REGIONAL-LEVEL ECONOMIC IMPACTS OF GRAZING POLICY CHANGES: A CASE STUDY FROM OWYHEE COUNTY, IDAHO

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ABSTRACT

Regional economic impact models are important tools used to analyze the impacts of policy changes to regional, state, county, or local economies. The National Environmental Policy Act requires economic analysis in preparing environmental impact statements to show the effects of policy alternatives on local economies. An input-output model was constructed for Owyhee County, Idaho, using farm- and ranch-level economic information to modify and "localize" the county IMPLAN model. This paper shows why an "out-of-the-box" model might not always be the best way to accurately account for economic impacts of policy changes on communities dependent on ranching and federal grazing. Results show that disparities exist between the hybrid model built for Owyhee County and an IMPLAN model of Owyhee County. Alternative grazing policy scenarios analyzed in the Owyhee Resource Management Plan and Final Environmental Impact Statement are used to show and compare results between the two models.

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BACKGROUND

Owyhee County is located in the southwestern corner of Idaho, bordering Elko County, Nevada, and Malheur County, Oregon. There are 4.9 million acres in the county, with approximately 84% of that acreage administered by federal and state government entities. The population of Owyhee County has risen from 9,562 in 1995 to 10,406 in 1999 (U.S. Department of Commerce 1999). The population growth rate over the last ten years has averaged 2.7% annually. Some of the area's growth can be attributed to relatively lower costs of land and housing when compared to the surrounding counties of Canyon (Caldwell/Nampa) and Ada (Boise). This has caused a strain on the county's government due to the increase in services needed and the lack of retail establishments to supply a stable stream of tax revenues.

Mining and range livestock production are the dominant sectors in the county's economy. Hunting and recreational activities on the Snake, Bruneau, Owyhee, and Jarbidge rivers (fishing, boating, and rafting) play minor roles in the economy. However, these recreational opportunities also create a strain on county resources through increased demand for medical facilities and services like search and rescue.

The Bureau of Land Management (BLM) prepared the "Draft Owyhee Resource Management Plan and Draft Environmental Impact Statement" (RMP/EIS) and released it for public comment in August 1996. The Owyhee Resource Area spans more than 1.7 million acres in the southwestern third of the county, with more than 1.4 million acres managed by the BLM and, therefore, affected by the RMP/EIS. The RMP/EIS provides guidelines for land management in the area for the next 20 years. These guidelines can potentially affect much of the county fiscally, economically, and socially. The National Environmental Policy Act (NEPA) mandates social and economic assessments of alternatives considered in the RMP/EIS. The University of Idaho, contracted by the BLM and other parties, constructed the framework used to analyze alternatives considered in the final RMP/EIS that was released in July 1999 (U.S. Department of Interior 1999).

The University of Idaho (U of I) study provided ranch-level cost-and-return estimates for representative ranches in Owyhee County. A regional input-output (I/O) model also was developed using locally estimated cost-and-return data to augment the agricultural sectors in IMPLAN. Social assessments of the communities in the county also were conducted. This paper reports on the development of the Owyhee County I/O model and illustrates its potential use in assessing the economic impacts to the county from changes in BLM grazing policy, as outlined in the RMP/EIS. The authors demonstrate that the least cost method of impact analysis—in most cases, IMPLAN—is not necessarily the best way to estimate economic impacts of policy changes on communities dependent on ranching and federal grazing.

PROCEDURES

A regional I/O model was derived for Owyhee County using various data sources. The original RMP/EIS used IMPLAN as its base economic modeling software. An I/O model can be explained as simply a mathematical representation of purchases and sales patterns within a region. The I/O model tracks inflows and outflows of dollars by economic sector and allows the estimation of impacts of a given change at a point in time. IMPLAN (Minnesota IMPLAN Group 1998) and other over-the-counter impact models, such as RIMS II (U.S. Department of Commerce 1997) and ADOTMATR (Lamphear et al. 1983), are based on national transactions, consumption, and employment patterns used to formulate county or regional models. In many cases, this results in a mis-specification of the local economy, with errors occurring in terms of the interaction of important sectors and transactions in the model. For the U of I Owyhee County model, livestock and crop cost-and-return estimates were used to "localize" the production functions in existing and aggregated agricultural sectors from IMPLAN, as discussed by Coupal and Holland (1995) and Darden et al. (1999). Four cow-calf enterprise budgets were created from producer panel interviews to account for different production practices and their respective costs and returns in Owyhee County. The budget values were weighted by an estimate of the number of cows represented by each budget area. The weighting is Bruneau, 46%; Jordan Valley, 32%; Three Creek, 11%; and Marsing, 11%. The various weighted production items from the cost and returns were summed to arrive at a localized and weighted production function for cow-calf operations specific to Owyhee County.

