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.

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 (2021) 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 178 are represented in the seventeen 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 region surrounding the Miles City Field Office in Montana, including employment estimates, labor earnings, and total industry output. Data on resource outputs from BLM (recreation visits, AUMs, mineral uses etc.) are also specific to BLM in the Miles City region. Because resource outputs from 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 administered 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 calf pair or five sheep for one month. Average annual AUMs authorized within the Field Office were obtained from the BLM's Rangeland Administration System (BLM 2013). According to Rangeland Reports the MCFO supported 524,648 cattle AUMs and 21,860 sheep AUMs in 2012.

The direct employment associated with cattle and sheep grazing on BLM administered lands within the planning area was estimated in two steps. First, the number of hired farm laborers was taken from the 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 MCFO, using data on authorized AUMs[2] 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 administered lands within the MCFO support more than 135,255 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 MCFO 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 MCFO 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 the BLM administered lands across the MCFO were eliminated. Instead, the significance analysis shows the size and nature of economic activity associated with these recreational experiences to show how importance they are to the local economy.

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 administered lands within the MCFO were segmented into local and non-local visits and then by trip type. Trip segments examined in the significance analysis included:

[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.

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

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

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

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

The analysis of recreation on BLM administered lands within the MCFO assumes that visitation in the planning area would be similar to that found nearby Dakota Prairie National Grasslands (DPNG), 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 responses[4]. Using the DPNG as a proxy for the MCFO, local recreation-related spending associated with visits to the MCFO was estimated by applying NF spending profiles (Table 2) to field office visits by trip type (Table 1). The economic contributions of current recreational visits to BLM administered lands within the MCFO, 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 1.
ANNUAL MCFO RECREATION VISITS BY TRIP SEGMENT

Annual Visits	Non-Local Segments			Local Segments			Total Annual Visits
	Day	Overnight on BLM	Overnight off BLM	Day	Overnight on BLM	Overnight off BLM	
Non-Wildlife Related	2,113	3,170	7,396	30,113	528	9,509	52,829
Wildlife Related	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; Percentages derived from White, Goodding, and Stynes, 2013

TABLE 2.
SPENDING PROFILES BY TRIP SEGMENTS FOR AVERAGE SPENDING FORESTS*

Spending Category	Non-Local Segments			Local Segments			Non-Primary‡
	Day	Overnight on NF	Overnight off NF	Day	Overnight on NF	Overnight off NF	
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

[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.

Spending Category	Non-Local Segments			Local Segments			Non-Primary‡
	Day	Overnight on NF	Overnight off NF	Day	Overnight on NF	Overnight off NF	
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 administered lands and within 50 miles of the boundary of BLM administered 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.**

Minerals

The economic impact analysis for mineral development reflects drilling, completion, and production activities. Future development scenarios of federally administered minerals within the Miles City Field Office 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 impacts of future oil and gas development under the alternatives were estimated from the Reasonable Foreseeable Development scenario developed by BLM minerals specialists see tables 3 and 4).

TABLE 3.
FEDERAL SOLID MINERALS RFD

	Annual Average					
	Existing	Alt A	Alt B	Alt C	Alt D	Alt E
Coal (short tons)	16,714,925	22,487,143	22,487,143	22,487,143	22,487,143	22,487,143
Bentonite (short tons)	337,838	337,838	337,838	337,838	337,838	337,838

TABLE 4.
FEDERAL FLUID MINERALS RFD

	Annual Average					
Wells	Existing	Alt A	Alt B	Alt C	Alt D	Alt E
New CBNG Wells- Producing	--	26.26	17.74	26.53	27.00	25.58
New Gas Wells - Producing	--	20.11	12.84	20.63	20.79	18.42
New Oil Wells - Producing	--	24.00	15.32	24.53	24.89	21.95
New Dry CBNG Wells	--	1.11	0.79	1.11	1.11	1.05
New Dry Gas Wells	--	5.37	3.37	5.42	5.58	4.84
New Dry Oil Wells	--	6.79	4.32	6.95	7.00	6.21
Gas Production (mcfs)	7,560,000	7,962,105	7,816,842	7,972,632	7,975,789	7,928,421
Oil Production (barrels)	5,595,000	5,955,000	5,824,737	5,962,895	5,968,421	5,924,211

The minerals analysis was based on forecasts of federal coal and bentonite production from BLM administered minerals within the planning area (Table 5) and average 2012 prices for Powder River Basin coal and domestic

bentonite (USGS, 2013). To quantify economic contributions of current federal solid mineral production, and those supported by anticipated production under the alternatives, the 2012 value of federal production was entered into IMPLAN as a change in final demand in the industrial sectors for coal and clay mining.

Since prices for fluid minerals are much more volatile than those for solids, economic contributions and impacts associated with federal oil and gas production were estimated based on the ratio of industry output to employment rather than as a change in final demand. This ratio was estimated based on total oil and gas production and industry employment. Data specific to the 17- county study was collected from DNRC: BOG and IMPLAN, and provided.

This ratio was then multiplied by the oil and gas output attributable to federals minerals administered by the MCFO to obtain the direct employment effect of BLM production in the planning area. 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 5.
BASELINE CONTRIBUTIONS & IMPACTS

Baseline Data	
Total Value of 17-County Production	$ 2,276,386,550
Average Output per Worker	$ 1,732,805
Total Local Employment Contribution (jobs)	548
Direct Employment	315
Indirect & Induced Employment	233
Total Local Income Contribution	$ 30,911,763
Direct Income	$ 21,545,107
Indirect & Induced Income	$ 9,366,656

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 Bureau of Land Management entitle local governments to a portion of receipts derived from the use, extraction, or sale of natural resources on BLM administered 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 (Table 6). 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 lands[5].

Federal revenues (Table 4-146) associated with livestock graving, mineral development, right-of-ways, timber, 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 6 and based on the assumption that 75% of minerals and 65% of surface acres administered by the Miles City Field Office 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 MCFO, 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 administered 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.

TABLE 6.
DISTRIBUTION OF NATURAL RESOURCE RELATED PAYMENTS TO STATE/COUNTIES

Type of Payment	Public Domain Lands	Acquired (LU) Lands	Reclamation Lands
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 area 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.	
Mineral Leasing Act of 1920 (30 U.S.C. 181)	49% of gross revenue is distributed to the State. These funds are redistributed back to counties of production and put towards the general fund and schools		

[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.**

Type of Payment	**Public Domain Lands**	**Acquired (LU) Lands**	**Reclamation Lands**
Proceed of Sales Payments (31 U.S.C. 487)			4% of gross revenues from the sale of lands and materials is distributed to the State
PILT	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.		

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