

Appendix A. Technical Information

This is the seventh Economic Contribution report produced by DOI. While all of the reports relied on the best available data and sound methods, there are changes across years as improved data, methods, and models are identified or become available. When making comparisons of DOI's economic contribution estimates across years, it is important to identify all of the factors that might contribute to estimates changing from one year to the next. These factors can include:

- Changes in land use. These might be due to changes in resource demand or management decisions, or reflect a natural progression in a project's life cycle, such as a shift from construction to operational status.
- Changes in the data describing a resource's annual economic output. These might be due to actual changes in the quantity or price of a good produced, or changes in data collection and assumptions.
- Changes in the economic models that describe the underlying structure of local economies. For most sectors, these models are developed independent of this report. In some cases, new models that better describe individual sectors replaced models used in prior reports. In other cases, the assumptions and data within the models changed significantly from year to year.

IMPLAN

This analysis primarily employs the widely used I/O software and data system known as IMPLAN for estimating the economic contribution of Interior activities in terms of output (sales), value added, and employment (jobs). In particular, this analysis uses IMPLAN data released in 2013²⁷. The underlying data drawn upon by the IMPLAN software is collected by the Minnesota IMPLAN Group (MIG) from multiple Federal and State sources including the Bureau of Economic Analysis, Bureau of Labor Statistics, and the U.S. Census Bureau. Additional information about the IMPLAN modeling software can be found at: <http://www.implan.com/>.²⁸

²⁷ BLM used 2014 IMPLAN data

²⁸ The most recent version of IMPLAN (Version 3.0) 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 had been criticized for its use of non-survey based RPCs, which have been shown to produce higher estimates than survey-based data. 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. A study by Koontz, Loomis, and Winter (2011) showed that the differences in the IMPLAN Version 3.0 software can result in lower estimates of employment and income effects for tourism impacts. 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. 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."

OSMRE

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

Indian Affairs, BIA, and BIE

- Sales volumes and values for BIA's oil, gas and coal activities are based on data from ONRR.
- Drilling costs for oil, gas, and dry wells were calculated for each State where Indian wells were completed in FY 2015. 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 cost data were taken from "The Oil & Gas Producing Industry in Your State" (IPAA, October 2012).
- 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 17 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). 2012 Census of Agriculture, Volume 2, American Indian Reservations. The Census of Agriculture does not provide complete coverage of all reservations. Irrigated acreage data were combined with average crop revenue per acre for irrigated acreage calculated based on data in the 2012 Agricultural Census. The agricultural revenue values in the Census were indexed to 2015 dollars using the NASS food grain prices received index. The multipliers used were based on IMPLAN grain farming sector. 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.

BLM

- The BLM estimates the contributions from oil and gas activities by adding the value of the gross output to drilling costs and then removing 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 including drilling costs in the initial sum 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 BOEM's figures for offshore production, and use a different approach. This complicates a direct comparison between the onshore and offshore analyses. The 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 with preliminary sales year data provided by the Office of Natural Resources Revenue (ONRR). Final demand is taken to be the sum of these two items less inter-industry sales.

