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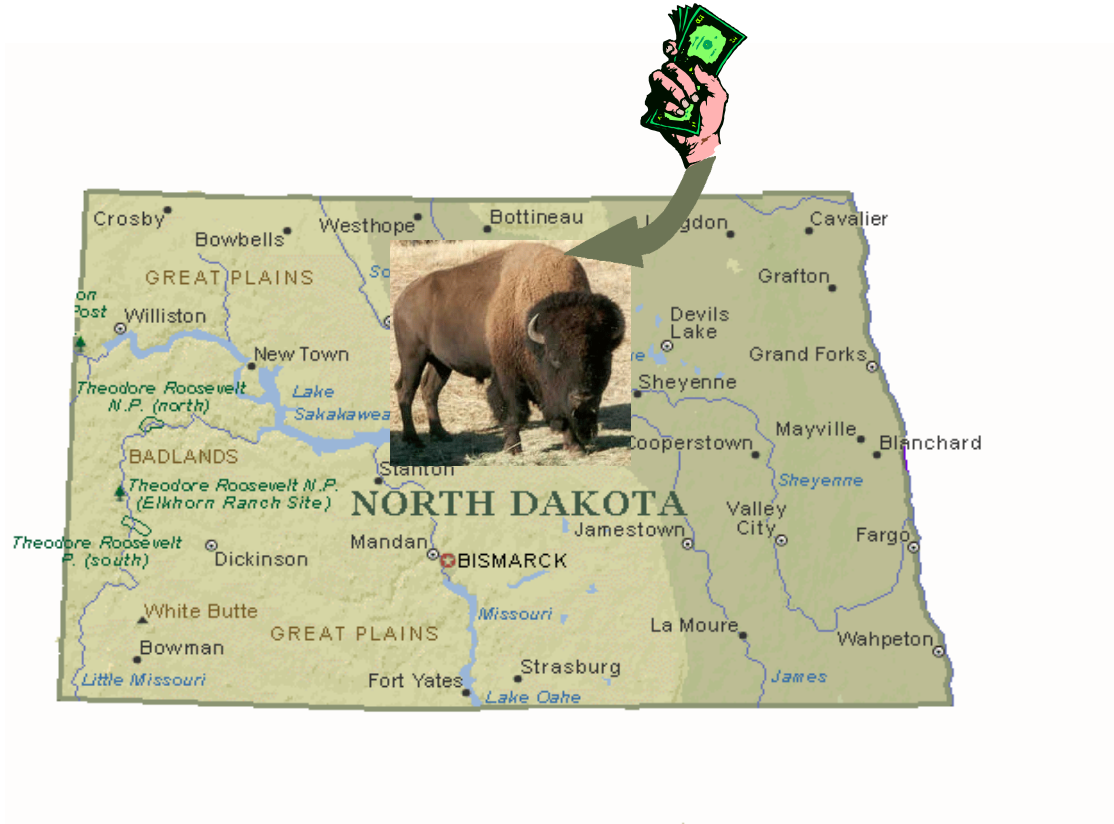
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# Contribution of the Bison Industry to the North Dakota Economy

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## INTRODUCTION

Throughout North Dakota's history, agriculture has been an important sector of the economy. Although the relative contribution of the agriculture sector has declined in recent years, it remains the largest component of North Dakota's economic base (Coon and Leistritz 1998).

Most people who are familiar with the state understand the

importance of agriculture to the area. However, the relationship of various activities within agriculture and the relative importance of those industries continues to undergo fundamental changes - even within

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just a few years. For example, the North Dakota bison industry is now a commercially viable agriculture industry, which was hardly the situation just 10 years ago.

The North American bison<sup>1</sup> has come full circle from just a few decades ago. The number of native bison left in the United States was estimated to be less than 1,500 head in the late 1800s (National Bison Association 2000). Currently, the number of bison in the United States has been estimated at 350,000 (National Bison Association 2000). In 1998, there were more than 20,000 head of bison in North Dakota (North Dakota Buffalo Association 1999b).

A producer-owned processing facility, which became operational in 1994, was a major factor in the development of the bison industry in North Dakota (Leistriz and Sell 2000). Prior to the construction of that facility, much of the production of bison in the state was of a hobby farm nature. Since the facility opened, bison production has become a viable, commercial industry. The facility has more than doubled its original capacity, and plans to build another processing facility are pending (Leistriz and Sell 2000).

