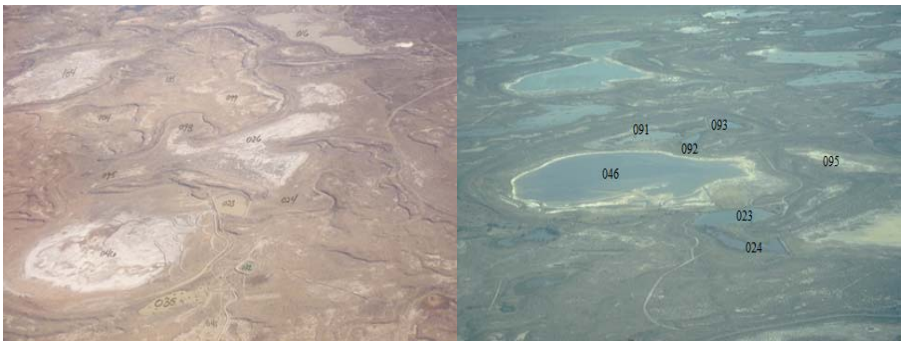
Economic Impacts of Restoration. To date about $3 million has been spent on restoration work, providing $300,000 of forest products to help offset the cost of this work. Activities have included hazardous fuel reduction, rangeland restoration, riparian/spring enhancement, wildlife habitat improvement, road improvement and obliteration, fence repair, biomass utilization, and forest health restoration. Rural and community benefits include employment opportunities, a substantial reduction in smoke emissions as a result of utilizing over 38,000 tons of biomass, restoration treatments on over 6,000 acres, and miles of road improvement. The biomass material removed included fuel that was delivered to a power generation facility, clean chips that went to a product manufacturer for hardboard production, commercial sawlogs, and sawlogs used for a variety of landscape and household products. Forest and road restoration, logging activities, and processing of biomass from the Gerber Stew Stewardship Contract directly accounted for 12 jobs and over $660,000 in labor income per year (salaries, wages, and benefits) in the local area. Spending by contractors and site workers accounted for an additional 10 jobs and an additional $350,000 in local labor income per year. Combined, the Gerber Stew Stewardship contract is estimated to have supported 22 jobs per year in rural counties in southern Oregon and northern California for the eight years (2004-2011) and over $1 million per year in local labor income.

Timber used for hog fuel sent to a nearby power generating facility.

Case example 4-3. BLM Blanca Wetland Restoration, Critical Habitat for Threatened, Endangered, and Sensitive Species, and Reliable Annual Contracts for Local Small Businesses in South-Central Colorado

View of Blanca Peak (BLM).

For thousands of years, much of the San Luis Valley basin of south-central Colorado was made up of a series of lakes, marshes, and shallow playa basins that were integral to the lives of indigenous peoples. By the mid-1900s, the basins had dried up from the diversion of water sources for irrigation and became known as the "Dry Lakes." In 1965, BLM began a series of wildlife habitat projects to restore some of the historic wetland characteristics and processes, and 9,600 acres of the former "Dry Lakes" area became known as Blanca Wetlands. BLM designated the Blanca Wetlands Area (BWA) as an "Area of Critical Environmental Concern" (ACEC) in 1991, due to its high importance for wildlife and recreational values. Today the BWA and the South San Luis Lakes system are managed by BLM to restore wetland habitat and provide wetland connectivity in the valley. BLM conducts wetland restoration activities across a 14,000-acre landscape, providing habitat to over 160 species of birds and 13 threatened, endangered and sensitive species, including bird, amphibian, fish, and plant species.

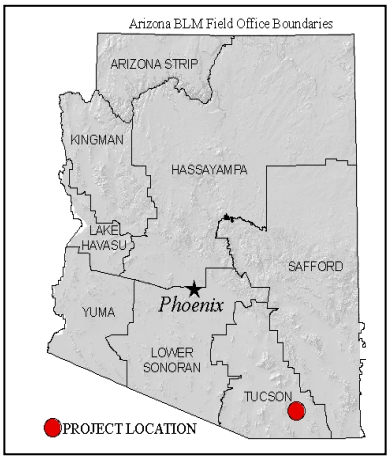


Blanca Wetlands 1968, pre- and post-restoration (BLM).

Wetland restoration in the BWA includes drawing water from an irrigation canal and a series of artesian wells and developing an infrastructure system of ditches and dikes to promote water movement through the area. BLM also has an active science program, collecting and analyzing a variety of data to continually improve wetlands management. These activities have resulted in the restoration of over 200 playa lakes, ponds, and marshlands. This area that was once dry due to human-induced dewatering has now become a nationally significant migration and nesting area for many wildlife species, including Colorado's largest breeding population of Western snowy plover. In FY 2011, BLM started investigating the possibility of enlarging the boundary of the ACEC to promote focused efforts toward wetland connectivity and restoration on a landscape scale.

Economic Impacts of Restoration. Restoration and monitoring activities in the BWA have been ongoing since the 1960s. Annual expenditures have been about $75,000 ($2011). Annual activities include site maintenance and infrastructure development, weed management, well certification, monitoring (to collect bird, amphibian, fish, macroinvertebrate, groundwater and water quality, soils, and vegetation data). These annual expenditures provide local firms with a reliable stream of work and support an average of over $29,000 in local labor income (salaries, wages, and benefits) each year. Over the next 10 years, BLM anticipates increased expenditures on deferred maintenance for wells and structures. Economic impacts in these years could support as much as $150,000 in labor income per year for local well drillers, welders, and heavy equipment operators.

Case example 4-4. Las Cienegas National Conservation Area Native Grassland Restoration



The desert grasslands found within the Las Cienegas National Conservation Area (LCNCA) include some of the rarest habitats in the American Southwest and are home to six endangered species. These grasslands have degraded over the last 100 years into mesquite woodlands due to grazing practices, fire suppression policies, and the introduction of non-native plant species. The loss of grassland has encouraged erosion, reduced watershed function, and decreased available habitat for pronghorn antelope and other species. In 2009 and 2010, BLM implemented a grassland restoration project on over 3,000 acres, out of an identified 20,000 acres of degraded grassland found within the LCNCA. The project has removed mesquite trees from the area, helping to restore habitat for pronghorn antelope and rare migratory and grassland birds. The project also helped to stabilize the regional watershed by increasing water infiltration and reducing erosion. The project has also provided local communities the opportunity to use the biomass generated from the thinning process.

The LCNCA is an archeologically significant site. Prior to ground disturbance, BLM completed cultural resource surveys and inventories to comply with the National Historic Preservation Act. Nearly 10,000 acres were surveyed, identifying 53 new archeological sites and an additional 378 isolated artifacts dating as far back as 3,000 B.C. The newly identified cultural sites will be entered into the State of Arizona Cultural Resource database operated by the Arizona State Museum. Many of the archaeological sites are eligible for entry into the National Register of Historic Places. Following the flagging of all identified archeological sites, mechanical and hand removal treatments were used to remove mesquite trees from the grasslands. The restoration resulted in the removal of nearly 1,500 tons of biomass through stewardship contracts and wood permits issued to the local public and local Native American tribes for firewood collection. Permits were also issued to a local mesquite mill that utilized otherwise unmerchantable root balls, trunks, and branches to create unique, hand-crafted furniture and household items.

(Above) Grubbing a mesquite tree to restore native grasslands. (Right) Pronghorn

A mesquite slab from the project site was provided to a contractor to replace the yoke for the Arizona Liberty Bell.

Economic Impacts of Restoration. Project funding was provided by ARRA and averaged $767,000 ($2011) per year for the two years (2009-2010). Ten primary vendors were awarded contracts and multiple other local vendors provided sub-contract work, supplies and materials purchasing, equipment rental and repair, and fuel. Project expenditures directly accounted for 4 jobs and over $330,000 in local labor income (salaries, wages, and benefits) per year. The emphasis on local contracting resulted in an additional 6 jobs in the local area and an additional $270,000 in local labor income per year generated through contractor expenditures. The project also employed a BLM youth hand crew to cut and spray mesquite on 196 acres of land. The college-aged youth were provided summer jobs working and learning about firefighting, land management, and conservation.

Case example 4-5. The Jaite Paper Mill Demolition in the Cuyahoga Valley National Park Removes a Human Health and Safety Hazard While Providing Engineering and Construction Jobs

The 24-acre Jaite Paper Mill site is located on a natural floodplain at the confluence between the Cuyahoga River and Brandywine Creek at Brecksville, Ohio. The Mill Site is immediately adjacent to the popular Ohio and Erie Canal Towpath Trail. Originally constructed in 1905, the Mill was operated continuously until 1984, by which time the size of the plant had grown to 180,000 square feet. In 1985, the Mill became part of the Cuyahoga Valley National Park. A fire in October 1992 severely damaged a large part of the plant. After this fire, the plant began deteriorating rapidly and became increasingly dangerous to park staff and visitors. The demolition and removal of the Mill was intended to eliminate a human health and safety hazard and to restore the site back to a natural, visitor-friendly area.

Demolition of mill building and fugitive dust abatement (NPS).

The project involved demolishing and removing all above-ground materials, including concrete, metal, wood, and glass. Mitigation work was needed for lead paint and asbestos-containing materials, including the active control of fugitive dust during demolition activities. Certain historical features were preserved so that the park can interpret the site for visitors in the future. These features include some railroad posts and a key part of the paper-making process, a "fourdrinier" which dried the paper (see photo).

Economic Impacts of Restoration. The project was implemented by NPS with nearly all of the planning, engineering, and construction tasks contracted to an environmental engineering firm and local construction subcontractor. Planning for the project took approximately 2.5 years to complete with expenditures totaling $600,000 ($2011). Planning activities supported a total of 4 jobs per year and over $535,000 ($214,000 per year) in local labor income (salaries, wages, and benefits).

The actual demolition and removal fieldwork occurred during the spring of 2006 and took approximately three months to complete. Expenditures for the demolition phase totaled $1.3 million ($2011). The demolition directly supplied jobs for approximately 27 construction workers for the three-month duration and supplied over $380,000 in labor income to the local economy. Salary spending and equipment purchases for the demolition project increased demand for products and services from local vendors and are estimated to have supported an additional 9 jobs and $375,000 in labor income within the local economy during 2006.

South end of the mill site after the demolition was completed (NPS).

Case example 4-6. Largest Prairie Grassland Restoration Project in U.S. Leads to New National Wildlife Refuge and Local Economic Impacts, Including New Small Businesses

The Agassiz Beach Ridges landscape is located in the Red River watershed of northwestern Minnesota, and falls within the larger Prairie Pothole Region (PPR). The PPR has been identified as being responsible for producing 50-80 percent of the continent's waterfowl, while accounting for only 10% of the available breeding habitat. It is estimated that less than 1% of Minnesota's historic native prairie remains intact, with much of the remnant prairie scattered about in small clusters. Restoration of key sites within this landscape has been identified as the most important strategy to create a contiguous expanse of prairie/wetland mosaic and improve the ecological functioning of these systems.

The Glacial Ridge National Wildlife Refuge (TNC).

In the fall of 2000, The Nature Conservancy (TNC) purchased the 24,000-acre Glacial Ridge property near the town of Crookston, Minnesota. Native cover and the natural functioning of over 90% of the property (22,000 acres) had been degraded or eliminated, primarily through conversion to row crop agriculture, wetland drainage activities, and gravel mining operations. The purchase and subsequent restoration of this property will provide native habitat and connect nearly 7,800 acres of existing native prairie and wetland communities. The project will become part of a mosaic of protected lands in the area, connecting several other ownerships that harbor native plant communities. In addition to supporting wildlife, the project will help protect water quality levels for the nearby town of Crookston and will contribute to flood control along the Red River. TNC subsequently transferred ownership of the property to FWS, and the property now makes up the majority of the new Glacial Ridge National Wildlife Refuge (NWR). This Refuge was established in 2004 and has a planned final size of 37,756 acres.[18] The Glacial Ridge restoration project has been identified by FWS as the largest tallgrass prairie and wetland restoration project in U.S. history.

A bulldozer fills a drainage ditch as part of a wetland restoration on the Glacial Ridge property (TNC).

Economic Impacts of Restoration. Restoration of the Glacial Ridge property began in 2001 and concluded in 2011. Through funding provided by over 20 partner agencies/organizations, including significant contributions from USFWS and USDA's Natural Resource Conservation Service, restoration and management activities brought substantial economic benefits to the surrounding rural counties in northwestern Minnesota each year over the course of this 11-year project. Yearly project expenditures averaged about $2.2 million ($2011). These expenditures directly supported 6 jobs in the local communities surrounding the property and provided nearly $476,000 in local labor income (salaries, wages, and benefits) each year. In addition to these direct impacts, the Glacial Ridge project supported another 9 jobs each year, which provided an additional $363,000 in local labor income. The Glacial Ridge project also supported the creation of new small businesses. Each year the project purchased over $430,000 worth of native seed from local vendors. Four new seed supply businesses and a new seeding and mowing business were created to meet this substantial new demand for seed. Other local vendors have expanded as a result of the new demand, with two new seed storage sheds built at one company and new seed cleaning equipment purchased at another.

[18] More information about Glacial Ridge is available on-line at http://www.fws.gov/midwest/GlacialRidge/

Case example 4-7. Ni-les'tun at Bandon Marsh National Wildlife Refuge: The Largest Tidal Marsh Restoration in Oregon Relies on Partnerships, Provides Construction Jobs, and Supports Local Businesses

Migrating shorebirds and waterfowl are so dependent on the food supply and stopover estuary habitat in the lower Coquille River that Congress established Bandon Marsh National Wildlife Refuge (OR) in 1983.[19] Through congressionally approved expansion, acquisition, and donation, the Refuge now encompasses 889 acres and is composed of two units: Bandon Marsh and Ni-les'tun (named by the Coquille Tribe and pronounced NYE-les-ton, which means People by the small fish dam). Historically, Ni-les'tun was a diverse tidal wetland like Bandon Marsh, but was diked and drained for agricultural purposes beginning in the mid to late 1800s. Restoring 418 acres of tidal marsh has required FWS and its many partners to collaborate through more than a decade of planning, land acquisition, scientific study, and extensive engineering design.

Restoration Success: *Since restoration construction activity stopped last September, wildlife has responded to the return of the tides to Ni-les'tun. Probably the most obvious response has been by waterfowl, most spectacularly a flock of up to 500 green-winged teal are taking advantage of the channels and pools filled by the tides. Compared to prior to the restoration, there have also been persistent flocks of sandpipers, plovers, dowitchers, scattered Wilson's snipe, as well as a greater presence of great blue herons and great egrets (*Oregon Coast National Wildlife Refuge Complex, Restoration Update, 12/8/11).

High tide aerial view of the Ni-les'tun tidal marsh restoration project, Nov. 2011, two months after the project was completed (Roy Lowe, FWS).

Construction funding was from a variety of sources including: small grants and donations, ARRA, Oregon Lottery funds granted through the Oregon Watershed Enhancement Board, and about $1.35 million from the New Carissa oil spill NRDAR settlement.[20] With a total of about $10 million of investment, the restoration of the twice daily tidal flush is now helping to rebuild a natural estuary foodchain, including an array of fish and birds that had sustained native tribes for thousands of years. The Coquille River's Chinook and Coho salmon runs will benefit from the habitat restoration. Local regional and national visitors are anticipated to visit the marsh to experience wildlife through hiking birdwatching, and waterfowl hunting.

Over two dozen public and private partners were involved in the restoration. Ducks Unlimited (DU), oversaw the design and construction of the restoration. Planning began 2001; construction began in 2009 and was completed in 2011. The final design included the removal of 6,700 feet of levee and three tidegates, construction of setback levees and a tidegate to protect neighbors, filling 15 miles of drainage ditches, removing 3,500 feet of old farm roads, excavating 4.5 miles of sinuous tidal and stream channels, installing large woody debris for fish habitat and planting native vegetation. The project included the restoration of 11 acres of freshwater wetlands, and stream channel and fish passage improvements. FWS also coordinated with Coos-Curry Electric Cooperative to relocate major electric utilities from above

[19] More information about the Bandon Marsh NWR is available on-line at http://www.fws.gov/oregoncoast/bandonmarsh/restoration/index.cfm
[20] More information on the New Carissa Oil Spill is available on-line at http://www.fws.gov/oregonfwo/Contaminants/Spills/NewCarissa/

ground where they would pose a flight hazard to birds, to 40 feet beneath the river bottom. FWS, the U.S. Department of Transportation, and Coos County worked together to raise and repave the adjacent county road to improve safety and prevent tidal flooding.

Archeology was a very important design factor on this site. FWS directed that all construction would proceed with caution, and DU worked with tribal and contract archeologists and the State Historic Preservation Office to ensure that designs were compatible with cultural resources onsite. FWS instructed construction workers to keep an eye out for anything that archaeologists might want to investigate, and to stop work until they did. During the restoration, the construction unearthed evidence that powerful earthquakes and sands washed in by tsunamis had dramatically and repeatedly altered the landscape. They also found clues that humans occupied the area before and after those cataclysmic events, uncovering living sites, tools and shells dating back more than 4,000 years.

Channel digging (Roy Lowe/FWS).

Economic Impacts of Restoration. As the largest tidal marsh restoration in Oregon to date, an extensive amount of work was coordinated with FWS and designed, engineered, constructed, and contracted by DU. Expenditures for the tidal marsh restoration portion of the project were about $31,000 annually during the planning phase (2001-2009) and $700,000 annually during the contracted implementation phase (2010-2011), accounting for a total restoration cost of $1.64 million ($2011). Of these costs, an average of $98,000 annually went directly to local labor income (salaries, wages, and benefits) to employee construction workers in Coos County during the implementation phase. An additional $165,000 annually went directly to scientists and project managers working within the state. Restoring the marsh was equipment intensive and required over $970,000 in materials, which were rented and purchased from businesses in Coos County. These purchases supported local equipment rental, rock quarry, and greenhouse businesses, indirectly providing 5 jobs and $190,000 in labor income annually in the county. In total, the project provided over $1,130,000 in labor income over the life of the project.

Case example 4-8. Conservation Easements in Connecticut Protect Habitat and Generate Local Income

Using funds from an NRDAR settlement, FWS obligated $557,810 ($2011) to TNC of Massachusetts for the purchase of permanent conservation easements on approximately 200 acres of riparian lands along the Housatonic River in Salisbury, Connecticut. Conservation of riparian habitat will help to: (1) protect water quality; (2) protect nesting habitat for migratory songbirds and other wildlife, including several rare and endangered plants, turtles, salamanders and dragonflies; and (3) maintain the scenic, agrarian character of the region. These efforts provide a beneficial tradeoff from the harm to the river and associated wildlife caused by historical polychlorinated biphenyls (PCBs) contamination.

Protecting a 13-acre property adjacent to the Housatonic River (FWS).

Economic Impacts of Restoration. From 2011 to 2015, it is anticipated that $500,000 will be spent to purchase conservation easements. An additional $58,000 will be spent to administer the easements, which includes identification, resource assessment, and management and restoration planning. These expenses will generate an average of $12,000 per year in labor income (salaries, wages, and benefits) for local businesses, and will directly impact businesses providing management, technical service, and real estate consulting. Although insufficient information is available to estimate the economic impact of the easements on these private properties, it is generally expected that conservation easement purchases also will inject new money into the local economy. The sale of easements provides landowners with additional revenue, some percentage of which may be spent in the local economy, including purchasing new real estate, consumer goods, or services in the local area. In many cases, the sale of easements also allows farm owners to continue farming practices on their land. For example, for one of the easements in this case, the money will help the farmer continue to raise beef for local markets. The farmer's costs for equipment, supplies and materials will be spent in the local economy, thus supporting local businesses and local employment. Farm workers will also spend their salaries in the local economy, thus supporting further local employment. From a social perspective, conservation easements generate benefits for local residents, communities, and governments by protecting values associated with biodiversity and wildlife abundance, aesthetic beauty, local agriculture, and social and culturally significant features of landscapes and livelihoods.

Case example 4-9. Nesting habitat management program for the federally threatened piping plover

This case study illustrates that even modest restoration projects can provide benefits to the environment and local economy.

Piping plover on eggs (FWS).

FWS provided $130,000 ($2011) over 2007-2011 to The Nature Conservancy of Rhode Island (TNC, RI) to implement a nesting habitat management program for the federally threatened piping plover, a shorebird that nests along sandy beaches on the Atlantic coast. The source of the funds was the NRDAR settlement for the North Cape Oil Spill. In 1996, the oil spill adversely impacted piping plover nesting habitat, resulting in fewer chicks produced during the following nesting season. To compensate for these impacts, natural resource trustees (FWS, RI, and NOAA) sought to increase the number of chicks produced in RI by providing funds to TNC to implement management actions aimed at reducing threats to piping plovers. At two nesting areas in Little Compton, RI, TNC staff conducted more than 70 public education programs to increase awareness about what people can do to reduce harm to piping plovers (e.g., keeping dogs off beaches, removing trash that attracts predators, staying out of nesting areas). Staff also monitored nesting beaches and informed recreational users about potential threats. Additionally, several predators (e.g., coyotes, skunks) known to consume adults and chicks, were removed from nesting areas. During five years with increased management efforts, piping plovers produced more chicks (108) than in the previous five years (80).

TNC Saturday morning education program (TNC).

Economic Impacts of Restoration. The piping plover management program has supported three full time seasonal positions in Little Compton, RI each summer between 2007 and 2011. These positions have provided employees with quality experience in natural resource management and public education, and brought over $32,000 per year in direct labor income (salaries, wages, and benefits) to the local area. Much of this income was spent within the local economy, and supported an additional $9,000 in labor income for local businesses. This case study demonstrates how even small investments in restoration can support jobs in local communities. The average yearly cost of the program was $32,000, and these expenditures supported over $41,000 per year in labor income in the local community.

CONCLUSION

Restoration, rehabilitation, remediation, and reclamation activities play an important role in maintaining the health and vitality of DOI lands and managed resources. The Department's commitment of human capital and financial resources for these activities is substantial. Analysis by USGS demonstrates that investment in restoration supports many jobs and contributes extensively to local economies. Interior's investment is leveraged through federal, state, local, non-governmental, and private partners, who have been critical for funding, implementing, and monitoring the quality and quantity of DOI-related restoration projects. Ecosystem monitoring and adaptive management help ensure that lessons learned are integrated into ongoing and future decision making at Interior.

While there are numerous and compelling restoration success stories, some of which are described in this chapter, challenges remain. Clearly, Interior's land holdings and natural resource responsibilities are vast. While the Department has inventory and monitoring programs, resource conditions are often dynamic and the baseline conditions needed to quantify improvements from restoration are not always known. Further, restoration science is still evolving for many resources. Physical measures of restored stream-miles or acres are valuable indicators of restoration success, but they do not easily facilitate quality comparisons for future decisions. Interior's scientists and managers are actively working on the development of improved endpoints and more meaningful criteria for measuring restoration success.

Although there is an increasing understanding of ecosystem services through a number of federal and departmental efforts, there still tends to be a disconnect between restoring natural resources and restoring the benefits to the public derived from these resources, which can affect the goals, planning, and outputs of scientific study. Relevant, high-quality scientific outputs are critical inputs for economic analysis. Even with relevant science, though, the total benefits from restoration can be difficult for economists to quantify and value. While the jobs and economic contributions from restoration are substantial and important, they do not represent the full economic value of ecosystem restoration, because they do not capture the net benefits associated with environmental goods and services not bought and sold in markets. As discussed above, there are methods to estimate the total economic value of restoration. Making the effort to include non-market benefits is an exercise worth carrying out, with precision and rigor where feasible. Looking forward, developing well-established, tangible values for the resources and associated services under Interior's trust would help ensure that the public's benefits are maximized from investment in DOI restoration activities.

REFERENCES

America's Great Outdoors: A Promise to Future Generations, February 2011. Available on-line at http://AmericasGreatOutdoors.gov/files/2011/02/AGO-Report-With-All-Appendices-3-1-11.pdf.

Adamowicz, Wiktor, Peter Boxall, Michael Williams, and Jordan Louviere. 1998. Stated Preference Approaches for Measuring Passive Use Values: Choice Experiments and Contingent Valuation. *American Journal of Agricultural Economics*, 80: 64-75.

Barbier, Edward B. 2007. Valuing Ecosystem Services as Productive Inputs. *Economic Policy*, 22(49): 177-229.

Bergstrom, John C., Jeffrey H. Dorfman, and John B. Loomis. 2004. Estuary Management and Recreational Fishing Benefits. *Coastal Management*, 32: 417-432.

Bradshaw, Anthony D. 1987. Introduction and Philosophy. In: *Handbook of Ecological Restoration, Volume 1*, Martin R. Perrow and Anthony J. Davy (Eds.), Cambridge University Press, Cambridge, UK.

Garber-Yonts, Brian, Joe Kerkvliet, and Rebecca Johnson. 2004. Public Values for Biodiversity Conservation Policies in the Oregon Coast Range. *Forest Science*, 50(5): 589-602.

Iverson, L.R., A.M. Prasad, S.N. Matthews, and M. Peters. 2008. Estimating potential habitat for 134 eastern US tree species under six climate scenarios. *Forest Ecology and Management* 254(3):390-406.

Kaushal, S.S., G.E. Likens, N.A. Jaworski, M.L. Pace, A.M. Sides, D. Seekell, K.T. Belt, D.H. Secor, and R.L. Wingate. 2010. Rising stream and river temperatures in the United States. *Frontiers in Ecology and the Environment* 8(9):461-466.

Loomis, John, Paula Kent, Liz Strange, Kurt Fausch, and Alan Covich. 2000. Measuring the Economic Value of Restoring Ecosystem Services in an Impaired River Basin: Results from a Contingent Valuation Survey. *Ecological Economics*, 33: 103-117.

National Academy of Sciences. 1974. *Study Committee on the Potential for Rehabilitating Lands Surface Mined for Coal in the Western United States*, Ballinger Publishing Company, Cambridge, MA.

O'Neill, Catherine A. 2009. The Mathematics of Mercury. In: *Reforming Regulatory Impact Analysis*, Winston Harrington, Lisa Heinzerling, and Richard D. Morgenstern (Eds.), Resources for the Future Report.

Schaller, F.W. and P. Sutton (eds.). 1978. *Reclamation of Drastically Disturbed Lands*, Madison, WI: American Society of Agronomy.

Sherrouse, B.C., and Semmens, D.J. 2010. Social Values for Ecosystem Services (SolVES)—Using GIS to include social values information in ecosystem services assessments: U.S. Geological Survey Fact Sheet 2010–3118, 2 p.

Society for Ecological Restoration International (SERI), Science & Policy Working Group. 2004. *The SER International Primer on Ecological Restoration,* Version 2, October, http://www.ser.org/content/ecological_restoration_primer.asp#3.

Stahl, P.D., Ingram, L.J., Wick, A.F. and S. Rana. 2006. "Relating Mineland and Reclamation to Ecosystem Restoration," presented at Billings Land Reclamation Symposium, June 4-8, 2006, Billings, MT, and jointly published by BLRS and ASMR, R.I. Barnhisel (ed.) 3134 Montavesta Rd., Lexington, KY 40502. Available on-line at: http://www.asmr.us/Publications/Conference%20Proceedings/2006%20Billings/0695-Stahl-WY.pdf.

U.S. Department of the Interior. 2011. Press Release: Secretary Salazar Applauds Beginning of Restoration of Elwha River, Largest in U.S. History, 09/17/2011. Available on-line at http://www.doi.gov/news/pressreleases/Secretary-Salazar-Applauds-Beginning-of-Restoration-of-Elwha-River-Largest-in-US-History.cfm.

Williamson, James M., Hale W. Thurston, and Matthew T. Heberling. 2008. Valuing Acid Mine Drainage Remediation in West Virginia: A Hedonic Modeling Approach. *The Annals of Regional Science*, 42(4): 987-999.

Chapter 5 PUBLIC CONSERVATION LANDS AND RURAL ECONOMIC GROWTH

INTRODUCTION

The economic structure of rural communities across the United States is typically thought of as one that is dependent on agricultural production or resource extraction. However, the natural amenities supplied by conservation lands in rural areas can also be an important supporter of service-oriented industries related to outdoor leisure and recreation activities. Publically owned conservation lands can play a major role in rural areas through the provision of natural amenities that facilitate engagement in numerous outdoor recreation activities, such as fishing, hunting, bird-watching, hiking, and boating. The conservation lands found in many rural areas can also serve as an attractant to households specifically looking for access to the natural amenities they offer and their contribution to overall quality of life. Combined with technological advances that have made it less necessary for businesses to be located in central city areas, publicly conserved lands and their influence on quality of life are increasing becoming a factor in the location decisions of businesses as well as serving as a tool for recruiting qualified employees.

In a nutshell

- Publically owned conservation lands can play a major role in rural areas through the provision of natural amenities that facilitate engagement in numerous outdoor recreation activities, such as fishing, hunting, bird-watching, hiking, and boating.
- Public lands in rural areas can serve as an attractant to households specifically looking for access to the natural amenities they offer and their contribution to overall quality of life.
- As the largest federal land management agency in the United States, Interior has the ability to play a role in shaping the economic and demographic profile of many rural communities through the diverse collection of conservation lands managed by its bureaus.
- Empirical research suggests that the environmental benefits of land conservation in rural areas do not come at the expense of diminished employment and economic growth. Additional analysis is warranted to better understand how the economic profiles of rural areas are affected over time from policies that change the landscape of conservation lands in surrounding areas.

As the largest federal land management agency in the United States, the U.S. Department of the Interior (Interior) has the ability to play a role in shaping the economic and demographic profile of many rural communities through the diverse collection of conservation lands managed by its bureaus. For example,

- The U.S. Fish and Wildlife Service's (FWS) National Wildlife Refuge System of public lands and waters set aside to conserve America's fish, wildlife and plants spans more than 150 million acres,

555 national wildlife refuges (NWR) and other units of the Refuge System, plus 38 wetland management districts.[21]

- The National Park Service (NPS) manages over 397 units in the National Park system including 125 historic parks or sites, 75 monuments, 58 national parks, 25 battlefields or military parks, 29 memorials, 18 preserves, 18 recreation areas, 15 rivers and riverways, 10 seashores, four parkways, four lakeshores, three trails, and two reserves covering over 84 million total acres.[22]
- The Bureau of Land Management's (BLM) National Landscape Conservation System (NLCS) includes over 886 federally recognized areas and approximately 27 million acres of national monuments, national conservation areas, wilderness areas, wilderness study areas, wild and scenic rivers, national scenic and historic trails, and conservation lands of the California desert.[23] BLM also manages many other lands for conservation purposes.

This chapter discusses some of the different ways public land conservation efforts can influence rural communities. Information specific to Interior's land conservation activities in rural communities is presented along with information from the literature analyzing the effects of broader land conservation efforts on the economic and social structures of rural areas. The remainder of the chapter proceeds as follows. The next section highlights some of the economic contributions Interior's conservation lands have on rural communities by providing state level estimates of jobs supported in rural areas from recreation visitation to Interior lands. A broader discussion of the literature related to how public land conservation affects rural county economic growth is then presented followed by preliminary information from a forthcoming analysis of Interior's conservation lands in the rural United States. Case studies with information on the economic contributions of select Interior recreation sites located in rural areas are provided next. The chapter ends with some concluding remarks.

CONTRIBUTIONS OF INTERIOR'S CONSERVATION LANDS IN RURAL COMMUNITIES

Public lands (through recreation visits, natural resource management activities, and amenity values) can help 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 fully quantify the many ways Interior contributes to rural communities, one way to illustrate the role Interior plays in many rural areas of the United States is to look at estimates of employment associated with recreational use at Interior sites. The information presented below shows the number of jobs supported in rural areas by visitation to Interior recreation sites. Additionally, case studies are presented to highlight how specific National Parks, National Wildlife Refuges, and BLM recreation sites can play a role in rural communities throughout the country.

The estimation of economic contributions to rural communities from recreational use at Interior sites relied on a common approach for identifying rural areas by using the Office of Management and Budget's (OMB) official metro-non-metro classification status for all U.S. counties and county equivalents. According to the latest available OMB metro or non-metro status of counties that that is based on 2000 Census data, there are 2,052 non-metro counties, which contain 75 percent of the Nation's land, and are

[21] Source: http://www.fws.gov/refuges/
[22] Source: http://www.nps.gov/news/upload/NPS-Overview-2011_5-20.pdf
[23] Source: http://www.blm.gov/wo/st/en/prog/blm_special_areas/NLCS.html

home to 17 percent (49 million) of the U.S. population. For this analysis, it was assumed that rural counties correspond to OMB's official non-metro county designation.