- BLM uses IMPLAN to estimate the economic contributions associated with salable minerals and other leasable minerals (i.e., other than oil, gas, and leasable hardrock minerals). The method parallels that of oil and gas production described above. Production and unit prices for leasable minerals for the fiscal year are based on preliminary sales year data provided by ONRR. Salable minerals production data for the fiscal year are from BLM's internal database LR2000; commodity price data are based on the USGS annual Mineral Commodity Summaries (MCS). Preliminary FY2015 sales year data on leasable mineral sales volume and value were received from ONRR on 12/11/2015 through a special data request.
- The economic contributions of hardrock mining on the Federal estate were estimated at a national level using an approach similar to the approach used in FY 2013 and FY 2014. The primary limitation in generating useable estimates of hardrock mineral production is identifying the portion coming from Federal lands. These data are generally unavailable. The production estimates from Nevada and Missouri account for the vast majority of production value from Federal lands. USGS's annual MCS provide commodity prices that were used in this analysis.
- For livestock grazing, the BLM developed state-specific economic contribution estimates associated with 1,000 Animal Unit Months (AUMs) – commonly termed response coefficients. An example of a response coefficient is “1,000 AUMs for grazing beef cattle support approximately X direct jobs in state X.” These response coefficients were revised this fiscal year using data primarily from the 2012 Census of Agriculture in combination with IMPLAN (2013 data). The results in the prior four DOI Economic Reports used response coefficients derived using data primarily from the 2007 Census of Agriculture, and also from the Census' American Community Survey, in combination with IMPLAN (2007 data). Due to the revisions of the response coefficients, the FY15 economic contribution estimates associated with livestock grazing are not comparable to prior years. The 2012 Census of Agriculture provides information on a specific subset of livestock that best reflects the animals that actually graze on BLM-managed lands – specifically, employment, income, sales, and expense data from operations classified by the North American Industry Classification System (NAICS) as beef cattle ranching and farming (112111) and sheep and goat farming (1124). In addition, the 2012 Census of Agriculture contains information related to self-employment as well as individuals who are unpaid or family laborers. In some areas unpaid or family labor represent a significant component of the labor used to run ranches and farms. The analysis assumes that the grazing operations included in the Census of Agriculture are representative of those operations using public forage from lands managed by the BLM. 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 response coefficients will remain constant from year-to-year. The economic contribution estimates associated with livestock grazing on BLM-managed lands were derived by multiplying response coefficients by the AUMs authorized on bills (associated with leases or permits to graze livestock on BLM managed lands) that were due during a given fee year. Economic contribution estimates in this report are based on the most current data on livestock grazing use on BLM-managed lands - fee year 2014 (3/1/2014 through 2/28/2015).

- 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 include fuelwood, posts, poles, etc. While the sales are negotiated, the BLM tries to follow the stipulation that sale prices will not go below 10 percent of the estimated market value. Stewardship Program timber sales are associated with BLM bartering goods (timber products) for services (land treatments) done by outside contractors. The product value is used to offset the total cost of service work in the contract.
- Estimates reflect economic contribution from commercial sales of timber, primarily wood-based products. The BLM's forestry and woodlands management program also manages public access to a variety of other forestry products including personal use fuelwood (fuelwood gathered by individuals for personal use rather than by companies for commercial resale) and non-wood Special Forest Products (such as Christmas Trees, native seeds, mushrooms, and floral/greenery). Non-wood Special Forest Products from BLM-managed lands generated over \$815,000 in sales in FY2015. Personal use fuelwood gathered from BLM-administered lands in FY2015 amounted to about 85,000 CCF. Assuming a market price of \$200 per cord (EIA, 2014), the market value of this fuelwood is almost \$13.5 million. The BLM collected around \$430,000 in permit fees for personal fuelwood collection.”
- Economic contributions related to constructing and operating wind, solar, and geothermal energy projects were derived using the Jobs and Development Economic Impact (JEDI) models produced by the National Renewable Energy Laboratory (NREL). Prior to FY 2013, economic contributions associated with geothermal energy development were developed using IMPLAN based on sales volume and value from ONRR and drilling data from BLM. Therefore, the economic contribution estimates for FY 2014 and FY 2015 should not be compared to prior years.
- The significant drop in the market price for oil and gas in 2015 reduced the average effective prices for oil and gas in FY 2015 and thus did effect the calculated economic contribution estimates. While DOI's contribution to the economy may decline, society receives benefits from lower oil and gas prices as consumers have more disposable income to spend elsewhere creating its own economic impacts.

Reclamation

- FWS trip-related multipliers and average visitor expenditures were used to estimate impacts for Reclamation's recreation activities. The analysis relies on Reclamation visitation data collected during 2010-2013 and applies current expenditures per day, value added, output, and employment multipliers from FWS.
- Prior to FY14, valuations of economic impacts from Reclamation's agricultural water deliveries in the Central Valley Project (CVP) area assumed that all crops grown in the CVP area used only Reclamation water supplies. However, Reclamation's water supply is only supplemental. Therefore, an adjustment was made to the value of CVP crops by comparing the calculated irrigation requirements to Reclamation's actual water deliveries.