The objective of this study is to estimate the economic contribution that the bison industry makes to the North Dakota economy. The economic contribution will be measured in terms of personal income, retail trade volume, total business activity, secondary employment, and selected state tax revenues. The bison industry, as defined

in this study, includes production and slaughter/processing activities within the state.

## **PROCEDURES**

Analysis of impacts associated with the bison industry required several steps. Discussion of the procedures used in the study was divided into the following sections: 1) bison production, 2) bison processing, and 3) input-output analysis.

### **Bison Production**

Commercial bison production is a relatively new industry to North Dakota's agricultural sector. The United States Department of Agriculture - National Agricultural Statistics Service, which is responsible for collecting data on production and prices for agricultural commodities, does not collect production and price information for the bison industry. Cost and return budgets are available for bison producers from Alberta Agriculture, Food and Rural Development (1999) and Metzger and Anderson (1998).

On-farm visits and personal interviews were conducted to develop a questionnaire which would be useful for developing the economic contribution analysis and be relatively simple to complete by the individual producers. All North Dakota members of the North Dakota Buffalo Association (NDBA) were mailed a one-page questionnaire which asked about their basic operation and whether they would be interested in completing a cost of production/economic contribution questionnaire. Of the 186 members, 87 (47 %) returned the one-page questionnaire. Of the respondents who returned the initial questionnaire, 50 respondents (57 %) agreed to complete a longer, more detailed

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<sup>1</sup> The American Buffalo is not a true buffalo. Bison is the proper scientific name, and it belongs to the Bovine family of mammals, as do domestic cattle. The National Bison Association encourages the use of the term 'Bison' to differentiate the American Buffalo from the Asian Water Buffalo and African Cape Buffalo.

questionnaire. Of the 50 respondents who initially agreed to complete the second questionnaire, 18 returned completed questionnaires (36 % of those who agreed to complete the survey).

The questionnaire asked respondents to provide the income and expenses generated by their bison enterprise. The questionnaire required information on revenues by type of animal sold and estimates of revenue from other sources (e.g., sale of hides, skulls, cooperative dividends). The respondents were asked to indicate the amount of the expenses by category and the percentage of each expense category which occurred within state versus out-of-state. An estimate of in-state expenditures was necessary so that an estimate of total direct impact within North Dakota could be calculated. In addition, producers were asked to provide some basic production coefficients related to their bison herd's performance. A more detailed breakdown of the expenditures for bison cow-calf and bison finishing can be found in the full report.

### **Bison Processing**

There were five USDA inspected and approved bison processing plants in North Dakota in 1997 (National Bison Association 2000). Of these facilities, only one buys and markets bison meat products on a commercial scale. This processing plant is located just south of New Rockford, North Dakota. The processing facility operates as a closed cooperative and was formed in 1993 by a group of bison ranchers whose goal was to build and operate a modern, efficient processing plant. To determine the direct economic impact of the processing plant on North Dakota's economy, the processing plant was asked to provide a breakdown of operating expenditures within the state.

A questionnaire was provided to the bison processing facility which asked for the total operating budget for 1998. The respondent was then asked to indicate the percentage of the operating budget for each expenditure category and the percentage of each item which occurred within state versus out-of-state.

### **Input-Output Analysis**

Economic activity from a project, program, or policy can be categorized into direct and secondary impacts. Direct impacts are those changes in output, employment, or income that represent the initial or direct effects of the project, program, or event. Secondary impacts (sometimes further categorized into indirect and induced effects) result from subsequent rounds of spending and respending within an economy. This process of spending and respending is sometimes referred to as the multiplier process, and the resultant secondary effects are sometimes called the multiplier effects (Leistritz and Murdock 1981). Input-output (I-O) analysis is a programming tool that delineates linkages among sectors of an economy and calculates the resultant total business activity resulting from a direct impact in a basic sector (Coon et al. 1985). The North Dakota I-O Model has 17 economic sectors, is closed with respect to households (households are included within the model), and was developed from primary (survey) data from firms and households in North Dakota. An economic sector is a group of similar economic units (e.g., communications and public utilities, retail trade, construction).

The process of spending and respending can be explained by an example. A single dollar from an area farmer (**Households** sector) may be spent for a

buffalo roast at a local store (**Retail Trade** sector); the store uses part of that dollar to pay for the next shipment of meat (**Transportation** and **Agricultural Processing** sectors) and part to pay the store employee (**Households** sector) who shelved or sold the roast; the meat supplier uses part of that dollar to pay for the animals from which the roasts are made (**Agricultural-Livestock** sector) ... and so on.