All agricultural sectors were augmented using University of Idaho crop and livestock cost-and-return estimates, however, time constraints only allowed for livestock producer panel interviews. As explained in Rimbey et al. (1999), four steps were used to create I/O accounts from the cost-and-return estimates: (1) gather control (output) total and cost-and-return estimates pertinent to the study region, (2) convert from purchaser prices to producer prices using retail trade margin procedures, (3) allocate cost-and-return accounts to I/O sectors, and (4) purge imports with IMPLAN or adjusted regional purchase coefficients.

Once the production functions were augmented in the IMPLAN model, the output, income, and employment were checked for accuracy with existing secondary data sources. Bureau of Economic Analysis (BEA) (U.S. Department of Commerce 1999) data was used to check the proprietors' income and wage and salary figures from IMPLAN for each sector. Journey to work data from BEA also was used to adjust personal income for out-commuters or those persons working in the county but living elsewhere. This is important in estimating the effects household spending of personal income (induced effects) has on the economy. Personal income is the wages and salaries of workers plus proprietor

income (Olson 1999). If all income were assumed to remain in the county, the impacts would be overstated.

Employment, which is indicated by the number of full- or part-time jobs, was adjusted using BEA employment figures (all full- or part-time employees and proprietors) and ES-202 (covered employment) data from the Idaho Department of Labor for 1992. Covered employment is that employment in which Federal Insurance Contributions Act (FICA) taxes are paid.

The output for agricultural sectors was estimated using a 5-year average of production values from the Idaho Agricultural Statistics Service. A 5-year average was used to stabilize market price swings common in agricultural production. The non-agricultural sectors were adjusted based on their IMPLAN (MIG 1999) value and their relationships to employment for each sector.

The model was constructed using general economic practices to create a Leontief input-output model as explained in Miller and Blair (1985). Further explanation of techniques used to build the Owyhee County I/O model can be found in various University of Idaho publications (Darden et al. 1999, and Taylor et al. 1999).

The U of I Owyhee County model was used to estimate the economic impacts of reducing the allocation of public forage in the Owyhee Resource Area. The Owyhee RMP/EIS (USDI 1999) detailed Alternative E as a possibility for area resource management. This alternative imposes a reduction of stocking level from the current grazing preference of 135,116 AUMs to 112,649 AUMs over the next five years. The alternative also proposes a further reduction in stocking level to 105,899 AUMs over the next 10 to 20 years (USDI 1999). The model was used to estimate the impacts on county output, income, and employment based upon the initial reduction in public forage.

MODEL COMPARISONS

The U of I Owyhee County I/O model is a hybrid or mongrel type model built using crop and livestock budgets from producer panel interviews and secondary data sources mentioned above. The procedures explained were all used to modify the IMPLAN I/O model (MIG 1999) for Owyhee County. Through these processes, some rather large differences were apparent between IMPLAN and the U of I model. There are 528 sectors in the IMPLAN model economy, some of which were aggregated in the U of I model of Owyhee County. For instance, IMPLAN's Ranch Fed Cattle and Range Fed Cattle were aggregated into a single Range Cattle sector, as the authors saw no need for two such sectors based on production practices in the county. Sector aggregation definitions can be found in the full description of the U of I model (Taylor et al. 1999).

Industry Output Comparison

The total output (agricultural value of production and total sales for non-agricultural sectors) only varied by $1.5 million between the two models. However, there were some sectors in the U of I model where drastic changes were made based on budget panels, Idaho agricultural statistics, observations of Owyhee County and U of I Extension personnel, and other information as previously discussed. Table 1 shows a comparison of estimated industry output between the IMPLAN and U of I models. The Range Cattle and Feedlot sectors, with differences of -$16,416,548 and $19,708,805, respectively, were the most inconsistent, along with the Forage Crop sector (-$12,123,183). This is due primarily to procedures employed by IMPLAN to estimate cattle production. For cattle production, IMPLAN does not allow one to produce calves and finish the cattle. In the IMPLAN sector, Range Cattle value of production was extremely low and the Feedlot sector was very high. Procedures employed by IMPLAN would allow a large portion of the cattle produced in the county to finish in the local feedlot sector. This resulted in underestimating the contribution of the Range Cattle sector and overestimating the contribution of the Feedlot sector. In the non-agricultural sectors, the service industries had the largest difference between the two models, with estimated Service sector production being $10 million lower using IMPLAN procedures versus the U of I model estimates.

Income Comparison

Wages and salaries, along with proprietor income, form the basis for income control totals in the model and are used to calculate income multipliers. Table 2 shows the differences in income between the two models. The largest disparities in the two models lie in the personal income total estimates, which differ by more than $29 million. As explained previously, the differences result from counting income based on place of work versus place of residence.

Employment Comparison

Comparisons of employment totals, presented as the number of full- or part-time jobs (not full-time equivalents), includes all wages and salaries plus proprietor income (Table 3). In total, only 24 jobs separate the two models. However, the distribution of employment among sectors shows major differences, ranging from a 129-job overage in the Health Care sector to a shortage of 96 jobs in Agricultural Services from IMPLAN's figures. Sometimes these types of disparities can be attributed to disclosure problems in county-level employment data. If there are any confidentiality problems for a given sector, BEA does not report those figures except in the total for the county or region (USDC 1999). Therefore, to build the IMPLAN data sets, all non-disclosed numbers must be extrapolated using other secondary information.

