

Appendix R

Economic Impact Analysis

Methodology

Introduction

This appendix describes the methodology and data used to model the economic impacts of public land management decisions on communities surrounding federal lands. Input-output models, such as the Impact Analysis for Planning (IMPLAN) model, provide a quantitative representation of the production relationships between individual economic sectors. Thus, the economic modeling analysis uses information about physical production quantities and the prices and costs for goods and services. The inputs required to run the IMPLAN model are described in the following narrative and tables. The resulting estimates from the IMPLAN model, by alternative, can be found in the Economic Conditions section in Chapter 4. The first section of this appendix describes general aspects of the IMPLAN model and how it was used to estimate economic impacts. The remaining sections provide additional detailed data used in the analysis for livestock grazing, recreation, and oil and gas.

L.2 The IMPLAN Model

IMPLAN is a widely accepted economic model commonly used for regional contribution and impact analysis. This model provides a mathematical representation of the local economy, which enables the flow of money, goods, and services to be tracked and reported in terms of regional jobs and income. IMPLAN models the way a dollar injected into one sector is spent and re-spent in other sectors of the local economy, creating a ripple-like effect. This ripple effect, also called the “multiplier effect,” reflects changes in economic sectors that may not be directly impacted by management actions, but are linked to industries that are directly impacted. In IMPLAN, these ripple effects are termed indirect impacts (for changes in industries that sell inputs to the industries that are directly impacted) and induced impacts (for changes in household spending as household income increases or decreases due to the changes in production).

This analysis conducted for this RMP used IMPLAN 2012; prior to running the model, cost and price data were converted to a consistent dollar year (2012) using sector-specific adjustment factors from the IMPLAN model. The values in this appendix are expressed in year 2012 dollars so that the earnings and employment estimates can be easily compared to the latest (i.e., 2012) earnings and employment data available from the Bureau of Economic Analysis. The current IMPLAN model has 440 economic sectors, of which 151 are represented in the eight planning area counties. This analysis involved direct changes in economic activity for 54 IMPLAN economic sectors, as well as changes in all other related sectors due to the ripple effect. The IMPLAN production coefficients were modified to reflect the interaction of producing sectors in the study area. As a result, the calibrated model does a better job of generating multipliers and the subsequent impacts that reflect the interaction between and among the sectors in the study area compared to a model using unadjusted national coefficients. For instance, worker productivity in oil and gas production is higher in Montana than the national average.

Key variables within the IMPLAN model use data specific to the HiLine region of Montana, including employment estimates, labor earnings, and total industry output. Data on resource outputs from the BLM (recreation visits, AUMs, mineral uses, etc.) are also specific to the BLM in the HiLine region. Because resource outputs from the BLM are only available at the multi-county level the IMPLAN model is run at a regional (multi-county) scale, with the coefficients that describe linkages between sectors aggregated to the eight-county level. Because of this mathematical aggregation, impacts for individual counties and communities are not included.

Livestock Grazing

Economic impacts associated with livestock grazing on BLM lands within the planning area were estimated in accordance with protocols developed by Economists at the Bureau of Land Management and Forest Service (U.S. Department of Interior 2012). Forage availability was measured in animal unit months (AUMs), with one AUM defined

as the amount of forage needed to feed a cow, a bison, one horse, or five sheep for one month. Data on two types of AUM measures were obtained from the BLM's Rangeland Administration System (BLM 2013): Active AUMs (amount of forage authorized under a term grazing permit or lease) and Billed AUMs (the amount of forage that the BLM billed for in a year). According to Rangeland Reports there were 408,282 active AUMs within the HiLine in 2012 but only 371,975 AUMs were billed that year.

Billed AUMs have a tendency to be lower than active authorized levels because active AUM counts include unit months indefinitely suspended for non-use, and forage needs of permitted operators change from year to year so they may utilize less than the maximum number of AUMs they are authorized under their permit. Since billed use reflects the availability of forage under varying climatic conditions (e.g. drought, wildfire) and provides a more accurate estimate of actual use levels by permittees, billed use is a more appropriate baseline from which reductions in available AUMs due to surface disturbance or restrictions on grazing land should be measured. If reductions were measured from a baseline of active AUMs, economic impacts of livestock grazing on BLM land within the HiLine would be overstated.