## ECONOMIC IMPACTS

The economic contribution from the bison industry was estimated from production and processing activities occurring within the state. Expenditures and returns from these activities represent direct economic impacts. The direct impacts were used with the North Dakota I-O Model to estimate the secondary impacts. This section is divided into four major sections: 1) direct impacts, 2) secondary impacts, 3) tax revenue, and 4) total economic impacts.

### Direct Impacts

Direct impacts are those changes in output, employment, or income that represent the initial or direct effects of a program, project, or activity. The direct impacts from the bison industry on North Dakota's economy are represented by 1) expenditures and returns from bison production (cow-calf and finishing) and 2) expenditures and returns from bison processing. The following section describes these direct impacts.

#### Bison Production

Bison producers generate direct economic impacts to North Dakota's economy through their expenditures for production outlays (e.g., feedstuffs, fuel, supplies, fencing materials, interest, equipment) and returns to unpaid labor,

management, and equity (i.e., money used to pay family living expenses or for reinvestment in the business). The direct economic impacts for the bison industry were estimated using the bison cow-calf and finishing budgets developed from survey data, combined with the North Dakota bison inventory determined by the NDBA.

The number of bison breeding animals was 16,395 head, composed of 15,337 female animals and 1,058 breeding males. An additional 6,499 head of slaughter males results in a total of 22,894 bison in North Dakota in January 1999.<sup>2</sup>

In-state production outlays were handled as direct impacts generated by the bison producers in North Dakota. Cash and non-cash expenses from bison cow-calf and finishing were considered as direct impacts. Returns to unpaid labor, management, and equity were considered direct impacts even though they did not represent a cash outlay. Net returns were considered retained by the producer and eventually result in personal or business expenditures.

#### Bison Cow-Calf

Bison producers generate direct economic impacts to the area economy through 1) direct expenditures for production outlays and 2) net returns. Direct economic impacts from bison cow-calf production were estimated by using the survey of NDBA members to develop a bison cow-calf production budget. The bison production budget contained estimated revenue, variable and fixed costs, and returns to unpaid labor, management, and equity

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<sup>2</sup> Bison which are not privately owned, primarily those within the Theodore Roosevelt National Park, were not included within this analysis.

(Table 1). Gross revenue per head was estimated by dividing the total revenue for the herd by the number of breeding animals. The number of animals in the breeding herd was the average of the beginning and ending inventory of brood cows, breeding bulls, and replacement females. Variable and fixed expenses were estimated from the completed questionnaires. Returns to unpaid owner labor, management, and equity were defined as the difference between revenue and production expenses.

Total direct impacts resulting from bison production would equal gross revenue per head, providing all economic activity (production expenses and returns to unpaid labor, management, and equity) remained in the North Dakota economy. Survey results of North Dakota bison cow-calf producers

revealed that a small amount of production expenses were paid to out-of-state sources and as such result in a slight economic leakage from the state.

Gross revenue per breeding animal in 1998 was \$814 per head. Total production expenditures were \$555 per head, of which more than 95 percent or \$529 per head occurred in North Dakota. Returns to unpaid labor, management and equity represented the difference between gross revenue and total expenditures or \$259 per head. Total in-state direct impact per breeding animal was \$788. Total in-state direct impact was slightly less than \$13 million.

**Table 1. North Dakota Bison Cow-calf Enterprise Budget per Head of Breeding Animals, 1998**

Gross Sales/Breeding Animal <sup>1</sup>	\$814.47	
	Total Cost/ breeding animal	In-State Cost/ breeding animal
Total Feed and Pasture Costs	\$236.05	\$233.05
Total Other Direct Costs	243.45	221.95
Total Equipment Costs	<u>75.65</u>	<u>73.54</u>
Total Cost	\$555.15	\$528.54
Contribution to unpaid labor, management, and equity	<u>\$259.32</u>	<u>\$259.32</u>
Total Direct Impact	\$814.47	\$787.86

<sup>1</sup> Gross sales = (cull cow income+cull bull income+bull calf income+heifer calf income+other income). No depreciation expense was calculated per breeding animal since revenue and expenses associated with replacement animals was included within the budget. Breeding animal = (beginning brood cow inventory + beginning breeding bulls+beginning replacement females inventory)/2+(ending brood cow inventory+ending breeding bull inventory+ending replacement female inventory)/2

## Bison Finishing

Similar to the bison cow-calf producers, bison producers who are involved in the finishing phase of the production schedule generate direct impacts to the area economy through operating expenditures and returns to unpaid labor, management, and equity. Direct economic impacts from bison finishing were estimated from the survey of NDBA members. The bison finishing budget contained estimated revenue, variable and fixed costs, and returns to unpaid labor, management, and equity (Table 2). Gross revenue per head was estimated by dividing the total revenue for the finishing enterprise by the average number of bison in the finishing herd (i.e., an average of the beginning and ending inventory of finishing animals plus the number of purchased animals). Variable and fixed expenses were estimated from completed questionnaires. Returns to unpaid owner labor, management, and equity were defined as the difference between revenue and production expenses.

