

Appendix AA

Economic Impact Analysis Methodology



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AA. Economic Impact Analysis Methodology

AA.1 Introduction

This appendix describes the methods and data that underlie the economic impact modeling analysis. Input-output models such as the Impact Analysis for Planning (IMPLAN) model, an economic impact analysis 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, are in **Chapter 4**, Environmental Consequences, **Section 4.15**, Social and Economic Conditions. The first portion of the following information 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.

AA.2 The IMPLAN Model

IMPLAN is a regional economic model that provides a mathematical accounting of the flow of money, goods, and services through a region's economy. The model provides estimates of how a specific economic activity translates into jobs and income for the region. It includes the ripple effect (also called the multiplier effect) of 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 used IMPLAN 2011; prior to running the model, cost and price data were converted to a consistent dollar year (2011) using sector-specific adjustment factors from the IMPLAN model. However, the values in this appendix are expressed in year 2010 dollars for comparability with the data provided in the socioeconomics section in chapter 3.

The current IMPLAN model has 440 economic sectors, of which 333 are represented in the Socioeconomic Study Area counties. This analysis involved direct changes in economic activity for 15 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 Socioeconomic Study Areas. 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 Socioeconomic Study Area compared to a model using unadjusted national coefficients. Key variables used in the IMPLAN model were filled in using data specific to the Socioeconomic Study Area, including employment estimates, labor earnings, and total industry output.

The trade data available in the current version of IMPLAN (Version 3.0) make it possible to do multi-region analysis to track how an impact on any of the IMPLAN sectors in the study area affects production in any of the sectors in any other region of the US. For this analysis, this feature allowed the estimation of how an impact in the primary study area disperses into

the secondary study area, and how these effects in the secondary study area create additional local effects in the primary study area. As a result, it was possible to estimate not only the jobs and income generation in the primary study area, but to also estimate how the economic activity in the primary study area affected jobs and income generation in the secondary study area.

AA.3 Livestock Grazing

Economic impacts from changes to livestock grazing are a function of the amount of forage available and the economic value of forage.

Forage availability was measured in Animal Unit Months (AUMs), with one AUM defined as the amount of forage needed to feed one cow, one horse, or five sheep for one month. Data on forage availability were obtained from BLM's Rangeland Administration System (BLM 2012a) and from the Forest Service's INFRA (infrastructure) range module (Forest Service 2013). Two types of AUM measures were used: Active AUMs and Billed AUMs. Active AUMs measure the amount of forage from land available for grazing. The Forest Service designates this measure "permitted" AUMs. Billed AUMs measure the amount of forage for which the BLM and Forest Service bill annually (i.e., the amount of forage that ranchers actually use, which is typically less than the amount of forage available). The Forest Service uses the designation "authorized" AUMs.

Data for 2011 and 2013 were used for active AUMs. BLM provided data on the breakdown of active AUMs in various GRSG habitat and non-habitat classes by alternative. For billed AUMs, data for 2000 to 2011 were used to develop a 12-year average for billed AUMs on BLM-administered lands. Under current management (Alternative A), the analysis estimated 2,047,170 total active AUMs in the Socioeconomic Study Area, with 1,190,255 active AUMs in GRSG habitat (all designated habitat [ADH]) in the Socioeconomic Study Area (BLM 2012a and Forest Service 2013).¹² The data on active and billed AUMs were used to determine the historical ratio of billed AUMs to active AUMs for each BLM field office. The analysis assumed a billed to active ratio of 100 percent for Forest Service lands because Forest Service has historically adjusted the number of active AUMs to correspond to the number of recently billed AUMs. **Table AA-1** presents the current and historical data used in the analysis.

¹ Because permitted AUMs include active and suspended AUMs (in BLM terminology), this comparison of total active AUMs with ADH permitted AUMs may overestimate the loss of AUMs under Alternative C.

² When a portion of an allotment was found in GRSG habitat, only the portion with GRSG was excluded from total active AUMs, under Alternatives C (not the entire allotment).