The direct employment associated with cattle and sheep grazing on BLM lands within the planning area was estimated in two steps. First, the number of hired farm laborers was taken from the 2007 Census of Agriculture for the beef cattle ranching and sheep and goat farming sectors. Second, unpaid and self-employed individuals are considered since the Census of Agriculture data does not include these individuals. The 2005-2009 American Community Survey includes information on the class of worker (e.g., self-employed, local government, unpaid family worker) by two-digit NAICS industry. In order to determine how public land forage contributed to industry employment (hired laborers, unpaid and self-employed individuals) the number of direct jobs per unit of forage was calculated. Data from the Census of Agriculture on total inventory of beef cows that calved, ewes one year or older, and all goats was used to calculate total forage requirements.¹ The ratio of employment to forage requirements was then used to calculate direct contributions from BLM-administered forage across the HiLine, using data on authorized AUMs² in 2012. The indirect and induced contributions were then estimated using analysis-by-parts in IMPLAN.³ Economic impacts associated with changes in range management under the alternatives were modeled in similar fashion.

Recreation

Visitation data collected from BLM's Recreation Management Information System RMiS suggests that BLM lands within the HiLine District support more than 113,000 recreational visits annually, more than half of which are associated with wildlife-related activities (BLM, RMIS 2011). On their way to the planning area, and once they arrive, these visitors spend money on goods and services such as gas, food, lodging, and souvenirs. In contrast to many other resource and land uses, outdoor recreation is not captured by any one industrial sector. Instead, spending associated with recreational visits to the HiLine stimulates economic activity in a wide range of economic sectors associated with accommodations and food service, arts and entertainment, passenger transportation, and retail trade (Marcouiller and Xia 2008).

Rather than measuring economic impacts, the analysis conducted for the revised HiLine RMP examined the economic significance of outdoor recreation on planning area lands to the local economy. While both impact and significance analysis measures the amount of economic activity in the local economy attributable to outdoor recreation within a defined area, impact analysis only includes spending by visitors who reside outside of the local region since their spending constitutes "new dollars" being injected into the local economy. A significance analysis however, includes the effects of spending by all visitors, both those who reside in the planning area and those who do not. Since much of the spending by local recreationists would likely be shifted to other sectors of the local economy, the results of this analysis do not reflect the loss to the local economy if recreation on BLM lands across the HiLine were eliminated. Instead, the significance analysis shows the size and nature of economic activity associated with these recreational experiences to show how important they are to the local economy.

¹ Total cattle annual Animal Unit Months (AUM) required = total inventory * 12; Total sheep annual AUMs required = (Sheep & lambs or Goats * 12)/5.

² Authorized AUMs are those AUMs that are authorized under a term grazing permit or lease.

³ Analysis-by-parts is a method of calculating the impacts of a particular activity by separating out the various spending activities of that activity and analyzing their specific impacts. This is done since production functions for IMPLAN sectors 11 and 14 for cattle ranching and other animal production, are not considered completely adequate for consideration of indirect and induced contributions.

Outdoor recreationists participating in activities on public lands have unique spending profiles. Analyses of expenditures reported by national forest visitors has shown that the primary factor determining the amount of money spent on a recreational visit to public lands was the type of trip taken rather than the specific activity they intended to participate while visiting (White, Goodding, and Stynes 2013). Based on this assumption, estimates of visitation to BLM lands within the HiLine were segmented into local and non-local visits and then by trip type. Trip segments examined in the significance analysis included:

Visitors who reside greater than 50 miles from BLM land within the planning area:

- Non-local residents on day trips
- Non-local residents staying overnight on BLM land
- Non-local residents staying overnight off BLM land

Visitors who live within 50 miles of BLM land within the planning area:

- Local residents on day trips
- Local residents staying overnight on BLM land
- Local residents staying overnight off BLM land

The analysis of recreation on BLM lands within the HiLine assumes that visitation in the planning area would be similar to that found on the Lewis and Clark National Forest because of their proximity and similar motorized use levels, enabling analysts to utilize detailed National Visitor Use Monitoring (NVUM) data. Expenditures associated with these visits were estimated using national forest visitor spending profiles developed by the U.S. Forest Service from NVUM survey responses⁴. Using the Lewis and Clark National Forest as a proxy for the HiLine, spending profiles for average spending forests (Table R.2) were applied to visitation estimates for the planning area (Table R.1). Economic contributions of current recreation use levels, and those anticipated under alternative management actions, were modeled in IMPLAN to estimate the indirect and induced effects of recreation related spending under the alternatives on the local economy.

Table R.1 Annual HiLine Recreation Visits by Trip Segment							
<i>Annual Visits</i>	<i>Non-Local Segments</i>			<i>Local Segments</i>			<i>Total Annual Visits</i>
	<i>Day</i>	<i>Overnight on NF</i>	<i>Overnight off NF</i>	<i>Day</i>	<i>Overnight on NF</i>	<i>Overnight off NF</i>	
Non-Wildlife	2,113	3,170	7,396	30,113	528	9,509	52,829
Wildlife	2,417	3,626	8,460	34,443	604	10,877	60,427
Share of Total Visits	4%	6%	14%	57%	1%	18%	113,256

Source: BLM, RMIS 2011; White, Goodding, and Stynes 2013

⁴ National average spending profiles are developed for seven trip type segments: day trips and overnight trips involving stays on and off the forest for local and non-local visitors, and visitors whose primary trip purpose was not recreation on the forest. Distinct spending profiles are also estimated for high and low spending areas and for selected recreation activity subgroups.