Total direct impacts resulting from bison finishing would equal the additional gross revenue per head, providing all

economic activity (production expenses and returns to unpaid labor, management, and equity) remained in the North Dakota economy. Survey results of North Dakota bison finishing producers revealed that a small amount of production expenses were paid to out-of-state sources and as such result in a slight economic leakage from the state.

Gross revenue per finishing animal in 1998 was \$1,289 per head. Total production expenditures were \$276 per head, of which more than 98 percent or \$271 per head occurred in North Dakota. The original value of the finishing animal, as transferred from the cow-calf enterprise, was \$740. This was the average bull calf selling price in the fall of 1998 (North Dakota Buffalo Association 1999a). Returns to unpaid labor, management and equity for the finishing phase of bison production represented the difference between total expenditures, the original value of the animal, and gross revenue, or \$272 per head. The additional in-state direct impact per finishing animal was \$543. Total direct impact for bison finishing in the state was \$3.5 million.

**Table 2. North Dakota Bison Finishing Enterprise Budget per Head of Finishing Animals, 1998**

Gross sales/finishing animal <sup>1</sup>	\$1,288.65	
	Total Cost/ finishing animal	In-State Cost/ finishing animal
Total Feed Costs	\$181.73	\$180.11
Total Other Direct Costs	66.53	64.23
Total Equipment Costs	<u>28.01</u>	<u>26.35</u>
Total Cost	\$276.27	\$270.69
Average purchase price of bull calves in 1998 <sup>2</sup>	\$740.00	\$740.00
Contribution to unpaid labor, management, and equity	<u>\$272.38</u>	<u>\$272.38</u>
Total Direct Impact <sup>3</sup>	\$548.65	\$543.07

<sup>1</sup> Gross sales formula = (gross sales of finished animals+ cooperative dividends+other income): Number of finishing = (beginning finishing bulls inventory + ending finishing bulls inventory)/2

<sup>2</sup> 1998 Fall Consignment Sale Bull calf average price on 100 head (North Dakota Buffalo Association 1999a).

<sup>3</sup> Total direct impact = gross revenue less purchase price (value) less out-of-state expenditures.

The total direct impact of bison cow-calf enterprise combined with bison finishing for North Dakota in 1998 was \$16.4 million (Table 3).

### Bison Processing

The bison processing facility impacts the North Dakota economy through its expenditures for production (i.e., finished bulls) and processing inputs, labor, and investment in facilities and capital. Total cash expenditures by the processing cooperative in 1998 were \$10 million. The majority of the operational expenditures were for animals to be processed, \$7.9 million. Approximately 54 percent of the bison processed in the state were purchased from members located within North Dakota; the remainder was purchased from members not located in North Dakota. The total direct impact in North Dakota from processing bison was \$6.4 million (Table 3).

### **Secondary Impacts**

The secondary impacts of the bison production in North Dakota were estimated using the North Dakota I-O Model. Total direct impacts of \$16.4 million generated about \$34 million in secondary impact to the state. Secondary impacts were greatest in the **Households** sector (\$11.3 million) followed closely by the **Retail Trade** sector (\$10.6 million). Total economic impacts from bison production were \$50 million and included indirect support for about 546 full-time equivalent (FTE) jobs. Secondary jobs represent employment outside of activities and services directly involved with bison production, but employment that is dependent on the existence of those activities.

Bison processing expenditures were allocated to the various economic sectors within the North Dakota I-O Model. Total in-state direct impacts from processing were \$6.4 million, which generated \$13.4 million in secondary impacts. The greatest secondary impact from the processing activities was \$4.6 million in the **Retail Trade** sector followed by \$3.9 million in the **Households** sector and \$ 1.0 million in the **Finance, Insurance, and Real Estate** (FIRE) sector. Secondary FTE jobs resulting from bison processing activities were 211.