Table AA-1
Current and Historical Annual Animal Unit Months Data

	Active AUMs	Active AUMs in ADH	Billed as Share of Active
Bruneau Field Office	109,567	98,528	78%
Burley Field Office	123,505	76,765	72%
Challis Field Office	53,570	39,935	59%
Dillon Field Office	72,637	64,283	75%
Four Rivers Field Office	118,918	43,602	81%
Jarbidge Field Office	178,271	129,014	84%
Owyhee Field Office	125,140	101,029	86%
Pocatello Field Office	68,768	40,876	86%
Salmon Field Office	55,966	37,376	80%
Shoshone Field Office	196,137	182,430	61%
Upper Snake River Field Office	140,084	126,608	67%
Beaverhead-Deerlodge National Forest	154,629	42,832	100%
Boise National Forest	59,319	9,596	100%
Caribou-Targhee National Forest	288,344	59,660	100%
Salmon-Challis National Forest	146,804	54,478	100%
Sawtooth National Forest	155,511	83,244	100%
Socioeconomic Study Area	2,047,170	1,190,255	-

Sources: Calculated based on data from BLM 2012a and Forest Service 2013.

ADH all designated habitat

AUM animal unit month

Forage availability was estimated for all alternatives. Alternatives A, B, D, E, and the Proposed Plan used the current data for active and billed AUMs (obtained as explained above). Alternative C discounted the current data to remove 100 percent of active and billed AUMs in ADH, as designated by the alternative. Alternative F discounted the current data to remove 25 percent of active and billed AUMs in ADH, as designated by the alternative. **Table AA-2** shows the resulting reductions in billed AUMs, calculated as the difference between the initial billed AUMs and the reduced billed AUMs under each alternative. AUMs are distinguished between those allocated to sheep, and those allocated to cattle and other animals, to allow different valuation of forage, as explained further below. The BLM and Forest Service consider these estimates to be a low-impact scenario because they do not account for the possibility that an initial reduction in AUMs on BLM-administered lands could lead to the loss of additional AUMs due to seasonal limitations in the availability of grazing areas. The possibility of additional losses in AUMs due to seasonal restrictions in the availability of grazing areas is considered in the high-impact scenario explained below.

Table AA-2
Estimated Change in Annual Animal Unit Months by Alternative and Livestock Type,
Relative to Alternative A, Low Impact Scenario

	Alternatives B, D, E, and Proposed Plan	Alternative C	Alternative F
Total			
Bruneau Field Office	0	-70,227	-19,528
Burley Field Office	0	-55,757	-14,252
Challis Field Office	0	-28,103	-7,026
Dillon Field Office	0	-45,766	-11,441
Four Rivers Field Office	0	-26,174	-9,036
Jarbidge Field Office	0	-107,571	-27,623
Owyhee Field Office	0	-92,142	-23,084
Pocatello Field Office	0	-38,523	-9,630
Salmon Field Office	0	-34,087	-8,522
Shoshone Field Office	0	-92,963	-26,828
Upper Snake River Field Office	0	-86,700	-21,695
Beaverhead-Deerlodge National Forest	0	-42,832	-10,708
Boise National Forest	0	-9,596	-2,399
Caribou-Targhee National Forest	0	-59,660	-14,915
Salmon-Challis National Forest	0	-54,478	-13,619
Sawtooth National Forest	0	-83,244	-20,811
Socioeconomic Study Area	0	-927,823	-241,116
Cattle and Other			
Bruneau Field Office	0	-70,157	-19,508
Burley Field Office	0	-50,973	-13,029
Challis Field Office	0	-27,710	-6,927
Dillon Field Office	0	-44,857	-11,213
Four Rivers Field Office	0	-24,562	-8,480
Jarbidge Field Office	0	-103,319	-26,531
Owyhee Field Office	0	-90,634	-22,706
Pocatello Field Office	0	-34,665	-8,665
Salmon Field Office	0	-33,944	-8,486
Shoshone Field Office	0	-78,244	-22,580
Upper Snake River Field Office	0	-70,327	-17,598
Beaverhead-Deerlodge National Forest	0	-57,768	-14,442
Boise National Forest	0	-9,964	-2,491
Caribou-Targhee National Forest	0	-45,984	-11,496
Salmon-Challis National Forest	0	-57,274	-14,318