<i>Spending Category</i>	<i>Non-Local Segments</i>			<i>Local Segments</i>			<i>Non-Primary‡</i>
	<i>Day</i>	<i>Overnight on NF</i>	<i>Overnight off NF</i>	<i>Day</i>	<i>Overnight on NF</i>	<i>Overnight off NF</i>	
Lodging	0	64	183	0	31	55	136
Restaurant	16	28	119	5	7	36	95
Groceries	10	60	73	7	72	59	46
Gas and Oil	25	57	76	14	41	43	51
Other Transportation	1	2	4	0	0	1	3
Activities	4	9	29	2	4	6	18
Admissions/Fees	5	10	19	2	4	7	12
Souvenirs/Other	7	21	46	5	15	21	34
Total	67	249	550	35	173	228	397

Source: White, Goodding, and Stynes 2013

* Dollar figures are expressed in 2012 dollars and represent the spending of the entire group on BLM lands and within 50 miles of the boundary of BLM lands during the trip. Figures have been adjusted to 2012 dollars using the Bureau of Labor Statistics' CPI Inflation Calculator, available online: http://www.bls.gov/data/inflation_calculator.htm. The spending figures depicted in this table are one of three sets of national-level spending averages developed from the NVUM data. The shown spending averages are those determined to be most-applicable to the selected forest based on statistical analysis. For more information see "Estimation of National Forest Visitor Spending Averages from National Visitor Use Monitoring: Round 2" by E.M. White, D. B. Goodding, and D. J. Stynes (2013), available online: http://www.fs.fed.us/pnw/pubs/pnw_gtr883.pdf.

Oil and Gas

The economic impact analysis for mineral development reflects drilling, completion, and production activities. Future development scenarios of federally administered minerals within the HiLine District were developed by BLM minerals specialists based on known mineral potential and commercial interest in developing these resources.

Since the BLM does not know exactly what areas will be targeted for development in the future, or how technological advances may affect future production costs or industry outputs, potential economic impacts associated with future mineral development on BLM lands within the HiLine under the alternatives were developed by BLM minerals specialists based on the Reasonable Foreseeable Development scenario (Tables R.3 and R.4). Local economic activity associated with the extraction of federal solid minerals was modeled in IMPLAN as a change in final demand for construction sand and gravel and bentonite. These changes in final demand were estimated by multiplying average annual production by the average 2012 market price for construction sand/ gravel and bentonite. Secondary effects (i.e. indirect and induced) were estimated by IMPLAN based on local trade flows between industrial sectors and those that support personal consumption.

<i>Annual Average</i>						
	<i>Existing</i>	<i>Alternative A</i>	<i>Alternative B</i>	<i>Alternative C</i>	<i>Alternative D</i>	<i>Alternative E</i>
Sand and Gravel (short tons)	38,480	38,480	38,480	38,480	38,480	38,480
Bentonite (short tons)	---	230,000	230,000	230,000	230,000	172,500

Table R.4 Federal Fluid Minerals RFD						
<i>Annual Average</i>						
<i>Wells</i>	<i>Existing</i>	<i>Alternative A</i>	<i>Alternative B</i>	<i>Alternative C</i>	<i>Alternative D</i>	<i>Alternative E</i>
New Gas Wells - Producing	--	76	24	65	76	72
New Oil Wells - Producing	--	1	1	1	2	1
New Dry Wells	--	12	12	12	12	12
Gas Production (MCFs)	16,956,257	21,408,854	7,103,972	18,278,203	21,639,476	20,141,212
Oil Production (barrels)	103,353	140,058	127,515	137,044	140,264	138,891

Prices for fluid minerals are much more volatile than those for solids, so economic contributions and impacts associated with federal oil and gas production were estimated using a local industry output to employment ratio rather than as a change in final demand. This ratio was then multiplied by the oil and gas output attributable to federal minerals administered by the HiLine to obtain the direct employment effect of BLM production in the planning area (Table R.5). The indirect and induced effects were then estimated from this direct effect using IMPLAN. Impacts associated with oil and gas development under the alternatives were estimated using the same two-step process where direct employment is calculated by maintaining the industry output to employment ratio and using IMPLAN to calculate the secondary effects (indirect and induced).