- Reclamation is utilizing GIS imagery to document the type and acreage of irrigated crops grown. Some Reclamation projects do not have GIS data and have not been included. GIS acreage from 2015, combined with 2014 State-level yields and prices provided by the USDA, are used to estimate gross crop value. The Reclamation M&I water economic contributions are associated with operating systems for water, sewage, etc. The economic contribution of delivering M&I water was estimated by using total 2005 M&I contract amounts in acre-feet, and multiplying the total amounts by recent average market M&I water rates for major urban areas derived from various studies that the Bureau of Reclamation Technical Services Center combined and analyzed. For the Central Valley Project in California actual M&I delivery data was used in both FY 2014 and 2015.
- The value of hydroelectricity generated at Reclamation facilities was estimated using regional wholesale prices for Reclamation major hydropower production areas as follows: BPA, \$0.035/kWh; Parker Davis, \$0.009/kWh; Boulder-Hoover, \$0.016/kWh; Loveland, \$0.041/kWh; Billings, \$0.033/kWh; Sacramento, \$0.055/kWh; and Salt Lake City, \$0.03/kWh.

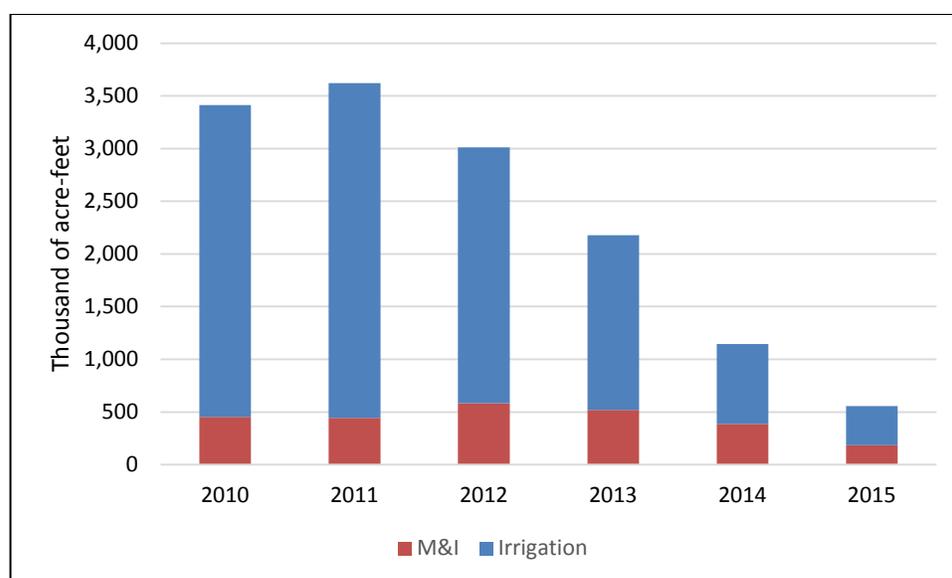


Figure A-1. Bureau of Reclamation Water Deliveries by Use for Central Valley Project (2009-2015)

BOEM and BSEE

- The total FY 2015 economic contributions of oil and gas activity on the federal Outer Continental Shelf (OCS) are less than estimated for FY 2014 (\$113 billion in total U.S. output, \$64 billion in total value added and 651,000 domestic jobs sustained). This reduced economic impact is the result of low oil prices which persisted throughout the year and the corresponding reduction in government revenues.
- 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.
- The basis for calculating the FY 2015 impacts of OCS oil and gas activity is the sales value of FY 2015 OCS oil and gas production as published by the Office of Natural Resources Revenue.²⁹

²⁹ <http://statistics.onrr.gov/ReportTool.aspx>

- As shown in Table A-2, the sales value of OCS production in FY 2015 was \$40.6 billion. 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 economic impact and individual State impacts. 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, so we omit any spending impact from this portion of total sales. That leaves \$35.6 billion of OCS stimulated direct spending in the U.S. economy, shown in the second column of Table A-2. The rows in Table A 2 identify the individual components that we estimated to arrive at these totals.