Table 1. Comparison of 1995 IMPLAN and University of Idaho model output totals for Owyhee County, Idaho.

Sector	IMPLAN	University of Idaho	Difference (IMPLAN – U of I)	Absolute % difference[1]
Dairy	$13,022,962	$11,682,738	$1,340,224	11.47
Range cattle	12,723,128	29,139,676	(16,416,548)	56.34
Cattle feedlots	26,297,396	6,588,591	19,708,805	299.14
Misc. livestock	1,535,721	1,427,312	108,409	7.60
Grains	5,112,175	6,746,584	(1,634,409)	24.23
Forage crops	8,256,602	20,379,785	(12,123,183)	59.49
Alfalfa seed	405,416	3,307,064	(2,901,648)	87.74
Misc. crops	14,252,384	16,888,130	(2,635,746)	15.61
Sugar beets	8,844,134	8,353,486	490,648	5.87
Agricultural services	5,285,143	8,303,862	(3,018,719)	36.35
Mining	16,565,992	17,311,448	(745,456)	4.31
Construction and maintenance	11,011,305	10,938,047	73,258	0.67
All manufacturing	15,143,153	12,700,276	2,442,877	19.23
Transportation and communication	7,144,593	8,706,931	(1,562,338)	17.94
Electric services	25,699,203	22,044,584	3,654,619	16.58
Irrigation, sanitary, water services	2,884,322	2,431,388	452,934	18.63
Wholesale trade	10,184,906	2,786,379	7,398,527	265.52
Misc. retail	817,902	3,277,411	(2,459,509)	75.04
Food stores	4,994,183	4,764,394	229,789	4.82
Auto dealers and service stations	2,060,711	2,230,737	(170,026)	7.62
Eating and drinking	3,630,823	3,422,323	208,500	6.09
Finance, insurance, and real estate	6,444,981	7,757,828	(1,312,847)	16.92
Hotels and lodging	180,636	648,115	(467,479)	72.13
Services	18,781,244	8,637,983	10,143,261	117.43
Health care	10,442,258	9,722,491	719,767	7.40
Totals	$231,721,273	$230,197,563	$1,523,710	0.66

[1]The absolute percentage difference is calculated by taking the absolute value of the difference divided by the U of I model output.

Economic Multipliers

The original Draft RMP/EIS used the Type III multiplier to estimate economic impacts from proposed changes in the Owyhee Resource Area (USDI 1996). The Type III multiplier measures the direct, indirect, and induced effects, with the induced effects based on the county population (Olson 1999). The induced effects are simply the household spending of wages and salaries throughout the economy. The U of I model employs the use of a Type II multiplier, which still measures the same direct, indirect, and induced effects, but with the induced effects based on resident income regardless of population. Table 4 shows the Type II output, income, value-added, and employment multipliers for the U of I Owyhee County model. Type II and Type III multipliers are not directly comparable, thus the U of I and IMPLAN multipliers are not compared. See the Draft RMP/EIS (USDI 1996) for the Type III multipliers estimated by BLM.

The multipliers are a primary product of input-output models and become the mechanism that generates all impacts. When a dollar enters the economy, part of that dollar stays in the economy and part leaves in the form of savings or as payment for imported goods. By dividing the $1 by the multiplier, in this case the Range Cattle multiplier of 1.42, the first transaction yields $0.70 leaving the economy (through savings or purchase of imported goods) and $0.30 retained in the economy. Then, dividing the remainder of the dollar in the economy by the same 1.42 gives a value of $0.21 leaving the economy ($0.30/1.42= $0.21) and $0.088 ($0.30-$0.21) staying within the economy. Repeat these steps until the values staying within the economy have all disappeared. Adding all of the amounts calculated as retained in the economy plus the original dollar yields the multiplier of 1.42. I/O model final demand multipliers illustrate the amount of local purchases made by a given sector—the larger the multiplier, the more linkages a given local sector has with other economic sectors in the local economy.

To use the final demand multipliers, one would find the economic sector where the impacts occur and multiply the numbers in that row by the change in final demand. For instance, the Range Cattle sector has a final demand output multiplier of 1.42. This means that for every $1 of livestock production output there is an additional $0.42 in economic activity generated throughout the economy in indirect and induced effects. The remaining multipliers (income, value-

Table 2. Comparison of 1995 IMPLAN and University of Idaho model personal income totals for Owyhee County, Idaho.