Table R.5 Baseline Contributions of Federal Oil and Gas Production	
<i>Baseline Data</i>	
Total Value of 8-County Production	\$ 275,648,596
Average Output per Worker	\$ 314,237
Baseline Local Employment Contribution (jobs)	496
Direct Employment	305
Indirect & Induced Employment	191
Baseline Local Income Contribution	\$ 22,013,170
Direct Income	\$ 14,608,278
Indirect & Induced Income	\$ 7,404,892

Source: IMPLAN Impact Analysis for Planning 2012

* Multipliers are used to measure economy-wide impacts of industry-specific economic changes. Estimated as the ratio of total to direct impacts, multipliers are a measure of the ripple effect created by new money.

Payments to Counties

Federal land management agencies administer a number of revenue-sharing programs to compensate states and counties for federal lands within their boundaries. These programs are complex and include stipulations affecting the formulas for the distribution of the payments, the recipients of the payments, and the timing, number, or specified uses of the payments. Since many of the programs and payments are crosscutting, numerous land management agencies work in partnership to collect and distribute revenue to counties entitled to compensation. While only a small portion of natural

resource-related payments are associated with BLM resources, these payments are critical to funding basic services such as law enforcement, education, fire protection and road maintenance in rural communities across the West.

Revenue-sharing programs administered by the BLM entitle local governments to a portion of receipts derived from the use, extraction, or sale of natural resources on BLM lands within their jurisdiction; as well as payments in lieu of the property taxes (PILT) that would have been received if these federal lands were privately owned (Chapter 4, Tables 4.35 and 4.36). While PILT payments are calculated based on population size and the number of federal acres, revenue-sharing payments are determined by use levels and whether the revenue was generated on acquired or public domain lands⁵.

Federal revenues (Chapter 4, Tables 4.35 and 4.36) associated with livestock grazing, mineral development, right-of-ways, and recreation were estimated based on current permit and rental costs, and market values. The distribution of these payments back to State and local governments were then estimated in accordance with the regulations in Table R.6 and based on the assumption that 75% of minerals and 65% of surface acres administered by the HiLine District are public domain and 25% of minerals and 35% of surface lands were LU acquired lands.

While payments associated with BLM resources only account for a portion of natural resource-related revenue distributed to counties across the HiLine, local rural communities rely heavily on these payments to cover basic operating costs and to fund basic community services. The economic contributions of payments to counties from BLM natural resources were analyzed through the salary and non-salary expenditures funded by these payments. Using institutional and household spending profiles developed by the US Forest Service, general local government, education, road, and household spending associated with natural resource revenues were modeled in IMPLAN. To assess how management actions under the alternatives may affect future payments to counties, changes in federal, state, and county revenue from BLM land and resource uses were estimated and anticipated levels of local government, education, construction, and household spending associated with these payments were modeled in IMPLAN.

<i>Type of Payment</i>	<i>Public Domain Lands</i>	<i>Acquired (LU) Lands</i>	<i>Reclamation Lands</i>
Taylor Grazing Act of 1934 (43 U.S.C. 315)	50% of grazing fees from section 3 (inside grazing districts) and 12.5% of grazing fees from section 15 (outside grazing district) are distributed to the State. 100% of these funds are reallocated back to the counties where 50% goes to the general fund and 50% goes to schools.		
Bankhead Jones Farm Tenant Act of 1937 (7 U.S.C. 1012)		25% of gross revenue from land uses (i.e. grazing, recreation, minerals, timber, and right-of-ways) are paid to the state who distributes 100% back to counties of production for schools, roads, or both.	

⁵ There are two types of land under federal ownership: public domain and acquired. Public domain lands are those that have always been in federal ownership, while acquired lands (LU) are lands in federal ownership but were obtained from private owners.

<p>Mineral Leasing Act of 1920 (30 U.S.C. 181)</p>	<p>49% of gross revenue is distributed to the State. 25% of these funds are redistributed back to counties of production and put towards the general fund and schools.</p>		
<p>Proceed of Sales Payments (31 U.S.C. 487)</p>			<p>4% of gross revenues from the sale of lands and materials is distributed to the State</p>
<p>PILT</p>	<p>Annual PILT payments are estimated in two ways based on 1) eligible federal acres in the county, 2) federal revenue sharing prior fiscal year, and 3) the population of the county to the extent that it provides a limit for the payment. The county then receives the larger of the two calculated amounts as PILT which is put towards the general fund.</p>		

Literature Cited

Marcouiller, D.W. and X. Xia. 2008. Distribution of income from tourism sensitive employment. *Tourism Economics* 14, 3: 545-565. Available online at <http://urpl.wisc.edu/people/marcouiller/publications/TE.pdf>.

White, Eric M., D. B. Goodding, and D. J. Stynes. 2013. "Estimation of National Forest Visitor Spending Averages from National Visitor Use Monitoring: Round 2" by E.M. Available online at http://www.fs.fed.us/pnw/pubs/pnw_gtr883.pdf.