Table A-1. BOEM and BSEE Administered Industry Economic Impact FY 2015

	OCS Oil, Gas, and NGL Sales Value (\$ millions)	Resulting Direct Domestic Spending (\$ millions)	Resulting Total Domestic Output (\$ millions)	Resulting Total Domestic Value Added (\$ millions)	Domestic Jobs Sustained ('000s)
Industry Spending	\$20,294	\$20,294	\$54,944	\$28,435	301
Government Revenue (includes profit and dividend tax revenues)	\$8,395	\$8,395	\$14,369	\$10,625	94
After-(both profit and dividend) Tax Profits	\$11,898	\$6,870	\$17,089	\$9,254	97
After-Tax Profits to Rest of World	\$5,028	NA	NA	NA	NA
After-Tax Profits remaining in U.S.	\$6,870	\$6,870	\$17,089	\$9,254	97
Sales Value	\$40,587	\$35,559	\$86,402	\$48,315	492

NB: Totals may not sum due to rounding

- The analysis assumes that direct industry spending (i.e., capital and operating expenditures) was 50 percent of total sales value in FY 2015.³⁰ BOEM applied MAG-PLAN national multipliers for direct, indirect, and induced spending (a total multiplier of 2.71) to estimate the total domestic output, value added (using a MAG-PLAN industry spending ratio of \$1.40 in total value added for every dollar of direct spending), and employment (using a MAG-PLAN ratio of 14.8 total jobs per million dollars of direct offshore oil and gas industry spending).
- Estimated after-tax profits (after both profit and dividend taxes) were estimated to be \$11.9 billion. These were distributed across domestic and foreign entities through both dividends and retained earnings. To calculate this distribution, EIA data were used to split profits into retained earnings and shareholders dividends and further to split retained earnings into those that would be spent domestically versus internationally.
- BOEM used Bureau of Economic Analysis, Department of Commerce data to split dividends into those for domestic versus foreign shareholders. Domestic dividends were assigned a 15 percent tax rate and those tax revenues were included with government spending. Of the after-tax domestic dividends we assume, based on two empirical studies, that 25 percent is reinvested and the remainder is spent.
- Government leasing revenues, corporate tax, and dividend tax are all treated together. Using appropriate IMPLAN Federal and state government institutional spending patterns we estimate a composite multiplier 1.72 for total output, a ratio of \$1.27 in total value added for every dollar of direct government revenue, and 11.21 total jobs per million dollars in direct spending.
- Additional analysis was required to estimate the distribution of economic impacts by State. BOEM's MAG-PLAN model provides percentages of industry spending economic impacts for each of the five Gulf of Mexico (GOM) States while aggregating the remainder to the "rest of U.S." The five GOM states account for 68% of total OCS generated spending and jobs and 65% of total value added. For the remainder of the U.S., we used State Bureau of Labor and Statistics (BLS) employment data for each of the ten largest MAG-PLAN sectors identified outside of the Gulf States and weighted industry spending accordingly.
- 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 Bureau of the Census.³¹
- 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.

³⁰ Previous calculations of the BOEM contribution have estimated this percentage to be 40% of total sales value based on results of our in-house leasing model, IMODEL. However, as the effective sales price of oil has fallen significantly from previous years, this factor was re-evaluated for FY 2015. As such, we determined that 50% of sales value is a more appropriate figure. Based on published estimates, oil companies report a cost savings of approximately 10 percent as a result of lower oil prices. Our new factor of 50% generates a total industry spending approximately 10 percent lower than what was estimated for FY 2014 and provides what we view as a reasonable estimate of FY 2015 industry spending.

³¹ 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>.