### **Tax Revenues**

Input-output analysis was used to estimate personal income, retail trade and other business activity, which in turn was used to estimate tax revenue. Estimated tax revenue generated by the bison industry in the state included \$0.8 million in sales and use taxes, \$0.3 million in personal income taxes, and \$0.4 million in corporate income taxes annually. Bison production was also directly responsible for about \$2.5 million in property taxes annually. When property tax collections and revenues from sales and use tax, individual income tax, and corporate income taxes are considered, the bison industry generates about \$4 million annually in tax revenues to the state of North Dakota.



**Table 3. Annual Direct Impacts of the Bison Industry to the North Dakota Economy, by Economic Sector, and Industry Activity, 1998**

Economic Sectors	Total Direct Impacts by Industry Activity		
	Production	Processing	Total
	----- 000's \$ -----		
Ag-crops	4,730	0	4,730
Construction	0	100	100
Transportation	29	200	229
Comm and public utilities	225	100	325
Retail trade	2,978	200	3,178
FIRE	1,273	500	1,773
Bus & Pers Serv	193	0	193
Prof and Soc Serv	28	0	28
Households	6,587	5,345	11,932
Government	<u>404</u>	<u>0</u>	<u>404</u>
Total Direct Impacts	16,447	6,445	22,892

**Table 4. Annual Total (Direct and Secondary) Impacts of the Bison Industry to the North Dakota Economy, by Economic Sector, and Industry Activity, 1998**

Economic Sectors	Total Economic Impacts by Industry Activity		
	Production	Processing	Total
	----- 000's \$ -----		
Ag-livestock	1,172	425	1,597
Ag-crops	5,490	173	5,663
Nonmetal mining	85	39	124
Construction	1,196	648	1,844
Transportation	196	262	458
Comm and public utilities	1,691	773	2,464
Ag proc and misc mnfg	1,273	277	1,550
Retail trade	13,623	4,767	18,390
FIRE	3,580	1,525	5,105
Bus & Pers Serv	1,091	381	1,472
Prof and Soc Serv	1,191	591	1,782
Households	17,887	9,277	27,164
Government	<u>1,869</u>	<u>706</u>	<u>2,575</u>
Total Economic Impacts	50,344	19,844	70,188
Secondary Employment	546	211	757
Share of Total Economic Activity	72 %	28%	

The annual total (direct and secondary) economic contribution from bison

production expenditures and returns was \$50.3 million (Table 4). Bison processing generated an additional \$20 million in annual economic impacts. The entire bison industry generated \$70.2 million in business activity in North Dakota in 1998. Bison production activities represented nearly three-fourths of all economic activity created by the industry.

Secondary employment estimates represent the number of full-time jobs generated based upon the volume of business activity created by the industry. The bison industry in North Dakota in 1998 indirectly supported 757 FTE secondary jobs (Table 4).

The economic sectors with the greatest overall impacts were **Households** (\$27 million), **Retail Trade** (\$18 million), **Agricultural-crops** (\$5.6 million), and **FIRE** (\$5.1 million). The top two sectors represented more than 60 percent of the total economic impact.

## CONCLUSIONS

A survey was mailed to all members of the North Dakota Buffalo Association. Those members who indicated they would be interested in completing an economic contribution questionnaire were surveyed. This survey was used to estimate the in-state economic contribution from bison cow-calf production and bison finishing. The bison processing facility provided in-state expenditures and returns for 1998 operations, which allowed estimates to be developed for bison processing occurring in North Dakota. The direct impact of production and processing of bison in North Dakota in 1998 was estimated at \$23 million. The \$23 million in direct impacts, based upon the North Dakota I-O Model, generated an additional \$47 million in secondary impacts within the state. The North Dakota bison industry supported a total of 757 secondary FTE jobs within the state. Total economic activity generated within the state was

estimated at \$70 million, including \$27 million in personal income and \$18 million in retail sales. In addition, the bison industry generated \$4 million in tax revenue (including property, personal income, sales & use, and corporate income taxes).

Every head of bison in the state generated an average total economic impact of \$3,100 (direct and secondary impacts of production and processing). Every head of bison in North Dakota in 1998 contributed about \$184 to state and local government tax collections. Furthermore, for every 30 bison in the state an additional secondary FTE job was supported.

The bison industry has become a major livestock sector within North Dakota. A comparison of North Dakota bison production to other North Dakota livestock industries reveals that, in terms of farm receipts in 1998, the bison industry ranks fourth below beef, dairy, and swine, but above poultry, and sheep and lambs. Furthermore, the bison industry is continuing to expand production, as evidenced by the use of female animals. Most females are more valuable as brood stock than for processing, as such they are currently being sold as breeding stock.

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