In order to approximate the economic contribution of recreation at Interior sites in rural areas, state-level contribution estimates were apportioned by county using visitation data, and estimates for counties classified as rural were summed for each state.[24] First, the number of recreation visits was estimated at the county level, where it was assumed total recreation visits to a site were equally divided across each county associated with the site (e.g., if three counties were associated with a particular site, then each county was assumed to represent one-third of the total visitation to that site). County level estimates of recreation visits were summed over all counties within a state to determine total state recreation visits. County level estimates of recreation visits were also summed over counties identified as rural to determine total state recreation visits in rural counties. The ratio of total state recreation visits in rural counties to total state recreation visits was then applied to the state level estimates of economic contributions to determine the state level economic contributions associated with rural counties. This methodology was applied separately for visitation and state level economic contribution estimates generated for recreation sites managed by the BLM, FWS, and NPS.[25]

The estimated employment and output contributions associated with visitors to Interior's recreation sites vary across the rural areas of the United States, where Interior-supported jobs can have a major contribution in isolated rural locations. The analysis conducted indicates the following:

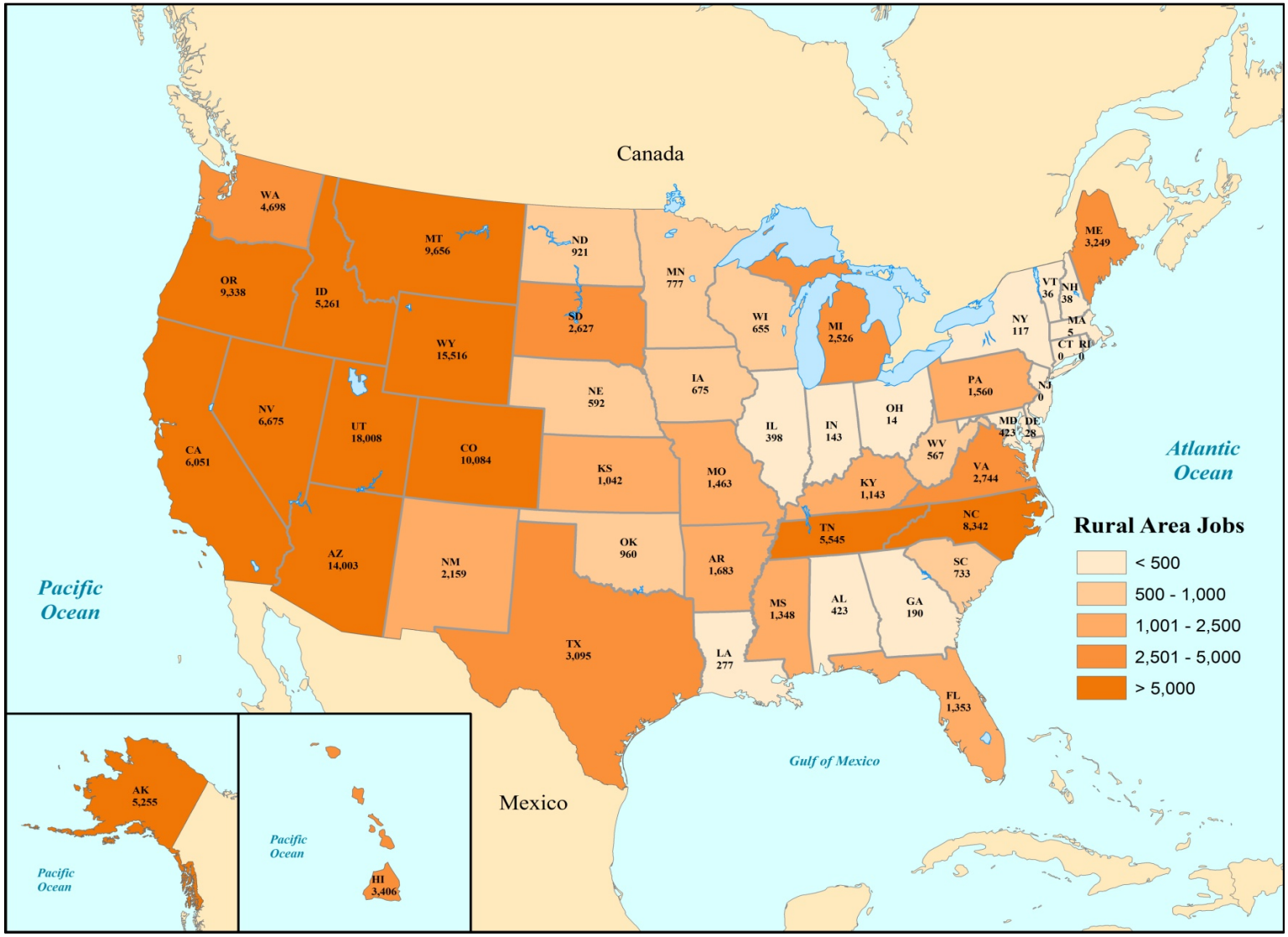
- Visitation to Interior sites supports thousands of jobs in rural areas of Utah (18,008 jobs); Wyoming (15,516 jobs); Arizona (14,003 jobs); Tennessee (5,545 jobs); and Colorado (10,084 jobs).
- Visitation to Interior sites also supports a significant number of rural jobs in states where most counties are rural, including Montana (9,656 jobs); Nevada (6,675 jobs); Washington (4,698 jobs); and Idaho (5,261 jobs).
- Interior's sites support rural jobs in States where the majority of the population is rural: Vermont (36 jobs); Maine (3,248 jobs); West Virginia (567 jobs); and Mississippi (1,348 jobs).
- Interior's sites support rural jobs in states with large rural populations: Texas; (3,095 jobs); North Carolina (8,342 jobs); Pennsylvania (1,560 jobs); Michigan (2,526 jobs); New York (117 jobs); and Georgia (190 jobs).

Figure 5-1 shows the jobs supported by FY 2011 recreation and tourism on Interior-managed lands in areas classified as rural, with the most recreation-related employment occurring in the rural areas of Utah, Wyoming, Arizona, and Colorado. The top five and eight of the top ten states in terms of recreation jobs supported in rural areas are located in the western United States.

[24] Ideally, economic contributions in rural counties would be estimated using county level IMPLAN data and additional information/data on the recreation visit patterns for Interior managed sites to determine county level recreation visits. In the absence of county level data, national level IMPLAN data were apportioned at the county level to approximate rural economic contributions.

[25] The percentage of Bureau of Reclamation recreation in rural areas was estimated based on PILT acreage due to the absence of site-specific visitation data.

Figure 5-1. Jobs in Rural Areas Supported by Visitors to Interior Recreation Sites



EFFECTS OF CONSERVATION ON THE GROWTH OF RURAL COMMUNITIES

Rural areas can offer a variety of characteristics that are attractive to many segments of the population. The economic structure of rural communities is often viewed as one that is dependent on agricultural or resource extraction activities and the industries that directly or indirectly support them. With the population's continued interest in outdoor recreation and desire for access to natural amenities, rural communities are now becoming increasingly intertwined with service-oriented sectors supporting natural resource dependent recreation and leisure activities. Conservation lands found in many rural areas can also serve as an attractant to households and businesses looking for the natural amenities offered and their contribution to overall quality of life. Proximity and access to such areas can also serve as a valuable tool for businesses to recruit employees. However, there has been considerable debate about the importance of conservation lands to rural communities. Opponents to land conservation policies argue that placing areas in a protected status hinders local economies by keeping potentially valuable resources out of development or productive use. Land conservation proponents emphasize the importance of the recreational activities supported, the natural amenities offered to local residents, and the overall suite of ecosystem services provided the lands (e.g., clean air, clean water, and flood protection).

The previous section of this chapter described economic contributions from expenditures associated with visitation to Interior-managed recreation sites. While this approach does provide one indication of how areas surrounding Interior's lands may be affected, it is limited in that it does not provide insight into the multiple ways land conservation can influence the social and economic structure of rural communities. However, developing an understanding of the many ways land conservation can affect rural communities is complicated by the fact that the amenity attributes provided by land conservation are latent non-market inputs into the production process of local economies (Deller et al., 2001 and Marcouiller 1998). Areas once viewed as a source of production of raw materials from extraction activities are now being viewed as valuable for their recreational opportunities or the scenic vistas offered to nearby homeowners (Deller et al., 2001). As such, it is important to capture the non-market attributes provided from land conservation to understand how land conservation affects the economic structure and growth of rural communities. The extent these various non-market attributes play a role, their identification could be important to consider in the development of policy (Deller et al., 2001).

One way the natural amenities and recreational opportunities provided from land conservation can affect the economic structure of a rural community is to serve as a base for tourism. Rural economies are affected by tourists from the injection of new dollars they bring for local businesses, supporting local tax bases, and creating increased demands for locally available land, labor and capital (English, Marcouiller, and Cordell 2000). In particular, the tourist expenditures associated with the recreational use of protected lands creates demands for goods and services that support jobs and incomes for the residents of local communities in rural areas (English, Marcouiller and Cordell 2000; Johnson and Moore 1993; English and Bergstrom 1994). While a tourism sector has not necessarily been clearly defined in terms of a sector of the overall economy, most of the expenditures made by tourists are typically associated with the following economic sectors: lodging (including hotels, motels campgrounds, and inns), eating/drinking (restaurants and bars), retail (grocery stores, gas stations, and gift shops), and recreation services (ski areas, golf courses, and amusement parks) (English, Marcouiller and Cordell 2000). As such, rural communities with sizable areas of protected conservation lands nearby can have a large portion of the

economic activity in these sectors influenced by the visitors to the conserved lands (English, Marcouiller and Cordell 2000).

While economic activity of rural areas can be heavily dependent on the amenities and recreational opportunities nearby conservation lands offer, one criticism is that growth or changes in overall employment levels and incomes of these communities are lower when compared to other rural areas without such protected lands. Furthermore, in areas of heavy federal land ownership that enable resource extraction activities to occur, changes in land management policies that place more restrictions on such activities are typically met with strong opposition from members of the local community and industry (Duffy-Deno 1998). In general, concerns about additional land conservation efforts are commonly centered on the apparent tradeoffs that need to be made between jobs and the environment (Lewis, Hunt and Plantinga 2002).

A considerable amount of empirical research has been conducted investigating the many issues surrounding the relationship between natural amenities, including public land conservation efforts, and changes in the economic structure of local communities. Studies have varied in terms of the geographic scope, where many have focused on rural areas, and the way in which natural amenities and land conservation efforts are taken in to account.

Deller et al., (2001) and Deller and Lledo (2007) applied the principal components method to compress a range of indicator variables into separate measures of local amenities to determine their effect on changes in income, population, and employment in rural counties of the U.S. Local amenity measures were developed associated with climate, built recreational environment, land, water, and winter. Rural county population, employment, and income growth rates were found to be positively influenced by the built recreational environment amenity measure in Deller et al (2001), while Deller and Lledo (2007) only found this to hold for population and employment growth with no effect on income growth.[26] The land amenity measure, designed to describe the terrain and land resources with a county, was only found to have a positive relationship with employment and population growth rates in rural counties with no effect on income growth in Deller et al., (2001).[27] In contrast, Deller and Lledo (2007) found no relationship. Although these two studies do not find consistent positive relationships for the measures of built recreational environment and land index measures, the results do suggest that rural county population, employment, and income growth rates are not negatively influenced by public land conservation efforts and land management activities associated with recreational use.

While the analysis Deller et al., (2001) and Deller and Lledo (2007) focused on rural counties, local amenities were accounted for using broad measures of different amenity types that were essentially a linear representation of many variables. This limits the ability to isolate the effect of certain types of conservation lands that may be of particular interest. For example, the designation of federal wilderness areas has been controversial, particularly in western portions of the U.S. Opponents of federal wilderness designations commonly argue the use restrictions imposed will hurt local economies due to the access limitations on federal lands by extractive industries, while proponents say local amenity values are

[26] The developed recreational infrastructure index is dependent on the availability of parks, tennis courts, golf courses, and other such factors, where Deller et al., (2001) suggests the index may be measuring a "certain type of higher end resort-type community".

[27] The land index measure was designed to "capture a region's land resources, such as the percentage of acres included in federal wilderness areas, forestland, farmland, and state park land" (Deller et al., 2001).

enhanced and attract people and businesses, thereby offsetting any negative effects on extractive industries (Duffy-Deno 1998). Similarly, opponents to additional conservation of forest areas argue that a reduction in the land available for timber production will harm local economies and lead to out-migration, but proponents highlight the benefits from increased access to public areas for recreational activities (Lewis, Hunt and Plantinga 2002).

An analysis by Duffy-Deno (1998) that more narrowly focused on the effect of federal wilderness designations on rural county growth in the intermountain western United States found that Federally owned land in a county designated as a wilderness or a wilderness study area (measured as a percentage of county land area) was found to have no direct or indirect effect on population density or total employment density growth rates between 1980 and 1990. No evidence of county-level resource based employment being negatively affected was also reported. Lewis, Hunt and Plantinga (2002, 2003) examined the effect public lands had on changes in employment, migration, and wages for non-metro counties in the Northern Forest Region, where a county's share of public conservation lands was found to have no effect on employment or wage growth and a small positive influence on net migration rates in the 1990s. Additionally, Lorah and Southwick (2003) observed positive correlations between protected federal lands (defined as wilderness areas, national parks, national monuments and roadless areas) and population, income, and employment growth in rural counties of the western United States. In contrast, Eichman et al., (2010) found the Northwest Forest Plan's reallocation of federal land used for timber to conservation had a negative effect on employment growth rates in rural counties after 1994, but was partially offset by its positive influence on net-migration.

Overall, prior empirical research suggests a lack of consensus on the extent public land conservation affects rural county employment, population, and income growth rates. While support is not found for the notion that policies for additional public land conservation necessarily lead to an economic boon to rural communities, the results do consistently counter the argument that public land conservation harms rural economies. In general, policies that change the use of public lands from extractive or resource production to more of a conservation focus may simply result in shifts in the type of economic sectors supporting a local community, such that losses in one or more sectors are offset by gains in other sectors of the local economy over time. Furthermore, the effects on rural communities or a rural area's ability to adjust may also vary geographically and depend on the inter-relationships between rural communities and the surrounding areas. Additional analysis of these factors would provide a valuable contribution to the overall understanding of how rural communities are impacted by public land conservation. Finally, beyond quantifying any employment, income, and population growth effects, analysis of the broader market and non-market economic effects of public land conservation efforts is important to understanding the full scope of their contribution on local communities.

INTERIOR'S CONSERVATION LANDS AND RURAL COUNTIES

As the largest federal land management agency in the United States, Interior has the ability to play a role in shaping the economic and demographic profile of many rural communities through the diverse collection of conservation lands managed by its bureaus. With the eventual goal of conducting a more formal analysis comparable to the studies described in the previous section, a preliminary assessment of U.S. Census and Bureau of Labor Statistics (BLS) data for rural counties and information on Interior's network of conservation lands is presented. For this preliminary assessment, Interior conservation lands

are defined as lands managed by the National Park Service; the FWS's management of NWR, wetland management district and waterfowl production area lands; and BLM's management of lands under the NLCS.

The identification of rural counties was based on information from the U.S. Department of Agriculture (USDA) Economic Research Service (ERS). The ERS developed a classification scheme that distinguishes metropolitan (metro) counties by the population size of their metro area, and nonmetropolitan (nonmetro) counties by the degree of urbanization and adjacency to a metro area or areas. The starting point of the ERS classification scheme is the grouping of all U.S. counties according to their official metro-nonmetro status as determined by the Office of Management and Budget (OMB). The ERS subdivided the metro category into three metro groupings, while the nonmetro category was subdivided into six nonmetro groupings. Overall, the ERS classification scheme results in a nine-part county codification.[28] The ERS explains that the codes allow county data to be broken up into finer residential groups beyond a simple metro-nonmetro dichotomy, which can be useful for analysis of nonmetro areas related to the degree of rurality and metro proximity.[29] Table 5-1 provides the definitions for the latest rural-urban continuum codes developed by the ERS.[30]

Table 5-1. USDA Rural-Urban Continuum Code Definitions

Code	Definition
Metro counties	
1	Counties in metro areas of 1 million population or more
2	Counties in metro areas of 250,000 to 1 million population
3	Counties in metro areas of fewer than 250,000 population
Nonmetro counties	
4	Urban population of 20,000 or more, adjacent to a metro area
5	Urban population of 20,000 or more, not adjacent to a metro area
6	Urban population of 2,500 to 19,999, adjacent to a metro area
7	Urban population of 2,500 to 19,999, not adjacent to a metro area
8	Completely rural or less than 2,500 urban population, adjacent to a metro area
9	Completely rural or less than 2,500 urban population, not adjacent to a metro area

[28] Metro counties are distinguished by population size of the Metropolitan Statistical Area of which they are part. Nonmetro counties are classified according to the aggregate size of their urban population. Within the three urban size categories, nonmetro counties are further identified by whether or not they have some functional adjacency to a metro area or areas. A nonmetro county is defined as adjacent if it physically adjoins one or more metro areas, and has at least 2 percent of its employed labor force commuting to central metro counties. Nonmetro counties that do not meet these criteria are classed as nonadjacent.

[29] Source: http://www.ers.usda.gov/Briefing/Rurality/RuralUrbCon

[30] The latest version of the ERS rural-urban continuum codes were published in 2003 and are based on OMB's official metro-nonmetro status determination announcement from June 2003 and 2000 Census data.

Table 5-6 provides information on population, per-capita income, median household income, employment, and unemployment rates for rural counties in the United States that contain some portion of Interior conservation lands. As stated previously, Interior conservation lands are defined as lands managed by the National Park Service; the FWS's management of NWR, wetland management district and waterfowl production area lands; and BLM's management of lands under the NLCS. Using the USDA rural-urban continuum codes, "rural" counties are defined in three ways.

- A rural county is defined as a county with a rural-urban continuum code equal to 4, 5, 6, 7, 8 or 9 (i.e., OMB's official designation of nonmetro status);
- A rural county is defined as a county with a rural-urban continuum code equal to 6, 7, 8 or 9; and
- A rural county is defined as a county with a rural-urban continuum code equal to 8 or 9.

Defining rural counties in these three ways was done simply as a form of sensitivity analysis based on different measurements for county rurality. The information presented in Table 5-6 should not be interpreted as implying Interior-managed conservation lands are the cause of any differences observed or that the addition of lands will lead to greater differences between counties with/without Interior conservation lands. Several unobserved factors could have an influence on the information presented below. The collection of additional data and the use of regression analysis are needed to properly determine the effect Interior-managed conservation lands have on rural counties.

Using the broadest classification scheme for rural counties, as defined by OMB's official designation of metro-nonmetro county status, those with Interior-managed conservation lands were found to have slightly higher population, per-capita income, median household income and employment levels; and marginally lower unemployment rates when compared to rural counties without Interior-managed conservation lands (see Table 5-6). In addition, counties with Interior-managed conservation lands also fared slightly better when looking at changes from 2000 for population, per-capita income, household income, and employment levels.

The second definition of rural counties defines a rural county in a more restrictive fashion using the ERS rural-urban continuum codes. In this instance, a rural county is defined as a county a rural-urban continuum code equal to 6 (urban population of 2,500 to 19,999, adjacent to a metro area), 7 (urban population of 2,500 to 19,999, not adjacent to a metro area), 8 (completely rural or less than 2,500 urban population, adjacent to a metro area) or 9 (completely rural or less than 2,500 urban population, not adjacent to a metro area). In general, the second definition of rural county places a tighter limit on county population levels as compared to the first definition that was based on OMB's official metro-nonmetro county status designation.

Based on the second definition of rural county, those with Interior-managed conservation lands were found to have slightly lower total populations as compared to counties without Interior-managed conservation lands. Consistent with the broadest definition, rural counties with Interior-managed conservation lands were also found to have slightly higher per-capita incomes, median household incomes, and employment levels and lower unemployment rates. When looking at changes from 2000, rural counties with Interior-managed conservation lands exhibited slightly larger increases in population, per-capita incomes, and median household incomes. All rural counties were found to have decreases in

employment levels, but those with Interior-managed conservation lands exhibit smaller decreases compared to counties without.

The third definition of rural county generated from the ERS rural-urban continuum codes defines rural county as a county with a rural-urban continuum code equal to 8 (completely rural or less than 2,500 urban population, adjacent to a metro area) or 9 (completely rural or less than 2,500 urban population, not adjacent to a metro area). This definition is the most restrictive in terms of population of the three used. As shown in Table 5-2, rural counties with Interior-managed conservations lands on average had populations of 7,699, almost 300 people fewer than rural counties without Interior-managed conservation lands. However, since 2000 rural counties with Interior-managed conservation lands grew by an average of 107 people compared to 32 people for counties without. Similar to the other two definitions for rural counties, per-capita incomes, median household incomes and employment levels were all slightly higher in rural counties with Interior-managed conservation lands compared to counties without. Since 2000, slightly higher increases in per-capita incomes and median household incomes were also found for rural counties with Interior-managed lands. Average unemployment rates for counties with Interior-managed lands (8.0%) were lower compared to counties without (8.4%) and the average decrease in employment since 2000 was also less severe in rural counties with Interior-managed conservation lands.

Table 5-2. Characteristics of Rural Counties with Interior-Managed Conservation Lands

	Rural Counties		
Year 2010	Counties with Interior Conservation Lands (average of counties)	Counties without Interior Conservation Lands (average of counties)	All Rural Counties (average of counties)
Rural County defined as Rural-Urban Continuum Code = 4, 5, 6, 7, 8 or 9			
Population	26,288	23,947	24,862
Change from 2000	1,414	859	1,075
Per-capita Income	$21,366	$20,130	$20,613
Change from 2000	$4,868	$4,126	$4,415
Median Income	$40,482	$38,226	$39,107
Change from 2000	$7,723	$6,668	$7,079
Employment	11,451	10,239	10,711
Change from 2000	42	-308	-172
Unemployment Rate	9.1%	9.2%	9.2%
Rural County defined as Rural-Urban Continuum Code = 6, 7, 8 or 9			
Population	17,015	17,278	17,178
Change from 2000	566	425	479
Per-capita Income	$21,149	$19,987	$20,430
Change from 2000	$4,949	$4,208	$4,491
Median Income	$39,928	$37,739	$38,574
Change from 2000	$7,863	$6,762	$7,182
Employment	7,355	7,328	7,338
Change from 2000	-99	-279	-210
Unemployment Rate	8.9%	9.1%	9.1%
Rural County defined as Rural-Urban Continuum Code = 8 or 9			
Population	7,699	7,995	7,875
Change from 2000	107	32	63
Per-capita Income	$21,687	$20,286	$20,852
Change from 2000	$5,618	$4,738	$5,093
Median Income	$39,833	$36,894	$38,082
Change from 2000	$8,687	$7,137	$7,763
Employment	3,390	3,353	3,368
Change from 2000	-59	-163	-121
Unemployment Rate	8.0%	8.4%	8.2%

RURAL AREA RECREATION CASE STUDIES

As shown in Figure 5-1, the expenditures associated with recreation activities at Interior-managed sites can provide a significant economic contribution to rural communities. In some particularly economically distressed rural areas where jobs are scarce, Interior-managed lands help provide a stable source of jobs and income.

The recreation case studies presented below, as well as additional examples in Appendix 4, provide a snapshot of the differing levels of economic support that recreational use at Interior-managed sites provide to selected rural communities. Areas where economic contributions are highlighted include the rural areas around Crater Lake National Park in Oregon, Great Sand Dunes National Park and Preserve in Colorado, Crab Orchard National Wildlife Refuge in Illinois, and Arches National Park in Utah. For context, the case studies profile some of the characteristics of the local area, including local area population and labor force, and annual visits to the site.

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 30,457 and an unemployment rate of 11.7 percent in April 2012. In 2010, Crater Lake National Park attracted 448,319 visits, and visitors spent an estimated $34.1 million in the local area. Of this total, $33.1 million came from non-local visitors. Total visitor spending contributed $39.7 million in total output and supported 556 jobs. Crater Lake National Park helps provide a much-needed stream of income to a rural area facing continued economic hardship.

Crater Lake Nation Park (NPS)

Table 5-3. Crater Lake NP Totals (2010)

Visits (2010)	Area Unemployment Rate (April 2012)	Visitor Spending ($ millions)	Total Output ($ millions)	Estimated Total Jobs Supported (jobs)
448,319	11.7% (p)	$34.1	$39.7	556

Source: NPS; Bureau of Labor Statistics; (p) preliminary.

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 17,161 and a combined unemployment rate of 9.2 percent in April 2012. The National Park and Preserve attracted nearly 283,284 visitors in 2010, and visitors spent an estimated $10.2 million. Of this total, $9.6 million came

Great Sand Dunes NPP (NPS/Patrick Myers)

from non-local visitors. Total visitor spending contributed an estimated $9.8 million in total output[31] and supported 149 jobs in the local economy. Great Sand Dunes is illustrative of Interior's contribution on a small rural community. Though the area population is only 34,000, Interior lands provided an important source of jobs and revenue.

Table 5-4. Great Sand Dunes NPP Totals (2010)

Visits (2010)	Area Unemployment Rate (April 2012)	Visitor Spending ($ millions)	Total Output[31] ($ millions)	Estimated Total Jobs Supported (jobs)
283,284	9.2% (p)	$10.2	$9.8	149

Source: NPS; Bureau of Labor Statistics; (p) preliminary.

Crab Orchard National Wildlife Refuge (IL)

Crab Orchard National Wildlife Refuge (USFWS)

Located west of Marion, Illinois, on the northern edge of the Ozark foothills, Crab Orchard National Wildlife Refuge is one of the largest refuges in the Great Lakes/Big Rivers Region. Total population of Williamson County where the refuge is located is 66,357 (Census, 2010). Established in 1947, the 43,890-acre Refuge includes three man-made lakes totaling 8,700 surface acres. The 4,050-acre Crab Orchard Wilderness, the first wilderness area designated in the State of Illinois, is within the Refuge. Crab Orchard National Wildlife Refuge received 714,918 total visitors in 2011, of which the refuge estimated there were 11,404 waterfowl hunting visits, 2,788 upland game hunting visits, 6,305 big game hunting visits and 170,634 fishing visits. Refuge visitors spent nearly $7.9 million in 2011, contributing a total of $15.0 million to the local economy and supporting 150 jobs.

[31] Total output is less than visitor spending for Great Sand Dunes NPP. Estimation of total output is based on direct sales. This represents only a portion of visitor spending, as most of the manufacturing share of retail purchases (groceries, gas, sporting goods, souvenirs) is not included. We assume that most of the producer price of retail purchases immediately leaks out of the region to cover the cost of goods sold. Sales figures for retail and wholesale trade are the margins on retail purchases (Stynes, D.J., 2011). Depending on the magnitude of the difference between visitor spending and direct sales after accounting for this adjustment, running the estimate of direct sales through IMPLAN can lead to an estimate of total output that is lower than visitor spending.

Table 5-5. Crab Orchard National Wildlife Refuge Totals (2011)

Visits (2011)	Area Unemployment Rate (April 2012)	Visitor Spending ($ millions)	Total Output ($ millions)	Estimated Total Jobs Supported (jobs)
714,918	7.5% (p)	$7.9	$15.0	150

Source: FWS; Bureau of Labor Statistics; (p) preliminary.

Moab Utah

DOI lands provide significant recreational opportunities and related economic contribution in and around Grand County, Utah. Grand County has a population of around 9,225 (Census, 2010). The county had a labor force of 5,473 and an unemployment rate of 7.7 percent in April 2012. Arches National Park is located 5 miles north of Moab, Utah and encompasses 76,546 acres. The National Park attracted over a million visitors in 2010, and visitors spent an estimated $105.1 million. All of these visitors were non-local. Visitor expenditures contributed $105.9 million in total output to the local economy and supported 1,659 jobs.

Arches National Park (NPS)

The BLM Moab Field Office manages 1.8 million acres in this area. In 2010, BLM lands around Moab attracted over 1.2 million visits. Non-local visitors spent an estimated $169.3 and supported 2,447 local jobs in 2010.

Table 5-6. Moab Utah Totals (2010)

	Visits (2010)	Area Unemployment Rate (April 2012)	Visitor Spending ($ millions)	Total Output ($ millions)	Estimated Total Jobs Supported (jobs)
NPS	1,014,405	7.7% (p)	$105.1	$105.9	1,659
BLM	1,258,456	7.7% (p)	$169.3	na	2,447

Source: NPS; BLM; Bureau of Labor Statistics; (p) preliminary

CONCLUSION

As the largest federal land management agency in the United States, Interior has the ability to play a role in shaping the economic and demographic profile of many rural communities with its wide range of land management responsibilities. At times these management responsibilities can be in conflict with each other, where arguments for and against certain management actions are commonly expressed according to an apparent need to evaluate the tradeoffs between jobs and the environment. Furthermore, in areas of heavy federal land ownership that enable resource extraction activities to occur, changes in land management policies that place more restrictions on such activities are typically met with strong opposition from members of the local community and industry (Duffy-Deno 1998). Such concerns are of

particular interest to rural areas given their inherently greater reliance on fewer economic sectors as compared to urban areas.

In general, the empirical research suggests that the environmental benefits of land conservation in rural areas do not come at the expense of diminished employment and economic growth. While policies for public land conservation may not lead to an economic boon for rural communities, the research does consistently show that public land conservation does not harm rural economies. Policies that change the use of public lands from extractive or resource production to more of a conservation focus may simply result in shifts in the type of economic sectors supporting a local community, such that losses in one or more sectors are offset by gains in other sectors of the local economy. Furthermore, a rural area's ability to transition may also vary geographically and depend on the inter-relationships between rural communities and the surrounding areas. Additional analysis is warranted to better understand how the economic profiles of rural areas are affected over time from policies that change the landscape of conservation lands in surrounding areas. These issues are important to evaluate in regards to policies that both lead to additional land conservation as well as in those situations where conservation lands are being considered for more intensive resource uses. Finally, beyond quantifying any employment, income, and population growth effects, analysis of the broader market and non-market economic effects of public land conservation efforts is important to understanding the full scope of their contribution to local communities.

REFERENCES

Deller, Steven C., et al., 2001. The Role of Amenities and Quality of Life in Rural Economic Growth. *American Journal of Agricultural Economics*, 83(2): 352-365.

Deller, Steven C. and Victor Lledo. 2007. Amenities and Rural Appalachia Economic Growth. *Agricultural and Resource Economics Review*, 36(1): 107-132.

Duffy-Deno, Kevin T. 1998. The Effect of Federal Wilderness on County Growth in the Intermountain Western United States. *Journal of Regional Science*, 38(1): 109-13.

Eichman, Henry, et al., 2010. Local Employment Growth, Migration, and Public Land Policy: Evidence from the Northwest Forest Plan. *Journal Agricultural and Resource Economics*, 35(2): 316-333.

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

Fleming, David A., David A. McGranahan, and Stephan J. Goetz. 2009. Natural Amenities and Rural Development: The Role of Land-Based Policies. *The Northeast Regional Center for Rural Development*, Rural Development Paper no. 45. (http://nercrd.psu.edu/Publications/rdppapers/rdp45.pdf)

Hunter, Lori M., Jason D. Boardman, and Jarron M. Saint Onge. 2005. The Association Between Natural Amenities, Rural Population Growth, and Long-term Residents' Economic Well –Being. *Rural Sociology*, 70(4): 452-469.

Kwang-Koo, Kim, David W. Marcouiller, and Steven C. Deller. 2005. Natural Amenities and Rural Development: Understanding Spatial and Distributional Attributes. *Growth and Change*, 36(2): 273-297.

Lewis, David J., Gary L. Hunt, and Andrew J. Plantinga. 2002. Public Conservation Land and Employment Growth in the Northern Forest Region. *Land Economics*, 78(2): 245-259.

Lewis, David J., Gary L. Hunt, and Andrew J. Plantinga. 2003. Does Public Land's Policy Affect Local Wage Growth? *Growth and Change*, 34(1): 64-87.

Lorah, Paul and Rob Southwick. 2003. Environmental Protection, Population Change, and Economic Development in the Rural Western United States. *Population and Environment*, 24(3): 255-272.

Marcouiller, David W. 1998. Environmental Resources as Latent Primary Factors of Production in Tourism: the Case of Forest-based Commercial Recreation. *Tourism Economics*, 4(2): 131-145.

McGrannahan, David A. 2008. Landscape Influence on Recent Rural Migration in the U.S. *Landscape and Urban Planning*, 85: 228-240.

Rudzitis, Gundars and Rebecca Johnson. 2000. The Impact of Wilderness and Other Wildlands on Local Economies and Regional Development Trends. USDA Forest Service Proceedings RMRS-P-15-Vol-2.

Stynes, D. J. 2011. Economic Benefits to Local Communities from National Park Visitation and Payroll, 20010. Natural Resource Report NPS/NRSS/EQD/NRR—2011/481. National Park Service, Fort Collins, Colorado.

Chapter 6 INNOVATION, INFORMATION, AND TECHNOLOGY TRANSFER

INTRODUCTION

The 2012 Economic Report of the President (ERP) discusses the role of innovation, the provision of information, and research and development as a means of facilitating economic growth. Technological change, or innovation, can be loosely defined as the introduction of a new or improved product, service, or process; it is the primary source of long-run increases in productivity and human welfare (Grossman and Helpman 1991). Over time, rising productivity drives growth in the output that an economy can produce (ERP, February 2012). The ERP discusses the fact that research and development is a critical driver of innovation:

In a nutshell

- Scientific information and technology transfer provide critical inputs to improved decision making in both the private and public sectors.
- Quantifying the economic value of the end-uses of publicly provided data and information, and incorporating these values into benefit-cost analyses can provide a useful mechanism to demonstrate the return on the public's investment.
- Economic analysis methods have been developed that can be applied to address challenges that arise when monetizing the value of public goods such as data and information sources.

> *"… Public support for research and development remains critically important, particularly in basic research, which aims to expand scientific knowledge and thus does not generally have immediate commercial applications. Private firms can thus find it especially difficult to capture the benefits that stem from this research, and the positive spillover effects of basic research can be especially large" (ERP, 2012).*

Interior's bureaus are engaged in a variety of activities designed to provide basic research, provide information (including both scientific and technical information), and transfer technology to decision makers in the public and private sectors. The information produced by Interior is a critical input that helps support private markets, the production processes of private entities, and many public sector decisions. For example, oil, gas, and mineral markets are underpinned by scientific and technical information on resource availability; water use and allocation decisions rely on precipitation and runoff predictions; and preparedness for natural hazards relies on information about the locations and probability of such events occurring. The information supplied in these examples has an economic value that is at least partly incorporated in the market prices of traded goods and services. In some cases,

What is Technology Transfer? *The concept of "technology transfer" from Federal laboratories is to transfer the ideas, inventions, and technologies conceived or developed with taxpayer dollars out of the laboratory and into the hands of potential users.*

the economic value of information is associated with reducing the uncertainty facing market participants or decision makers. In other cases the value of information is associated with the impetus it provides for technological change.