Table AA-2
Estimated Change in Annual Animal Unit Months by Alternative and Livestock Type,
Relative to Alternative A, Low Impact Scenario

	Alternatives B, D, E, and Proposed Plan	Alternative C	Alternative F
Sawtooth National Forest	0	-68,865	-17,216
Socioeconomic Study Area	0	-869,247	-225,688
Sheep			
Bruneau Field Office	0	-70	-20
Burley Field Office	0	-4,784	-1,223
Challis Field Office	0	-394	-99
Dillon Field Office	0	-909	-227
Four Rivers Field Office	0	-1,612	-556
Jarbridge Field Office	0	-4,253	-1,092
Owyhee Field Office	0	-1,507	-378
Pocatello Field Office	0	-3,859	-965
Salmon Field Office	0	-144	-36
Shoshone Field Office	0	-14,719	-4,248
Upper Snake River Field Office	0	-16,373	-4,097
Beaverhead-Deerlodge National Forest	0	-2,373	-593
Boise National Forest	0	-3,527	-882
Caribou-Targhee National Forest	0	-18,046	-4,512
Salmon-Challis National Forest	0	-2,318	-580
Sawtooth National Forest	0	-19,648	-4,912
Socioeconomic Study Area	0	-94,535	-24,417

Sources: Calculated based on data from BLM 2012a and Forest Service 2013.

In addition to the low-impact scenario reflected in Table R-2, the BLM and Forest Service considered the possibility that the loss of AUMs on public lands could lead to the loss of additional AUMs due to seasonal limitations of grazing areas. This would be the case if livestock operations have no reasonable alternative to seasonal grazing on public lands. Livestock grazing on federal lands often occurs during the spring and summer seasons, with other feeding alternatives (hay) being used during fall and winter. If there are no grazing alternatives to federal lands during spring and summer, farmers may need to reduce their operations and the resulting loss of output, jobs, and earnings would be larger than that otherwise estimated. Torell et al. (2014) provide estimates of the potential impacts to a model ranch in Idaho from seasonal closures of federal lands for cattle grazing. These estimates show the number of AUMs lost on and off BLM-administered lands for each AUM lost on BLM-administered lands under various scenarios. These scenarios range from a 25 percent reduction in BLM AUMs to a complete elimination of AUMs on BLM-administered lands with the livestock operation going out of business. The estimates are based on an economic model that assumes farmers respond to the loss of availability of federal lands for grazing in several ways to maximize their profits (gross margins), including

reducing the size of their operations. Based on the Torell et al. (2014) estimates, BLM and Forest Service assumed that for each BLM AUM lost under Alternative C, an additional 1.01 AUMs would be lost for a total of 2.01 AUMs lost (mid-point between the scenarios of 100 percent loss of BLM AUMs with and without closure of operations).. Under Alternative F, an additional 0.47 AUM would be lost for each reduction of BLM AUMs for a total of 1.47 AUMs (scenarios of loss of 25 percent of AUMs on BLM-administered lands). These AUM adjustment factors are based on a model Idaho ranch that relies on a total of approximately 4,620 AUMs, of which 2,098 AUMs (45%) are linked to federal land. These factors were applied only to cattle AUMs, because no similar estimate was available for sheep. **Table AA-3** shows the resulting reductions in billed AUMs, calculated as the difference between the initial billed AUMs and the reduced billed AUMs under each alternative.