Sector	IMPLAN	University of Idaho	Difference (IMPLAN – U of I)	Absolute % difference[1]
Dairy	$3,811,798	$3,603,466	$208,332	5.78
Range cattle	2,588,804	1,062,837	1,525,967	143.57
Cattle feedlots	5,566,009	186,518	5,379,491	2,884.17
Misc. livestock	343,622	269,681	73,941	27.42
Grains	1,029,777	436,431	593,346	135.95
Forage crops	1,334,205	1,385,521	(51,316)	3.70
Alfalfa seed	52,289	49,710	2,579	5.19
Misc. crops	4,737,441	5,350,459	(613,018)	11.46
Sugar beets	1,228,405	1,101,001	127,404	11.57
Agricultural services	3,440,658	1,823,698	1,616,960	88.66
Mining	2,928,075	3,959,936	(1,031,861)	26.06
Construction and maintenance	3,579,168	1,632,403	1,946,765	119.26
All manufacturing	3,180,711	0[2]	3,180,711	0
Transportation and communication	2,091,256	937,413	1,153,843	123.09
Electric services	6,062,766	2,517,380	3,545,386	140.84
Irrigation, sanitary, water services	1,110,196	633,302	476,894	75.30
Wholesale trade	3,590,477	290,850	3,299,627	1,134.48
Misc. retail	412,706	295,356	117,350	39.73
Food stores	2,703,561	1,150,116	1,553,445	135.07
Auto dealers and service stations	930,179	350,153	580,026	165.65
Eating & drinking	1,088,661	704,838	383,823	54.46
Finance, insurance, and real estate	1,667,853	815,379	852,474	104.55
Hotels and lodging	50,607	94,608	(44,001)	46.51
Services	3,011,036	1,652,705	1,358,331	82.19
Health care	4,226,063	809,769	3,416,294	421.89
Totals	$60,766,323	$31,113,530	$29,652,793	95.31

[1]The absolute percentage difference is calculated by taking the absolute value of the difference divided by the U of I model income.

[2]Although there was employment and output from the Manufacturing sector, it was found that all of the personal and proprietors' income went to non-county residents.

added, and employment) are employed in the same manner as the output multiplier with the only difference being in their interpretation. The income, value-added, and employment multipliers are interpreted as the impact per dollar change in final demand. For example, the income multiplier for mining is .24418. This means that for every dollar's change in final demand, there is a 24-cent change in income generated throughout the economy.

Statistical Comparison of Models

Following steps outlined by Butterfield and Mules (1980), the output totals were evaluated to assess how closely the IMPLAN model contributes to the prediction of the U of I model. The process for evaluating the two models is as follows, 1) non-parametric test, 2) regression analysis, and 3) Chi-square analysis. For purposes of this paper, the output by sector was analyzed statistically for differences between the two models.

The first evaluation, a non-parametric sign test of the two data sets, was performed with the null hypothesis being that the median value of the distribution is equal to zero. The positives equal 13 and negatives equal 12 with r => 1. The conclusion is to fail to reject the null hypothesis and assume the median value of the distribution is equal to zero and the probability of observing IMPLAN output to U of I model output is equal to that of observing U of I output to IMPLAN model output.

The second step in comparing the model output requires a regression analysis. The regression equation as described by Butterfield and Mules (1980) is as follows:

$$A^*_{IMP} = \alpha + \beta A_{UofI}$$

Where:

A^*_{IMP} = Output by sector from the IMPLAN model,

A_{UofI} = Output by sector from the U of I model,

Table 3. Comparison of 1995 IMPLAN and University of Idaho model employment totals for Owyhee County, Idaho.

Sector	IMPLAN	University of Idaho	Difference (IMPLAN – U of I)	Absolute % difference[1]
Dairy	64	63	1	1.59
Range cattle	184	104	80	76.92
Cattle feedlots	103	101	2	1.98
Misc. livestock	55	48	7	14.58
Grains	85	104	(19)	18.27
Forage crops	299	345	(46)	13.33
Alfalfa seed	27	26	1	3.85
Misc. crops	124	151	(27)	17.88
Sugar beets	117	112	5	4.46
Agricultural services	232	328	(96)	29.27
Mining	87	184	(97)	52.72
Construction and maintenance	142	144	(2)	1.39
All manufacturing	166	127	39	30.71
Transportation and communication	58	85	(27)	31.76
Electric services	74	75	(1)	1.33
Irrigation, sanitary, and water services	27	25	2	8.00
Wholesale trade	145	36	109	302.78
Misc. retail	40	51	(11)	21.57
Food stores	180	176	4	2.27
Auto dealers and service stations	53	50	3	6.00
Eating and drinking	133	140	(7)	5.00
Finance, insurance, and real estate	88	81	7	8.64
Hotels and lodging	6	21	(15)	71.43
Services	229	246	(17)	6.91
Health care	360	231	129	55.84
Totals	3,078	3,054	24	.79

[1]The absolute percentage difference is calculated by taking the absolute value of the difference divided by the U of I model employment.

$$H_0 : \alpha = 0, \beta = 0,$$

$$H_a : \alpha \neq 0, \beta \neq 0.$$

The results of the regression analysis (R^2=0.35) indicated that the intercept was 3,726,146 (SE 1,971,104) with a t-statistic of 1.89 (r = 0.07) and ß of 0.602 (SE 0.17) with a t-statistic of 3.54 (r = 0.002). At the 95% confidence level, H_0 is rejected due to ß being statistically different from zero and we conclude that the IMPLAN and U of I models are significantly different.