This chapter discusses some of the different types of information produced by DOI, and the economic concepts associated with this information. For the purposes of this chapter, "information" includes information developed by the bureaus through research or systematic data collection, and activities that facilitate the transfer of information to the private sector.

Each Interior bureau conducts research and data collection to support its individual mission. However, many of these activities are undertaken within the U.S. Geological Survey (USGS), since it is the Department's primary science organization. These activities include:

- Energy and mineral assessments;
- Natural hazards;
- Land use change;
- Understanding of ecosystems;
- Climate change; and
- Water resources.

USES OF INFORMATION

Information resulting from government research and development activities is often available at little or no cost to the user, providing an inexpensive input to decision making. In general, information and data sources generated through DOI research are used in both the private and public sectors for a variety of end-uses that generate significant societal benefits. They are used both directly and indirectly as an input to production processes or decision making by federal, state and local governments, private markets, and the general public. For instance, The National Weather Service, U.S. Army Corps of Engineers, the Federal Emergency Management Agency and, through them, the broader public rely on input from continuous records of streamflow information provided by the USGS streamgaging network for timely and accurate flood forecasts and warnings, flood management, and disaster mitigation. The same streamflow information is directly used by boaters, swimmers, and fishermen in their decisions to pursue their chosen activities.

An important stage in the process of innovation is commercialization of new technologies. In some cases, government research and development activities might follow a path from basic research, to applied research, to the development of specific technologies that can be transferred to the private sector, resulting in commercial applications. Such activities may be undertaken collaboratively between DOI and external entities such as industry, universities, trade associations, and state and local governments. Tools such as Cooperative Research and Development Agreements (CRADAs) help facilitate partnerships between the Federal government and non-Federal entities, as well as the efficient transfer of federally conceived or developed technology into the private sector.[32]

[32] Some of the benefits provided by CRADAs include: enabling both partners to leverage their research budgets and optimize resources; providing a means for sharing technical expertise, ideas, and information in a protected environment; permitting federal scientists to work closely with their non-federal counterparts; offering non-federal

DOI also uses its own research to help inform a wide range of management decisions in the interest of the general public. For instance, NPS regularly monitors a range of vital ecosystem indicators such as soil structure, water quality, water quantity, wetland and grassland vegetation, among many others, in an effort to improve management of natural resources within the National Park system. The BLM likewise uses scientific methods to monitor rangeland conditions. Information collected directly from the public, usually through surveys, is also used for DOI management purposes. For example, Interior bureaus responsible for managing lands and providing recreational opportunities directly to the public often conduct surveys to gather a range of information from visitors, community members, and the general public used for planning and improved management of these lands.

Landsat Image Maps Aid Fire Recovery Efforts: The Remote Sensing Applications Center (RSAC), operated by the U.S. Department of Agriculture Forest Service, and other federal agencies that specialize in fire recovery use Landsat 5 and 7 satellite data to observe vegetation, water and soil changes after a fire. Fire response teams use these data to fight the fire, protect threatened and resources, including wildlife and water bodies.

"Before we started using Landsat data …,Burned Area Emergency Response teams had to conduct aerial and ground-based surveys, sit down with a topographic map and sketch out areas of high burn severity," said Brad Quayle, of the RSAC, Salt Lake City, Utah. "With our USGS partners, we've now mapped over 28 million acres and 900 fires since 2001 using Landsat satellite data." Melissa Quijada, NASA Goddard Space Flight Center; see http://www.nasa.gov/mission_pages/fires/main/post-fire2011.html).

QUANTIFYING THE VALUE OF DOI INFORMATION – CONCEPTS, CHALLENGES, AND EXAMPLES FROM THE LITERATURE

Concepts and Challenges

Information is a valuable economic resource. It improves decision making by reducing the uncertainty of outcomes. Publically provided scientific data and information sources generate significant societal benefits, and quantifying the return on the public's investment in the development of scientific information and transfer of federal technology has become increasingly important. In concept, the value of information can be evaluated using standard economic techniques such as benefit-cost analysis. However, evaluating the net economic benefits of the scientific information provided by DOI presents some challenges, one of which is related to the "public good" nature of the data and information provided.[33]

---

partners access to a wide range of expertise in many disciplines; allowing the partners to agree to share intellectual property emerging from the effort; and permitting the Federal Government to protect information emerging from the CRADA from disclosure for up to 5 years, if this is desirable.

[33] *Public goods*, as defined by economists, are goods which have the characteristics of *non-rivalry* and *non-excludability*. Goods with these characteristics are often, but not always, provided by the public sector. *Non-rivalry* implies that, in general, the additional cost of one more person using this type of good is typically zero. For example, if one individual goes to the USGS National Streamflow Information Program website and downloads data on streamflows in a particular river to determine whether they should kayak that day, this does not diminish the availability of this same information to other users at no direct cost. *Non-excludability* implies that individuals cannot be prevented from using the good. In direct contrast, private goods are both *rival* and *excludable*, and are provided through private markets, allowing forces of supply and demand to set a market-clearing price in the absence of market failures.

An additional challenge stems from the fact that the information generated through DOI research is used in a variety of national (and sometimes international) uses, providing economic benefits that could be monetized in different ways. Further, this information is often shared freely among users, making quantification of its total value to society challenging. One of the key components to developing estimates of values is obtaining information from users on how they are using the data. Few such studies have been conducted to date. In addition, much of the information provided by Interior bureaus also has few or no substitutes, so it may not be possible to use secondary sources to quantify its value. Despite these challenges, significant advancements have been made in quantifying the economic value of public goods, in particular the value of information sources.

Examples from the Literature

Many economic studies have estimated the value of various types of information to individual decision makers. The majority of these studies have focused on estimating the value of weather forecasts used by producers to increase agricultural productivity. The construct used to analyze these problems has historically been oriented around a decision-analytic cost-loss framework, where a decision maker chooses between two actions: protecting an activity at a known cost or doing nothing and facing the risk of a loss due to some event. Information helps the decision maker more accurately assess the risk of this event occurring.[34] Additional studies have attempted to estimate the social, rather than individual, market value of information sources. For instance, Adams et al., (1995) estimate the economic value of improved El Niño-Southern Oscillation (ENSO) forecasts to the entire U.S. agricultural sector.[35] Considerable advancements using dynamic integrated models to address the economic value of information in relation to global climate change have also been made over the years (Nordhaus, 1994; 1997).

> *"If information is only as valuable and useful as it is easy to obtain, the USGS Real-time Streamflow World Wide Web page is the ultimate source of information for river anglers"* (Dave Motes, Mark Kovach Fishing Services; article available at: http://recreation.usgs.gov/riversmallies.html.)

Within Interior, the U.S. Geological Survey has carried out a number of studies quantifying the economic benefits associated with the uses of scientific and technical data and information that it provides. Beginning in the 1990s, a number of studies have estimated the value of geologic maps (Bernknopf et al., 1993; Halsing et al., 2004; Bernknopf et al., 2007); earth science information (Bernknopf et al., 2001); and satellite imagery (Miller et al., 2011). These studies all provide estimates of the economic value for a sample of the end uses which publically provided data and information sources are put towards. However, for reasons mentioned previously, these estimates are neither comprehensive nor certain.

Studies implementing an alternative cost approach to quantify the economic value of data and information provided by the National Oceanic and Atmospheric Administration (NOAA) have been conducted in

[34] Often a Bayesian framework is applied, where some prior probability of an event is specified and then updated as new information arises. The decision maker is assumed to choose the action that maximizes their expected return (utility) or minimizes expected costs.

[35] Johnson and Holt (1997) provide a comprehensive summary of some early value of information approaches and studies specific to weather and climate forecasts.

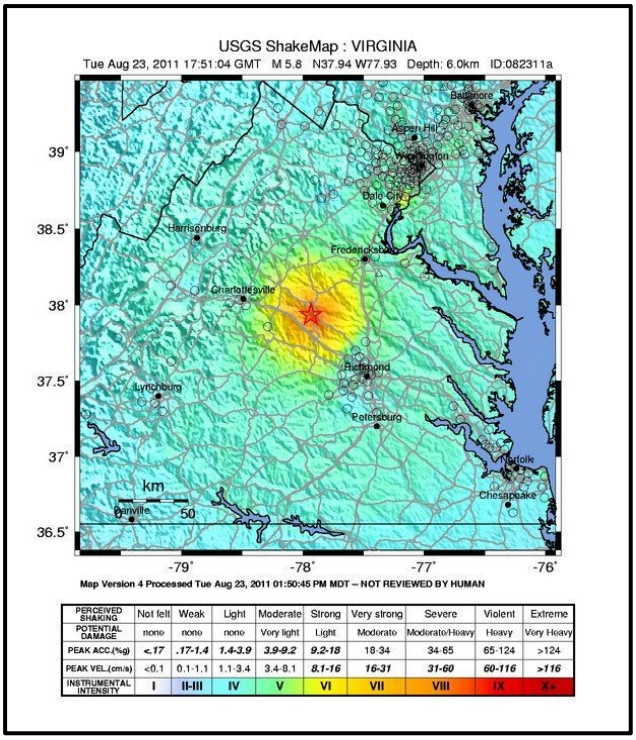
recent years (NOAA, 2002; Centrec Consulting Group, LLC, 2003; 2005).[36] Additional studies have used an avoided cost approach to value improvements in data provided by NOAA (NOAA, 2002; 2004). In addition, a handful of studies have focused on estimation of the value of information in relation to improvements in hazards forecasting specifically (National Weather Service, 2002; Centrec Consulting Group, 2007). An issue commonly raised in these studies is how to capture the full range of benefits to society from these improvements (Carsell et al., 2004; National Weather Service, 2002; Letson et al., 2007).

Non-market valuation techniques have also been applied to monetize the societal value of publically provided data and information sources. Examples include households' values for current and improved weather forecasting services (Lazo and Chestnut, 2002; Lazo et al., 2010); the benefits of supercomputers used in research to contribute to improved weather forecasting (Lazo et al., 2003); the economic benefits of the information provided by NOAA's Physical Oceanographic Real-Time System (Kite-Powell, 2005; 2007; 2010); as well as the value of Landsat moderate resolution imagery (Miller et al., 2010).

[36] Under this approach, the price a given company or industry pays to obtain needed data from NOAA (often a highly subsidized price) can be compared to the costs that would be required for that company or industry to perform the functions on their own to obtain those same data internally, the difference being the value of the data in that use.

EXAMPLES OF DOI INFORMATION AND DATA COLLECTION WHICH PROVIDE SOCIETAL BENEFITS

Interior bureaus produce a wide range of information through research and data collection that benefit the general public. The following are a few examples. Given the wide range of such activities, however, this chapter only scratches the surface of the real and potential benefits flowing from such activities. The descriptions provided here are qualitative because currently there is insufficient information to quantify their value in monetary terms.



Shake map, Virginia's 8/23/11 5.8 Magnitude Earthquake.

U.S. Geological Survey

The USGS operates many programs which provide easily accessible historical and real-time scientific data to national and international users on a wide array of topics. These data contribute to an increased understanding of natural resources and hazards which improves the accuracy of hazards forecasting, societal resilience to natural hazards, land-use planning, and decision making, all of which has considerable economic value.

For instance, the bureau's Earthquake Hazards Program provides near real-time maps of ground motion and shaking intensity following significant earthquakes. These maps are used by both public and private entities for post-earthquake response and recovery, preparedness, and disaster planning. Hazard maps, which identify areas of the country that are most likely to experience strong shaking in the future due to earthquakes, are used to establish seismic building codes, insurance rate structures, and risk assessments.

The bureau's Volcano Hazards Program conducts continuous, real-time monitoring of volcanoes in the United States. This program provides information regarding volcanic unrest and potential eruptions for public officials and communities. This information facilitates disaster preparedness and response which helps reduce loss of life and property resulting from volcanic activity. Information is also provided to the Federal Aviation Association in order to reroute flights and reduce the risk of future ash encounters, which can cause large economic losses in the aviation sector through aircraft damages, cargo delays, and passenger flight delays and cancellations.

USGS' Land Remote Sensing Program is the Nation's archive for the world's largest collection of civilian remotely sensed data covering the Earth's land masses. Real-time data and information, including millions of satellite images and aerial photographs, can be searched and accessed online by any individual with internet access. Imagery obtained through Landsat satellites, which are jointly managed by USGS and the National Aeronautics and Space Administration (NASA), are used in a broad range of applications by both public and private sectors. For example, Figure 6-1 shows a satellite image of

Arizona's Wallow North Fire in 2011. The image's false colors are used to help firefighters and emergency response teams identify various aspects of the fire

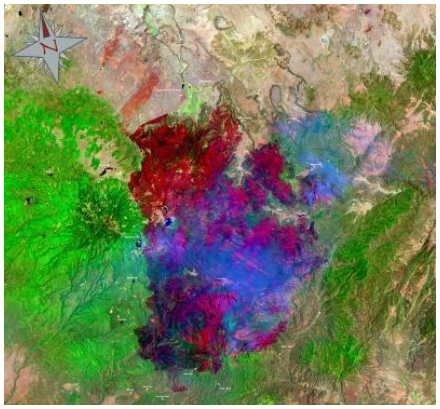


Figure 6-1. Landsat 5 Satellite Image of the Wallow North Fire in East Central Arizona (6/15/11).

(NASA/USGS, Mike Taylor).

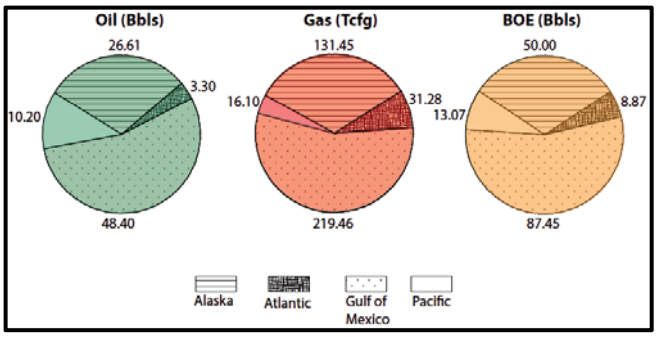
Miller et al., (2011), in a survey of nearly 1,400 current U.S. users of moderate resolution Landsat imagery, identified applications ranging from agricultural forecasting and biodiversity conservation to law enforcement and real estate assessments and taxation. The contingent valuation method was applied to determine what respondents would be willing to pay for substitute imagery equivalent to the current Landsat product they use. The researchers found that respondents would pay on average about $750 per scene (plus-or-minus $250). The results, however, are not generalizable to the population of imagery users due to the sampling approach taken (Miller et al., 2011). In its next phase, this research effort will include international imagery users and attempt to provide estimates that can be generalized to the population of users.

Another easily accessible source of information is real-time data on daily streamflow conditions throughout the United States, provided through the USGS National Streamflow Information Program. Provision of these data is made possible by the bureau's streamgage network, which has measured river streamflow since 1889. Streamflow data are used for such valuable end uses as:

- Water resource appraisal and allocations;
- Assessments of interstate agreements, compacts, and court decrees;
- Engineering design (reservoirs, bridges, roads, culverts, treatment plants);
- Operations (reservoirs, power production, navigation);
- Identifying changes in streamflows due to changes in land use, water use, and climate;
- Flood planning and warning;
- Streamflow forecasting;
- Support of water quality sampling; and
- Characterizing and evaluating instream conditions (for habitat assessments, instream flow requirements, and recreation).

Bureau of Ocean Energy Management and the Bureau of Safety and Environmental Enforcement

The Bureau of Ocean Energy Management (BOEM) and the Bureau of Safety and Environmental Enforcement (BSEE) manage natural gas, oil and other mineral resources on the outer continental shelf (OCS). These resources provide a significant amount of the U.S.'s energy supply. BOEM periodically conducts an oil and gas assessment of the OCS to determine the amount of undiscovered technically recoverable resources, as well as the quantity of undiscovered economically recoverable resources. The 2011 assessment (Bureau of Ocean Energy Management, 2011) estimated a mean of 88.6 billion barrels of undiscovered technically recoverable oil and 398.4 trillion cubic feet of undiscovered technically recoverable natural gas in the Federal OCS of the United States. This information underlies leasing and management decisions on the OCS and serves as an important input to energy markets. Many entities, including corporations, offshore operators, exploration companies, and energy markets, use these estimates for long-term planning, evaluation of investment options, and design of exploration strategies.



Mean Undiscovered Technically Recoverable Resources, by Type and Region, 2011 Assessment

BOEM oversees environmentally sound development of offshore energy and mineral resources. The bureau uses data and information provided by its Environmental Studies Program as one resource to achieve this goal. Initiated in 1973, this program plans, conducts, and oversees scientific research related to ocean resources. This research is used to inform policy and management decisions regarding development of offshore energy and mineral resources, such as the

Box 6-1. BOEM Arctic Research

A recent cooperative agreement signed by BOEM with the University of Texas and a team of leading Arctic researchers, begins a five year comprehensive study of the Hanna Shoal ecosystem in the Chukchi Sea off Alaska's northwest coast, an important and productive biological ecosystem which supports a high concentration of marine life. The study will document ocean circulation, ice conditions, and organisms such as zooplankton. Bowhead whales depend on zooplankton for food and are valuable culturally to the native Inupiat people of the Arctic coast as part of their subsistence diet. The resulting information on physical and biological processes will be used by industry and BOEM in decisions regarding energy development in this region, and will be included in future National Environmental Policy Act analyses.

"Industry is ready to begin exploratory drilling, but they want as much information as possible to avoid having any obvious or measureable impacts on the local ecosystem. Knowing the location of biologically sensitive areas is very valuable to the permit holders. The information we gather will allow BOEMRE to make better decisions on how best to recover oil and gas from in the Chukchi Sea at minimum risk to the Arctic ecosystem."

Dr. Kenneth Dunton, project Principal Investigator, professor of marine science, The University of Texas at Austin. (Source: Lee Clippard, http://web5.cns.utexas.edu/news/2011/10/chukchi-sea.)

determination and scheduling of oil and gas lease sales on the OCS. This information enables BOEM to better balance any trade-offs between energy development and environmental protection of marine and coastal resources. Through this program, BOEM has also become a leader in the provision of scientific knowledge on the nation's marine and coastal environment.

BSEE supports research associated with operational safety and pollution prevention through its Technology Assessment and Research (TA&R) program, and is also the principal Federal agency funding offshore oil spill response research. The TA&R program helps determine the best available and safest technology for offshore conventional and renewable energy operations, while the Oil Spill Response Research program maintains a comprehensive, long-term research program to improve oil spill response technologies, including in Arctic environments. BSEE also operates Ohmsett - the National Oil Spill Response & Renewable Energy Test Facility, one of the world's largest wave tanks, which helps to test and evaluate full-scale equipment for the detection, containment, and cleanup of oil spills.

Bureau of Reclamation

The Bureau of Reclamation's Science and Technology Program is the bureau's primary Research and Development arm, responsible for evaluating and funding research projects to further Reclamation's mission of helping the American West fulfill its growing demands for water, while protecting the environment and the public's investment. To address technical and scientific challenges facing the provision of water and power to the 17 Western States, the bureau's Research and Development Office over the past seven years has funded 800 research projects focused on innovative solutions to these challenges. Current research projects include such topics as:

- Conserving or expanding water supplies;
- Advanced water treatment technologies;
- Environmental issues in water delivery and management;
- Water and power infrastructure reliability;
- Water operations decision support;
- Ongoing research on climate change and variability; and
- Early detection of zebra and quagga mussels.

Specific examples of data provided by Reclamation include near-real time water and environmental data collected by a network of hydrologic and meteorologic monitoring stations operated and maintained by the bureau's Pacific Northwest Region. This network, collectively referred to as Hydromet, is used to manage Reclamation's water operations in this region. Hydromet data, when integrated with other available information, are used to estimate the status of river and reservoir water supplies. A subset of Hydromet includes a satellite-based network of agricultural weather stations, referred to as Agrimet. These data are used for crop water use modeling and other agricultural applications.

Box 6-2. Using Technology to Address a Damaging Invasive Species

Zebra and quagga mussels are invasive, freshwater mollusks that attach to structures and surfaces in or close to water. They first appeared in the Eastern United States in 1988 and have since spread to Western waters. They can clog pipes, screens, fire control systems, and cooling water systems, which can reduce the capacity and efficiency of power plants and water pumping and treatment facilities. These invasive mussels are a growing concern for owners and operators of water infrastructure because getting rid of and protecting against them can entail significant costs.

Zebra and Quagga Mussels

Reclamation is the second largest producer of hydropower in the United States. It operates 58 hydroelectric power plants that annually produce about 40 billion kilowatt-hours of electrical energy with revenues of over $1 billion. It delivers 10 trillion gallons of water to more than 31 million people each year, and manages, with partners, recreation sites that have an estimated 50 million visits annually. Consequently, it has a large stake in addressing, in an environmentally sound manner, the zebra and quagga mussel problem efficiently and effectively.

One solution being investigated by Reclamation is the use of Pseudomonas fluorescens (Pf), a common bacterium found in soil and water. Dead cells of a specific strain of Pf have been found to disrupt the digestive tract of zebra and quagga mussels, killing the adult mussels within hours of ingestion. It therefore has the potential to purge established mussel colonies as well as prevent new colonies from being established. Pf is highly selective; at applied rates it does not harm native bivalves, fish, or other aquatic organisms. Unlike mechanical treatments, Pf treatments should not require facilities to shut down ongoing operations and can be applied to pipes with small diameters. Moreover, Pf has been found to work faster and with less environmentally hazardous effects or byproducts than traditional biocide treatments.

Reclamation is working with Marrone Bio Innovations, Inc. (MBI) under a Cooperative Research and Development Agreement (CRADA) to tailor Pf as an environmentally safe treatment to protect water facilities water facilities located in the west. Field trials and testing have been conducted at Davis Dam, Nevada. A solution to the zebra and quagga mussel problem will benefit Reclamation as well as other owners/operators of water facilities in the West and elsewhere. It also will benefit owners of boats, docks, and other structures that in or near water. This product may be commercially available as early as 2012.

Office of Surface Mining Reclamation and Enforcement

The Office of Surface Mining Reclamation and Enforcement (OSM) is responsible for balancing continued domestic coal production with the protection of society and the environment. The bureau collaborates with states and tribes to ensure that coal mining operations are carried out in a safe and reliable manner, and that the lands on which these operations take place are restored to their beneficial uses once mining is completed. In addition, OSM reclaims abandoned mine lands and oversees and assists state programs in restoring lands and water degraded by mining operations that occurred prior to the bureau's establishment. OSM frequently uses scientific information to achieve these objectives and thus actively works with academic institutions, as well as state and federal agencies, to promote scientific research related to reclamation of mining lands and overall environmental protection.

OSM funds numerous applied research projects under its National Technology Transfer Team Applied Science Program. The goal of this research is to develop and improve technologies used to address environmental impacts of current and past coal mining, including the reclamation of land after mining occurs. Examples of current research efforts and partnerships include working with:

- Researchers at Pennsylvania State University and the University of Oklahoma to improve passive treatment technologies for mine drainage.

- Virginia Tech's Water Resources Research Center to monitor and assess the response of aquatic life to total dissolved solids (TDS) in order to better understand TDS levels in Central Appalachian headwater streams where coal mining occurs.

- U.S. Department of Agriculture to improve the design of reclamation plans through researching effective strategies to control annual brome grasses on mine lands. This information will assist OSM in designing effective reclamation plans.

- Clark Atlanta University to investigate the effects of high conductivity mining effluents on benthic organisms in Alabama coal mining streams.

Bureau of Land Management

The Bureau of Land Management (BLM) is a multiple-use land management agency within Interior, responsible for administering approximately 248 million surface acres. Activities on these lands include recreation, energy development, mining, logging, livestock grazing, and management of wild horses and burros. To balance these varied uses, BLM's decisions draw upon scientific data and information sources.

For instance, as a result of the 1971 Wild Free-Roaming Horses and Burros Act, the bureau is responsible for managing the majority of wild horses and burros on public lands. This has resulted in a large portfolio of research and databases used to inform management decisions within the bureau's Wild Horse and Burro Program and balance conflicting opinions regarding how these animals should be managed. In an effort to protect rangelands from deterioration due to overpopulation and ensure that horses and burros are kept at populations consistent with the land's capacity, the BLM must maintain herds at Appropriate Management Levels. These levels are established through monitoring and evaluation of extensive rangeland data on factors such as vegetation, soils, water, wildlife, and wildfire. To meet these management levels, the BLM conducts ongoing research related to the effectiveness and practicality of contraceptive agents, sex-ratio management, and other management techniques used to maintain minimally reproducing, self-sustaining herds. The bureau also collects data to determine the genetic diversity of herds in order to determine whether management actions need to be taken to address genetic concerns. To further facilitate successful management of wild horses on public lands, the BLM maintains the Wild Horse Identification and Management System. This visual database is used by federal wild horse managers, federal adoption program managers, individual horse owners, academic researchers, and federal and state land managers to identify wild horses and track information on them.

Wild Horses – In early 2011, an estimated 38,500 wild horses and burros roamed BLM-managed rangelands.

Reliable, science based population estimates are critical to virtually all aspects of wild horse and burro management decisions. In an effort to improve herd counts, which are conducted every four years, the BLM has partnered with the USGS and Colorado State University to test various aerial survey techniques and improve their wild horse and burro census. Accurate and defensible population estimates provide considerable benefits to both federal wild horse managers as well as external interest groups. These include improved management of wild horses and burros on public lands, determination of the number of animals that can remain on public lands, as well as a more accurate allocation of grazing units provided to ranchers. To ensure that best science is used in all aspects of its wild horse and burro management, in early 2011 the bureau requested an independent review of its scientific studies and overall Wild Horse and Burro Management Program by the National Academy of Sciences/National Research Council. The results will be used by the BLM to determine the best way to use scientific research within this program and identify areas where more research is needed. These findings will also be made available to the public.

In addition to using its own scientific research to improve management, the BLM also incorporates information obtained from the public into resource management decisions. For example, by conducting visitor use surveys and research through its National Recreation Office, the bureau gathers information from the public regarding their experiences and satisfaction with BLM recreation sites, including opinions on amenities, services, and staff. Surveys also allow visitors the opportunity to provide input as to how BLM lands can be enhanced and better managed. This information is used by the bureau to improve management of the lands it administers, providing a direct benefit to visitors of BLM recreation sites.

Box 6-3. A BLM Socio-economic Survey

The Upper Las Vegas Wash Conservation Transfer Area (Wash) is a highly sensitive area located in the northern Las Vegas Valley. The Bureau of Land Management was tasked with researching how alternative scenarios of development would impact sensitive resources (e.g., wildlife, plants, cultural resources, soils) around the Wash. BLM contracted with Utah State University to design and implement a survey to better understand residents' attitudes toward the Wash and protection of its resources.

The survey was designed to help understand how social and economic conditions in nearby neighborhoods are linked to the landscape and environment that surrounds the Wash. Survey questions centered on what people thought of the Wash and how they made use of the area. Survey results indicated that both visual accessibility and spatial proximity were related to use of the Wash area for outdoor activities, familiarity, and attachment to the Wash environment. However, visual accessibility and spatial proximity were not important predictors in the likelihood that residents would engage in 'sanctioning' behavior if they observed environmentally damaging activities in the Wash.

The results suggested that educational programs about the ecological sensitivity of the Wash, combined with management actions that provide residents with opportunities to experience the area in positive ways that foster environmental attachment, may increase protective orientations toward the Wash.

Source: Utah State University. June 2011. Upper Las Vegas Wash Conservation Transfer Area: A System to Develop Alternative Scenarios, Final Report.

National Park Service

The National Park Service (NPS) plays a critical stewardship role, charged with preserving the natural resources on the lands it manages to provide for the enjoyment and education of current and future generations. Much of the scientific information collected by NPS is done within its Inventory and Monitoring (I&M) Program, established in 1992. This program conducts natural resource inventories and monitors the status and trends of various park resources. The National Park Service's I&M Program collects a wide range of natural resource data from the nation's parks. The primary goals of the I&M Program are to:

NPS Inventory and Monitoring Program Staff

- Inventory the natural resources under NPS stewardship to determine their nature and status;
- Monitor park ecosystems to better understand their dynamic nature and condition and to provide reference points for comparisons with other, altered environments;
- Establish natural resource inventory and monitoring as a standard practice throughout the National Park system that transcends traditional program, activity, and funding boundaries;
- Integrate natural resource inventory and monitoring information into NPS planning, management, and decision making; and to
- Share NPS accomplishments and information with other natural resource organizations and form partnerships for attaining common goals and objectives.

12 "Baseline" Natural Resource Inventories:

- ✓ Natural Resource Bibliography
- ✓ Base Cartography Data
- ✓ Air Quality Data
- ✓ Air Quality Related Values
- ✓ Climate Inventory
- ✓ Geologic Resources Inventory
- ✓ Soil Resources Inventory
- ✓ Water Body Location and Classification
- ✓ Baseline Water Quality Data
- ✓ Vegetation Inventory
- ✓ Species Lists
- ✓ Species Occurrence and Distribution

Through this program, a set of 12 baseline natural resource inventories are conducted throughout the National Park system to document the location and condition of park resources. This establishes comprehensive baseline data used to inform park management and decision making, design long-term monitoring plans for key resources, and facilitate comparison of current park conditions with natural or desired conditions within the National Park system. Information obtained through the bureau's long-term ecological monitoring program is also used for research, education, and promoting the public understanding of park resources.

Organization of the large quantities of resulting data is accomplished through data management plans for each of 32 I&M networks. The individual data sets are then transformed into useful and readily available information through analysis, synthesis, and modeling. I&M network staff deliver the information to managers, planners, policy makers, scientists, and other key audiences.

NPS I&M networks

The NPS also uses data and information obtained through surveys of the public to inform park management and planning. Many of these surveys, conducted through the Visitor Services Project, employ questionnaires to gather data on visitor characteristics and opinions regarding a particular NPS unit. This information is used by park managers and planners to improve visitor services and overall park management. In addition, the National Park Service in partnership with the University of Wyoming recently completed its second comprehensive survey of the American public. The questionnaire obtained information from over 4,000 households on public attitudes and behaviors regarding various aspects of National Park Service programs and services, as well as demographic characteristics of visitors and non-visitors to national parks.

U.S. Fish and Wildlife Service

The U.S. Fish and Wildlife Service (FWS) is charged with conserving the nation's fish, wildlife, plants and their habitat. FWS plays a large role in generating and collecting scientific data and information used to meet this objective. For example, the FWS's Migratory Bird Data Center (a partnership with the USGS) houses extensive data sets and information on various bird populations and habitats in an effort to support conservation activities. Data sets collected through bird inventories, surveys, and monitoring programs are used to assess the status and trends of North American bird populations and facilitate planning and evaluation of bird conservation strategies and overall natural resource management. Long-standing surveys such as the Waterfowl Breeding Population and Habitat Survey date back to the 1950s and represent a successful partnership in data collection efforts between the FWS and the Canadian Wildlife Service. This survey provides population and trend information for various North American duck species and provides critical information used in the establishment of hunting regulations, as well as in waterfowl conservation. Hunter activity and harvest data are also available at this data center.

The FWS also houses a variety of geospatial data sets. For example, The National Wetlands Inventory, established in 1974, is a series of topical maps depicting wetland and deepwater habitat throughout much of the United States. These maps provide information to decision makers and the general public regarding the status, characteristics, and functions of wetlands and other key aquatic habitats. This information is used in resource management decisions at all levels of government, for purposes such as habitat management, acquisition of important wetland areas, fisheries restoration, floodplain planning, and endangered species recovery plans. Additional key uses beneficial to the general public include watershed and drinking water supply planning, municipal building and transportation corridor siting, oil spill contingency planning, and land appraisals. This information is also used by private organizations, as well as academic institutions in research and education. Analyzing trends in the status of the nation's wetlands is critical in ensuring that the ecological, social, and economic benefits provided by these valuable ecosystems are maintained.

Duck hunters will find plenty to cheer about in the annual breeding population and habitat survey. Conducted each May by the U.S. Fish and Wildlife Service and the Canadian Wildlife Service, this year's survey reveals the second-highest pond count and a record 45.6 million ducks, the most since the survey was started in 1955 (Chris Hustad, Editor, DuckHuntingChat.com, July 1st, 2011)

As the Interior bureau responsible for administering the Endangered Species Act, the FWS is also responsible for designating critical habitat necessary for the conservation of a threatened or endangered species. Metadata, spatial data, and an interactive map providing boundaries of areas across the United States where final critical habitats exist are provided through the bureau's Critical Habitat Portal webpage. This information is used to inform the public of the importance of these areas to

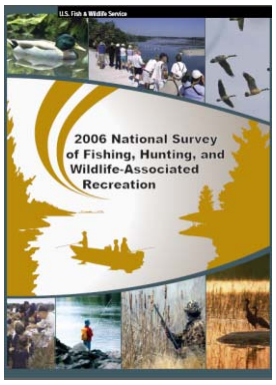
The Critical Habitat Mapper.

the conservation of a species, as well as for planning and land management.