Table AA-3
Estimated Change in Annual Animal Unit Months by Alternative and Livestock Type,
Relative to Alternative A, High Impact Scenario

	Alternatives B, D, E, and Proposed Plan	Alternative C	Alternative F
Total			
Bruneau Field Office	0	-141,086	-28,696
Burley Field Office	0	-107,239	-20,376
Challis Field Office	0	-56,091	-10,282
Dillon Field Office	0	-91,071	-16,711
Four Rivers Field Office	0	-50,982	-13,022
Jarbidge Field Office	0	-211,924	-40,093
Owyhee Field Office	0	-183,682	-33,756
Pocatello Field Office	0	-73,536	-13,703
Salmon Field Office	0	-68,371	-12,510
Shoshone Field Office	0	-171,990	-37,440
Upper Snake River Field Office	0	-157,730	-29,966
Beaverhead-Deerlodge National Forest	0	-118,487	-21,823
Boise National Forest	0	-23,555	-4,543
Caribou-Targhee National Forest	0	-110,473	-21,411
Salmon-Challis National Forest	0	-117,438	-21,628
Sawtooth National Forest	0	-158,067	-30,220
Socioeconomic Study Area	0	-1,841,721	-356,179
Cattle and Other			
Bruneau Field Office	0	-141,015	-28,677
Burley Field Office	0	-102,455	-19,153
Challis Field Office	0	-55,697	-10,183
Dillon Field Office	0	-90,162	-16,484
Four Rivers Field Office	0	-49,370	-12,466
Jarbidge Field Office	0	-207,671	-39,001

Table AA-3
Estimated Change in Annual Animal Unit Months by Alternative and Livestock Type,
Relative to Alternative A, High Impact Scenario

	Alternatives B, D, E, and Proposed Plan	Alternative C	Alternative F
Owyhee Field Office	0	-182,175	-33,378
Pocatello Field Office	0	-69,677	-12,738
Salmon Field Office	0	-68,227	-12,474
Shoshone Field Office	0	-157,271	-33,193
Upper Snake River Field Office	0	-141,356	-25,869
Beaverhead-Deerlodge National Forest	0	-116,115	-21,230
Boise National Forest	0	-20,028	-3,662
Caribou-Targhee National Forest	0	-92,427	-16,899
Salmon-Challis National Forest	0	-115,120	-21,048
Sawtooth National Forest	0	-138,419	-25,308
Socioeconomic Study Area	0	-1,747,186	-331,762
Sheep			
Bruneau Field Office	0	-70	-20
Burley Field Office	0	-4,784	-1,223
Challis Field Office	0	-394	-99
Dillon Field Office	0	-909	-227
Four Rivers Field Office	0	-1,612	-556
Jarbidge Field Office	0	-4,253	-1,092
Owyhee Field Office	0	-1,507	-378
Pocatello Field Office	0	-3,859	-965
Salmon Field Office	0	-144	-36
Shoshone Field Office	0	-14,719	-4,248
Upper Snake River Field Office	0	-16,373	-4,097
Beaverhead-Deerlodge National Forest	0	-2,373	-593
Boise National Forest	0	-3,527	-882
Caribou-Targhee National Forest	0	-18,046	-4,512
Salmon-Challis National Forest	0	-2,318	-580
Sawtooth National Forest	0	-19,648	-4,912
Socioeconomic Study Area	0	-94,535	-24,417

Sources: Calculated based on data from BLM 2012a, Forest Service 2013 and Torell 2014.

The economic value of forage is estimated based on the value of production associated with the forage. Values for cattle and sheep are estimated separately, with the value of forage for other animals considered equivalent to the value for cattle. Due to price fluctuations, average per-AUM values for cattle and sheep are based on the 2002 to 2011 average value of production estimates from the US Department of Agriculture, Economic Research Service (2012). The value for cattle is \$50.37 per AUM, and the value for sheep is \$57.20 per AUM (in 2010 dollars). Including indirect and induced impacts, the per-AUM values are \$101.90 for cattle and \$127.54 for sheep in the primary study area and \$102.19 for cattle and \$127.89 for sheep in the primary and secondary study area (in 2010 dollars). **Table AA-4** shows the economic impact assumptions for cattle and sheep. The direct economic impact is the estimated change in livestock output per AUM; IMPLAN generates the indirect and induced impacts.