Finally, a Chi-square test was performed on the differences between the two models to test for the possibility of a compensation effect, where there is no statistical difference in the means but the positive errors are compensated for in the negative errors (Butterfield and Mules 1980). The analysis returned a test value of 148 with a critical value of 36.415 (a = 0.05). At the 95% confidence level, it was determined that the values were not normally distributed and that there, in fact, was a compensation effect within the data set.

POLICY ANALYSIS RESULTS

There are numerous ways to analyze the impacts of public land grazing policy depending on what the policy will do and whom it will affect, such as grazing allotment reductions on individual ranchers. However, policies that impact a large group of ranches may be analyzed regionally through I/O analysis to show the distributional impacts to a community, county, state, or region. As discussed by Torell et al. (1998), there are five potential ranch-level economic impacts from changes in grazing policies that can be analyzed or used to evaluate regional economic impacts. These are: 1) public land grazing costs, 2) the number of AUMs of federal forage available, 3) changes in season of use, 4) changing the class of livestock allowed to graze and, 5) the uncertainty created by changing grazing policies. Most of the ranch-level impacts can be estimated using the I/O model through the Range Cattle sector production function. In other words, the ranch-level impacts are merely redistributions of purchases and/or sales within the I/O model. These changes can have differing effects to the multipliers in the model depending on which sectors' feed purchases are required to replace public land forage. These new feed sources can occur locally or be

Table 4. University of Idaho Owyhee County model final demand multipliers.

Sector	Output	Income	Value-added	Employment
Dairy	1.745296	0.3722073	0.5244183	0.00001253
Range cattle	1.420417	0.0692594	0.1564705	0.00000891
Cattle feedlots	1.619766	0.0648234	0.2823491	0.00002132
Misc. livestock	1.744167	0.2430101	0.4658437	0.00004354
Grains	1.431205	0.1180838	0.6079610	0.00002297
Forage crops	1.561259	0.1426848	0.3646415	0.00002769
Alfalfa seed	1.638175	0.1087644	0.2274538	0.00002287
Misc. crops	1.570624	0.3484990	0.7853013	0.00001389
Sugar beets	1.344889	0.1596971	0.7403108	0.00001766
Agricultural services	1.310214	0.2296899	0.3435887	0.00004108
Mining	1.361777	0.2441822	0.4845780	0.00001230
Construction and maintenance	1.335799	0.1741867	0.2396981	0.00001656
All manufacturing	1.152119	0.0119525	0.1392557	0.00001177
Transportation and communication	1.318529	0.1325767	0.4962591	0.00001252
Electric services	1.198232	0.1250235	0.6805563	0.00000472
Irrigation, sanitary, and water services	1.495357	0.2952546	0.5592942	0.00001345
Wholesale trade	1.244775	0.1211779	0.4000874	0.00001517
Misc. retail	1.137167	0.0954528	0.1938513	0.00001632
Food stores	1.364573	0.2553923	0.5972920	0.00003895
Auto dealers and service stations	1.282965	0.1708017	0.4641703	0.00002434
Eating & drinking	1.386585	0.2274216	0.3812195	0.00004373
Finance, insurance, and real estate	1.255285	0.1237351	0.6199089	0.00001261
Hotels and lodging	1.399406	0.1786191	0.3682530	0.00003607
Services	1.445719	0.2552760	0.3202147	0.00003232
Health care	1.271568	0.1056632	0.1821309	0.00002688

imported, but still are more of a change in accounting. However, economic impacts of increases or decreases in the number of AUMs of public forage can be estimated using I/O models.

The following will show a comparison of economic impacts generated from Owyhee County IMPLAN and U of I I/O models based on Alternative E from the Owyhee RMP/EIS (USDI 1999). In the RMP/EIS, gross revenues, or output per cow/calf pair, was defined as $508 with a conversion of 13.1 AUMs equal to one pair (USDI 1999). Using these figures, the reduction translates into a loss of 1,715 cow/calf pairs (22,467 AUMs) at a value of $871,239. This $871,239 becomes a direct impact to the Range Cattle sector in both models. With a reduction in the AUM base and reduced gross output, reductions in purchases made by the Range Cattle sector from other sectors of the local economy will occur. The two models were used to estimate these reductions to other sectors, along with the total impact to the county. It should be noted that this analysis details only the impacts of the initial reduction (135,116 to 112,649 AUMs) on the Owyhee County economy. The later reduction to 105,899 AUMs (a reduction of 6,750 AUMs, 515 cow/calf pairs, and $261,776 in output) is not considered in this analysis.