Similar to the NPS, the FWS has an extensive program of inventorying and monitoring of the nation's natural resources. In a partnership with the USGS, the FWS has identified 21 geographic landscapes, each comprising an area within which a Landscape Conservation Cooperative (LCC) operates. An LCC is a network of partnerships between federal, state, and local government, tribes, universities, nongovernmental organizations, landowners, and other stakeholders. Each network shares and uses scientific information to proactively address land use pressures and resource threats accelerated by climate change, such as habitat fragmentation, invasive species, and water scarcity. The value of this information is in its use to help inform resource management decisions.

In addition, the bureau collects a variety of information from the public used in both state and federal decision making. For example, the FWS and USGS recently conducted a visitor survey on a sample of 53 National Wildlife Refuges throughout the country. Refuge visitors were queried on various aspects of their visit, providing the FWS with information that can be used to improve refuge management and visitor services.

Box 6-4. FWS National Survey of Fishing, Hunting and Wildlife-Associated Recreation



The National Survey of Fishing, Hunting and Wildlife-Associated Recreation provides invaluable data about demographic trends in hunting, fishing and outdoor recreation, while also informing the public about the economic benefits provided by these activities. The survey is one of the Nation's most important wildlife-related recreational databases. It is the only source of comprehensive information on participation and expenditures that is comparable on a state-by-state basis, and is widely used by the outdoor recreation industry. The national survey provides state fish and game agencies with information and assistance that they would have had difficulty obtaining on their own and at a much lower cost.

Federal Decision Making: FWS's Adaptive Management and Regulation of Waterfowl Harvests used the National Survey to report the number of people who engaged in migratory bird hunting, how often they went hunting, and how much money they spent participating in this activity. This information was used in decision making with impacts extending to the national level. FWS's North American Waterfowl Management Plan used information from the national survey to report the number of waterfowl hunters and how much money they spent. The impacts are nationwide and the information was crucial in decision making, such as the creation of special seasons on more abundant species, the setting of harvest and species-specific limits.

State Decision Making (State Wildlife Action Plan): The Arizona Game and Fish Department used the survey to help guide and implement a statewide watchable wildlife project, which will be part of a Wildlife Viewing Action Plan. "This is a step to include users and stakeholders in evaluating the plan," says Watchable Wildlife Coordinator Joe Yarchin. "We're looking for input on any broad objectives or strategies we might have missed, including alternatives. We want feedback on whether this is hitting the mark or has some gaps that need to be addressed." The National Survey was the data source used to show that there is strong public interest in watching wildlife (over 1.3 million visitors and $838 million in spending annually, 2006). Without the National Survey the Arizona Game and Fish Department would not have been able to report how many people watch wildlife in their state and how much they spend on the activity. Several other states have similar uses for the National Survey data.

Sources: http://www.fws.gov/migratorybirds/CurrentBirdIssues/Management/AHM/ahm2.html; http://www.fws.gov/birdhabitat/NAWMP/index.shtm; http://azgfd.net/artman/publish/NewsMedia/Game-and-Fish-seeks-input-on-Wildlife-Viewing-Action-Plan.shtml

FUTURE DIRECTIONS

Scientific information provides a critical input to improved decision making in both the private and public sectors. It also helps identify problems and fashion solutions, a process that can be speeded up through technology transfer. The examples presented in this chapter illustrate applications of some of the scientific research, information, and technology transfer activities undertaken by DOI.

Advances in economic analysis have led to the development of methods that that can be applied to address the challenges associated with monetizing the value of 'public goods' such as data and scientific information. Applying these methods is challenging, but additional empirical research can help quantify the value of information and technology transfer and can help to demonstrate a return on the public's investment.

A critical step in quantifying the value of scientific information is a deeper understanding of how the information is actually used. Various approaches to strengthen this understanding could be considered, including establishing the ability to track how online data are used, say, by including optional feedback forms where users could voluntarily describe their uses of the data. This type of information could be used to better understand why the information has value and to help estimate these values.

REFERENCES

Adams, R.M., Bryant, K.S., McCarl, B.A., Legler, D.M., O'Brien, J., Solow, A. and R. Weiher. 1995. Value of improved long-range weather information. *Contemporary Economic Policy* 13: 10-19.

Bernknopf, R.L., Brookshire, D.S., Soller, D.R., McGee, M.J., Sutter, J.F., Matti, J.C. and R.H. Campbell. 1993. Societal value of geological maps. U.S. Geological Survey Circular 1111, 53 p.

Bernknopf, R.L., Dinitz, L.B. and K. Loague. 2001. An interdisciplinary assessment of regional-scale nonpoint source ground-water vulnerability: Theory and application. U.S. Geological Survey Professional Paper 1645, 21 p.

Bernknopf, R.L., Wein, A.M., St-Onge, M.R. and S.B. Lucas. 2007. Analysis of improved government geological map information for mineral exploration: Incorporating efficiency, productivity, effectiveness, and risk considerations. U.S. Geological Survey Professional Paper 1721, 45 p

Carsell, K.M., Pingel, N.D., and D.T. Ford. 2004. Quantifying the benefit of a flood warning system. *Natural Hazards Review* 5: 131-140.

Centrec Consulting Group, LLC. 2003. Investigating the economic value of selected NESDIS products. Benefits of meteorological services. A report to the National Environmental Satellite, Data, and Information Service (NESDIS). Centrec Consulting Group, Savoy, IL, 50 pp.

Centrec Consulting Group, LLC. 2005. Economic value of selected NOAA products within the railroad sector. A report to NOAA's National Climatic Data Center. Centrec Consulting Group, Savoy, IL, 37 pp.

Centrec Consulting Group, LLC. 2007. An investigation of the economic and social value of selected NOAA data and products for Geostationary Operational Environmental Satellites (GOES). A report submitted to NOAA's National Climatic Data Center. Centrec Consulting Group, Savoy, IL.

Council of Economic Advisers. 2012. Economic Report of the President.

Halsing, D., Theissen, K. and R.L. Bernknopf. 2004. A cost-benefit analysis of the National Map. U.S. Geological Survey Circular 1271, 40 p.

Grossman, Gene M., and Elhanan Helpman. 1991. Innovation and Growth in the Global Economy. MIT Press.

Johnson, S.R. and M.T. Holt. The value of weather information. 1997. In: Katz, R.W. and A.H. Murphy (Eds.) *Economic Value of Weather and Climate Forecasts* (pp. 75-107). United Kingdom: Cambridge University Press.

Kite-Powell, H. 2005: Estimating economic benefits from NOAA PORTS information: a case study of Tampa Bay. Tampa Bay Harbor Safety & Security Committee, Tampa, FL.

Kite-Powell, H. 2007: Estimating economic benefits from NOAA PORTS information: a case study of Houston/Galveston. Port of Houston Authority, Houston, TX.

Kite-Powell, H. 2010. Estimating economic benefits from NOAA PORTS information: a case study of the Columbia River. Port of Portland.

Lazo, J.K., and L. Chestnut. 2002. Economic value of current and improved weather forecasts in the U.S. household sector. Boulder, CO: Stratus Consulting.

Lazo, J.K., Hagenstad, M.L., Cooney, K.P., Henderson, J.L. and J.S. Rice. 2003: Benefit analysis for NOAA high performance computing system for research applications. Boulder, CO: Stratus Consulting.

Lazo, J.K., Waldman, D.D., Hearn Morrow, B. and J.A. Thacher. 2010. Household evacuation decision making and the benefits of improved hurricane forecasting: developing a framework for assessment. *Weather Forecasting* 25: 207–219.

Letson, D., Sutter, D. and J. Lazo, 2007. The economic value of hurricane forecasts: an overview and research needs. *Natural Hazards Review* 8: 78-86.

Miller, H., Sexton, N., Koontz, L., Loomis, J., Koontz, S. and C. Hermans. 2011. The users, uses, and value of Landsat and other moderate-resolution satellite imagery in the United States – Executive Report. USGS Open-File Report 2011–1031.

National Weather Service. 2002. Data collection component configuration for flood warning: significance of value.

NOAA. 2002. Geostationary Operational Environmental Satellite system (GOES) GOES-R sounder and imager cost/benefit analysis (CBA). NOAA NESDIS Office of Systems Development, Silver Spring, 88 pp.

NOAA. 2004. Geostationary Operational Environmental Satellite system (GOES) GOES-R sounder and imager cost/benefit analysis (CBA) - Phase III. NOAA/NESDIS Office of Systems Development, Silver Spring, MD, 51 pp.

Nordhaus, W. 1994. *Managing the Global Commons*. Cambridge, MA: The MIT Press.

Nordhaus, W.D. and D. Popp. 1997. What Is the Value of Scientific Knowledge? An Application to Global Warming Using the PRICE Model. *Energy Journal* 18: 1–46.

U.S. Department of the Interior, Bureau of Ocean Energy Management. 2011. Assessment of Undiscovered Technically Recoverable Oil and Gas Resources of the Nation's Outer Continental Shelf, 2011. BOEM Fact Sheet RED-2011-01a

Chapter 7 THE EXTERNALITIES OF DOI ACTIVITIES: MOVING TOWARD FULL COST ACCOUNTING

INTRODUCTION

Other chapters of this report discuss economic contributions of DOI activities and highlight the contributions the Department's activities make in supporting important sectors of the economy. In particular, Interior resources provide energy, minerals, forage, water, habitat, and timber that are subsequently used throughout the economy to generate electricity, provide fuel for transportation, and provide raw materials used as inputs in a number of industries. Yet, in many cases the benefits provided by the raw materials and products that flow from DOI managed lands, as well as the production, distribution and use of these products, also may cause adverse effects on the environment, economy, or society. Economists typically characterize these adverse effects as *negative externalities*. Conversely, some of Interior's activities (e.g., restoration of habitat, historic buildings) have external benefits called *positive externalities*.

In a nutshell

- Market prices often do not fully reflect the impacts of land management decisions on environmental goods and services because these goods and services are not directly bought and sold in markets.
- Activities or actions by one party that are not reflected in market prices and that affect the well-being of another party are termed *externalities*.
- The ability to evaluate negative externalities is an important component to strengthening the set of information available to decision makers. The use of a common metric allows comparisons across alternatives to be made on a consistent basis.
- Full cost accounting would help promote more cost-effective investments on public lands.

This chapter provides an introduction to the concept of externalities, discusses the application of these concepts in the context of several Interior related examples, and highlights the importance of moving toward full cost accounting of DOI land management activities. Full cost accounting refers to the collection and presentation of information about the economic, environmental, and social costs and benefits related to a particular policy decision.

What is a Negative Externality?

A negative externality is an activity that imposes uncompensated costs on other people. For example, externalities from energy exploration, development, production, and use can include the air pollution emitted by cars and power plants, oil spills, radioactive emissions from nuclear power plants, acid mine drainage, and congestion from overloaded streets and highways. More recently, scientists have identified greenhouse gas emissions, such as the carbon dioxide that comes from burning fossil fuels, as a particularly important externality.

DEFINITION OF AN EXTERNALITY

Market prices typically account for both the positive and negative effects associated with the use of a good or service. However, it is common for market prices to not fully reflect the impacts of land management decisions on environmental goods and services because these goods and services are not directly bought and sold in markets. Activities or actions by one party that are not reflected in market prices and that affect the well-being of another party are termed *externalities*. Externalities can be positive or negative. The explanation for why market prices may not fully reflect the opportunity costs (the value of the next-highest-valued alternative use of the resource) associated with environmental goods and services (e.g., clean air and water) is complex, but is closely related to the fact that goods such as clean air and clean water are not typically bought and sold in markets (thus they do not have a market price that consumers and producers can readily observe and account for in the market value of the product). The reason these environmental goods and services are not typically bought and sold in market is often associated with the lack of clear property rights for these goods and services.

Externalities can be distinguished from secondary or indirect effects. For example, increased food prices caused by the conversion of agricultural land from food to biofuel production, are not considered to represent an external cost, as they result from (presumably properly functioning) markets. Higher food prices may of course raise important social concerns and may thus be an issue for policy makers, but they would not be considered an externality.

THE IMPORTANCE OF ACCOUNTING FOR EXTERNALITIES

The presence of externalities has implications for decision making because if market prices leave out important benefits or costs, buyers and sellers cannot make informed decisions. Thus, failure to account for externalities can distort decision making and reduce society's total welfare. When the prices of goods and services does not adequately reflect the monetary value of benefits or adverse effects, decision makers (including individual consumers, public land managers, and entities in the private sector that lease, develop, or purchase energy, minerals and other resources) may not recognize the full effects of their actions. In general, when external benefits are ignored, the result is an underproduction and overpricing of the goods that generate the positive externalities. In contrast, when external costs are ignored, the result is an over-production and under pricing of the goods that generate these negative externalities.

Why environmental goods and services are not typically bought and sold in markets? *Some goods and services are easy to put a price on and integrate into the economy, for example a movie ticket or a loaf of bread. Others such as a clean air and water, biodiversity, resilient ecosystems, and clear vistas are not typically bought and sold in markets, and thus very difficult to value or put a price on. This lack of markets is due to the fact that the property rights for these resources are often not well specified. When ownership of resources is unclear, markets to allocate them are slow to arise.*

Negative externalities matter because, when they are not accounted for, they can lead to a lower quality of life for at least some members of society. For example, suppose that a proposed energy development on public land has the ability to reduce the amount of air pollution emitted during exploration and development by 10 tons, at a cost of $40 per ton. Suppose further that the full cost of the air pollution (for example, health and visibility impacts) is $50 per ton. If the developer were to reduce its air pollution emissions, total social welfare would

increase—the additional cost to the developer would be $400 (10 tons × $40 per ton), but the "savings" to society (that is, the reduction in adverse effects) would be $500 (10 tons × $50 per ton). Society's wellbeing would be increased by this change. However, if the externality had not been accounted for in the developer's decisions, aggregate well-being of all members of society would be lowered.

The Role of Government in Correcting Externalities

> *"Government investments as well as regulatory policies can improve well-being by correcting market failures and protecting safety, health, and environmental quality. In fashioning long-term policies, the Nation should not overlook those factors that contribute to well-being even if they are not fully captured in economic statistics." —Economic Report of the President, 2012*

When market prices do not fully reflect the opportunity costs associated with a particular activity, there may be a case for government intervention. The goal of policies that correct for externalities is to essentially have private companies or individuals "internalize" the externality in their decision making or production decisions so that more socially optimal levels of output are produced. Possible policy approaches to correct externalities range from "command and control" policies to "market-based" policies (or perhaps a combination of the two approaches). Command and control policies are generally regulatory approaches; market-based policies rely on establishing markets for pollution or markets for activities to offset the impacts of environmentally damaging activities (examples include transferrable permits, pollution taxes, and habitat conservation banks). Each approach may have advantages in particular situations. For example, pollution issues involving highly toxic materials (e.g., nuclear waste) or high-cost events (e.g., large oil spills), a regulatory approach might be appropriate. Thus, regulation by the new Bureau of Safety and Environmental Enforcement (BSEE) is intended to reduce the likelihood of significant oil spills. Market-based approaches offer advantages in situations where the concern is with large numbers of polluting entities that have varying pollution control costs. Market-based policies that may have relevance for addressing externalities associated with DOI activities include habitat conservation banks, policies to facilitate the development of ecosystem service markets, and policies that promote the sale or lease of DOI-managed resources at their opportunity cost.

Understanding why particular externalities occur, and the monetary value of such externalities, is important because they provide an example of a situation where government involvement can potentially be used to improve market outcomes. For example, estimates of the monetary value of externalities associated with energy development could be used to inform decisions about the locations, scale, scope, and technology choices when making public land use decisions. Should mining of coal, extraction of oil and gas, development of renewable energy, grazing, or timber harvesting activities be allowed in a particular area? Should the area be set aside for recreation use? While the National Environmental Policy Act (NEPA) compliance process is designed to disclose impacts resulting from federal actions, it does not provide a set of information that allows comparisons of impacts relative to a baseline across alternatives to be made with a common metric (such as dollars). Valuing all of the impacts, including those associated with external costs, would allow such comparisons to be made and could be used to inform land management decisions.

RECENT LITERATURE

An example of how externalities are addressed using economic analysis is provided by a recent report published by the National Research Council (NRC 2010). This study examined the external costs associated with various sources of energy, focusing on the costs associated with air pollution (such as sulfur dioxide from coal-fired electricity and emissions from cars and trucks) and on the costs associated with climate change.[37] The study did not evaluate the external costs associated with changes to ecosystem service flows during exploration, development, or extraction activities.

The table below summarizes the results from the National Research Council study. It shows the ratio of the estimated external or uncompensated costs of energy to the market price. For example, electricity generated from coal has an estimated external cost of 70 percent of its market price. Petroleum is used primarily for automotive fuels, and its social costs are one quarter of the price of gasoline. Electricity production from natural gas has among the lowest ratios of social cost to market price at 19 percent. These percentages can be used to estimate the dollar value of the external costs of energy. For example, the U.S. average sales price of coal in 2010 was $37.61 per ton. Assuming the external costs are 70% of the market price implies that the external costs are about $26.30 per ton.

Table 7-1. The External Costs of Energy

Sector and Fuel	External Costs as a Percentage of Market Price
Electricity generation—coal	70%
Electricity generation—natural gas	19%
Transportation—primarily automotive gasoline	25%
Heat production—natural gas	42%

Source: National Research Council, Hidden Costs of Energy, 2010.

In another study, Epstein et al., (2011) estimated that the negative externalities related to coal were $345.3 billion annually ($2008, ranging from a lower bound of $175.2B to an upper bound of $523.3B) using a process called "life cycle assessment" (LCA). Commonly used by USGS, LCA broadly accounts for the entire life cycle of a land use activity. In the case of energy, LCA includes exploration, development, and extraction of the energy source as it is found in nature; through conversion, transportation, and transmission to its point of use; and then to the ultimate fate of waste products from that use. The authors recommended that "[c]omprehensive comparative analyses of life cycle costs of all electricity generation technologies and practices are needed to guide the development of future energy policies" (pp. 93-94).

[37] Some of the externalities associated with the production and consumption of energy have been corrected, to some degree, through public policies. For example, coal mining and oil and gas extraction are subject to federal, state, and local regulations that are intended to limit the environmental damages associated with mining and oil and gas development. Air pollution emissions by power plants are regulated under the Clean Air Act, and tailpipe emissions from motor vehicles are regulated at the federal and state levels.

RELEVANCE FOR THE DEPARTMENT OF THE INTERIOR

Many land and water management decisions made by Interior involve some resources for which there is a market value (e.g., oil, gas, coal, electricity) and other resources where such values are not readily available (e.g., recreation, water quality, habitat for endangered or threatened species). For example, in considering whether an area should be leased for oil and gas development the market value of the oil and gas that might be extracted can be easily evaluated and displayed in monetary terms. However, the costs external to this decision, such as the effects of the oil and gas exploration, development and extraction on air and water quality, recreation opportunities, wildlife habitat, or energy security cannot be easily accounted for in dollar terms. Because the full costs of the decision cannot be easily displayed and compared, the information to make a fully informed decision is incomplete.

Similar considerations apply in decisions concerning renewable resources. The energy produced by wind and solar developments can be easily valued. However, the external costs—which arise because some renewable developments preclude other land uses—are less easily quantified and valued.

Examples of Interior's Environmental Cost Models

Offshore: *As an input into the decision making process for the offshore oil and gas 5-Year leasing program, the Bureau of Ocean Energy Management (BOEM) conducts a "cost-benefit" or "net benefits" analysis using a model that monetizes environmental and social costs associated with offshore oil and gas exploration and development and energy market substitutions in the absence of the offshore oil and gas. The model places monetary values on the following categories: recreation; air quality; property values; subsistence harvests; fiscal impacts; commercial fishing; and ecological impacts. The model compares a series of exploration and development scenarios to a no action alternative. The model's output allows BOEM to do a comparative analysis of all 26 "planning areas" comprising the outer continental shelf (OCS), accounting for the estimated environmental costs, and to then obtain the "relative ranking" of those planning areas required for the 5-Year Plan.*
Onshore*: BLM is currently investigating the feasibility of developing an environmental cost model for activities taking place on public lands.*

Because no fossil fuel is involved in electricity generation from renewable sources, no gases or other contaminants are released during the operation of a wind turbine or a solar collector. To the extent that renewable energy generation offsets energy imports, renewables can increase energy security. This may be seen as a positive externality of renewable generation. However, there are still potential negative externalities from wind energy developments, including adverse visual and noise effects, and the killing of birds and bats. FWS's Conservation Planning Assistance Program (CPA) typically becomes involved in the review of potential wind energy developments on public lands through NEPA. This may be as a cooperating agency or because of the Service's responsibilities under the Migratory Bird Treaty Act, the Bald and Golden Eagle Protection Act, the Endangered Species Act, or because of the Agency's special technical expertise. CPA may also become involved in the review of potential wind energy developments on private lands if their technical expertise in addressing wildlife issues is requested on a voluntary basis.

From an economic perspective, the negative externalities of wind energy development and eagle take from wind power operations could be internalized by the developers through mitigation. The FWS has recently finalized its Land-Based Wind Energy Guidelines. The Guidelines are voluntary and provide a

structured, scientific process for addressing wildlife conservation concerns at all stages of land-based wind energy development.[38] In addition, Draft Eagle Conservation Plan Guidance was developed by FWS to provide interpretive guidance to wind developers, Service biologists who evaluate potential impacts on eagles from proposed wind energy projects, and others in applying the regulatory permit standards as specified by the Bald and Golden Eagle Protection Act and other federal laws. The guidance provides recommendations for the development of *Eagle Conservation Plans* (ECPs) to support issuance of eagle programmatic take permits for wind facilities. Programmatic take permits will authorize limited, incidental mortality and disturbance of eagles at wind facilities, provided effective offsetting conservation measures that meet regulatory requirements are carried out.

Solar energy developments on public land typically are not compatible with other uses of the land, thus some loss of ecosystem services accompanies large-scale solar developments. These losses would be considered external costs and in concept should be valued so they can be considered as part of the land use management decision. As renewable energy generation technology improves and penetration into the U.S. energy market grows, it will become more important that the external costs of these sources be evaluated.

CONCLUSIONS

Each stage in the life cycle of fossil fuel extraction, transport, processing, and combustion, generates a waste stream that can damage human health and the environment. The ability to evaluate these negative externalities is an important component to strengthening the set of information available to decision makers. The use of a common metric allows comparisons across alternatives to be made on a consistent basis. Specifically, engaging in full cost accounting of all energy sources—fossil fuels, wind, solar, and other forms of non-fossil fuel power generation—would help promote more cost-effective investments on public lands.

A useful step to consider in moving toward full cost accounting would involve the development of more robust underlying information. This could include better information on recreation use and users of BLM lands and information on baseline levels of ecosystem services on DOI lands.

[38] For additional details see http://www.fws.gov/windenergy/.

REFERENCES

Epstein, Paul R., Jonathan J. Buonocore, Kevin Eckerle, Michael Hendryx, Benjamin M. Stout III, Richard Heinberg, Richard W. Clapp, Beverly May, Nancy L. Reinhart, Melissa M. Ahern, Samir K. Doshi, and Leslie Glustrom. 2011. Full Cost Accounting for the Life Cycle of Coal. In "Ecological Economics Reviews," *Ann. N.Y. Acad. Sci*. 1219: 73–98.

National Research Council. 2010. Hidden Costs of Energy: Unpriced Consequences of Energy Production and Use. Washington, DC: The National Academies Press.

Chapter 8 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 2011 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 Department of the Interior has a substantial impact on the national economy, supporting nearly 2.4 million jobs while infusing billions of dollars into the economy which in turn support many jobs across the Nation. In 2011, Interior supported approximately $385 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.

One of the challenges associated with providing economic information about Interior's activities is that many of the ecosystem goods and services produced on Interior-managed lands, or produced by Interior bureaus, are not bought and sold in markets (and thus not tracked in the national accounts). This makes valuing these goods and services difficult and makes understanding the tradeoffs between marketed goods and goods and services not typically bought and sold in markets difficult because a common metric for making comparisons is not readily available. The chapters of this report addressing conservation, the value of information and technology, and ecosystem restoration discussed some of these types of goods and services. A variety of economic analysis techniques are available to analyze these types of "non-market" goods and services. Additional empirical work to evaluate some of the values associated with these areas would be a useful addition to the set of information available to decision makers.

Some of the issues highlighted in the report included:

- The measurement of benefits from conservation investments can provide important information to policymakers for future decisions. Economic techniques allow the benefits and costs of conservation investments to be represented in monetary terms, enabling comparison across locations or projects in a common metric. Absent the ability to quantify benefits in monetary terms, physical measures of benefits (e.g., number of species conserved) can be substituted, where either measure of benefit can be used to calculate a return on investment. Such calculations can provide valuable information to evaluate, target and prioritize land acquisition decisions or other conservation activities.

- Restoration, rehabilitation, remediation, and reclamation activities play an important role in maintaining the health and vitality of DOI lands and managed resources. While there are numerous and compelling restoration success stories, some of which are described in this report,

challenges remain. Although there is an increasing understanding of ecosystem services through a number of federal and departmental efforts, there still tends to be a disconnect between restoring natural resources and restoring the benefits to the public derived from these resources, which can affect the goals, planning, and outputs of scientific study. Relevant, high-quality scientific outputs are critical inputs for economic analysis. Even with relevant science, though, the total benefits from restoration can be difficult for economists to quantify and value. While the jobs and economic contributions from restoration are substantial and important, they do not represent the full economic value of ecosystem restoration, because they do not capture the net benefits associated with environmental goods and services not bought and sold in markets. Valuation of non-market benefits is an exercise worth carrying out, with precision and rigor where feasible. Looking forward, developing well-established, tangible values for the resources and associated services under Interior's trust would help ensure that the public's benefits are maximized from investment in DOI restoration activities.

- Quantifying the economic value of the end uses which publicly provided data and information are put towards and incorporating these values into benefit-cost analyses can provide a useful mechanism to demonstrate the return on the public's investment in them. The examples presented in the report illustrate some of the beneficial uses of DOI bureau scientific research, information, and technology transfer activities. Advances in economic theory have led to an extensive range of methods that have been developed and applied to address the challenges that arise when monetizing the value of public goods such as data and information sources. But challenges remain and there are many opportunities to conduct empirical research that can help quantify the value of information and technology transfer.

- Empirical research suggests that the environmental benefits of land conservation in rural areas do not come at the expense of diminished employment and economic growth. While policies for public land conservation may not lead to an economic boon for rural communities, the research does consistently show that public land conservation does not harm rural economies. Policies that change the use of public lands from extractive or resource production to more of a conservation focus may simply result in shifts in the type of economic sectors supporting a local community, such that losses in one or more sectors are offset by gains in other sectors of the local economy. Furthermore, a rural area's ability to transition may also vary geographically and depend on the inter-relationships between rural communities and the surrounding areas. Additional analysis is warranted to better understand how the economic profiles of rural areas are affected over time from policies that change the landscape of conservation lands in surrounding areas. These issues are important to evaluate in regards to policies that both lead to additional land conservation as well as in those situations where conservation lands are being considered for more intensive resource uses. Finally, beyond quantifying any employment, income, and population growth effects, analysis of the broader market and non-market economic effects of public land conservation efforts is important to understanding the full scope of their contribution to local communities.

- Accounting explicitly for the externalities associated with the extraction and development of resources from Interior lands is an important component to strengthening the set of information available to decision makers. The use of a common metric allows comparisons across

alternatives to be made on a consistent basis. Specifically, engaging in full cost accounting of all energy sources—fossil fuels, wind, solar, and other forms of non-fossil fuel power generation—would help promote more cost-effective investments on public lands. A useful step to consider in moving toward full cost accounting would involve the development of more robust underlying information. This could include better information on recreation use and users of BLM lands and information on baseline levels of ecosystem services on DOI lands.

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 CONTRIBUTIONS BY STATE

STATE-LEVEL CONTRIBUTIONS FOR BLM MINERALS AND ENERGY DEVELOPMENT

The BLM manages some 700 million acres of Federal onshore mineral estate, providing access to oil, natural gas, coal, and other minerals. Beyond these minerals, BLM lands are managed for renewable energy opportunities including geothermal, solar, and wind energy.

The following data provide estimated employment and economic output resulting from BLM-managed minerals and renewable energy projects in 18 western states, and from BLM's Eastern States Office in 2011. State-level data for locatable minerals were not available. National economic contribution estimates from the mining of these minerals on BLM lands were estimated and presented in the body of this report. The economic contributions of BLM minerals production are shown in terms of direct and total employment and output. Total employment 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 and direct economic estimates are produced using the IMPLAN input-output model.

Table A1-1. State-Level Contributions for BLM Minerals (2011)

State	Sector	Employment (jobs)		Output (billions, $2011)	
		Direct	Total	Direct	Total
Alaska	Oil and Gas	201	527	0.09	0.14
	Coal Mining	0	0	0	0
	Other Minerals (excluding locatables)	6	8	0.001	0.001
	Geothermal Energy	0	0	0	0
	Wind Energy	0	0	0	0
	Solar Energy	0	0	0	0
Arizona	Oil and Gas	0	0	0	0
	Coal Mining	0	0	0	0
	Other Minerals (excluding locatables)	4	8	0.001	0.002
	Geothermal Energy	0	0	0	0
	Wind Energy	3	7	0.0002	0.0009
	Solar Energy	0	0	0	0
California	Oil and Gas	8,246	18,834	2.25	3.99
	Coal Mining	0	0	0	0
	Other Minerals (excluding	1,058	2,262	0.24	0.43

State	Sector	Employment (jobs)		Output (billions, $2011)	
		Direct	Total	Direct	Total
	locatables)				
	Geothermal Energy	402	1,028	0.12	0.21
	Wind Energy	40	102	0.003	0.017
	Solar Energy	2,194	5,469	0.38	1.16
Colorado	Oil and Gas	18,101	39,128	6.50	9.51
	Coal Mining	2,650	5,719	0.88	1.31
	Other Minerals (excluding locatables)	45	131	0.02	0.03
	Geothermal Energy	0	0	0	0
	Wind Energy	0	0	0	0
	Solar Energy	0	0	0	0
Idaho	Oil and Gas	0	0	0	0
	Coal Mining	0	0	0	0
	Other Minerals (excluding locatables)	1,017	1,712	0.17	0.25
	Geothermal Energy	0	0	0	0
	Wind Energy	0	0	0	0
	Solar Energy	0	0	0	0
Kansas	Oil and Gas	527	766	0.06	0.09
	Coal Mining	0	0	0	0
	Other Minerals (excluding locatables)	0	0	0	0
	Geothermal Energy	0	0	0	0
	Wind Energy	0	0	0	0
	Solar Energy	0	0	0	0
Montana	Oil and Gas	2,404	4,023	0.44	0.63
	Coal Mining	1,394	2,649	0.37	0.51
	Other Minerals (excluding locatables)	0	0	0	0
	Geothermal Energy	0	0	0	0
	Wind Energy	0	0	0	0
	Solar Energy	0	0	0	0
Nebraska	Oil and Gas	26	41	0.003	0.005
	Coal Mining	0	0	0	0
	Other Minerals (excluding locatables)	0	0	0	0
	Geothermal Energy	0	0	0	0
	Wind Energy	0	0	0	0
	Solar Energy	0	0	0	0
Nevada	Oil and Gas	344	530	0.04	0.07
	Coal Mining	0	0	0	0
	Other Minerals (excluding locatables)	16	29	0.002	0.004

State	Sector	Employment (jobs)		Output (billions, $2011)	
		Direct	**Total**	**Direct**	**Total**
	Geothermal Energy	507	920	0.13	0.18
	Wind Energy	87	571	0.01	0.08
	Solar Energy	527	1,277	0.07	0.21
New Mexico	Oil and Gas	47,807	86,672	10.96	15.28
	Coal Mining	577	1,129	0.17	0.23
	Other Minerals (excluding locatables)	2,522	4,635	0.55	0.80
	Geothermal Energy	12	22	0.004	0.005
	Wind Energy	0	0	0	0
	Solar Energy	0	0	0	0
North Dakota	Oil and Gas	14,467	25,552	4.23	5.47
	Coal Mining	104	220	0.04	0.05
	Other Minerals (excluding locatables)	0	0	0	0
	Geothermal Energy	0	0	0	0
	Wind Energy	0	0	0	0
	Solar Energy	0	0	0	0
Oklahoma	Oil and Gas	873	1,678	0.26	0.36
	Coal Mining	103	235	0.04	0.05
	Other Minerals (excluding locatables)	0	0	0	0
	Geothermal Energy	0	0	0	0
	Wind Energy	0	0	0	0
	Solar Energy	0	0	0	0
Oregon	Oil and Gas	0	0	0	0
	Coal Mining	0	0	0	0
	Other Minerals (excluding locatables)	0	0	0	0
	Geothermal Energy	18	29	0.003	0.005
	Wind Energy	0	0	0	0
	Solar Energy	0	0	0	0
South Dakota	Oil and Gas	201	267	0.03	0.03
	Coal Mining	0	0	0	0
	Other Minerals (excluding locatables)	0	0	0	0
	Geothermal Energy	0	0	0	0
	Wind Energy	0	0	0	0
	Solar Energy	0	0	0	0
Texas	Oil and Gas	1,483	4,277	0.74	1.16
	Coal Mining	0	0	0	0
	Other Minerals (excluding locatables)	0	0	0	0
	Geothermal Energy	0	0	0	0

State	Sector	Employment (jobs)		Output (billions, $2011)	
		Direct	**Total**	**Direct**	**Total**
	Wind Energy	0	0	0	0
	Solar Energy	0	0	0	0
Utah	Oil and Gas	21,777	49,233	6.55	9.71
	Coal Mining	952	2,171	0.26	0.40
	Other Minerals (excluding locatables)	179	382	0.04	0.06
	Geothermal Energy	101	219	0.03	0.05
	Wind Energy	2	4	0.0001	0.0006
	Solar Energy	0	0	0	0
Washington	Oil and Gas	0	0	0	0
	Coal Mining	0	0	0	0
	Other Minerals (excluding locatables)	0	0	0	0
	Geothermal Energy	0	0	0	0
	Wind Energy	0	0	0	0
	Solar Energy	0	0	0	0
Wyoming	Oil and Gas	58,012	98,667	17.86	23.08
	Coal Mining	14,295	26,035	4.98	6.51
	Other Minerals (excluding locatables)	2,807	5,458	0.97	1.30
	Geothermal Energy	0	0	0	0
	Wind Energy	2	4	0.0001	0.0006
	Solar Energy	0	0	0	0
Eastern States	Oil and Gas	1,550	3,807	0.31	0.65
	Coal Mining	430	1,394	0.14	0.29
	Other Minerals (excluding locatables)	50	143	0.01	0.03
	Geothermal Energy	0	0	0	0
	Wind Energy	0	0	0	0
	Solar Energy	0	0	0	0

STATE-LEVEL ECONOMIC CONTRIBUTIONS FOR BLM GRAZING AND TIMBER

The Bureau of Land Management (BLM) manages livestock grazing on about 157 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 and output resulting from BLM-managed grazing and timber activities in 2011. The method used to estimate the economic contributions associated with BLM forage has been revised and the FY 2011 estimates better reflect the contributions of BLM forage to Western communities. For additional information on the revised methods see Appendix 8. BLM grazing and timber operations have direct effects in terms of employment and output, as well as indirect effects in the local economy, such as the activities of other businesses required to support ranching operations, and induced effects such as 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 using the IMPLAN input-output model.