Table AA-2
Assumptions for Analysis of Impacts on Output for Livestock Grazing

Economic Impact	Cattle	Sheep
Primary Study Area		
Direct Economic Impact (\$/AUM)	\$50.37	\$57.20
Indirect Economic Impact (\$/AUM) ¹	\$44.69	\$59.61
Induced Economic Impact (\$/AUM) ²	\$6.83	\$10.74
Total Economic Impact (\$/AUM)	\$101.90	\$127.54
Multiplier (Total Impact/Direct Impact)	2.02	2.23
Primary and Secondary Study Area		
Direct Economic Impact (\$/AUM)	\$50.37	\$57.20
Indirect Economic Impact (\$/AUM) ¹	\$44.92	\$59.86
Induced Economic Impact (\$/AUM) ²	\$6.90	\$10.83
Total Economic Impact (\$/AUM)	\$102.19	\$127.89
Multiplier (Total Impact/Direct Impact)	2.03	2.24

Note: All dollar values are in 2010 dollars.

¹ Indirect impacts reflect increased demand in sectors that directly or indirectly provide supplies to the livestock industry.

² Induced impacts reflect increased demand in the consumer and government sectors.

Table AA-5 provides a summary of the employment impacts that would result, according to IMPLAN, based on unit changes in livestock AUMs.

Table AA-3
Assumptions for Analysis of Employment Impacts for Livestock Grazing

Employment Impact	Cattle	Sheep
Primary Study Area		
Direct Employment (Jobs/1,000 AUMs)	0.000559	0.000980
Indirect Employment (Jobs/1,000 AUMs)	0.000338	0.000603
Induced Employment (Jobs/1,000 AUMs)	0.000067	0.000104
Total Employment (Jobs/1,000 AUMs)	0.000963	0.001688

Table AA-3
Assumptions for Analysis of Employment Impacts for Livestock Grazing

Employment Impact	Cattle	Sheep
Primary Study Area		
Multiplier (Total Impact/Direct Impact)	1.72	1.72
Average Earnings per Job (2010 dollars)	\$36,839	\$22,890
Primary and Secondary Study Area		
Direct Employment (Jobs/1,000 AUMs)	0.000559	0.000980
Indirect Employment (Jobs/1,000 AUMs)	0.000338	0.000603
Induced Employment (Jobs/1,000 AUMs)	0.000067	0.000104
Total Employment (Jobs/1,000 AUMs)	0.000963	0.001688
Multiplier (Total Impact/Direct Impact)	1.72	1.72
Average Earnings per Job (2010 dollars)	\$36,904	\$22,934

Note: Direct, indirect, and induced employment impacts and average earnings per job are calculated using IMPLAN.

Output, labor, and earning impacts summarized in Table 4-71 in the economic impact section of the EIS are presented as lower and upper bound impacts. Estimates of lower bound impacts are equal to the ‘low impact scenario’ reductions in AUMs in Table R-2 multiplied by impact multipliers in Tables R-4 and R-5; calculations are performed for cattle and sheep separately and then added together. Estimates of upperbound impacts are equal to the ‘high impact scenario’ reductions in AUMs in Table R-3, and multiplied by multipliers in Tables R-4 and R-5 in a similar manner, noting that the high impact reductions in AUMs include the Torell et al. (2014) production adjustment factors as described earlier (similar adjustment factors are not available for sheep).

The IMPLAN sectors used to model an exogenous change in demand for livestock grazing were the following (IMPLAN sector numbers are shown in brackets): grain farming (2), all other crop farming (10), support activities for agriculture and forestry (19), residential structures maintenance and repairs (40), wholesale trade (319), truck transportation (335), banking (354), real estate (360), accounting (368), veterinary services (379), equipment repair and maintenance (417), and labor income (NA). Cattle grazing used the following additional sector: cattle ranching and farming (11). Sheep grazing used the following additional sectors: animal production except cattle and poultry and eggs (14) and retail-food and beverages (324).

AA.4 References

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