Grants and Payments

- The total grants and payments included in the report represent all grants and payments for bureaus and Interior-wide programs in FY 2015, including current and permanent Payment in Lieu of Taxes (PILT) payments, mineral revenue payments and all AML grants to States and tribes. The DOI Office of Budget provided State-level data for the grants and payments analyzed in this report.
- The report includes a total of \$4.68 billion in grants and payments. The FY 2016 Budget in Brief reports actual FY 2015 grants and payments totaling \$4.83 billion. Variances between the two figures can be attributed for certain grant and payment totals to the exclusion of program administration costs in grant awards, Coastal Impact Assistance Program (CIAP) payments made during FY 2015, and payments to support tribal governments.
- Economic contribution estimates use national-level multipliers for the appropriate sectors. The State-level analysis of employment impacts related to grants and payments included in Chapter 3 only includes those categories 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 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 onshore and offshore royalties were included in the category of Energy and Minerals for the national and State-level analyses.
- 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 BOEM section above.
- 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 most cases, States receive about 50 percent of the revenues associated with mineral production on Federal public lands within their borders.³² 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. 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.
- Grants and Payments include mineral revenue payments to States associated with onshore production, and grant programs funded by offshore leasing and other sources of revenues.
- Land Acquisitions: Output and employment contribution estimates for land acquisition are derived using State and national-level multipliers. It is assumed that 90 percent of funds goes to landowners and 10 percent goes to transaction costs. Much of the money land owners receive is

³² Alaska is an exception, receiving 50 percent of revenues for production from the National Petroleum Reserve A (NPR-A), and 90 percent elsewhere.

likely to go into savings, be used to pay off loans, or be subject to tax. It is therefore assumed that landowners will spend only 50 percent of funds they receive. These expenditures are modeled as a household income change for households with annual incomes greater than \$150,000. The remaining 10 percent of funds are assumed to go to service providers associated with real estate transaction costs or monitoring and administration of easements. 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 440 is used to model the services associated with land acquisition.³³ Temporal issues 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 the landowner spends the funds. Contributions are typically reported for one year, and only a small portion of the funds received by landowners is likely to be spent in that same year; monitoring expenditures will also often be incurred in perpetuity whereas transaction costs are all up-front. As a simplifying assumption, all landowner expenditures and service fees are assumed to occur in the same year that the transaction takes place.

Payroll Impacts

- The domestic jobs supported by Interior in Table 2-1 represent additional jobs above and beyond Interior employees.
- For Table 2-1, 2015 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.
- DOI payroll contributions are estimated using the IMPLAN Labor Income Change activity. Leakages in this IMPLAN activity include payroll taxes and salaries earned by employees who commute from outside of the local area (and thus primarily spend their salaries outside of the local area). Contributions are based on household spending patterns for a distribution of household income levels. Household spending patterns account for leakages related to personal taxes and savings. For the payroll contributions shown in Table 2-1, a national multiplier was used to estimate the employment contributions of Interior payroll, equaling 8.5 jobs per \$1 million.
- For State-level salary effects shown in Tables 3-1 and 3-2, 2015 payroll data and State-level multipliers were used. Since State multipliers do not capture leakages outside of each State, 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.

Recreation Impacts

- Total recreation economic and employment at the national-level are larger than the sum of the state level contributions because interstate expenditures are leaked from state level models but are included in the national level model.

³³ In previous years, we used Sector 374 (management, scientific, and technical consulting services). The change to Sector 440 is related to IMPLAN's switch to a 536-sector scheme.

- Last year's report did not include data for NPS and FWS units in U.S. territories. This year's report does include these areas in the economic analysis for NPS units. Visitation data for NPS reported in Table 1-1 includes visitation for all NPS units including U.S. territories. 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, and data from *2015 National Park Visitor Spending Effects, Economic Contributions to Local Communities, States, and the Nation*, (Cullinane Thomas, et al. 2015). We calculated site-level impacts of visitor spending for BLM sites using Forest Service expenditure data, and for Reclamation expenditures 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. BLM visitation estimates are from BLM's Recreation Management Information System (RMIS). BLM used results from the U.S. Forest Service's National Visitor Use Monitoring (NVUM) survey to estimate the distribution of visitor types and the associated expenditure profile.
- For the Bureau of Reclamation, most project recreation sites are managed by Reclamation partners, including both Federal and non-Federal entities.
- NPS visitation data are for CY 2015. FWS visitation data are for FY 2015. BLM visitation data are for FY 2013. BOR visitation data are for FY 2012, however the economic contribution estimates for BOR are based on 2011 spending information in 2013-\$ (from FWS). Multipliers used for BOR are from the 2008 version of IMPLAN. Multipliers used for NPS and FWS are from the 2013 version of IMPLAN.
- 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.
- The BOR and FWS recreation valued added figures are based on the ratio of NPS valued added to total output.