Table A1-2. State-Level Contributions for BLM Grazing and Timber (2011)

	Grazing				Timber			
	Employment (jobs)		Output (billions, $2011)		Employment (jobs)		Output (billions, $2011)	
	Direct	Total	Direct	Total	Direct	Total	Direct	Total
Alaska	0	0	0.000	0.000	1	2	0.000	0.001
Arizona	677	912	0.026	0.052	0	0	0.000	0.000
California	217	515	0.026	0.066	67	189	0.012	0.033
Colorado	467	842	0.046	0.094	15	39	0.003	0.007
Idaho	1,844	2,898	0.147	0.275	45	108	0.010	0.018
Kansas	0	0	0.000	0.000	0	0	0.000	0.000
Montana	1,417	2,220	0.099	0.185	42	109	0.010	0.020
Nebraska	1	1	0.000	0.000	0	0	0.000	0.000
Nevada	939	1,342	0.083	0.132	12	25	0.002	0.004
New Mexico	1,929	2,566	0.100	0.173	17	36	0.005	0.013
North Dakota	10	16	0.001	0.001	0	0	0.000	0.000
Oklahoma	0	0	0.000	0.000	0	0	0.000	0.000
Oregon	1,416	2,145	0.068	0.140	905	2,779	0.226	0.537
South Dakota	137	183	0.008	0.013	4	8	0.001	0.001
Texas	0	0	0.000	0.000	0	0	0.000	0.000
Utah	1,258	1,650	0.057	0.105	24	57	0.004	0.011
Washington	78	122	0.003	0.008	14	36	0.003	0.008
Wyoming	1,036	1,543	0.104	0.166	14	31	0.002	0.004
Eastern States	0	0	0.000	0.000	0	0	0.000	0.000
Total (Sum of States)	**11,426**	**16,954**	**0.768**	**1.411**	**1,162**	**3,420**	**0.278**	**0.659**

STATE-LEVEL EFFECTS OF ABANDONED MINE LAND FUNDING (OSM AND BLM)

The information below represents the readily available information on State-level contributions 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.

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 2011 AML funding by state and the estimated jobs impacts. The long-term economic contribution of reclaimed abandoned mine land (e.g., increased tax revenue from higher property values, improved water quality) is not measured in this report. States and tribes that have certified the completion of their abandoned mine lands may use AML funds for non-coal projects. To date, this group includes Louisiana, Montana, Texas, Wyoming, the Navajo Nation, and the Crow and Hopi tribes.

Table A1-3. Office of Surface Mining, AML Funding, FY 2011

State	2011 Funding (billions, $2011)	Estimated Number of Jobs Supported (jobs)
Alabama	0.0074	87
Alaska	0.0024	25
Arkansas	0.0023	30
Colorado	0.0073	79
Crow Tribe	0.0020	24
Hopi Tribe	0.0012	15
Illinois	0.0172	207
Indiana	0.0131	161
Iowa	0.0025	30
Kansas	0.0024	26
Kentucky	0.0377	509
Louisiana	0.0004	4
Maryland	0.0027	32
Mississippi	0.0003	3
Missouri	0.0025	33
Montana	0.0122	151
Navajo Nation	0.0068	85
New Mexico	0.0046	52
North Dakota	0.0034	41
Ohio	0.0123	162
Oklahoma	0.0025	32
Pennsylvania	0.0476	610
Tennessee	0.0026	32
Texas	0.0047	58
Utah	0.0042	49
Virginia	0.0091	107
West Virginia	0.0513	544
Wyoming	0.1331	1198
Total (Sum of States)	0.3956	4387

STATE-LEVEL CONTRIBUTIONS FOR OFFSHORE MINERALS – BOEMRE

The BOEMRE program (formerly MMS, currently BOEM and BSEE) supports approximately 734,500 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 calculation of industry jobs is based on the BOEMRE's MAG-PLAN model, as well as additional calculations for determining the impact of government revenues and industry profits.

Using the MAG-PLAN model and additional data, jobs from industry spending, OCS revenues paid to the Federal Government (bonus bids, royalties, rentals, and taxes) and industry profits were distributed to both the Gulf of Mexico region and to the rest of the U.S. based on methods outlined in Appendix 8.

Table A1-4. Offshore Energy Minerals – Estimated Job and Output Contributions by State

State	Estimated Number of Jobs Supported [1] (Jobs)	Output[1] (billions, $2011)	State	Estimated Number of Jobs Supported [1] (Jobs)	Output[1] (billions, $2011)
Alabama	31,600	4.44	Montana	1,400	0.25
Alaska	2,800	0.50	Nebraska	2,400	0.39
Arizona	7,100	1.20	Nevada	2,500	0.42
Arkansas	4,100	0.74	New Hampshire	1,700	0.27
California	46,100	7.83	New Jersey	11,400	1.88
Colorado	7,700	1.36	New Mexico	3,800	0.72
Connecticut	5,500	0.92	New York	24,400	4.09
Delaware	1,100	0.19	North Carolina	11,200	1.88
District of Columbia	3,800	0.71	North Dakota	1,500	0.27
Florida	65,100	9.10	Ohio	16,200	2.74
Georgia	9,900	1.67	Oklahoma	7,600	1.50
Hawai'i	2,400	0.42	Oregon	4,700	0.78
Idaho	1,700	0.29	Pennsylvania	19,900	3.39
Illinois	16,500	2.75	Rhode Island	5,100	0.68
Indiana	8,000	1.35	South Carolina	5,300	0.90
Iowa	3,900	0.63	South Dakota	1,100	0.18
Kansas	4,600	0.81	Tennessee	7,700	1.31
Kentucky	5,700	0.98	Texas	157,500	28.97
Louisiana	107,400	16.04	Utah	3,100	0.55
Maine	1,800	0.29	Vermont	800	0.14
Maryland	9,400	1.60	Virginia	16,300	2.83
Massachusetts	10,800	1.81	Washington	9,100	1.49
Michigan	12,100	2.02	West Virginia	2,500	0.46
Minnesota	7,500	1.23	Wisconsin	8,500	1.41
Mississippi	21,500	2.83	Wyoming	1,800	0.38
Missouri	8,800	1.49			
			Total	**734,500**	**121.00**

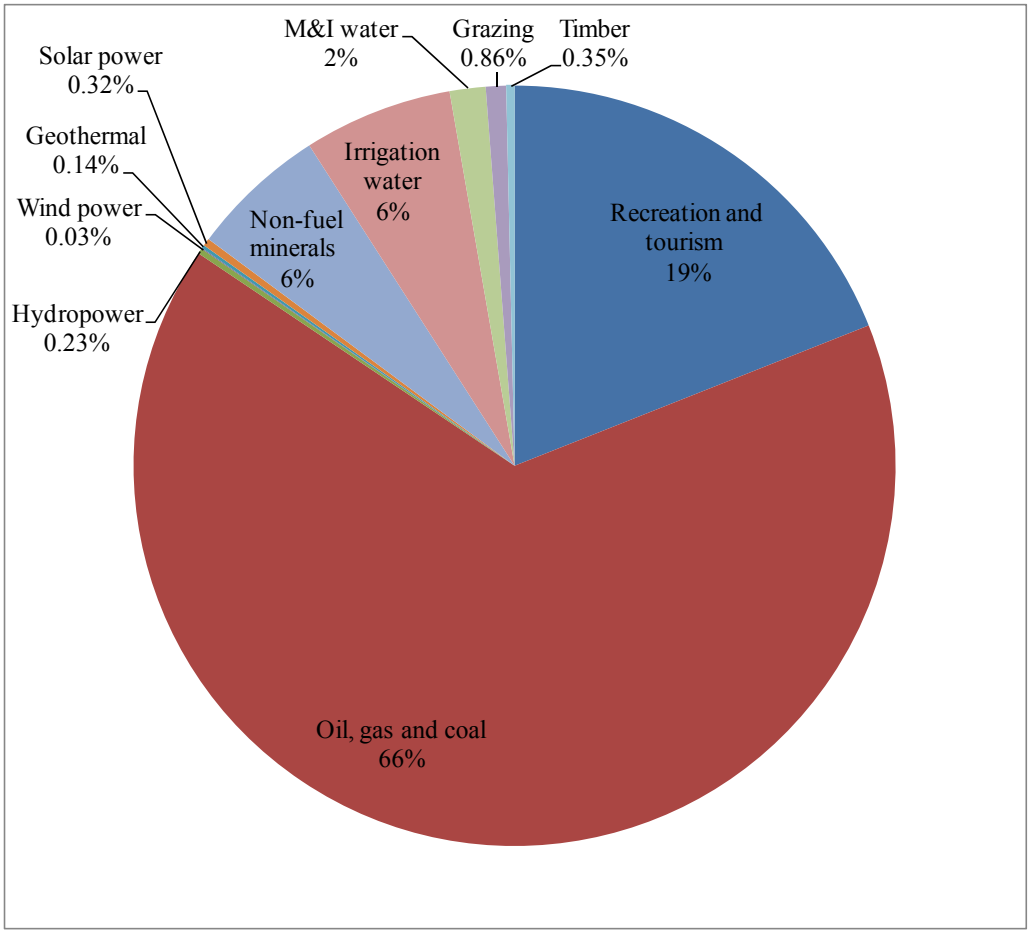
[1] These estimates do not include estimates of jobs or output supported by grants and payments.

Appendix 2. Economic Contributions by Sector and State

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. This appendix provides summary information by sector and state. Figure A2-1 shows the percentage of total Interior employment contributions by each sector, at the national level.

Figure A2-1. Percentage of DOI Employment Contributions by Management Activity



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:

- Wildlife associated expenditures ($133.9 billion; $2011) were 0.9% of US GDP ($15.1 trillion; $2011);
- Wildlife associated expenditures were 17.9% of Total Direct Tourism Output ($746.2 billion; $2010)[39];
- 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 ($10.7 trillion; $2011); and
- Wildlife associated expenditures were 9.4% of Personal Consumption Expenditures associated with Recreational goods and vehicles, Transportation services, Recreation services and Food services and accommodations ($1.43 trillion; $2011). While this is a very broad category, 9.4% 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.

Recreation visits to Interior-managed lands in the contiguous United States, Hawaii, and Alaska in 2011 supported over 403,000 jobs and about $48.7 billion in economic contributions to the 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 by Interior and organizational partners totaled 21,874 in FY 2010 and 21,084 in FY 2011, mostly in seasonal and part-time positions

[39] The most recent data in the Bureau of Economic Analysis's Travel and Tourism Satellite account are for 2010.

developing skills and experience as interpreters, visitor assistants, and trail maintenance workers. The NPS and organizational partners employed the largest number in FY 2011, with 9,089 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.

Box A2-1. Wildlife-Associated Recreation: Spending for DOI Lands

The 2006 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation (the most recent survey available) documented the trip-related equipment purchases attributed to wildlife-related recreational activities. Equipment type and demand varies widely among visitors, depending on the purpose of the visit, length of stay, and whether the visitor is local or traveled from outside the region. Equipment includes rods and reels, rifles and ammunition, camping gear, binoculars, and GPS devices (big ticket items such as boats and campers are not included).

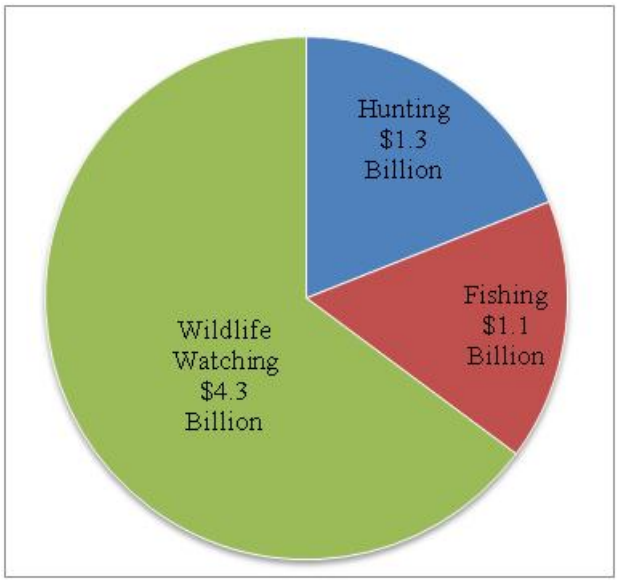


Figure A2-2. Wildlife-Associated Trip-related Equipment Spending for DOI Lands (2011 $)

In 2006, 41% of wildlife-related recreation occurred on public lands (Federal, state, and local) throughout the United States. The trip-related equipment spending by wildlife-related recreationists amounted to $22.5 billion (in 2011 dollars). $13.2 billion of this spending was related to recreation on private lands, and $9.3 billion was related to recreation on public lands.
In 2006, an estimated $6.7 billion (in 2011 dollars) was spent on trip-related equipment by wildlife-related recreationists on DOI lands. 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 for recreation on DOI lands were $21 (in 2011 dollars) for trip-related equipment.

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 2011, including almost 30 million camping and picnicking visits, over 2 million non-motorized boating trips, over 6 million interpretation and education visits.

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.

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 AND 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 734,500 jobs and $121 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.
BOEM and BSEE employ nearly 500 engineers, scientists, inspectors, and mapping specialists 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 2010, U.S. oil and gas production workers earned an average of $28.93 an hour compared to the private industry average of $21.35 an hour for all job types.[40] BLS predicts net employment in the mining sector to increase by 24,800 jobs between 2010 and 2020. The oil and gas extraction industry will account for the most new jobs created in the sector (23,200) during this period.

Employment in the coal and metal ore mining industries, on the other hand, is expected to decrease by 3,100 and 8,300 jobs, respectively, during the next decade.[41] 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 funding allocated, the AML program is estimated to create 1,566 jobs in these two states in 2011.

[40] Department of Labor, Bureau of Labor Statistics. May 2010. National Industry-Specific Occupational Employment and Wage Estimates. http://www.bls.gov/oes/current/oessrci.htm
[41] Department of Labor, Bureau of Labor Statistics. January 2012. Industry Employment and Output Projections to 2020. http://www.bls.gov/opub/mlr/2012/01/art4full.pdf

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

The Energy Information Administration (EIA) projects that increased generation from renewable energy in the electric power sector, excluding hydropower, will account for 33 percent of the overall growth in electricity generation from 2010 to 2035. Generation from renewable resources is projected to grow in response to Federal tax credits, state-level policies, and Federal requirements to use more biomass-based transportation fuels, some of which can produce electricity as a byproduct of the production process. The renewable energy share of electric power generation is projected to increase share grows from 10 percent in 2010 to 16 percent in 2035.[42]

The Bureau of Labor Statistics (BLS) predicts an overall decline in utility jobs sector-wide between 2010 and 2020, but a potential employment increase in the renewable energy sectors. Utility industry jobs pay well; lower-skilled maintenance and installation workers earn on average $29 per hour while highly trained civil and mechanical engineers earn $39-41 per hour.[43]

As employment in electric power generation, transmission, and distribution is expected to decline by 0.9% annually for the next decade, BLS predicts green energy, especially wind and solar, to account for a larger share of growing U.S. energy needs. As these sectors expand, there will be a growing need for more high and low skilled workers to construct, maintain, and operate plants.[44]

Wind Energy

The BLM has authorized some 200 rights-of-way for the use of public lands for wind energy site testing or development. Of these, 31 development authorizations have a total installed capacity of some 440 megawatts. The BLM has approved the first wind energy project on public lands in Nevada, with a potential capacity of 150 MW. The BLM currently has some 40 pending wind energy development applications on the public lands with a potential capacity of over 7,000 MW.

Since 2010, the BLM has approved three wind energy projects on public lands in California, Nevada, and Oregon with a combined capacity of 440 megawatts, estimated to support nearly 1,000 jobs. In California, about 3,062 wind turbines on public lands produce 420 megawatts of power and $1,385,295 annually in royalties.

Solar Energy

The BLM has approved 11 utility-scale solar energy projects on public lands encompassing all of the commercially viable technologies: parabolic trough, power tower, dish engine, and photovoltaic systems. These 11 projects have a combined capacity over 4,500 megawatts, estimated to support over 10,000 jobs.

Geothermal Energy

The BLM currently manages 818 geothermal leases, with 59 leases in producing status generating about 1,275 megawatts of installed geothermal energy on public lands. This amounts to over 40 percent of U.S. geothermal energy capacity and supplies the electrical needs of about 1.2 million homes. Since 2010, the

[42] Department of Energy, Energy Information Administration, AEO2012 Early Release Overview, January 23, 2012. Available at http://www.eia.gov/forecasts/aeo/er/early_elecgen.cfm.
[43] Department of Labor, Bureau of Labor Statistics. May 2010. National Industry-Specific Occupational Employment and Wage Estimates. http://www.bls.gov/oes/current/oessrci.htm
[44] Bureau of Labor Statistics. 2011. Green Jobs. http://www.bls.gov/green/greencareers.htm

BLM has approved eight priority geothermal projects on public lands in Nevada with a combined capacity of 407 megawatts—enough energy to power over 400,000 homes, and to create 700 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 about 21,600 jobs and nearly $2.2 billion in economic activity. Timber and grazing activities support small and family-owned businesses and enterprises. 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's FY 2011 $83.3 million direct rangeland economic contribution represented about 37% of the $222.3 million total value of 2010 cash receipts for cattle/calves and sheep/lambs. Similar values for other western states include: New Mexico - 8.4%; Oregon - 14.6%; Utah - 18.6%; and Wyoming - 13.6%.[45] In addition, forage from BLM lands indirectly contributes to other products from ranch operations, including clover and hay.

State-level data are presented in Table A2-1, Table A2-2, and Table A2-3. Unless otherwise noted, each of the following economic contribution summaries relies on state-level multipliers to develop output and employment contributions 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 contribution. In contrast, when a national-level multiplier is used, spillover effects among states are taken into account, providing better estimate of nationwide contributions.

[45] Source: USDA, National Agricultural Statistics Service, Meat Animals Production, Disposition, and Income 2010 Summary, available at http://usda01.library.cornell.edu/usda/current/MeatAnimPr/MeatAnimPr-04-28-2011.pdf. 2011 data were not available at the time the DOI report was prepared.

Table A2-1. Total Jobs Supported by Interior Activities, by State, by Sector

State	Recreation[1,2]	Energy & Minerals[2,3]	Grazing & Timber[2,4]	Major Grants & Payments[5]	DOI Salary[6]	Total[7]
			(jobs)			
Alabama	965	31,600	0	964	81	33,611
Alaska	5,615	3,335	2	1,467	1,049	11,478
Arizona	22,755	7,116	913	917	2,370	34,073
Arkansas	2,866	4,100	0	528	154	7,648
California	35,416	73,795	704	3,082	4,152	117,170
Colorado	13,365	52,678	881	3,324	3,878	74,203
Connecticut	20	5,500	0	115	28	5,662
Delaware	67	1,100	0	113	14	1,294
District of Columbia	12,043	3,800	0	18	457	16,318
Florida	11,411	65,100	0	645	826	77,981
Georgia	3,737	9,900	0	426	617	14,681
Hawaii	4,515	2,400	0	166	220	7,302
Idaho	6,823	3,412	3,006	838	1,001	15,122
Illinois	732	16,500	0	555	139	17,925
Indiana	1,177	8,000	0	435	142	9,755
Iowa	946	3,900	0	280	69	5,195
Kansas	1,070	5,366	0	339	183	6,958
Kentucky	1,521	5,700	0	816	164	8,201
Louisiana	847	107,400	0	1,291	562	110,100
Maine	3,388	1,800	0	187	144	5,519
Maryland	2,561	9,400	0	222	419	12,602
Massachusetts	6,355	10,800	0	155	584	17,893
Michigan	2,548	12,100	0	584	327	15,559
Minnesota	1,419	7,500	0	555	491	9,965
Mississippi	2,123	21,500	0	615	200	24,437
Missouri	2,881	8,800	0	575	398	12,655
Montana	9,958	8,072	2,328	1,845	1,018	23,248
Nebraska	630	2,441	2	256	242	3,573
Nevada	10,457	5,827	1,367	665	934	19,333
New Hampshire	53	1,700	0	162	51	1,966
New Jersey	2,652	11,400	0	159	195	14,406
New Mexico	3,989	96,258	2,602	8,465	1,972	113,402
New York	6,096	24,400	0	355	460	31,310
North Carolina	12,176	11,200	0	494	351	24,221
North Dakota	1,014	27,272	16	887	374	29,563
Ohio	1,163	16,200	0	536	200	18,098

State	Recreation[1,2]	Energy & Minerals[2,3]	Grazing & Timber[2,4]	Major Grants & Payments[5]	DOI Salary[6]	Total[7]
			(jobs)			
Oklahoma	1,812	9,513	0	499	470	12,295
Oregon	12,159	4,729	4,924	614	1,758	24,232
Pennsylvania	5,546	19,900	0	1,083	630	27,158
Rhode Island	274	5,100	0	114	24	5,512
South Carolina	1,353	5,300	0	249	127	7,029
South Dakota	3,654	1,367	191	356	605	6,173
Tennessee	8,242	7,700	0	499	380	16,821
Texas	5,095	161,777	0	1,513	625	169,010
Utah	21,269	55,109	1,707	3,938	1,190	83,292
Vermont	49	800	0	190	44	1,083
Virginia	9,136	16,300	0	419	2,305	28,161
Washington	6,519	9,100	158	594	1,234	17,605
West Virginia	1,049	2,500	0	794	322	4,665
Wisconsin	1,267	8,500	0	541	420	10,729
Wyoming	15,821	131,964	1,574	17,170	612	167,186

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

[2] BLM's Eastern States and locatable mineral mining on all BLM lands are not included in these totals due to lack of state-specific information.

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

[4] Timber contributions are based on the value of timber harvested on BLM lands in 2011. Grazing contributions are based on a state-specific estimate of jobs supported per 1,000 animal unit months (AUMs).

[5] Grants and Payments jobs include Mineral Revenue Payments, PILT, AML, and certain other grants (Sport Fish, Wildlife Restoration, State and Tribal Wildlife Grants, LWCF with GOMESA, Historic Preservation, CIAP, CESCF, NPS Grants, and 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.

Table A2-2. Total Output Supported by Interior Activities, by State, by Sector

State	Recreation[1,2]	Energy & Minerals[2,3]	Grazing & Timber[2,4]	Major Grants & Payments[5]	DOI Salary[6]	Total[7]
			(billions, $2011)			
Alabama	0.07	4.44	0.00	0.09	0.01	4.61
Alaska	0.51	0.64	0.00	0.16	0.13	1.45
Arizona	2.00	1.20	0.05	0.09	0.28	3.64
Arkansas	0.19	0.74	0.00	0.05	0.02	0.99
California	4.01	13.63	0.10	0.40	0.61	18.75
Colorado	1.27	12.22	0.10	0.35	0.49	14.44
Connecticut	0.00	0.92	0.00	0.01	0.00	0.94
Delaware	0.01	0.19	0.00	0.01	0.00	0.21
District of Columbia	1.32	0.71	0.00	0.00	0.07	2.11
Florida	1.05	9.10	0.00	0.07	0.10	10.32
Georgia	0.34	1.67	0.00	0.04	0.07	2.12
Hawaii	0.46	0.42	0.00	0.02	0.03	0.92
Idaho	0.53	0.54	0.29	0.07	0.10	1.54
Illinois	0.07	2.75	0.00	0.07	0.02	2.91
Indiana	0.09	1.35	0.00	0.05	0.02	1.49
Iowa	0.07	0.63	0.00	0.03	0.01	0.73
Kansas	0.09	0.89	0.00	0.03	0.02	1.03
Kentucky	0.10	0.98	0.00	0.09	0.02	1.19
Louisiana	0.08	16.04	0.00	0.12	0.06	16.30
Maine	0.25	0.29	0.00	0.02	0.02	0.57
Maryland	0.24	1.60	0.00	0.03	0.05	1.92
Massachusetts	0.63	1.81	0.00	0.02	0.08	2.54
Michigan	0.19	2.02	0.00	0.06	0.04	2.31
Minnesota	0.12	1.23	0.00	0.06	0.06	1.46
Mississippi	0.14	2.83	0.00	0.05	0.02	3.04
Missouri	0.22	1.49	0.00	0.05	0.05	1.81
Montana	0.79	1.39	0.20	0.16	0.10	2.65
Nebraska	0.05	0.40	0.00	0.02	0.03	0.49
Nevada	1.07	0.97	0.14	0.07	0.11	2.37
New Hampshire	0.00	0.27	0.00	0.02	0.01	0.30
New Jersey	0.23	1.88	0.00	0.02	0.03	2.16
New Mexico	0.31	17.04	0.19	0.74	0.21	18.54
New York	0.71	4.09	0.00	0.05	0.07	4.91
North Carolina	0.89	1.88	0.00	0.05	0.04	2.86
North Dakota	0.07	5.79	0.00	0.07	0.04	5.97
Ohio	0.09	2.74	0.00	0.06	0.02	2.91
Oklahoma	0.15	1.91	0.00	0.04	0.05	2.16
Oregon	1.11	0.78	0.68	0.06	0.20	2.83

State	Recreation[1,2]	Energy & Minerals[2,3]	Grazing & Timber[2,4]	Major Grants & Payments[5]	DOI Salary[6]	Total[7]
			(billions, $2011)			
Pennsylvania	0.50	3.39	0.00	0.14	0.08	4.10
Rhode Island	0.03	0.68	0.00	0.01	0.00	0.72
South Carolina	0.11	0.90	0.00	0.02	0.01	1.04
South Dakota	0.26	0.22	0.01	0.03	0.06	0.58
Tennessee	0.63	1.31	0.00	0.05	0.05	2.03
Texas	0.42	30.13	0.00	0.16	0.08	30.79
Utah	1.71	10.76	0.12	0.35	0.13	13.08
Vermont	0.00	0.14	0.00	0.02	0.00	0.16
Virginia	0.74	2.83	0.00	0.05	0.29	3.90
Washington	0.61	1.49	0.02	0.07	0.16	2.34
West Virginia	0.07	0.46	0.00	0.10	0.03	0.66
Wisconsin	0.10	1.41	0.00	0.05	0.05	1.60
Wyoming	1.24	31.27	0.17	1.50	0.07	34.26

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

[2] BLM's Eastern States and locatable mineral mining on all BLM lands are not included in these totals due to lack of state-specific information.

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

[4] Timber contributions are based on the value of timber harvested on BLM lands in 2011. Grazing contributions are based on a state-specific estimate of jobs supported per 1,000 animal unit months (AUMs).

[5] 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 Treasures, Refuge Revenue Sharing)

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

[7] 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 A2-3. State-level Employment and Output Contributions for Recreation Visits

	BLM			BOR			FWS			NPS			Total		
State	Visits	Jobs	Output (billions, $2011)	Visits	Jobs	Output (billions, $2011)	Visits	Jobs	Output (billions, $2011)	Visits	Jobs	Output (billions, $2011)	Visits	Jobs	Output (billions, $2011)
AL	0	0	0.00	0	0	0.00	1,136,692	584	0.05	781,550	382	0.02	1,918,242	965	0.07
AK	696,003	540	0.05	0	0	0.00	1,464,315	2,431	0.24	2,274,843	2,644	0.21	4,435,099	5,615	0.51
AZ	5,588,132	4,996	0.50	7,153,910	7,232	0.73	500,225	506	0.05	10,546,150	10,021	0.73	23,788,417	22,755	2.00
AR	0	0	0.00	0	0	0.00	1,118,024	491	0.04	3,125,664	2,375	0.16	4,243,688	2,866	0.19
AS										3,006	NA	NA			
CA	9,074,385	7,268	0.88	12,363,434	8,278	1.08	4,621,833	3,094	0.40	34,915,676	16,776	1.64	60,693,316	35,416	4.01
CO	6,843,838	5,454	0.56	3,482,242	3,308	0.35	77,850	74	0.01	5,635,307	4,529	0.35	16,035,174	13,365	1.27
CT	0	0	0.00	0	0	0.00	25,000	5	0.00	19,313	14	0.00	44,313	20	0.00
DE	0	0	0.00	0	0	0.00	201,748	67	0.01	0	0	0.00	201,748	67	0.01
DC	0	0	0.00	0	0	0.00	0	0	0.00	33,140,005	12,043	1.32	33,140,005	12,043	1.32
FL	0	0	0.00	0	0	0.00	3,804,784	2,833	0.29	9,222,981	8,577	0.76	13,027,765	11,411	1.05
GA	0	0	0.00	0	0	0.00	283,223	118	0.01	6,776,556	3,620	0.32	7,059,779	3,737	0.34
GU										219,349	91	0.01	219,349	91	0.01
HI	0	0	0.00	0	0	0.00	900,400	1,095	0.12	4,493,123	3,420	0.34	5,393,523	4,515	0.46
ID	5,959,217	5,603	0.44	923,074	650	0.05	367,077	258	0.02	530,977	312	0.02	7,780,345	6,823	0.53
IL	0	0	0.00	0	0	0.00	1,247,618	442	0.05	354,125	290	0.02	1,601,743	732	0.07
IN	0	0	0.00	0	0	0.00	212,288	41	0.00	2,395,485	1,136	0.08	2,607,773	1,177	0.09
IA	0	0	0.00	0	0	0.00	1,964,207	744	0.06	222,295	202	0.01	2,186,502	946	0.07
KS	0	0	0.00	2,027,655	870	0.07	278,700	120	0.01	100,361	80	0.01	2,406,716	1,070	0.09
KY	0	0	0.00	0	0	0.00	40,000	16	0.00	1,797,894	1,505	0.10	1,837,894	1,521	0.10
LA	0	0	0.00	0	0	0.00	1,058,296	492	0.04	496,329	356	0.04	1,554,625	847	0.08
ME	0	0	0.00	0	0	0.00	390,945	199	0.02	2,504,208	3,189	0.23	2,895,153	3,388	0.25
MD	0	0	0.00	0	0	0.00	499,195	190	0.02	3,541,570	2,371	0.22	4,040,765	2,561	0.24
MA	0	0	0.00	0	0	0.00	1,064,552	394	0.05	9,913,501	5,960	0.58	10,978,053	6,355	0.63

	BLM			BOR			FWS			NPS			Total		
State	Visits	Jobs	Output (billions, $2011)	Visits	Jobs	Output (billions, $2011)	Visits	Jobs	Output (billions, $2011)	Visits	Jobs	Output (billions, $2011)	Visits	Jobs	Output (billions, $2011)
MI	0	0	0.00	0	0	0.00	114,290	50	0.00	1,796,006	2,498	0.19	1,910,296	2,548	0.19
MN	0	0	0.00	0	0	0.00	1,611,210	918	0.09	540,195	501	0.03	2,151,405	1,419	0.12
MS	0	0	0.00	0	0	0.00	321,288	109	0.01	6,588,026	2,014	0.13	6,909,314	2,123	0.14
MO	0	0	0.00	0	0	0.00	433,650	159	0.01	4,140,544	2,722	0.21	4,574,194	2,881	0.22
MT	4,297,224	3,865	0.31	717,933	857	0.07	636,926	761	0.06	4,584,011	4,475	0.34	10,236,094	9,958	0.79
NE	0	0	0.00	835,223	343	0.03	220,284	90	0.01	290,323	197	0.01	1,345,830	630	0.05
NV	7,012,262	5,138	0.55	3,899,134	2,960	0.32	178,238	135	0.01	5,399,439	2,223	0.19	16,489,073	10,457	1.07
NH	0	0	0.00	0	0	0.00	74,000	35	0.00	30,941	18	0.00	104,941	53	0.00
NJ	0	0	0.00	0	0	0.00	607,000	300	0.04	5,858,443	2,353	0.20	6,465,443	2,652	0.23
NM	1,900,624	1,638	0.14	1,459,061	1,149	0.09	240,651	190	0.02	1,657,550	1,012	0.07	5,257,886	3,989	0.31
NY	0	0	0.00	0	0	0.00	654,633	316	0.04	17,506,355	5,780	0.67	18,043,875	6,096	0.71
NC	0	0	0.00	0	0	0.00	1,977,480	1,248	0.11	17,093,464	10,928	0.78	19,070,944	12,176	0.89
ND	23,821	22	0.00	202,818	151	0.01	383,733	286	0.02	659,927	555	0.03	1,270,299	1,014	0.07
OH	0	0	0.00	0	0	0.00	146,783	67	0.01	2,738,275	1,096	0.09	2,885,058	1,163	0.09
OK	0	0	0.00	1,740,753	712	0.06	2,164,490	886	0.08	1,266,189	214	0.01	5,171,432	1,812	0.15
OR	7,609,140	7,325	0.67	1,626,975	876	0.08	5,745,989	3,095	0.29	888,358	862	0.06	15,870,462	12,159	1.11
PA	0	0	0.00	0	0	0.00	159,132	49	0.00	8,970,475	5,497	0.50	9,129,607	5,546	0.50
PR										1,105,252	834	0.06	1,105,252	834	0.06
RI	0	0	0.00	0	0	0.00	403,702	221	0.02	51,559	53	0.00	455,261	274	0.03
SC	0	0	0.00	0	0	0.00	935,451	610	0.05	1,529,172	743	0.05	2,464,623	1,353	0.11
SD	31,493	27	0.00	362,768	398	0.03	349,896	384	0.03	4,199,267	2,844	0.19	4,943,424	3,654	0.26
TN	0	0	0.00	0	0	0.00	1,005,750	319	0.03	7,898,557	7,923	0.60	8,904,307	8,242	0.63
TX	0	0	0.00	1,074,925	721	0.07	1,125,001	755	0.08	5,495,156	3,619	0.27	7,695,082	5,095	0.42
UT	5,701,904	5,483	0.49	6,105,894	6,385	0.58	55,261	58	0.01	8,975,525	9,343	0.63	20,838,584	21,269	1.71
VT	0	0	0.00	0	0	0.00	72,000	26	0.00	31,209	23	0.00	103,209	49	0.00
VA	0	0	0.00	0	0	0.00	1,676,389	900	0.09	22,708,338	8,236	0.65	24,384,727	9,136	0.74
VI										638,298	1,174	0.08	638,094	1,174	0.08

	BLM			BOR			FWS			NPS			Total		
State	Visits	Jobs	Output (billions, $2011)	Visits	Jobs	Output (billions, $2011)	Visits	Jobs	Output (billions, $2011)	Visits	Jobs	Output (billions, $2011)	Visits	Jobs	Output (billions, $2011)
WA	506,740	406	0.04	2,615,505	1,628	0.18	936,365	583	0.06	7,281,785	3,902	0.32	11,340,395	6,519	0.61
WV	0	0	0.00	0	0	0.00	77,895	30	0.00	1,811,722	1,018	0.07	1,889,617	1,049	0.07
WI	0	0	0.00	0	0	0.00	1,459,920	930	0.08	251,145	337	0.02	1,711,065	1,267	0.10
WY	2,420,782	1,943	0.16	3,498,866	4,326	0.36	336,200	416	0.03	6,307,997	9,137	0.68	12,563,845	15,821	1.24
Eastern States	117,603	114	0.01	0	0	0.00	0	0	0.00	0	0	0.00	117,603	114	0.01
Total for All Areas	57,783,168	49,822	4.81	50,090,170	40,847	4.17	45,360,579	28,118	2.77	281,303,769	172,022	14.32	434,131,226	290,809	26.07
Total Using National Multipliers		58,942	7.04		51,596	6.31		34,529	4.22		258,416	31.08		403,482	48.65

Note: Totals may display rounding error.