Table 5 shows the economic impacts estimated using the IMPLAN model with a loss of 1,715 cow/calf pairs, while Table 6 shows the impacts generated by the U of I model of Owyhee County. Notice that the total economic impacts differ by just over $295,000, with IMPLAN providing the higher estimate. This difference is largely due to differences in regional income and value-added estimates of the two models. Value-added impacts consist of wages and salaries, proprietor income, other property income, and indirect business taxes, while regional income (defined as labor income in IMPLAN), as defined in the U of I model, consists of wages and salaries plus proprietor income only. In the U of I model, income earned by persons residing outside the county were removed to arrive at a more accurate estimate of household re-spending. The difference in regional income impacts was $202,658, while the total difference in value-added impacts was $290,461. Most of the difference in value-added impacts appeared in the Range Cattle sector (aggregated Range Fed and Ranch Fed Cattle sectors in IMPLAN), with a difference of $226,705, almost five times more than the U of I model.

The total industry impacts differ by only $4,978, with IMPLAN exhibiting the larger number of the two. However, impact distribution throughout the economy differs significantly. For instance, the IMPLAN model shows only half as much secondary impacts in the Forage Crop and Auto Dealer/Service Station sectors than the U of I model, with differences of $18,047 and $7,377, respectively. But, IMPLAN shows

Table 5. IMPLAN model economic impacts of $871,239 reduction in range cattle final demand, Owyhee County.

Sector		Direct final demand impacts	Indirect/induced final demand impacts	Total final demand impacts	Value-added impacts	Total employment impacts
Dairy	1	0.00	(1,913.20)	(1,913.20)	(706.85)	(0.01)
Misc. livestock	2	0.00	(3,882.42)	(3,882.42)	(1,223.82)	(0.13)
Cattle ranch	3	(871,239.00)	(51,544.79)	(922,783.81)	(284,638.59)	(13.65)
Cattle feedlots	4	0.00	(53,463.52)	(53,463.52)	(21,316.59)	(0.21)
Misc. crops	5	0.00	(1,750.39)	(1,750.39)	(1,349.82)	(0.02)
Grains	6	0.00	(7,333.77)	(7,333.77)	(5,326.08)	(0.09)
Forage crops	7	0.00	(14,109.41)	(14,109.41)	(7,278.81)	(0.51)
Alfalfa seed	8	0.00	(17.23)	(17.23)	(9.67)	(0.00)
Sugar beets	9	0.00	(310.45)	(310.45)	(212.73)	(0.00)
Agricultural services	10	0.00	(12,867.15)	(12,867.15)	(10,183.57)	(0.56)
Mining	11	0.00	(66.94)	(66.94)	(35.91)	(0.00)
Construction	12	0.00	(8,430.88)	(8,430.88)	(4,129.36)	(0.14)
All manufacturing	13	0.00	(7,063.60)	(7,063.60)	(2,213.70)	(0.05)
Transportation and communication	14	0.00	(17,311.26)	(17,311.26)	(8,376.15)	(0.20)
Electric services	15	0.00	(4,398.46)	(4,398.46)	(3,423.21)	(0.01)
Irrigation, sanitary, and water services	16	0.00	(1,375.00)	(1,375.00)	(824.96)	(0.01)
Wholesale trade	17	0.00	(42,079.37)	(42,079.37)	(26,560.79)	(0.60)
Misc. retail	18	0.00	(1,482.93)	(1,482.93)	(1,220.46)	(0.07)
Food stores	19	0.00	(4,819.86)	(4,819.86)	(4,124.34)	(0.17)
Automotive dealers and service stations	20	0.00	(3,616.94)	(3,616.94)	(2,756.12)	(0.09)
Eating and drinking	21	0.00	(6,544.39)	(6,544.39)	(2,708.48)	(0.24)
Finance, insurance, and real estate	22	0.00	(17,676.90)	(17,676.90)	(11,845.38)	(0.21)
Services	23	0.00	(26,302.23)	(26,302.23)	(16,633.75)	(0.32)
Hotels and lodging	24	0.00	(343.94)	(343.94)	(143.72)	(0.01)
Health care	25	0.00	(21,387.32)	(21,387.32)	(9,122.55)	(0.72)
U.S. Postal Service	26	0.00	(827.22)	(827.22)	(418.62)	(0.01)

	Direct impacts	Indirect/induced impacts	Total impacts
Total industry impacts	(871,239.00)	(310,919,60)	(1,182,158.60)
Total value added impacts			(426,784.03)
Total regional income impact			(262,999.22)
Total employment impacts			(18)
Total economic impacts	(871,239.00)	(310,919.60)	(1,608,942.63)

much larger interactions with Wholesale Trade, at a difference of $39,675, and the Health Care sector difference of $18,293 greater than the U of I model.

Employment impacts differ by 10 jobs. Most of this difference occurs in the directly impacted Range Cattle sector. IMPLAN generated a 13.65 job impact, while the U of I model estimates an employment impact of 3.28 jobs.

CONCLUSIONS AND IMPLICATIONS

Regional economic impact models are important and useful tools for analyzing the impacts of policy changes to a region, state, county, or local economy. The NEPA process requires an economic analysis when preparing environmental impact statements to estimate the effects of proposed policy alternatives on local economies. Decision makers and the public must be apprised of these impacts before important policy decisions are made. The formulation of economic models can dramatically affect the level of economic impact. Only by "ground-truthing" data used in out-of-the-box models, such as IMPLAN, can valid estimates of economic impacts of policy alternatives be specified. Robison (1997) states that the regional I/O model is valuable in estimating impacts of rural issues; however, the off-the-shelf model needs refinement to include a rural community focus along with transboundary income and expenditure flows.