Appendix 3. DOI-Related Ecosystem Restoration – Additional Case Studies and Information on Case Study Methods

This appendix provides additional information on the cases studies and sources of restoration funding to supplement the material in Chapter 4, Ecosystem Restoration.

Job and income contributions for each case study were estimated using IMPLAN (IMpact Analysis for PLANning). IMPLAN is a widely used input-output software and data system for estimating the job and income effects resulting from the interdependencies and interactions of economic sectors and consumers. See Appendix 7 for additional details on the IMPLAN model. To estimate the economic contributions of the case-study projects, cost data provided by project managers and contractors were used to determine the mix of products and services required to accomplish each project. This mix is commonly referred to as a production function. Local regional impacts were estimated by constructing unique production functions in IMPLAN for each case study. IMPLAN 3.0 county-level data for 2009 were used to estimate the indirect and induced effects (secondary impacts) of each restoration project. Direct impacts were estimated using employment figures, labor expenditures, and non-labor expenditures provided by contractors. Job impacts include full, part-time, and temporary positions, and are reported on an annual basis. Labor income impacts include all salaries, wages, and benefits accruing to local workers. Total output impacts are equal to annual local expenditures and include intermediate expenditures. All impacts are reported on an annual basis in 2011 dollars ($2011).

The case studies illustrate the substantial economic benefits that restoration projects provide for local communities, and the variation in impacts across projects emphasizes the need to take caution when transferring impact estimates from one project to another. Restoration type, costs and availability of inputs and labor, and modeling methods all play large roles in the final impact estimates. Each of these factors need to be considered when comparing or transferring impact estimates. The four main variables that affect the magnitude of estimated impacts include:

1. **The type of restoration project.** The mix of products and services required to accomplish each project plays a large role in job and income impacts. Projects that are labor intensive, such as projects with large percentages of planning and engineering expenditures and projects requiring hand-labor, will have the largest job and income impacts. Conversely, projects that have large percentages of equipment intensive expenditures or materials expenditures will have relatively lower job and income impacts.

   For this analysis, data provided by project managers and contractors were used to determine the mix of labor and non-labor inputs required to accomplish each project. The expenditures for many of the case-studies in this analysis were materials and equipment intensive.

2. **The structure, size, and diversity of the local economy.** Local economies are comprised of a mix of input and service providers. For many projects, firms and input suppliers are chosen within the local economy when possible; however, smaller, less diverse economies often do not

include all of the industries required for a project. If the services and supplies for a project cannot be purchased within the local economy, then they will be purchased outside of the local economy. When money leaves the local economy, it is "leaked" from the model and no longer generates local economic impacts. This means that the economic diversity of the local area matters: the more urban, or diverse, a local area is, the less economic activity will leak. This also makes the selection of the local area an important variable in determining the economic impacts of a project. An appropriate local area definition will include a cohesive economic region, and is often defined to include communities within a reasonable commuting distance of the site.

For this analysis, local areas were defined by considering only those counties that fell within a reasonable commuting distance of each project site. Local area definitions were made through consultation with project managers. For some of the case studies, local is defined as a single county, whereas for others, local is defined as a small cluster of counties adjacent to the project site. In all cases, the local area is constrained to counties located no farther than 60 miles from the project site. Thus, the impact estimates reported in this study represent only those jobs supported in counties with direct ties to the restoration project. Projects with relatively small local area definitions, especially those that are more rural, will generally have lower local economic impacts than similar projects located in larger, more economically diverse locations.

3. **Retail versus direct purchasing.** When a contracting firm purchases materials for a project, they can either purchase the materials from a retail or wholesale supplier, or directly from the manufacturer. If supplies are purchased directly from the manufacturer, then 100% of the purchase price goes to that manufacturing sector. If the supplies are purchased from a wholesaler or retailer, then it is necessary to "margin" the purchase so that the sale price is distributed between the retail, wholesale, transportation, and producing sectors. For example, 100% of the purchase price for grass seed purchased directly from the farmer would go to the farming sector; whereas for grass seed purchased from a retail store, about 60% would go to the farming sector, 30% to the retail sector, 4% to the wholesale trade sector, and 5% to the truck transportation sector. If grass seed for a project is purchased at a retail store and if a local area does not include grass seed farming, then more than 60% of the expenditures for grass seed will leak from the model, thus reducing overall local economic impacts.

   For this analysis, contractors identify those supplies that were purchased from a retailer, and appropriate margins were applied. This level of detail in the modeling results in more accurate, albeit smaller, local economic impacts.

4. **The duration of the project.** Many restoration projects occur over multiple years. The underlying data used by the IMPLAN software captures one year's worth of economic activity, thus it is important to express all expenditure values input into IMPLAN on an annual basis. Furthermore, output from IMPLAN is also expressed on an annual basis. Many existing studies report "total jobs" for a project, but this can be misleading. If a study reports that a project lasting 3 years supported 90 total jobs, the project actually supported 30 jobs per year. The 30 jobs supported in the first year are likely to be the same 30 jobs supported in the following two years, thus the project only really supported 30 jobs per year for three years.

For this analysis, average yearly expenditures were input into IMPLAN, and all impacts are reported as average impacts per year. For multi-year projects, employment during any one year may exceed or fall below the average.

SUMMARIES OF RESTORATION CASE STUDIES

The following provides brief descriptions of the economic impacts for each case study.

Truckee River Restoration Project

This project includes nearly 9 river miles, 19 new wetlands, 13 new river meanders, 31 in-stream riffles, and 263 acres of revegetation in Nevada. The series of projects has been led by The Nature Conservancy in collaboration with FWS, BLM, and the Pyramid Lake Paiute Tribe. Restoration expenditures have so far totaled $18.9 million ($2011) over the combined projects' five-year duration, averaging $3.8 million spent annually (2006-2010). Project expenditures directly accounted for 15 jobs in the local area each year and economic contributions of about $4.7 million and nearly $1.5 million annually in local labor income (salaries, wages, and benefits). Over 90% of the materials for the project were purchased from local suppliers. The resulting spending by the suppliers and site workers accounted for an additional 22 jobs and an additional $1.2 million in local labor income per year. To date, the Truckee River Restoration has brought over $5.7 million in economic contributions, 37 jobs, and $2.7 million in labor income to the local economy each year. Beyond these economic impacts, local communities are expected to benefit in the long-term from improved water quality, more flood attenuation, added open recreational space, and enhanced educational opportunities.

Table A3-1. Truckee River Restoration - Economic Contribution Summary

Lead bureau and partners	BLM and TNC
Restoration type	River rechanneling
Project location	NV
Total expenditure ($2011)	18.9M
Project duration	5 yrs
Average annual expenditure ($)	3.8M
Local job impact: average jobs per year	37
Local economic contribution: avg/yr ($)	5.7M
Local labor income impact: avg/yr ($)	2.7M

Gerber Stew Stewardship Project

This project utilized BLM's new stewardship contracting authority to implement an array of restoration treatments and projects in BLM's Klamath Falls Resource Area within the Lakeview District Office in Klamath County Oregon. BLM stewardship contracts allow the use of the value or sale of forest products to offset the cost of services. The stewardship contracting mechanism allowed BLM to restore forest health and reduce wildfire risk, while supporting timber utilization markets and providing employment for local rural communities. The stewardship project

Table A3-2. Gerber Stew Restoration - Economic Contribution Summary

Lead bureau and partners	BLM
Restoration type	Forest stewardship
Project location	OR
Total expenditure ($2011)	3M
Project duration	8 yrs
Average annual expenditure ($)	370,000
Local job impact: average jobs per year	19
Local economic contribution: avg/yr ($)	not calculated
Local labor income impact: avg/yr ($)	870,000

resulted in approximately $3 million of service work and over 4.4 million cubic feet of marketable biomass removed from the land. Rural and community benefits included: employment opportunities, a substantial reduction in smoke emissions from the utilization of biomass, restoration treatments on over 6,000 acres, and miles of road improvement. Forest and road restoration, logging activities, and processing of biomass from the Gerber Stew Stewardship Contract directly accounted for 10 jobs and over $570,000 in labor income per year (salaries, wages, and benefits) in the local area. Spending by contractors and site workers accounted for an additional 9 jobs and an additional $300,000 in local labor income per year. Combined, the Gerber Stew Stewardship contract supported 19 jobs per year in rural counties in southern Oregon and northern California for the eight years (2004-2011) and over $870,000 per year in local labor income.

Blanca Wetlands Restoration

This project in the San Luis Valley basin of south-central Colorado has been ongoing since the 1960s and has resulted in the restoration of over 200 playa lakes, ponds, and marshlands. This area was once dry due to human-induced dewatering, and has now become a nationally significant migration and nesting area for many wildlife species. Average restoration and monitoring expenditures are about $75,000 ($2011) annually and vary from year-to-year based on project need and available funding. Restoration and monitoring contracts are awarded to local businesses and recur annually, providing local contractors with reliable work each year, supporting an average annual economic contribution of about $102,900 and supporting as many as ten small contracts and an average of over $29,000 in local labor income (salaries, wages, and benefits) each year.

Table A3-4. Blanca Wetlands Restoration - Economic Contribution Summary

Lead bureau and partners	BLM
Restoration type	Wetland restoration
Project location	CO
Average annual expenditure ($2011)	75,000
Project duration	on-going
Local job impact: average jobs per year	< 1
Local economic contribution: avg/yr ($)	102,900
Local labor income impact: avg/yr ($)	29,000

Las Cienegas Grassland Restoration Project

This project restored over 3,000 acres of degraded grassland in the Las Cienegas National Conservation Area in southeast Arizona. By removing mesquite trees from the area, the project has helped to restore proper living conditions for pronghorn antelope and rare migratory and grassland birds, and has helped to stabilize the regional watershed by increasing water infiltration and reducing erosion. The funding required for the project was granted through American Recovery and Reinvestment Act of 2009 (ARRA) and averaged $767,000 ($2011) per year for two years (2009-2010). Project expenditures directly

Table A3-3. Las Cienegas Restoration - Economic Contribution Summary

Lead bureau and partners	BLM
Restoration type	Grasslands restoration, invasive species mitigation
Project location	NM
Total expenditure ($2011)	1.5M
Project duration	2 yrs
Average annual expenditure ($)	767,000
Local job impact: average jobs per year	10
Local economic contribution: avg/yr ($)	not calculated
Local labor income impact: avg/yr ($)	600,000

accounted for 4 jobs and over $330,000 in local labor income (salaries, wages, and benefits) per year. An emphasis on local contracting resulted in an additional 6 jobs in the local area and an additional $270,000 in local labor income per year generated through contractor expenditures.

Jaite Paper Mill

This former paper mill became part of the Cuyahoga Valley National Park in 1985. The demolition and removal of the Mill was intended to eliminate a human health and safety hazard and to restore the site back to a natural, visitor-friendly area. Planning for the project took approximately 2.5 years to complete with expenditures totaling $600,000 ($2011). Planning activities supported a total of 4 jobs per year and $214,000 per year in local labor income (salaries, wages, and benefits). The actual demolition and removal fieldwork occurred during the spring of 2006 and took approximately three months to complete. Expenditures for the demolition phase totaled $1.3 million ($2011). The total economic contribution of the demolition was estimated to be $2.4 million. The demolition directly supplied jobs for approximately 27 construction workers for the three month duration and supplied over $380,000 in labor income to the local economy. Salary spending and equipment purchases for the demolition project increased demand for products and services from local vendors and are estimated to have supported an additional 9 jobs and $375,000 in labor income within the local economy during 2006.

Table A3-5. Jaite Paper Mill Restoration - Economic Contribution Summary

Lead bureau and partners	NPS
Restoration type	Hazardous building demolition
Project location	OH
Total expenditure ($2011)	Planning: $600,000; Implementation: $1.3M
Project duration	Planning: 2.5 yrs; Implementation: 3 months
Local job impact: average jobs per year	Planning: 4; Implementation: 36 (3 months)
Local economic contribution: avg/yr ($)	Planning: $479,000; Implementation: $2.4M (3 months)
Local labor income impact: avg/yr ($)	Planning; $214,000; Implementation: $755,000 (3 months)

The Glacial Ridge Prairie and Wetland Restoration Project

This project located in the Prairie Pothole region in northwestern Minnesota, is the largest tallgrass prairie and wetland restoration project in U.S. history. Restoration of the Glacial Ridge property began in 2001 and concluded in 2011. As the area was restored, TNC turned the property over to FWS to establish the new Glacial Ridge National Wildlife Refuge (NWR). With funding provided by over 20 partner agencies/organizations, including significant contributions from USFWS and USDA's Natural Resource Conservation Service,

Table A3-6. Glacial Ridge Wetlands Restoration - Economic Contribution Summary

Lead bureau and partners	FWS, TNC, USDA/NRCS
Restoration type	Prairie/wetland
Project location	MN
Total expenditure ($2011)	24M
Project duration	11 yrs
Average annual expenditure ($)	2.2M
Local job impact: average jobs per year	15
Local economic contribution: avg/yr ($)	1.9M
Local labor income impact: avg/yr ($)	839,000

yearly project expenditures averaged about $2.2 million ($2011) and supported an average economic contribution of about $1.9 million over the duration of the project. These expenditures directly supported 6 jobs in local communities surrounding the property and provided nearly $476,000 in local labor income (salaries, wages, and benefits) each year. In addition to these direct impacts, the Glacial Ridge project supported another 9 jobs each year, which provided an additional $363,000 in local labor income.

The Ni-les'tun Tidal Marsh Restoration Project

This project restored over 418 acres of tidal marsh in the Bandon Marsh National Wildlife Refuge along the coast of Oregon. As the largest tidal marsh restoration in Oregon, an extensive amount of work was coordinated with FWS and designed, engineered, constructed, and contracted by Ducks Unlimited (DU). Construction funding was pieced together from many smaller grants, ARRA funds, Oregon Lottery funds granted through the Oregon Watershed Enhancement Board, and about $1.35 million from the New Carissa oil spill NRDAR settlement. Expenditures for the tidal marsh restoration portion of the project were about $31,000 annually during the planning phase (2001-2009), and $700,000 annually during the implementation phase (2010-2011), accounting for a total restoration cost of $1.65 million ($2011). In total, including planning and implementation phases, the project supported an average economic contribution of about $1.1M per year, and provided an average of about $453,000 per year in labor over the life of the project.

Table A3-7. Ni-les'tun Marsh Restoration - Economic Contribution Summary

Lead bureau and partners	FWS, DU
Restoration type	Tidal marsh
Project location	OR
Total expenditure ($2011)	1.4M
Project duration	2 yrs
Average annual expenditure ($)	700,000
Local job impact: average jobs per year	5
Local economic contribution: avg/yr ($)	1.1M
Local labor income impact: avg/yr ($)	453,000

Housatonic River Conservation Easements

Conservation easements along the Housatonic River are being purchased by The Nature Conservancy (TNC) to protect water quality and nesting habitat for migratory songbirds and other wildlife and to maintain the scenic, agrarian character of the region. Using funds from an NRDAR settlement, FWS has obligated $558,000 ($2011) to TNC for the purchase of permanent conservation easements on approximately 200 acres of riparian lands along the Housatonic River in Salisbury, Connecticut. From 2011 to 2015, $500,000 will be spent to directly purchase conservation easements and an additional $58,000 will be spent to administer the easements. Easement administration will be contracted to local business and is estimated

Table A3-8. Housatonic River Conservation Easements - Economic Contributions Summary

Lead bureau and partners	FWS, TNC
Restoration type	Riparian/farm preservation
Project location	CT
Total expenditure ($2011)	58,000
Project duration	5 yrs
Average annual expenditure ($)	12,000
Local job impact: average jobs per year	< 1
Local economic contribution: avg/yr ($)	23,000
Local labor income impact: avg/yr ($)	12,000

that the project will contribute about $23,000 per year in economic contributions to the local economy, and an average of $12,000 per year in labor income (salaries, wages, and benefits), directly impacting businesses providing management, technical service, and real estate consulting.

The Piping Plover Nesting Habitat Management Program is an ongoing effort by The Nature Conservancy of Rhode Island to increase the number of piping plover chicks produced in Rhode Island following the 1996 North Cape Oil Spill. From 2007-2011, FWS provided $130,000 ($2011) to TNC to implement management actions aimed at reducing threats to piping plovers, with funding for the project coming from a NRDAR settlement for the North Cape Oil Spill. This case study demonstrates how even small investments in restoration can support jobs in local communities. The average yearly cost of the program was $32,000, and these expenditures are estimated to have supported an average annual economic contribution of $58,000 per year in the local community.

Table A3-9. Piping Plover Nesting Habitat Management Program - Economic Contributions Summary

Lead bureau and partners	FWS, TNC
Restoration type	Habitat management, public education
Project location	RI
Total expenditure ($2011)	130,000
Project duration	4 yrs
Average annual expenditure ($)	32,000
Local job impact: average jobs per year	< 1
Local economic contribution: avg/yr ($)	58,000
Local labor income impact: avg/yr ($)	41,000

SOURCES OF FUNDING FOR DOI RESTORATION ACTIVITIES

A wide variety of sources provide funding for DOI restoration activities (e.g., bureaus' appropriated base funding; grant funding, funding from the Abandoned Mine Reclamation Fund; funding provided as a result of legal settlements). Each funding source typically has specific goals, timelines, partners, guidelines, rules and/or mandates to implement the restoration projects, which need to be taken into account when evaluating the overall success of the final restoration.

Multiple Bureaus

- **Federal Lands Recreation Enhancement Act (FLREA).** FLREA (P.L.104-134) provides authority for BLM, FWS, NPS, Reclamation, and the USDA Forest Service to collect entrance and expanded amenity fees on federal lands and waters. These fees are to be invested primarily at the collecting sites. FLREA allows the fees to be used for habitat restoration directly related to wildlife-dependent recreation that is limited to hunting, fishing, wildlife observation, or photography. Of the $260.56 million in FLREA revenues that agencies collected in FY 2011, NPS collected $172.4 million, BLM collected $17.4 million, FWS collected $5.19 million, and Reclamation collected $0.69 million. In FY 2011, NPS budgeted approximately $25 million in FLREA funds for habitat restoration. FWS budgeted approximately $247,000. Fee revenues from BLM management of the Warren Bridge Campground in Wyoming were used to fund several wildlife habitat restoration projects in 2011, including a project to restore native cottonwood trees. This project was designed to replenish Bald Eagle foraging and nesting habitat and other avian habitat. Reclamation has used FLREA revenues to pay for habitat restoration projects such as wood duck and bluebird nesting boxes.

- **Challenge Cost Share (CCS) Program**. The CCS Program works through partnerships to accomplish high priority habitat, recreation and cultural resource work "on-the-ground." BLM, FWS, NPS and the USFS use appropriated funds to pay for no more than 50% of CCS projects. Eligible private partners include state/local governments, private individuals/organizations, business enterprises, education institutions, non-profit organizations, and charitable groups. Most of BLM's projects are funded with at least a 1:1 match by state in funds or in-kind contributions from partners. There have been some instances where the program received matches ranging from (1:3) to (1:6). BLM expects to complete habitat restoration projects that benefit bats, birds, deer, elk, and fish while cross-benefitting recreation activities such as hiking, fishing, and hunting in a variety of land designation areas across more than 12 states. FWS has used CCS funds to assist in conservation of coral reef ecosystems through protection and restoration of upland and wetland coastal habitats. One-third of NPS' CCS funding is set aside for National Trails System projects, supporting work under the National Trails System Act (16 U.S.C. 1241-51).

- **Restoration Fund.** There are two sources of funds for the NRDA Restoration Program: (1) "appropriated funds" received annually from the Congress and (2) "recoveries" received from the entities responsible for natural resource injuries. These funds are maintained and managed in the DOI Restoration Fund, administered by the Office of Restoration and Damage Assessment (ORDA). Over the last several years, the NRDA Restoration Program has received approximately $6 million in its annual appropriation to help fund damage assessments.

- **Central Hazardous Materials Fund (CHF).** In 1995, Congress created the CHF to allow Interior to better deal with contaminated sites requiring medium to long-term cleanup under the Superfund law. DOI is prohibited by statute from using the Superfund. The CHF enhances the protection of the Interior's interests, lands, resources, and facilities through its multi-bureau clean-up efforts, as well as by working closely with others, including EPA, states, and tribal governments that manage the response to, remediation, and reuse of contaminated sites located on Interior managed lands. The objectives of the CHF are to achieve greater consistency and oversight of site cleanups; promote cost-effective cleanup; conduct cleanup consistent with the National Contingency Plan and bureau land use plans; and pursue cost recovery or cost sharing from parties responsible for the contamination. Annually, the program funds remediation and restoration at approximately 35 sites. The CHF was appropriated $10.2 million for FY 2011.

- **Great Lakes Restoration Initiative (GLRI).** The Obama Administration established the GLRI in 2009 to restore and protect the Great Lakes region. Comprised of more than 10,000 miles of coastline and 30,000 islands, the Great Lakes provide drinking water, transportation, power, recreation and economic opportunities to 30 million citizens. Led by EPA, the GLRI invests in the region's environmental and public health through a coordinated interagency process. The program focuses on five major restoration priorities: (1) cleaning up toxics and areas of concern, (2) combating invasive species, (3) improving nearshore health by protecting watersheds from polluted run-off, (4) restoring wetlands and other habitats, and (5) improving the information, engagement, and accountability in the program overall. GLRI funds are distributed by EPA and are meant to supplement base funding for federal agencies' Great Lakes activities. Through an interagency agreement with EPA, FWS was allocated approximately $37.4 million in FY 2011 to implement GLRI priority programs, projects and activities. FWS also received an additional $10 million in GLRI funding to implement action items from the Asian Carp Control Strategy Framework to stop Asian carp from entering the Great Lakes. The NPS is also a strong partner in carrying out the five major restoration priorities through activities in parks throughout the region. USGS' GLRI contributions are discussed in the Chapter 4.

Box A3-1. Northern California Habitat Restoration

In 1953, the *S.S. Jacob Luckenbach* collided with its sister ship and sank in the Gulf of the Farallones near San Francisco. This vessel was loaded with 457,000 gallons of bunker fuels, which sporadically leaked over the years. In 2002, oil associated with several mystery spills was linked to this vessel; the remaining oil was subsequently removed and the vessel was sealed. Over 50,000 seabirds and shorebirds, including federally threatened marbled murrelets were killed by the leaking bunker fuel between 1990 and 2003. Natural resource trustees (FWS, California Department of Fish and Game, and NOAA) have implemented over $4 million in habitat restoration and protection projects to address these injured resources. Nesting habitat for rhinoceros auklets was restored on Ano Nuevo Island State Preserve as depicted in these before (May 2004) and after (August 2011) photos.

After non-native vegetation died in a drought, this island was literally blowing away, losing up to 6 feet of topsoil each year. Today, rhinoceros auklets can nest in protected burrows under the restored native vegetation (Steve Hampton, California Fish and Game)

BLM

Receipts from land sales in Nevada have been used to fund conservation, recreation, and restoration-related activities:

Nevada's natural beauty and unique landscapes are economic engines for the state, and these funds will not only help restore and enhance these special areas for future generations, but the projects will create jobs and provide vital resources to hard hit communities for the benefit of all who live in and visit the state (Secretary Salazar's announcement of $43 million for Nevada and Lake Tahoe restoration, conservation and recreation projects, 8/16/11).

- **Burton-Santini Act (P.L. 96-586).** The Act authorizes and directs the Secretary to sell no more than 700 acres of public lands per calendar year in and around Las Vegas, Nevada. The proceeds are to be used to acquire environmentally sensitive land in the Lake Tahoe Basin of California and Nevada.

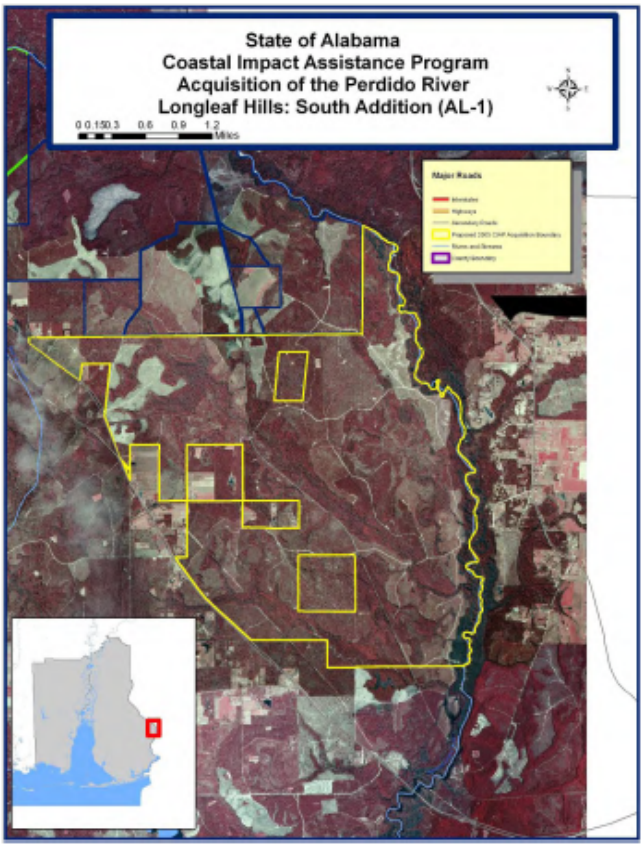
- **Southern Nevada Public Land Management Act (SNPLMA).** The SNPLMA, as amended, allows BLM to sell certain public lands in Clark County, Nevada, near the city of Las Vegas. Approximately 50,000 acres of public land are within the disposal boundary area. The proceeds are used to fund environmental restoration, conservation, and public recreational projects throughout the state. Land sales have provided more than $3 billion since passage of the Act in 1998 to projects throughout Nevada, including more than $300 million for Lake Tahoe Basin restoration, since passage of the Act in 1998. This $300 million, in conjunction with local, state and private donations, has resulted in more than $1 billion to restore Lake Tahoe's water clarity and critical natural resources, and enhance public safety through the implementation of hazardous fuels reduction projects to protect lives and property throughout the Lake Tahoe Basin.

BOEMRE/FWS

- **Coastal Impact Assistance Program.** Section 384 of the Energy Policy Act of 2005 (P.L. 109-58) established the Coastal Impact Assistance Program (CIAP), authorizing funds to be distributed to Outer Continental Shelf (OCS) oil and gas producing states for the conservation, protection and preservation of coastal areas, including wetlands. Under the CIAP, Secretary Salazar is authorized to distribute, to offshore oil producing states and their coastal political subdivisions (CPS), $250 million for each of the fiscal years 2007 through 2010. The CIAP directs funding to conserve, protect, and restore coastal areas, including wetlands, and to mitigate the impacts of offshore drilling to natural resources and the public. This money is shared among Alabama, Alaska, California, Louisiana, Mississippi, and Texas and is allocated to each producing state and eligible CPS based upon legislated allocation formulas. CIAP grant-funded projects include enhancement, conservation, mitigation, and restoration of a wide variety of natural resources. In addition to improved environmental quality, many communities also benefit from increased recreational opportunities. This program has been implemented from its inception by MMS/BOEMRE. However, in FY 2012, CIAP was transferred to FWS as the purpose of the CIAP aligns more directly with the mission of the Service.

Box A3-1. Examples of FY 2011 Coastal Impact Assistance Program Projects

Alabama. The project objective was to purchase the remaining acreage of this tract (approximately 4,796 acres) from The Nature Conservancy. BOEMRE awarded a $6,957,000 Coastal Impact Assistance Program (CIAP) grant to the State of Alabama to be used towards the purchase of 2,782 acres along the Perdido River. The result is conservation and preservation of natural waterway systems, wetland forests and estuarine sea life in the Longleaf Hills and Perdido Bay area of coastal Baldwin County. The Perdido River is one of the highest-quality, free-flowing blackwater river systems in the Gulf Coastal Plain. The forests along the river corridor include slash pine flatwoods, pitcher plant seepage bogs, longleaf pine forests, and Atlantic white cedar swamps. The Perdido River clarity provides high-quality fresh water to Perdido Bay, which is home to an abundant diversity of estuarine life, including dwarf seahorses, dolphins, manatees, and coastal arch grasses. The Perdido River contains numerous, large beach-quality sandbars at nearly every curve in the river. In addition, it will protect and conserve vital wetlands and sensitive habitats in the northern bay area and along the Perdido River. Lands along the Perdido River corridor are utilized by hundreds of species of neotropical migratory birds as feeding and resting sites during spring and fall migrations.



Louisiana: Adolph Thomae Park Shoreline Restoration. CIAP funds of $847,000 were awarded to the Texas General Land Office to improve the county park, which is located in the Laguna Atascosa region. With the funds, Cameron County built a bulkhead to stabilize about 1,650 feet of shoreline at Adolph Thomae Park where erosion had been exacerbated by increased currents from the nearby Gulf Intracoastal Waterway, flooding from storms, and frequent barge traffic in the Arroyo Colorado River. With the bulkhead construction, erosion on the shoreline should be reduced by approximately 90% and is expected to protect saline habitat in the Laguna Atascosa National Wildlife Refuge.

California: Removal of Hazards in Coastal Areas. BOEMRE awarded a $700,000 CIAP grant to the California State Lands Commission for removing hazards in coastal areas of the Santa Barbara Channel. According to BOEMRE Director Bromwich, "This project will help to increase public safety and provide for the cleaning and restoration of these coastal areas." The CIAP grant will fund a hazards removal program to eliminate old and unusable structures located within or adjacent to state lands at 22 sites along the coastline of Santa Barbara and Ventura Counties. These hazards are obsolete, deteriorating structures that include corroded sheet piling, railroad irons, and electric cables to old pipes. They impede coastal uses and/or pose a potential threat to public health and safety. Many of these hazards are located on lands that are used for commerce, navigation, fishing, recreation, or reserved for open space. The goal of the removal program is to eliminate these potential risks to public health and safety.