When estimating impacts of alternative policies, government entities should at least examine the model framework and compare output, income, and employment figures derived by IMPLAN to those published by state, local, or

Table 6. U of I model economic impacts of $871,239 reduction in range cattle final demand, Owyhee County.

Sector		Direct final demand impacts	Indirect/induced final demand impacts	Total final demand impacts	Value-added impacts	Total employment impacts
Dairy	1	0.00	(23.18)	(23.18)	(9.10)	(0.00)
Range cattle	2	(871,239.00)	(48,078.90)	(919,317.90)	(57,933.12)	(3.28)
Cattle feedlots	3	0.00	(54,026.74)	(54,026.74)	(9,417.08)	(0.83)
Misc. livestock	4	0.00	(0.14)	(0.14)	(0.04)	(0.00)
Grains	5	0.00	(30,054.21)	(30,054.21)	(15,343.95)	(0.46)
Forage crops	6	0.00	(32,156.88)	(32,156.88)	(7,511.97)	(0.54)
Alfalfa seed	7	0.00	0.00	0.00	0.00	0.00
Misc. crops	8	0.00	(113.11)	(113.11)	(81.44)	(0.00)
Sugar beets	9	0.00	(0.43)	(0.43)	(0.29)	(0.00)
Agricultural services	10	0.00	(17,427.37)	(17,427.37)	(5,548.67)	(0.69)
Mining	11	0.00	(6.89)	(6.89)	(3.00)	(0.00)
Construction and maintenance	12	0.00	(35,609.72)	(35,609.72)	(6,570.42)	(0.47)
All manufacturing	13	0.00	(6,225.14)	(6,225.14)	(636.93)	(0.06)
Transportation and communication	14	0.00	(17,485.35)	(17,485.35)	(7,453.95)	(0.17)
Electric services	15	0.00	(622.42)	(622.42)	(410.05)	(0.00)
Irrigation, sanitary, and water services	16	0.00	(3,623.47)	(3,623.47)	(1,755.73)	(0.04)
Wholesale trade	17	0.00	(2,404.68)	(2,404.68)	(865.81)	(0.03)
Misc. retail	18	0.00	(5,209.58)	(5,209.58)	(936.55)	(0.08)
Food stores	19	0.00	(1,603.52)	(1,603.52)	(898.64)	(0.06)
Auto dealers and service stations	20	0.00	(10,994.12)	(10,994.12)	(4,691.90)	(0.25)
Eating and drinking	21	0.00	(1,376.73)	(1,376.73)	(447.22)	(0.06)
Finance, insurance, and real estate	22	0.00	(19,765.66)	(19,765.66)	(11,287.89)	(0.21)
Hotels and lodging	23	0.00	(167.99)	(167.99)	(48.17)	(0.01)
Services	24	0.00	(15,871.26)	(15,871.26)	(4,075.87)	(0.45)
Health care	25	0.00	(3,094.43)	(3,094.43)	(395.39)	(0.07)
Regional income	26	0.00	(60,341.45)	(60,341.45)	0.00	0.00

	Direct impacts	Indirect/induced impacts	Total impacts
Total industry impacts	(871,239.00)	(305,941.90)	(1,177,180.90)
Total value-added impacts			(136,323.19)
Total regional income impact			(60,341.45)
Total employment impacts			(8)
Total economic impacts	(871,239.00)	(305,941.90)	(1,313,504.09)

federal government agencies. Using steps outlined by Holland et al. (1997), these models may be adjusted to more accurately reflect the regional economy at merely the cost of taking the time to compare IMPLAN with readily available data sources and make necessary changes. In addition, Lahr (1993) suggests that, in constructing a hybrid model, superior data should always be sought for households and resource-based sectors with an examination of the sensitivity of other sectors to output changes.

Some of the major differences between the U of I model and IMPLAN model arose from the Range Cattle sector, which is the directly impacted sector for public grazing policy analysis. An argument for replacing production functions in the Range Cattle sector stems from Bartlett et al. (1993), who showed that grazing costs were significantly different by state, size of permit or lease, and land ownership, which specifically implies that national averages would be a less accurate assessment of the ranching industry. The other major difference was in regional income estimation, which, as Lahr (1993) mentioned, is generally the largest purchase coefficient for any sectors' production function. If there are errors in wages and salaries for a given sector, they are magnified through higher multiplier effects (increase in induced effects) resulting in an overestimation of local economic activity.