As described in the Sources of Funding section, CIAP grants are now managed by FWS.

FWS

The Service's budget includes $1 billion of permanent appropriations, most of which is provided directly to the states for fish and wildlife restoration and conservation, including:

- **The Appropriations Act of August 31, 1951** (P.L. 82-136, 64 Stat. 693*)*, which authorizes receipts from excise taxes on selected hunting and sporting equipment to be deposited in the Wildlife Restoration Account, as a permanent, indefinite appropriation. Receipts and interest distributed to the Wildlife Restoration Account are made available for use by FWS in the fiscal year following collection.

- **The Wildlife and Sport Fish Restoration Programs Improvement Act of 2000**, (P.L. 106-408) amends the Pittman-Robertson Wildlife Restoration Act and the Dingell-Johnson Sport Fish Restoration Act, authorizing the Secretary of the Interior to provide funding under the Multistate Conservation Grant program for wildlife and sport fish restoration projects identified as priority projects by the Association of Fish and Wildlife Agencies. These high priority projects address problems affecting states on a regional or national basis. It also provides $200,000 each to the Atlantic States Marine Fisheries Commission, the Gulf States Marine Fisheries Commission, the Pacific States Marine Fisheries Commission, and the Great Lakes Fisheries Commission; and $400,000 to the Sport Fishing and Boating Partnership Council. The Act provides 12 allowable cost categories for administration of the Act, as well.

- **Wildlife Restoration Trust Fund.** The Federal Aid in Wildlife Restoration Act of 1937, now referred to as The Pittman-Robertson Wildlife Restoration Act*,* as amended (16 U.S.C. 669-669k), provides federal assistance to the 50 states and territories for projects to restore, enhance, and manage wildlife resources, and to conduct state hunter education programs. The Act authorizes the collection of receipts for permanent-indefinite appropriation to FWS for use in the fiscal year following collection. Funds not used by the states within two years revert to the Service for carrying out the provisions of the Migratory Bird Conservation Act.

- **Fisheries Restoration and Irrigation Mitigation Act of 2000**, (16 U.S.C. 777 note; PL 106-502)**.** Congress recently passed, and the President signed into law, legislation reauthorizing the Fisheries Restoration and Irrigation Mitigation Act (FRIMA) as part of the Omnibus Public Land Management Act of 2009, P.L. 111-11. FRIMA was established in 2000 and has been an important tool for addressing fish screening and fish passage needs in the Pacific Northwest states. Authorization of Appropriations: Expires September 30, 2015

- **The Federal Aid in Sport Fish Restoration Act of 1950,** now referred to as the Dingell-Johnson Sport Fish Restoration Act (16 U.S.C. 777, et seq.), as amended, authorizes assistance by FWS to the 50 states, the District of Columbia, the Commonwealths of Puerto Rico and the Northern Mariana Islands, and the Territories of American Samoa, Guam, and the U.S. Virgin Islands to carry out projects to restore, enhance, and manage sport fishery resources.

- **Aquatic Resources Trust Fund** (26 U.S.C. 9504) authorizes appropriations from the Sport Fish Restoration Account to carry out the Coastal Wetlands Planning, Protection and Restoration Act

of 1990 (16 U.S.C. 3951 et. seq.) provides for three federal grant programs for the acquisition, restoration, management, and enhancement of coastal wetlands in coastal states (including Great Lakes). FWS administers two of the three grant programs for which this Act provides funding, including the National Coastal Wetlands Conservation Grant Program and the North American Wetlands Conservation Grant Program. The latter program receives funds from other sources, as well as from the Dingell-Johnson Sport Fish Restoration program. The U.S. Army Corps of Engineers administers the third grant program that receives funding because of this Act.

FWS also has access to the:

- **Estuary Restoration Act of 2000 (ERA;** P.L. 106-457**).** The Act promotes restoration of estuary habitat through enhanced coordination of federal and non-federal restoration activities and more efficient project financing. Specifically, the Act established a national program to restore one million acres of estuary habitat; established a federal council of five agencies (includes FWS) to assist in program development; established a National Estuary Restoration Strategy; and authorized federal assistance for restoration projects sponsored by non-federal partners. The Army Corps has traditionally been the only agency to receive funding for project implementation under the ERA. In the 2007 ERA Amendments, all five ERA agencies are now authorized to receive appropriations to carry out restoration projects.

NPS

- **Everglades National Park Protection and Expansion Act of 1989.** As amended, the Act authorizes activities to restore Everglades National Park. The Everglades Forever Act, passed in 1994 and amended in 2003, extends this commitment to cleaning up and restoring all of the Everglades, not just the federal areas.

OSM

- **Abandoned Mine Reclamation Fund.** The Surface Mining Control and Reclamation Act (SMCRA) authorized an Abandoned Mine Land (AML) Reclamation fee based on coal production in order to hold the entire coal industry responsible for reclaiming coal mine lands left abandoned across the country. OSM collects the AML fee, and then distributes the fee receipts to states and tribes for reclamation activities. The current law allows the fees to be used for purposes other than reclamation of abandoned coal mine lands. Therefore, the fees are not necessarily spent on the highest priority AML coal sites. AML Fees are calculated based on the OSM tonnage estimates multiplied by the applicable fee rates—$0.135, $0.315, and $0.9 for underground, surface, and lignite, respectively—through 2012. In 2011, $269.2 million were projected to be deposited in the AML fund. For 1978 through 2011, the cumulative receipts and interest income total over $10 billion.

Reclamation

In FY 2011, Reclamation participated in extensive restoration projects through the following four funding mechanisms:

- **California Bay-Delta Restoration Fund.** Title I of P.L. 108-361, the CALFED Bay-Delta Authorization Act (2004), authorized $389.0 million in federal appropriations for FY 2005-FY 2010, which was extended through 2014 by the Energy and Water Development and Related Agencies Appropriations Act of 2009. The Sacramento–San Joaquin River Delta (Delta) is an integral part of an ecosystem with more than 750 wildlife species and more than 120 species of fish. As a migratory corridor, the Delta hosts two-thirds of the state's salmon and nearly half of the waterfowl and shorebirds along the Pacific flyway. The Bay-Delta system is critical to California's economy because the two rivers that flow into the Bay-Delta provide potable water for two-thirds of California's homes and businesses. It also irrigates more than 7 million acres of farmland on which 45 percent of the nation's fruits and vegetables are grown as part of a $28 billion agricultural industry.[46] Using various appropriations before transitioning to the Restoration Fund, the CALFED Bay-Delta Program (1995) was established for the purpose of developing a comprehensive, long-term solution to the complex and interrelated problems in the Bay-Delta. The program's focus is on the health of the ecosystem and improving water management. In addition, this program addresses the issues of uncertain water supplies, aging levees, and threatened water quality. A component of the CALFED Program is the Ecosystem Restoration Program (ERP). The goal of the ERP is to improve and increase aquatic and terrestrial habitats and improve ecological functions in the Bay-Delta to support sustainable populations of diverse and valuable plant and animal species. In addition, the ERP, along with the Water Management Strategy (WMS), is designed to achieve or contribute to the recovery of covered and at-risk species found in the Bay-Delta and, thus, achieve goals in the Multi-Species Conservation Strategy (MSCS). Improvements in ecosystem health will reduce the conflict between environmental water uses and other beneficial uses and allow more flexibility in water management decisions. Environmental Water Account (EWA) agencies are coordinating EWA actions with the ERP to ensure that EWA is consistent with the ERP goals.

- **Central Valley Project (CVP) Restoration Fund.** This fund was established by the Central Valley Project Improvement Act, Title XXXIV of P.L. 102-575 (1992) to provide approximately $53 million in funding from project beneficiaries for habitat restoration, improvement and acquisition, and other fish and wildlife restoration activities in the CVP area of California. Revenues are derived from payments by project beneficiaries and from donations. Extensive coordination and cooperation between FWS and Reclamation, in conjunction with the Restoration Fund Roundtable, helps ensure efficient and effective implementation of the Act. The Restoration Fund Roundtable includes Central Valley water users, hydropower representatives, and interested groups.

- **San Joaquin River Restoration Fund.** This $9 million fund was established to implement the provisions described in the Settlement for the National Resources Defense Council (NRDC) et al., v. Rodgers lawsuit. The Settlement's two primary goals are: (1) to restore and maintain fish populations in "good condition" in the main stem of the San Joaquin River below Friant Dam to the confluence of the Merced River, including naturally reproducing and self-sustaining

[46] A Reclamation Fact Sheet on California water is available on-line at http://www.usbr.gov/newsroom/presskit/factsheet/factsheetdetail.cfm?recordid=3001

populations of salmon and other fish; and (2) to reduce or avoid adverse water supply impacts to all of the Friant Division long-term contractors that may result from the Interim Flows and Restoration Flows provided for in the Settlement.

- **Lahontan Valley and Pyramid Lake Fish and Wildlife Fund.** The Fallon-Paiute Shoshone Indian Water Settlement Act (P.L. 101-618) establishes the Fund to be administered by FWS for use in restoring Lahontan Valley wetlands and recovering the endangered and threatened fish of Pyramid Lake. Section 206(a) authorizes the acquisition of water rights for restoring wetlands in Lahontan Valley. The Act stipulates that sufficient water rights be acquired to restore and sustain, on a long term average, approximately 25,000 acres of primary wetland habitat within Nevada's Lahontan Valley.

Box A3-2. West Shore Northern Pike Habitat Restoration Project in Green Bay Ecosystem

To help restore the northern pike, an important predator fish in the Green Bay ecosystem, the Fox River/Green Bay Natural Resource Trustee Council implemented the West Shore Northern Pike Habitat Restoration Project. This project was funded by NRDAR settlement funds, and included the establishment of vegetated riparian buffers in the Suamico/Little Suamico watershed to improve spawning and rearing habitat for adult and young northern pike. A total of 5.8 acres of vegetated buffers were established, along with 20 acres of spawning wetlands. In addition to providing northern pike habitat, this project has also helped improve water quality in Green Bay by filtering sediment, nutrients, and pesticides present in surface runoff. The Fox River/Green Bay natural resource trustees include FWS, Oneida Tribe of Indians of Wisconsin, Menominee Indian Tribe of Wisconsin, Wisconsin Department of Natural Resources, Michigan Department of Environmental Quality, Michigan Department of Natural Resources, Michigan Attorney General's Office and NOAA.

Young northern pike (Colette Charbonneau).

Appendix 4. EXAMPLES OF LOCAL AND REGIONAL ECONOMIC CONTRIBUTIONS

Interior activities can provide a significant economic contribution to 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 contributions associated with visitor spending in local areas for selected NPS and FWS units (additional rural case studies can be found in Chapter 5). 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.

NATIONAL PARK SERVICE EXAMPLES

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 6.9 percent. In 2010, Golden Gate National Recreation Area attracted over 14.2 million visitors, and visitors spent an estimated $264.2 million. Of this total, $109.7 million came from non-local visitors. Total visitor spending supported 3,445 local jobs and $402.5 million in economic output. Even in a large metropolitan area like San Francisco, Interior's activities can provide a significant economic contribution to the economy and bring in important tourism dollars.

Table A4-1. Golden Gate NRA Totals, 2010

Visits (2010)	Area Unemployment Rate (%, April 2012)	Visitor Spending ($ millions)	Estimated Total Jobs Supported (jobs)
14,271,503	6.9 (p)	264.15	3,445

Source: NPS; Bureau of Labor Statistics; (p) preliminary.

Grand Canyon National Park (AZ)
Grand Canyon National Park is located in Coconino and Mojave Counties in northern AZ. These geographically large counties have a combined population of around 334,607 (Census, 2010), a combined labor force of 155,642 and an unemployment rate of 8.1 percent. In 2010, Grand Canyon National Park attracted 4.4 million visits (all from non-locals), and visitors spent an estimated $415.8 million. These expenditures supported 6,167 local jobs and $428.9 million in economic output. Grand Canyon National Park provides substantial economic contributions to the Northern Arizona region.

Table A4-2. Grand Canyon NP Totals, 2010

Visits (2010)	Area Unemployment Rate (%, April 2012)	Visitor Spending ($ millions)	Estimated Total Jobs Supported (jobs)
4,388,386	8.1 (p)	415.80	6,167

Source: NPS; Bureau of Labor Statistics; (p) preliminary.

Gettysburg National Military Park (PA)

Gettysburg National Military Park is located in Adams County, PA. The county has population of around 100,000 (Census, 2010), a labor force of 54,481 and an unemployment rate of 5.9 percent. In 2010, Gettysburg National Military Park attracted over a million visits, and visitors spent an estimated $63.6 million. Of this total, $63.1 million came from non-local visitors. Total visitor spending supported 1,058 local jobs, and $71.4 million in economic output. Gettysburg National Military Park provides an important source of economic activity in Southeast Pennsylvania.

Table A4-3. Gettysburg NP Totals, 2010

Visits (2010)	Area Unemployment Rate (%, October 2011)	Visitor Spending ($ millions)	Estimated Total Jobs Supported (jobs)
1,031,554	5.9	63.57	1,058

Source: NPS; Bureau of Labor Statistics.

Fort Sumter National Monument (SC)

Fort Sumter National Monument is located in Charleston County, SC. The urban county has population of around 350,209 (Census, 2010), a labor force of 176,181 and an unemployment rate of 7 percent. In 2010, Fort Sumter National Monument attracted 797,713 visits, and visitor spent an estimated $18.4 million. Of this total, $16.4 million came from non-local visitors. Total visitor spending supported 238 local jobs and $19.3 million in economic output. Fort Sumter National Monument provides important long-term employment opportunities in Charleston County, SC.

The NPS also conducted a study in 2000 to estimate the economic value of a visit to Fort Sumter. The goal of this study was to estimate the user-day values for a visit to an historic fort. The study relied on a stated preference approach and estimated that the mean economic value (or willingness-to-pay) for a Fort Sumter visit was $8.26 with a 95 percent confidence interval of ($7.79, $8.80). The economic value represents a measure of value over and above the amount individuals actually spend to visit the Fort.

Table A4-4. Fort Sumter NM Totals, 2010

Visits (2010)	Area Unemployment Rate (%, April 2012)	Visitor Spending ($ millions)	Estimated Total Jobs Supported (jobs)
797,713	7.0 (p)	18.41	238

Source: NPS; Bureau of Labor Statistics; (p) preliminary.

U.S. FISH AND WILDLIFE SERVICE EXAMPLES

Deer Flat National Wildlife Refuge (ID)

Deer Flat National Wildlife Refuge, established in 1909, is one of the nation's oldest refuges. Located southwest of Boise, Idaho, the refuge includes the Lake Lowell sector (10,588 acres) and the Snake River Islands sector. The Snake River Islands sector contains about 800 acres on 101 islands. These islands are distributed along 113 river miles from the Canyon-Ada County Line in Idaho to Farewell Bend in Oregon. Lake Lowell is an irrigation project reservoir that provides an oasis for wildlife in this arid region.

The refuge provides a mix of wildlife habitats from the open waters and wetland edges of Lake Lowell, to the sagebrush uplands around the lake, to the grasslands and riparian forests on the Snake River islands. With assistance from local growers, the refuge also cooperatively farms 240 acres to provide food for wildlife.

The variety of habitats makes Deer Flat NWR an important breeding area for resident and migratory birds and other wildlife. The refuge is also a significant resting and wintering area for birds migrating along the Pacific Flyway. The late-summer drawdown of the lake reveals mud flats that provide food for a variety of resident and migratory wildlife. Historic wintering waterfowl populations averaged over 300,000 birds. The Snake River Islands (101 islands along 113 miles of river) provide a diversity of habitats from small wetlands to sagebrush uplands. Several islands house heron rookeries and gull colonies, and provide feeding and resting spots for migratory birds. The refuge is popular with the public. Each year, more than 100,000 people visit to hunt, fish, photograph and view wildlife, learn about natural resources through displays and programs at the visitor center, and walk the nature trail.

- The refuge received 228,182 visitors in 2011.
- Visitors participated in fishing trips (over 46,000), waterfowl hunts (over 5,000), upland game hunts (over 1,100), and big game hunts (75).
- Non-consumptive visits included photography (1,583), wildlife observation (27,852), environmental education and interpretation (16,836), and general recreation (122,426).

Table A4-5. Deer Flat NWR Totals, 2011

Visits	Area Unemployment Rate (April, 2012)	Visitor Spending ($ millions)	Estimated Total Jobs Supported (jobs)
228,182	Canyon County – 9.1 % (p)	7.8	99

Source: FWS; Bureau of Labor Statistics; (p) preliminary.

J.N. "Ding" Darling National Wildlife Refuge (FL)

The J.N. "Ding" Darling National Wildlife Refuge is located on the subtropical barrier island of Sanibel in the Gulf of Mexico. The refuge is part of the largest undeveloped mangrove ecosystem in the United States. It is world famous for its spectacular wading bird populations. Travel author Arthur Frommer recently ranked Sanibel Island as his all-time favorite travel destination – ahead of Bali, Paris, and St. John – because the Refuge makes the island a mecca for "thousands of birds of every species."

The refuge includes over 6,300 acres of habitat, with 2,825 acres designated as Wilderness, and 950 acres of submerged habitat in the Tarpon Bay Recreation Area. The refuge informs and educates over half a million visitors annually in its 12,000 square foot Environmental Education Center and four-mile long Wildlife Drive. The refuge is home to 238 bird species, 51 species of reptiles and amphibians, and 32 species of mammals native to southwest Florida.

The refuge consists of the following habitat types: estuarine habitat consisting of open water, seagrass beds, mud flats and mangrove islands; and interior freshwater habitats consisting of open water ponds, cordgrass marshes, and West Indian hardwood hammocks. Two brackish water impoundments totaling 850 acres managed for wading birds, fisheries and estuarine health. A variety of wildlife-dependent recreational activities are available to visitors, including salt water fishing, wildlife viewing, canoeing and kayaking, and auto-tours, biking and hiking trails.

- The refuge received 674,312 visitors in 2011.
- While all visitors were considered to engage in wildlife viewing, the Refuge estimated that there were over 29,000 fishing visits, approximately 350,000 trail visits, 74,000 boat launches and bike visits, and 108,000 interpretive program visitors.
- Based on data collected by the National Survey of Hunting, Fishing, and Wildlife Recreation, the Service estimates that visitors to the refuge directly spent nearly $14.0 million in 2011. These direct expenditures contributed a total of $26.5 million to the local economies and supported 264 jobs.
- In addition to contributing directly to the local economy, the refuge's presence also service to provide important ecosystem services to the community. Although not easily quantified, the refuge's undeveloped presence serves as a natural barrier for the developed portions of the island as well as the greater Fort Myers area.

Table A4-6. J.N. "Ding" Darling NWR Totals, 2011

Visits	Area Unemployment Rate (April, 2012)	Visitor Spending ($ millions)	Estimated Total Jobs Supported (jobs)
674,312	Lee County – 8.5% (p)	13.9	264

Source: FWS; Bureau of Labor Statistics; (p) preliminary.

Parker River National Wildlife Refuge (MA)

Parker River National Wildlife Refuge was established in 1942 primarily to provide feeding, resting, and nesting habitat for migratory birds. Located along the Atlantic Flyway, the refuge is of vital stopover significance to waterfowl, shorebirds, and songbirds during pre- and post-breeding migratory periods. The refuge occupies in part, the southern three-fourths of Plum Island, an 8 mile long barrier island near the city of Newburyport, Massachusetts.

The refuge consists of 4,662 acres of diverse upland and wetland habitats including sandy beach and dune, shrub/thicket, bog, swamp, freshwater marsh, saltwater marsh and associated creek, river, mud flat, and salt panne. These and other refuge habitats support varied and abundant populations of resident and migratory wildlife including more than 300 species of birds and additional species of mammals, reptiles, amphibians, insects, and plants. A variety of wildlife-dependent recreational activities are available to visitors, including hunting and fishing, wildlife viewing, canoeing and kayaking, and general beach recreation.

- The refuge received 251,312 visitors in 2011.
- While all visitors were considered to engage in wildlife viewing, the Refuge estimated that there were 1,400 migratory bird hunting visits, 11,000 salt water fishing visits, 35 big game hunting visits, and 238,877 visitors who participated in non-consumptive activities such as wildlife viewing, photography, and other types of recreation, including general beach recreation.
- Based on data collected from the National Survey of Hunting, Fishing, and Wildlife Recreation, the Service estimates that visitors to the refuge directly spent $7.3 million in 2011. These direct expenditures contributed a total of $13.1 million to the local economies and 113 jobs.
- In addition to contributing directly to the local economy, the refuge's presence also serves to provide important ecosystem services to the community. Although not easily quantified, the refuge's undeveloped presence most notably on Plum Island serves to protect the infrastructure of the city of Newburyport along with the Towns of Newbury, Rowley, and Ipswich from flooding and erosion associated with storm surges and extreme weather events.

Table A4-7. Parker River NWR Totals, 2011

Visits	Area Unemployment Rate (April, 2012)	Visitor Spending ($ millions)	Estimated Total Jobs Supported (jobs)
251,312	Essex County – 6.2% (p)	7.3	113

Source: FWS; Bureau of Labor Statistics; (p) preliminary.

Crab Orchard National Wildlife Refuge (IL)

Located west of Marion, Illinois, on the northern edge of the Ozark foothills, Crab Orchard National Wildlife Refuge is one of the largest refuges in the Great Lakes/Big Rivers Region. Established in 1947, the 43,890-acre Refuge includes three man-made lakes totaling 8,700 surface acres. The Refuge landscape also includes hardwood and pine forests, croplands, grasslands, wetlands, rolling hills, and rugged terrain with slopes of 24 percent. The 4,050-acre Crab Orchard Wilderness, the first wilderness area designated in the State of Illinois, is within the Refuge.

Crab Orchard National Wildlife Refuge has four primary purposes:

- Wildlife conservation: The Refuge exists to protect, enhance, and manage natural resources and the Refuge landscape through an ecosystem approach that sustains optimum populations of migratory waterfowl, native fish and wildlife species, and threatened and endangered wildlife.
- Agriculture: The Refuge seeks to provide opportunities for and encourage agricultural uses that help attain wildlife conservation goals, benefit the local economy, and are compatible with other Refuge purposes.
- Industry: The Refuge manages an industrial complex fully utilized by compatible tenants that conform to prescribed safety, health, environmental, and maintenance standards.
- Recreation: The Refuge provides safe and equitable public use programs and facilities so that visitors have a wholesome, enjoyable recreational experience and gain an appreciation for fish and wildlife resources, natural and cultural history, outdoor ethics, and environmental awareness

Public use opportunities at the Refuge include an auto tour route, hiking trails, hunting, fishing, wildlife observation and photography, environmental education and interpretation, boating, swimming, camping, and picnicking.

- The refuge received 714,918 visitors in 2011.
- The refuge estimates that there were 11,404 waterfowl hunting visits, 2,788 upland game hunting visits, 6,305 big game hunting visits and 170,634 fishing visits.
- Based on data collected by the National Survey of Hunting, Fishing, and Wildlife Recreation, the Service estimates that recreational visitors to the refuge directly spent nearly $7.9 million in 2011. These direct expenditures contributed a total of $15.0 million to the local economies and supported 150 jobs.
- In addition to contributing directly to the local economy, the refuge's presence also service to provide important ecosystem services to the community.

Table A4-8. Crab Orchard NWR Totals, 2011

Visits	Area Unemployment Rate (April, 2012)	Visitor Spending ($ millions)	Estimated Total Jobs Supported (jobs)
714,918	Williamson County – 7.5% (p)	7.9	150

Source: FWS; Bureau of Labor Statistics; (p) preliminary.

BUREAU OF LAND MANAGEMENT EXAMPLES

Spring Valley Wind Project
This 150-megawatt wind generation farm will be located on 7,673 acres of the public lands in north Spring Valley, about 30 miles east of Ely, Nevada. The project will consist of 75 wind turbines, electrical substation and utilize an existing 230 kilovolt (kV) transmission line for distribution. The Record of Decision for this project was signed in October 2010 and construction is well underway. Construction during FY2011 consisted primarily of infrastructure including project buildings and roads. Turbine construction is planned for spring of 2012 with the goal of having the wind farm in operation by fall of 2012. Construction activities are estimated to directly support over 80 jobs annually, which produces approximately $6.5 million in labor income. The total economic contribution related to the construction of this project (including direct, indirect, and induced effects) is estimated to support approximately 570 jobs annually in the region with labor income exceeding $35 million.

Moab Area Examples

North Area Cooperative Community non-motorized trail projects
Moab BLM has partnered with Grand County to create at least eight projects immediately north of Moab City to enhance bicycling and hiking opportunities on a series of paved trails. Moab BLM has performed all the environmental work on these projects, constructed interpretive kiosks, and has been an integral part of the planning and implementation process. According to Grand County Engineer Mark Wright, these projects would not have been accomplished without the involvement of Moab BLM. Monies spent or obligated to date on the paved path projects total $16,026,000, of which $1,031,000 is from Moab City or Grand County funds, with the remainder ($14,657,000) from federal and/or state funding sources. The $16 million spent or obligated through the end of FY 2011 on these projects has contributed (or will contribute) $24.5 million in direct and indirect income effects and support 224 jobs in the local economy.

Mountain Bike Trail Construction
During 2011, volunteers donated nearly 11,000 hours to constructing 40 miles of new single-track mountain bike routes on BLM lands in Grand County, Utah. A joint Grand County-BLM entity known as Trailmix planned and supervised this new construction. BLM helps fund this group and is a major partner in its operation. The availability of new trails attracts both return visitors and new visitors to the Moab area for mountain-biking, and helps maintain Moab's position as one of the nation's premier mountain bike destinations.

Commercial Filming and Professional Photography in the Moab, Utah Area
The Moab area has been featured in numerous professional photographs and feature films, ranging from Stagecoach in 1939 to the recent 127 Hours and John Carter. Filming and photography in the Moab area take place on BLM lands, as well as private, state and National Park Service-managed lands. In 2010, filming and photography on BLM land in the Moab area contributed an estimated $4.3 million dollars to the local economy and supported an estimated 99 jobs. Commercial filming and professional photography provide additional employment and income opportunities for local residents, as well as benefits to local businesses.

Appendix 5. COASTAL VISITATION TO NATIONAL PARKS AND NATIONAL WILDLIFE REFUGES

Visitation to coastal national parks and national wildlife refuges contribute to local economies in many coastal states. Units of the NPS in coastal areas welcomed nearly 83 million visitors in 2010. These visitors spent a total of over $3.3 billion across the United States. Estimated economic contributions from coastal recreation to NPS sites were significant in many states, with $895 million in economic output in California, $764 million in Florida, $515 million in New York, and $398 million in Massachusetts. Visitation to coastal parks supported thousands of jobs in many states, including over 8,500 jobs in Florida, over 7,900 jobs in California, over 4,300 jobs in New York, and over 4,100 jobs in Massachusetts.

National Wildlife Refuges in coastal areas of the United States welcomed nearly 20 million visitors in 2011. Expenditures from these visits total $770 million. These expenditures contribute to economic output in many states, with contributions in Oregon, Florida, Alaska, and North Carolina of over $100 million each. These expenditures also support jobs in coastal communities, with over 2,800 jobs supported in Oregon, over 2,500 in Florida, over 2,300 in Alaska, and over 1,100 in North Carolina.

Table A5-1 and Table A5-2 provide additional details.

Table A5-1. Economic Contribution of Recreation at Coastal Parks

State	Visitation	Expenditures ($ millions)	Estimated Economic Contribution* ($ millions)	Estimated Number of Jobs Supported* (jobs)
Alaska	1,872,454	58.3	67.6	721
California	23,812,831	637.2	895.0	7,940
Florida	9,222,981	582.0	763.5	8,577
Georgia	802,772	41.5	50.5	628
Hawaii	3,120,399	198.5	252.3	2,615
Indiana	2,150,345	63.5	70.8	934
Louisiana	391,019	19.4	28.1	278
Maine	2,504,208	186.3	232.8	3,189
Maryland	1,306,592	86.6	102.6	1,225
Massachusetts	7,809,165	308.8	397.8	4,154
Michigan	1,796,006	143.4	186.7	2,498
Minnesota	113,996	12.6	13.3	198
Mississippi	1,070,937	29.7	31.1	430
New Jersey	1,764,151	32.2	44.0	376
New York	11,967,307	370.0	514.9	4,327
North Carolina	3,029,184	156.4	176.1	2,467
Ohio	92,944	7.2	10.4	145
South Carolina	797,713	18.4	19.3	268
Texas	753,205	50.8	69.1	809
Virginia	4,999,203	159.2	195.7	2,471
Washington	3,326,486	131.0	143.5	1,887
Wisconsin	156,945	17.3	18.0	292

* Estimates of economic contributions and jobs supported are calculated as the sum of effects for individual parks in each state.

Table A5-2. Economic Contribution of Recreation at Coastal Refuges

State	Visitation	Expenditures ($ millions)	Estimated Economic Contribution* ($ millions)	Estimated Number of Jobs Supported * (jobs)
Alabama	40,000	1.1	1.7	21
Alaska	1,397,669	146.3	230.7	2,320
California	1,006,000	44.3	88.1	674
Connecticut	25,000	0.4	0.7	5
Delaware	201,748	4.0	6.5	67
Florida	3,405,805	134.2	255.3	2,536
Georgia	131,042	2.9	5.3	54
Hawaii	395,411	30.8	53.0	481
Louisiana	573,362	14.8	24.0	266
Maine	382,620	10.0	16.9	195
Maryland	242,700	5.9	9.9	92
Massachusetts	302,065	7.3	13.1	112
Michigan	350	0.0	0.0	0
Mississippi	10,478	0.2	0.3	4
New Hampshire	20,000	0.5	0.9	9
New Jersey	415,000	13.7	24.1	205
New York	455,235	14.4	25.9	220
North Carolina	1,806,000	60.0	103.4	1,140
Ohio	146,783	3.4	5.9	67
Oregon	5,259,626	151.3	269.1	2,833
Rhode Island	403,702	13.0	22.6	221
South Carolina	526,794	18.1	29.4	343
Texas	793,518	28.9	53.5	532
Virginia	1,602,656	48.4	82.2	861
Washington	326,949	12.3	22.5	204
Wisconsin	119,100	3.6	6.2	76

* Estimates of economic contributions and jobs are calculated using visitation and expenditure totals for each state with state-level multipliers.

Appendix 6. ECONOMIC CONTRIBUTIONS ASSOCIATED WITH LAND ACQUISITIONS AND INFRASTRUCTURE INVESTMENTS

Land Acquisition: Output and employment contribution estimates for land acquisition are derived using national-level multipliers, assuming that land owners receive funds when lands are purchased and that 50% of these funds are spent. Much of the money land owners receive is likely to go into savings, be used to pay off loans, or be subject to tax. Of the 50% of funds assumed to be spent, 40% is modeled as a change in household income, and 10% is assumed to go to service providers associated with real estate transaction costs or monitoring and administration of easements. The change in household income is modeled for households with annual income of $100,000-$150,000 (the average household income for the national model in IMPLAN is $106,630). Specific services associated with land acquisition could include land appraisal, title examination and legal services, environmental site assessments, and ecological inventory and management planning. IMPLAN sector 374 (management, scientific, and technical consulting services) is used to model the services associated with land acquisition. Temporal issues also complicate the analysis, as there may be a delay between the date of the purchase, the date the landowner receives the funds, and the dates for the landowner's purchases. Contributions are typically reported for one year, and only a very small portion of the funds received by land sellers is likely to be spent in a year; monitoring expenditures will also often be incurred in perpetuity whereas transaction costs are all up-front.

Table A6-1. Land Acquisition

Bureau	FY2011 Actual (billions, $2011)	Output (billions, $2011)	Employment (Jobs)
National Park Service	0.05	0.05	384
U.S. Fish and Wildlife Service	0.05	0.05	384
Bureau of Land Management	0.02	0.02	154
Interior, Appraisal Services	0.01	0.01	85
Total	**0.14**	**0.14**	**1,007**

Table A6-2. Infrastructure

Bureau	Construction FY2011 Actual (billions, $2011)	Maintenance FY2011 Actual (billions, $2011)	Output (billions, $2011)	Employment (Jobs)
National Park Service	0.210	0.697	2.533	17,399
U.S. Fish and Wildlife Service	0.021	0.191	0.590	4,081
Bureau of Land Management	0.005	0.091	0.265	1,841
Bureau of Reclamation	0.564	0.424	2.784	18,784
Indian Affairs	0.210	0.084	0.831	5,566
Wildland Fire Mgt		0.006	0.017	118
USGS - surveys, investigations, research		0.030	0.072	617
Central Utah Project	0.027		0.078	515
Total	1.036	1.524	7.171	48,921

Source: FY 2013 Department of the Interior Budget in Brief and Bureau of Reclamation data. The estimates of economic contributions and employment are based on national-level multipliers.

Appendix 7. 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.[47]

Table A7-1. Glossary of Economic Terms

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 non-market 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 non-market 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.

[47] 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. 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. Economic input-output models capture the complex interactions of consumers and producers of goods and services in local economies. Economies are complex webs of interacting consumers and producers in which goods produced by one sector of an economy become inputs to another, and the goods produced by that sector can become inputs to yet other sectors. Thus, a change in the final demand for a good or service can generate a ripple effect throughout an 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 environmental 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 2010 data for up to 440 economic sectors and 9 income brackets. The IMPLAN platform was developed by USFS and is now privately maintained and updated by the Minnesota IMPLAN Group (MIG).