The differences between the U of I and IMPLAN models presented here show that a hybrid model might better estimate the impacts of proposed grazing policy actions than an out-of-the-box model such as IMPLAN. The model built for use in the Owyhee Resource Area originally started as an

IMPLAN model, but was adjusted using University of Idaho crop and livestock budgets, State of Idaho labor information, BEA data, and other sources to "localize" the model. Statistical analysis of the output showed significant differences between the two models. It is the authors' belief that the modified model more accurately represents the Owyhee County economy and its linkages than the nationally adjusted model employing secondary data procedures. Grazing policy has the potential to have adverse economic impacts on many rural counties in the western United States. This fact alone, as well as others presented here, illustrates the need for accurate data and construction of I/O models used to analyze grazing policy impacts.

REFERENCES

Bartlett, E.T., N. Rimbey, L.A. Torell, L.W. Van Tassell, J. DeVilbiss, R. Appel, T. Heisler, G. Stoebig, T. Bagwell, P. Burgener, and J. Coen. 1993. The federal grazing fee: 1993. *In:* Incentive-based grazing fee system for public lands administered by the Bureau of Land Management and United States Forest Service, Part I. Washington, D.C.

Butterfield, M., and T. Mules. 1980. A testing routine for evaluating cell by cell accuracy in short-cut regional input-output tables. J. of Regional Science. Vol. 20, No. 3.

Coupal, R., and D. Holland. 1995. On the use of farm enterprise budgets in interindustry analysis: an example from the Washington state wheat study. Washington State Univ. Dep. of Agr. Econ. Rep. A.E. 95-10.

Darden, T.D., T.R. Harris, and N.R. Rimbey. 1999. Integrating crop and livestock cost-and-return estimates into input-output analysis. *In:* Bartlett, E.T. and L.W. Van Tassell (eds.), Grazing land economics and policy: proceedings of a symposium sponsored by the western coordinating committee on range economics WCC-55. February 1999. Western Regional Res. Pub. Fort Collins, Colo.

Darden, T.D., T.R. Harris, N.R. Rimbey, and A.J. Harp. 1999. Integrating crop and livestock cost-and-return estimates into an input-output model of Owyhee County, Idaho. Univ. of Idaho. Dep. of Agr. Econ. and Rural Soc. AEE Series 99-08. Moscow, Ida.

Holland, D.W., H.T. Geier, and E.G. Schuster. 1997. Using IMPLAN to identify rural development opportunities. USDA Forest Service, Intermountain Res. Sta. General Tech. Rep. INT-GTR-350. Ogden, Ut.

Lahr, M.L. 1993. A review of the literature supporting the hybrid approach to constructing regional input-output models. Econ. Systems Res. 5:3:277-293.

Lamphear, F.C., R.J. Supalla, D. Jewell, R. Konecny, and C. Montgomery. 1983. "The ADOTMATR software program for developing and applying regional input-output models for economic analysis." Univ. of Lincoln. Lincoln, Neb.

Miller, R. and P. Blair. 1985. Input-output analysis: foundations and extensions. Prentice-Hall, Inc. Englewood Cliffs, N.J.

Minnesota IMPLAN Group, Inc. (MIG). 1998. IMPLAN system (data and software). Stillwater, Minn. http://www.implan.com

Olson, D., and S. Lindall. 1999. IMPLAN professional software, analysis, and data guide. Minnesota IMPLAN Group, Inc. Stillwater, Minn. http://www.implan.com.

Robison, M.H. 1997. Community input-output models for rural area analysis with an example from central Idaho. The Ann. of Regional Science. 31:325-351.

Rimbey, N.R., T.D. Darden, C. Gibson, and A.J. Harp. 1999. Costs and returns of cattle ranches and other agriculture in Owyhee County, Idaho. Univ. of Idaho. Dep. of Agr. Econ. and Rural Soc. AEE Series 99-07. Moscow, Ida.

Taylor, R.G., N. Meyer, N. Rimbey, T. Darden, C. Gibson, and M. Guaderrama. 1999. The Owyhee County economy. Univ. of Idaho. Dep. of Agr. Econ. and Rural Soc. AEE Series 99-17. Moscow, Ida.

Torell, L.A., N.R. Rimbey, L.W. Van Tassell, and J.A. Tanaka. 1998. Impacts of grazing policy on ranching practices and ranch income. Invited paper presented at the 1998 AAEA Annual Meetings. August 2–5, 1998. WAEA invited paper session "The Impacts of Federal Grazing Policy on Ranches and Communities." Salt Lake City, Ut.

U.S. Department of Commerce. 1997. Regional multipliers: a user handbook for the regional input-output modeling system (RIMS II) (3rd Ed). U. S. Government Printing Office, Washington, D.C

U.S. Department of Commerce, Bureau of Economic Analysis, Economics and Statistics Administration. 1999. Regional economic information system. U.S. Government Printing Office. Washington, D.C.

U.S. Department of the Interior, Bureau of Land Management. 1996. Draft Owyhee resource management plan and draft environmental impact statement. 3 Volumes. Lower Snake River District. Boise Field Office. Boise, Ida.

U.S. Department of the Interior, Bureau of Land Management. 1999. Proposed Owyhee resource management plan and final environmental impact statement. 3 Volumes. Lower Snake River District. Boise Field Office. Boise, Ida.