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.

Note that IMPLAN accounts for profits as a portion of the total revenues received by firms in an industry. Output represents the value of industry production in producer prices, and IMPLAN considers the full amount firms receive for their products as the relevant shock to model.

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 demand (consumers, exports).

Employment (jobs) is defined as average annual employment.[48] 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 a 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), the following should be kept in mind:

- 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 generated for large geographic areas may 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.

[48] 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 Economic Contributions

Economic contributions are generally calculated using the following formulas:

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

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

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. Estimate Total Recreation Expenditures
   (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 Output Effect
   (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 incorporated 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 a 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.

Approaches for Estimating Output and Employment Effects of Fiscal Stimulus

The economic analysis of the effects of fiscal policy typically focuses on what is called the fiscal multiplier. The most common definition of this multiplier is the magnitude of the change in economic activity caused by a change in fiscal policy. For example, a GDP fiscal spending multiplier of 1.5 means that a $1 increase in government spending leads to a $1.50 increase in GDP. The term multiplier refers to the broad effects of government spending and taxes on overall economic activity, not just on those households or businesses directly targeted by fiscal policy.

The CEA has used two methods to estimate the impact of the fiscal stimulus provided via the American Recovery and Reinvestment Act (ARRA): one approach uses estimates of the effects of fiscal policy from standard macroeconomic forecasting models; the second involves a comparison of the actual behavior of GDP and employment relative to a plausible, statistically determined baseline (for details see Executive Office of the President, Council of Economic Advisers, "Estimates of Job Creation from the American Recovery and Reinvestment Act of 2009," May 2009). CEA further assumed that a one-percent increase in GDP corresponds to a three-quarter percent increase in employment (about one million jobs). Using these multipliers, CEA estimated that $1 million in government spending creates 10.9 jobs; equivalently, creating one job requires $92,136 of government spending. In contrast, $1 million provided to states for fiscal relief is estimated to create 8.6 jobs, or $116,603 per job. Job creation was assumed to occur over the three fiscal quarters, starting with the quarter in which spending occurs. The $92,163-per-job figure is assumed to exceed the wages paid for the job retained or created, and includes the effects of increased hours or productivity in current jobs, increased non-wage compensation, and in non-compensation income (rents, profits, etc.). Jobs fall into three categories:

- Direct jobs created in the actual government-sponsored project.
- Indirect jobs created at suppliers for the project.
- Induced jobs created elsewhere in the economy from increased spending by workers and firms.

The Congressional Budget Office (CBO) has also estimated the impacts associated with ARRA. CBO used various economic models and historical data to develop its estimate of the way in which output and employment are affected by increases in outlays and reductions in revenues under ARRA.

CBO grouped the provisions of ARRA into general categories and assigned high and low multipliers to each. CBO estimates that a one-time increase of $1 in federal purchases of goods and services in one calendar quarter last year raised GDP above what it would have been otherwise by a total of $0.50 - $2.50, over several quarters. That cumulative multiplier of $2.50 at the high end of the range comprises

increases in GDP of roughly $1.45 in the quarter when the federal spending occurred, roughly 60 cents in the following quarter, and roughly 45 cents in later quarters combined. The range of the output multiplier for transfer payments to state and local governments for infrastructure was 0.4 - 2.2; the range for transfer payment to state and local governments for other purposes was 0.4 - 1.8 (Congressional Budget Office, "Estimated Impact of the American Recovery and Reinvestment Act on Employment and Economic Output from July 2011 Through September 2011," November 2011).

The CEA and CBO estimates guidelines differ from the approach taken in this report in several notable respects.

- The CEA and CBO estimates were developed to assess the impact of a discrete change in GDP from stimulus spending, and were not intended to be applied to agencies' baseline activities. Nevertheless, CEA notes that the ratio of GDP to total employment is not far off from their numbers at $105,000 per job.
- The CEA and CBO approaches do not account for differences in wages and other costs across project types or regions.

Over the past three years, there has been a resurgence in economic research on the impacts of fiscal policy, as implemented through direct government spending and tax rates. This resurgence is due in large part to the severe global economic downturn and the massive fiscal stimulus programs put in place in many countries as a response. The literature provides a wide range of multiplier estimates, ranging from –1 to 3 (Wilson, 2012 provides a concise summary). However, Wilson states that this range is not so much a reflection of disagreement over an underlying parameter as it is a reflection of one of the key lessons of this research—that there is no single multiplier that can be applied mechanically to all situations. The impact depends on the type of fiscal policy changes in question and the environment in which they are implemented.

Appendix 8. DATA SOURCES AND NOTES

General

- Estimated DOI Inputs as a Percent of National Sector – DOI contributions as a percentage of the entire industry at the national level. For hydropower, wind power, and geothermal the percentage represents the DOI capacity as a percentage of total capacity.
- Table 1-1 and Table 2-1 capture no output or employment effects 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.
- American Recovery and Reinvestment Act (ARRA) funding is not included. The economic impacts of ARRA have been estimated by the President's Council of Economic Advisers, the Congressional Budget Office, and others.

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, BIA, and BIE

- Sales volumes and values for BIA's oil, gas and coal activities are based on data from ONRR. 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.
- BIA's economic contributions from oil, gas, and coal are assumed to be proportional to BLM's.
- Drilling costs for oil, gas and dry wells were calculated for each state where Indian wells were completed in FY 2011. Costs per well were calculated as the total costs for each type of well (oil, gas, or dry) divided by the total number of completed wells of each type. The data were taken from
- "The Oil & Gas Producing Industry in Your State" (IPAA, August 2011).
- The ratio of dry holes to total wells completed was calculated for each state where Indian wells were drilled. These results were used to estimate the number of dry holes associated with Indian wells completed in each state.
- A single entry is provided for BIA timber and grazing activities; to date, no grazing data were provided.
- "Other minerals" were assumed to be construction aggregate (sand and gravel; crushed stone). The value of output was estimated by assuming the 2011 royalty collections of $35 million were derived from a 5% royalty. This implies a commodity value of about $698 million. This estimated value represents about 4.12% of the total value of about $17 billion of construction aggregates produced in the US in 2010 (source: Sand and Gravel, Crushed Stone, U.S. Geological Survey, Mineral Commodity Summaries, January 2011).
- 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 were evaluated by applying state and local government multipliers.
- Irrigation: The Department of the Interior's Bureau of Indian Affairs (BIA) manages 16 irrigation projects on Indian reservations in the western United States. The overall approach for estimating economic contributions and employment estimates is similar to that used for Reclamation's irrigation activities. Economic contributions and employment estimates were estimated for agricultural activities associated with BIA operated irrigation projects using data from the USDA National Agricultural Statistics Service (NASS) 2007 Census of Agriculture, Volume 2, American Indian Reservations. The Census of Agriculture does not provide complete coverage of all reservations. Where information was not available from the Census of Agriculture, irrigated acreage information was from "Numerous Issues Need to Be Addressed to Improve Project Management and Financial Sustainability," GAO-06-314, Mar 27, 2006. Irrigated acreage data were combined with average crop revenue per acre for irrigated acreage calculated based on data in the 2007 Agricultural Census. The agricultural revenue values in the Census were indexed to 2011 dollars using the NASS food grain prices received index. The multipliers used were based on IMPLAN grain farming sector.

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 inter-industry 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.
  Note that BLM's results are developed independently of BOEMRE's figures for offshore production, using a different approach. This complicates a direct comparison between the onshore and offshore analyses. BLM considers onshore direct output to include 1) oil and gas well drilling, with costs taken from the Independent Petroleum Producers Association report *IPAA Oil & Gas Producing Industry in Your State*; and 2) oil and gas sales, based on sales volume and sales value for the fiscal year. Final demand is taken to be the sum of these two items less interindustry sales.
- Figures reported for hardrock/locatable minerals were developed by the Office of Policy Analysis, assuming a total sales value of U.S. hardrock and other locatable minerals production of $41.4 billion (USGS Mineral Commodity Summary 2011) and 12.8 total jobs (direct, indirect and induced) per $1 million and an output multiplier of 2.43 from IMPLAN Sector 27 "Mining and quarrying other nonmetallic minerals". It was assumed that 15.3 percent of this production value (and hence 15.3 percent 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 minerals included in the locatables category were as follows: barite, beryllium, bentonite, Fuller's earth, kaolin, copper, diatomite, feldspar, gemstones, gold, iron ore, lead, mica, molybdenum, nickel, perlite, platinum, salt, sand, silica, silver, sulfur, talc, and zinc. Non metallic minerals included gypsum, pumice, and crushed rock.

- Economic contributions associated with locatable minerals are not included in the state-level summaries because sufficient information was not available to apportion the contributions among the states.
- BLM revised the methodology used in the FY2011 report to estimate the economic contributions associated with public lands grazing. The methodology changes result in a substantial increase in the estimated employment, labor income, and output estimated to from BLM forage. Had this methodology been used in the FY 2010 report, the economic contribution from BLM forage would have been substantially higher. Specifically, two changes in the analysis increased the impacts between 2010 and 2011: 1) the methodology used in 2009 and 2010 counted all livestock in each state. The revised analysis focuses on a specific subset of livestock to better reflect the animals that actually graze on BLM lands. 2) The previous analysis of employment from BLM forage did not include individuals who are unpaid or family laborers. In some areas this accounts for up to 35% of the total labor on ranches and farms. The revised methodology includes these workers. That figure was derived by developing a ratio between paid and unpaid/self-employed individuals for each of the relevant states. This methodology more accurately reflects the economic contribution that grazing on public lands makes to the ranching sector more generally. The analysis assumes that the grazing operations included in the Census of Agriculture are representative of those using BLM forage. It is possible that ranchers utilizing public lands have different spending or employment patterns than grazing operations as a whole, but using the Census of Agriculture provides a standard dataset for comparison across states. In addition, because the Census of Agriculture is only available every five years it is assumed that the per 1,000 AUM calculation remains constant from year-to year. It is also assumed that the ratio of paid to unpaid and self-employed labor is constant across all agriculture and forestry sectors. The sales 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.
- Timber value is composed of the sales receipts for harvested sawtimber, sales of Special Forest Products, and stewardship timber sales. Contracts for sawtimber are typically sold at auction, and the BLM receives the agreed payments when timber is actually cut and sold. Special Forest Products includes fuelwood, posts, poles, etc. While the sales are negotiated, the BLM tries to follow the stipulation that sale prices will not go below 10% of the estimated market value. Stewardship Program timber sales are associated with BLM bartering goods (timber products) for services (land treatments) done outside contractors. The product value is used to offset the total cost of service work in the contract.
- Contributions related to building and operating wind and solar energy projects were derived using the Jobs and Development Economic Impact (JEDI) models produced by the National Renewable Energy Laboratory (NREL). For FY 2011, six solar projects were under construction (four in California and two in Nevada), one wind power project was under new construction (Nevada), and one wind project was retrofitted with new turbines (California). Wind projects in the operations phase were located in four states: California, Nevada, Utah and Wyoming.
- The prices used for determining the value of coal leased by BLM were as follows: Alabama – $50.49 per short-ton; Colorado -- $45.58 per short ton; Kentucky – $50.49 per short-ton; Montana -- $16.31 per short-ton; New Mexico – $43.71 per short-ton; North Dakota -- $17.46 per short-ton; Ohio -- $35 per short-ton; Utah -- $37.19 per short-ton; and Wyoming -- $13.01 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 – $92.57/barrel; Alaska – $ 93.70/barrel; Arkansas – $92.57/barrel; California – $95.95/barrel; Colorado – $84.71/barrel; Illinois – $71.45/barrel; Indiana – $ 71.80/barrel; Kansas – $86.24/barrel; Kentucky – $92.57/barrel; Louisiana – $92.57/barrel; Michigan – $92.57/barrel; Mississippi – $ 92.57/barrel; Montana – $ 86.67/barrel; Nebraska – $92.98/barrel; Nevada – $81.33/barrel; New Mexico – $88.32/barrel; North Dakota – $84.87/barrel; Ohio – $92.57/barrel; Oklahoma – $88.53/barrel; Pennsylvania – $92.57/barrel; South Dakota – $83.74/barrel; Texas – $91.48/barrel; Utah – $78.70/barrel; Wyoming – $81.47/barrel.
- The prices used to determine the value of the natural gas produced from on shore Federal leases were: Alabama – $4.00/m cubic feet; Alaska – $5.25/m cubic feet; Arkansas – $4.00/m cubic feet; California – $4.13/m cubic feet; Colorado – $4.22/m cubic feet; Kansas – $4.30/m cubic feet; Kentucky – $4.00/m cubic feet; Louisiana – $11.03/m cubic feet; Michigan – $4.00/m cubic feet; Mississippi – $4.00/m cubic feet; Montana – $3.18/m cubic feet; New Mexico – $4.34/m cubic feet; New York – $4.00/m cubic feet; North Dakota – $4.02/m cubic feet; Ohio – $5.32/m cubic feet; Oklahoma –$4.24/m cubic feet; Pennsylvania – $4.00/m cubic feet; South Dakota – $3.43/m cubic feet; Texas – $5.21/m cubic feet; Utah – $4.34/m cubic feet; Virginia – $4.00/m cubic feet; West Virginia – $4.00/m cubic feet; Wyoming – $4.15/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 gross value of the crops produced using irrigation water supplied by Reclamation. This value overstates the actual production attributable to Reclamation, as some level of crop production would occur without the irrigation water delivered by Reclamation, and water is only one of many inputs into agricultural production. The multipliers used were developed for the 17-western state Reclamation service area. Reclamation is currently revising the methodology used to calculate the economic and jobs impact of Reclamation activities. Reclamation is utilizing GIS imagery to document the type and acreage irrigated crops. These data, combined with state-level yields and nation-wide prices provided by the USDA, will be used to quantify net crop value. Reclamation will then use these values to model the economic contributions and jobs supported by Reclamation activities. Reclamation currently has completed approximately 20% of this project and expects to have enough completed projects in 2013 to extrapolate an accurate estimate.
- 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. For the FY 2011 report, no new information was available, so the FY2010 value was indexed using the CPI values for water, sewer, and trash collection services. These values are: Dec 2011 – 182.758; Dec 2010 – 174.543; Dec 2009 – 165.204. The economic contributions associated with Reclamation supplied

M&I water are associated with the activities associated with operating water, sewage and other treatment and water delivery systems.

- Hydroelectricity generated at Reclamation facilities was valued using regional retail prices adjusted by a factor of 26%, 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 2011 the daily weighted-average wholesale price ranged from $21.92/MWh to $56.29/MWh, with an average for the year of $36.51/MWh. Over this same period, California retail prices ranged from $82.80/MWh (Transportation) to $152.40/MWh (Residential), with an average across all sectors of $130.90/MWh. The average wholesale price represented 26% 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 26% to the regional retail price to estimate the wholesale value of the project's power. For comparison purposes, in 2009 the wholesale prices represented 28% of the average retail price. The retail/wholesale power price ratio is calculated using EIA calendar year data, as only calendar year retail price data were available.

BOEMRE (formerly MMS, currently BOEM and BSEE)

- The BOEM maintains an in-house socio-economic impact model, MAG-PLAN, for economic impact analyses to support its lease sale planning duties. MAG-PLAN identifies the industry sectors that contribute to offshore oil and gas activity (e.g., wells drilled, platforms installed, etc.) and calculates the size of the direct impact in each sector. Total OCS related spending and employment in the U.S. economy is estimated with ratios and multipliers from the recently updated version of the MAG-PLAN model which incorporates 2010 IMPLAN data.
- The basis for calculating the FY2011 impacts of OCS oil and gas activity is the sales value of FY2011 OCS oil and gas production as published by the Office of Natural Resources Revenue. Because different sources of spending generate different degrees of economic impact, we distributed this sales value among industry spending, government revenue, and after-tax profits to enable the calculation of total domestic economic impact and individual state impacts. Because the portion of industry profits that flow to foreign entities has spending impacts that cannot be separated from those of other U.S. activities that generate income abroad, we omit any spending impact from this portion of total sales. That leaves slightly less than $52.4 billion of OCS stimulated direct spending in the U.S. economy.

	Industry Spending	Government Revenue	Domestic Spending from Profits	Total
Total Output Multiplier	2.26	3.19	3.12	NA
Total Jobs per Direct Million Dollars Spent	14.48	16.86	26.59	NA
Total Spending ($ millions)	55,867	38,826	26,706	121,398
Total Jobs	358,000	205,000	173,000	737,000

- We assumed direct industry spending (i.e., capital and operating expenditures) was 40% of total sales value in FY2011.[49] We then applied MAG-PLAN multipliers for direct, indirect, and induced spending (a total multiplier of 2.26) to estimate the total domestic output associated with this direct spending. In addition, we estimated jobs sustained by industry spending using the ratio from MAG-PLAN of 14.48 total jobs per million dollars of direct offshore oil and gas industry spending, resulting in a figure of 358,000 jobs sustained.
- 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, Land and Water Conservation Fund (LWCF) and the Historic Preservation Fund (HPF). The remaining 98 percent of leasing revenue and all of the tax revenue go into the Treasury General Fund. To calculate the total output from the spending of government revenues, we used the MAG-PLAN derived Federal government spending multiplier (based on IMPLAN data) of 3.19. We converted government spending to jobs using the IMPLAN ratio of 16.86 total jobs per million dollars of direct spending by the Federal government. 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 to shareholders using EIA data. We split the retained earnings into money that would flow to the rest of the world and money that would stay in the U.S. Using EIA data on oil and gas expenditures, we determine that 47% of expenditures will be spent in the rest of the world and the remaining 53% of the expenditures will occur in the U.S.[50] Splitting retained earnings this way treats funds that go to the rest of the world as a leakage from the economy that have no discernable direct spending impacts in the U.S. Moreover, the domestic retained earnings are either saved or are already included in industry spending, so we assigned no additional economic impact to retained earnings beyond the direct spending. As with foreign shares of retained earnings, we allocated a portion of total dividends to foreign shareholders. Of the dividends paid out domestically, we used the IRS dividend tax rate of 15% to calculate taxes. Of the after-tax domestic dividends, we assume, based on two empirical studies, that 25% is reinvested and the remaining dividends are spent by shareholders.[51] We group reinvested dividends with retained earnings and assume they have no additional economic impact beyond the $1.4 billion in direct spending. Since domestic retained earnings and reinvested dividends have no multiplier effect the total output from domestic retained earnings is only $8.733 billion and $1.425 billion from reinvested dividends. To calculate the corresponding employment impacts, we used the MAG-PLAN ratio from oil and gas industry spending of 4.18 direct jobs per million dollars spent. The only revenue from profits that we associate with creating multiplier economic impacts is the tax revenue from dividends and the spending from domestic dividends. The tax revenue from dividends is treated in the same way as government revenues. We based the total impact from the spending of domestic dividends on the average of the multipliers of the consumer sectors in IMPLAN (sectors 320-425). Likewise, we used the IMPLAN ratio of 26.59 total jobs per million dollars of consumer spending to calculate the employment effects.

[49] This assumption is based on the results of BOEM's in-house leasing model, IMODEL
[50] Energy Information Agency, Financial Reporting System Survey, Schedule 5211: Petroleum Segments Expenditure and Operating Expenses: 2009. <*ftp://ftp.eia.doe.gov/pub/energy.overview/frs/s5211.xls*>.
[51] Rough estimate using the following papers as sources: Baker, Malcolm, Stefan Nagel, and Jeffrey Wurgler. "The Effect of Dividends on Consumption. http://www.people.hbs.edu/mbaker/cv/papers/Effect_of_Dividends.pdf>. Rantapuska, Elias. "Do Investors Reinvest Dividends and Tender Offer Proceeds?" http://papers.ssrn.com/Sol3/papers.cfm?abstract_id=675981>.

- Additional analysis was required to estimate the distribution of economic impacts by state. For the industry spending category, the MAG-PLAN model reports the economic impacts that occur in each of the five Gulf of Mexico (GOM) states while aggregating the remainder of the U.S. Since MAG-PLAN has the breakout of economic impact (direct spending, total output, and total jobs) for the GOM states, we applied the percentages for each individual state to the FY2011 industry spending data to calculate the impacts in each of the GOM states. For the remainder of the U.S., we used Bureau of Labor and Statistics (BLS) data on employment by state for each industry sector that MAG-PLAN identifies as having meaningful levels of activity (at least 1% of activity) outside the GOM states.[52] We weighted the BLS state employment data by the contribution of each sector to total industry spending from MAG-PLAN to give us the distribution of economic impacts from industry spending by state. Next, we allocated the spending outside the GOM states according to the new BLS-derived distribution.
- For the government revenue sector, we allocated the spending and job components of grant and revenue sharing programs to the state which receives the funds. We allocated the remaining leasing revenue and tax revenue between states in the proportion in which each receives government funds based on historical federal funds distributions to states as reported by the Census Bureau.[53]
- In order to split the revenues from retained earnings and reinvested dividends, we determined what portion of spending would occur in onshore oil and gas activity and what would occur in offshore activity. Using EIA data, we determined that 73% of the retained earnings and reinvested dividend spending would occur in onshore oil and gas activities and the remaining 27% would occur offshore.[54] Because a portion of the profits earned offshore are reinvested onshore, we calculate the impact of onshore spending based on BLS data for onshore oil and gas production. The retained earnings and reinvested dividends that were spent on offshore activities were distributed to states using the same methodology as the offshore industry spending category discussed above. We allocated the spending of domestic dividends by state using data from the Census Bureau on the amount of interest income earned in each state and distributed accordingly.[55]
- Note that BOEM's results are developed independently of BLM's figures for onshore production, using a different approach. This complicates a direct comparison between the offshore and onshore analyses. BOEM considers offshore direct output to include several related supporting sectors, including steel product manufacturing, water transportation, air transportation, food supply, etc. Interindustry sales are removed in calculating final demand.

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 2011, including current and permanent PILT payments

[52] http://www.bls.gov/cew/

[53] U.S. Census Bureau Statistical Abstract Table 467: Federal Funds - - Summary Distribution by State and Island Areas: 2007. <http://www.census.gov/compendia/statab/2010/tables/10s0467.xls>.

[54] Energy Information Agency, Financial Reporting System Survey, Schedule 5211: Petroleum Segments Expenditure and Operating Expenses: 2009. < *ftp://ftp.eia.doe.gov/pub/energy.overview/frs/s5211.xls*>.

[55] U.S. Census Bureau, American Community Survey, Table B19054: Interest, Dividends or Net Rental Income: 2010. <http://factfinder2.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_10_1YR_B19054&prodType=table>.

and mineral revenue payments. State-level FY 2011 grants and payments data were obtained from the DOI Office of Budget for the grants and payments analyzed in this report. The FY 2013 Budget in Brief reports actual FY 2011 grants and payments totaling $4.66 billion. Table 1-1 includes a total of $4.18 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 2 only includes those categories listed above for which state-level data were 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.
- 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 $4.18 billion total of FY 2011 grants and payments (displayed in Table 1-1 and Table 2-1) does not include $12 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 BOEMRE section above.

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, 2011 payroll data were 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 pay period 17, 2011.
- The number of employees in each bureau as of 2011 pay period 17 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 contributions 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 contributions shown in Table 1-1 and Table 2-1, a national multiplier was used to estimate the employment contributions of Interior payroll, equaling 12.9 jobs per $1 million.
- For state-level salary effects shown in Tables A2-1 and A2-2, 2011 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. These data were 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.
- Some DOI bureaus, such as NPS, report payroll impacts in separate publications such as "*Economic Benefits to Local Communities from National Park Visitation and Payroll, 2010.*" The payroll numbers presented in the NPS report differ somewhat from those in the DOI report due to the fact that DOI used Department-wide FY 2011 payroll data from the central human resources data system and used a different set of national-level multipliers.

Additional Notes for Recreation

- In Table 1-1, the value of the national sector was taken to be $746.2 billion, the 2010 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 Travel and Tourism Satellite Accounts).
- 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 included for NPS but not for FWS in this analysis. FWS does maintain some 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, the MGM 2010 report, and unpublished data for FY 2010 from Stynes (2011) for site-level impacts of visitor spending (in Chapter 5); for BLM sites, Forest Service expenditure data were used; Reclamation expenditures were also based on the FWS Fishing, Hunting, and Wildlife-Associated Recreation survey. Spending profiles associated with these data sources were used to develop estimates of average expenditures. Table A8-1, Table A8-2, and Table A8-3 provide additional details. For BLM the assumptions that were used were based on *Spending Profiles of National Forest Visitors, NVUM Four Year Report* by Stynes and White, 1998.
- The source of the NPS visitation, employment, and output information is Stynes (2011). In May 2012 we received updated visitation figures from the NPS Statistical Abstract for the following areas: Alaska, American Samoa, California, Colorado, New York, and the Virgin Islands. This increased visitation by 406,460 relative to the totals shown in Stynes. NPS did not provide an updated employment or output contribution analysis, thus the employment and output contributions associated with these 406,460 visits are not reflected in the estimates presented in the report. We did not attempt to independently develop output and employment estimates to accompany these 406,460 visits because we did not have specific expenditure profiles for the locations of these visits. However, as a rough approximation, these visits would support a total of approximately 200 jobs. This represents less than one percent of the total number of NPS supported jobs.
- The jobs data in Stynes (2011) includes fractional values, and the sum of the jobs column in Table A2-3 displays rounding error. When the jobs figures for each area are rounded to units, the total appears to be 172,024. The accurate tally is 172,022. Table A2-3 contains a footnote to this effect.
- 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.
- FWS used 2008 IMPLAN data and FY2011 visitation numbers; NPS used 2009 IMPLAN data and calendar year 2010 visitation numbers.
- 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). NPS visitation and economic contribution data are from FY2010, the most recent information available.
- The FWS National Survey of Hunting, Fishing, and Wildlife Associated Recreation state-level data were used to determine the average recreationist's trip spending per day.
- Table A2-3 presents a state-by-state summary of the employment and total economic impacts of recreation visits for NPS, FWS, BLM, and Reclamation.

Table A8-1. BLM Spending Profiles (Based on Spending Profiles of National Forest Visitors)

National Average Visitor Shares

Segment	Non-local Day	Non-local Onsite	Non-local Offsite	Local Day	Local Onsite	Local Offsite	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

Source: Stynes and White, 1998.

Table A8-2. FWS Refuge Visitor Days and Average per Day Trip-Related Expenditures

State	Refuge Visitor Days	Average per Day Trip-Related Expenditures
Alabama	876,674	$34.56
Alaska	1,129,353	$135.71
Arizona	385,799	$73.61
Arkansas	862,276	$28.11
California	3,564,589	$57.11
Colorado	60,042	$69.96
Connecticut	19,281	$20.28
Delaware	155,598	$26.01
Florida	2,934,440	$51.07
Georgia	218,436	$28.66
Hawaii	694,434	$100.97
Idaho	283,108	$45.54
Illinois	962,225	$25.50
Indiana	163,727	$13.19
Iowa	1,514,895	$24.50
Kansas	214,947	$29.42
Kentucky	30,850	$26.20
Louisiana	816,211	$33.45
Maine	301,516	$33.82
Maryland	385,004	$31.43
Massachusetts	821,036	$31.19
Michigan	88,146	$28.59
Minnesota	1,242,646	$37.61
Mississippi	247,793	$23.12
Missouri	334,453	$25.07
Montana	491,229	$80.99
Nebraska	169,894	$26.07
Nevada	137,466	$66.04
New Hampshire	57,073	$34.99
New Jersey	468,149	$42.67
New Mexico	185,602	$54.60
New York	504,886	$40.90
North Carolina	1,525,131	$43.07
North Dakota	295,954	$51.30
Ohio	113,206	$29.67
Oklahoma	1,669,363	$27.78
Oregon	4,431,594	$37.31
Pennsylvania	122,731	$21.64
Rhode Island	311,355	$41.89
South Carolina	721,467	$44.46
South Dakota	269,857	$71.84
Tennessee	775,685	$22.58
Texas	867,657	$47.26
Utah	42,620	$68.82
Vermont	55,530	$25.79
Virginia	1,292,915	$39.12
Washington	722,172	$48.83
West Virginia	60,077	$28.07
Wisconsin	1,125,963	$39.72
Wyoming	259,294	$95.32
United States	34,984,347	

Source: FWS

Table A8-3. NPS Spending Profiles

	Visitor Segment						
Spending category	**Local Day Trip**	**Non-local Day Trip**	**NPS Lodge**	**NPS Campground**	**Back-country**	**Motel-Outside Park**	**Camp-Outside Park**
Motel, hotel, B&B	0.00	0.02	157.57	0.83	3.02	104.82	0.16
Camping fees	0.00	0.00	1.24	18.09	1.99	0.24	25.33
Restaurants & bars	12.61	19.37	73.42	13.86	7.35	62.45	16.56
Amusements	4.56	9.25	29.11	9.99	5.75	20.62	15.21
Groceries	6.08	6.86	14.06	16.32	5.71	15.29	12.63
Gas & oil	8.75	18.97	22.27	24.59	12.73	22.60	23.82
Local transportation	0.55	1.97	14.11	4.42	1.20	9.19	2.12
Retail Purchases	7.80	13.16	28.78	13.27	8.94	27.21	19.69
Total	**40.36**	**69.60**	**340.55**	**101.39**	**46.69**	**262.41**	**115.51**

Source: NPS (2011) Economic Benefits to Local Communities from National Park Visitation and Payroll, 2010 (p. 3)

Appendix 9. COMPARISON TO PREVIOUS INTERIOR ECONOMIC CONTRIBUTION REPORTS

This is the third Economic Contribution report produced by DOI, and primarily presents data from FY 2011. The first Economic Contribution report was released by Interior in December 2009, and relied on data from 2008. The second Report was released in June 2011 and relied primarily on data from FY 2010. All of these reports rely on generally similar methodological approaches. However, some changes in modeling have been made since the first report to improve the estimates for certain commodities. Therefore, comparisons of estimates across the reports are difficult because underlying modeling may be changing simultaneously with economic data such as production and prices, making it difficult to determine the underlying reason for the change in economic contribution estimates. Keeping these notes of caution in mind, changes in total value and contribution estimates of DOI activities are shown below:

- In general, comparing FY 2010 and FY 2011, the value of the commodities and other inputs to production associated with Interior's activities increased by 6% in nominal terms from $136 billion to $144 billion. This change can 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 2.2 million to 2.4 million, an increase of 9%. Economic output contributed increased from about $363 billion to $385 billion, an increase of 6%.

As noted above, differences in estimates from one year to the next result in some part from underlying economic conditions. Economic growth in the United States was modest in 2011, with an increase in nominal GDP of 1.7% between 2010 and 2011. Changes in the value of production and economic contributions of Interior's activities are affected by economic factors that change from one year to the next, including price changes and changes in the total quantity of the good or service produced. Some economic factors that influence the estimates include:

- Changes in price of a good or service (see Appendix 8 for more information about sales prices for different commodities included in the report). Price changes result in different production values for commodities from year to year.
- Changes in the total quantity of the good of service produced. Changes in quantity produced also affect total value of production for a given commodity.
- Future efforts will attempt to show more information on trends in price and quantity of DOI activities over time.

Changes in modeling and assumptions used for certain estimates can also influence differences in estimates from one year to the next. Some of the major changes in modeling and assumptions between the FY 2010 and FY 2011 reports include:

- Improvements in the methodology used to model BLM's grazing contributions (see Appendix 8 for additional details).
- Changes in the underlying economic structure of local economies between 2009 and 2010, reflected in the updated IMPLAN data.

Errata

The jobs figure reported for the Bureau of Reclamation in the previous report (FY 2010) was erroneously reported as 415,978 jobs. This figure should have been 357,069 jobs. The source of the errors were in the employment estimates for M&I water, listed as 78,479 jobs, which should have been 32,296 jobs and in the employment estimates for hydropower which were listed as 19,581 and should have been 7,126.

CONTRIBUTORS

The Office of Policy Analysis would like to acknowledge the following Department of the Interior staff who developed economic contribution information and collaborated across bureaus and offices in order to produce this Report

Office of the Secretary
Raghav Aggarwal
Antonio Benavidez
Shella Biallas
Joel Clement
Sarah Cline
Christian Crowley
Olivia Ferriter
Peter Grigelis
Benjamin Miller
Wali Osman
Malka Pattison
Benjamin Simon
Kristin Skrabis
Jonathan Steele

Indian Affairs
Steven Payson

Bureau of Land Management
Joel Larson
Darla Pindell
Josh Sidon
Bill Stevens
John Thompson
Rob Winthrop
USDA Forest Service Supporting BLM
Susan Winter
Doug Smith

Bureau of Reclamation
Randy Christopherson
Paula Engel
Tara Kinsey
Brook Miller Levy
Omid Rowhani
Margot Selig
Karl Stock

Fish and Wildlife Service
Richard Aiken
Sylvia Cabrera
Anna Harris
Andrew Laughland
Ted Maillett

Bureau of Ocean Energy Management, Regulation & Enforcement
Kim Coffman
Marty Heinze
Sarah Peters Coffman
Marshall Rose

National Park Service
Bruce Peacock

Office of Surface Mining
Mark Gehlhar

US Geological Survey
John Donnelly
William Gascoigne
Lynne Koontz
Leslie Richardson
Carl Shapiro
Rosemary Stenback
Catherine Thomas

U.S. Department of the Interior
Office of Policy Analysis
1849 C Street NW
Washington, DC 20240