AgEcon SEARCH
RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

The World's Largest Open Access Agricultural & Applied Economics Digital Library

This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.

Help ensure our sustainability.

Give to AgEcon Search

AgEcon Search
http://ageconsearch.umn.edu
aesearch@umn.edu

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

Agricultural Economics Report No. 442 **June 2000**

Contribution of the Bison Industry to the North Dakota Economy

Randall S. Sell
Dean A. Bangsund
F. Larry Leistritz

Department of Agricultural Economics
Agricultural Experiment Station
North Dakota State University
Fargo, ND 58105

ACKNOWLEDGMENTS

Financial support of this project was provided jointly by the North Dakota Buffalo Association and North Dakota Agricultural Products Utilization Commission.

Individuals who contributed their efforts towards the successful completion of this project (by providing tours and explanation of management procedures or providing thoughtful reviews and suggestions on the cost of production questionnaire) included the following:

Robert Erbele, Drift Prairie Bison, Lehr, ND
Aaron and Bill Riebe, Riebe Bison, Pingree, ND
Dennis Sexhus, Manager, North American Bison Cooperative, New Rockford, ND
Ken Throlson, RX Ken Mar Buffalo Ranch, New Rockford, ND

Sincere appreciation is extended to all the North Dakota bison producers who took the time to complete the questionnaire. Without their input, this project would not have been possible.

Thanks are extended to Norma Ackerson for document preparation and to Sheila Renner for data entry. Our gratitude is also extended to our colleagues for their helpful review of the manuscript.

The authors assume responsibility for any errors of omission, logic, or otherwise. Any opinions, findings, conclusions, or recommendations expressed in this publication are those of the authors.

We would be happy to provide a single copy of this publication free of charge. You can address your inquiry to: Carol Jensen, Department of Agricultural Economics, North Dakota State University, PO Box 5636, Fargo, ND 58105-5636, (Ph. 701-231-7441, Fax 701-231-7400), (e-mail: cjensen@ndsuext.nodak.edu) or electronically from our web site: http://agecon.lib.umn.edu/ndsu.html

NOTICE:

The analyses and views reported in this paper are those of the author(s). They are not necessarily endorsed by the Department of Agricultural Economics or by North Dakota State University.

North Dakota State University is committed to the policy that all persons shall have equal access to its programs, and employment without regard to race, color, creed, religion, national origin, sex, age, marital status, disability, public assistance status, veteran status, or sexual orientation.

Information on other titles in this series may be obtained from: Department of Agricultural Economics, North Dakota State University, P.O. Box 5636, Fargo, ND 58105. Telephone: 701-231-7441, Fax: 701-231-7400, or e-mail: cjensen@ndsuext.nodak.edu.

Copyright © 2000 by Randall S. Sell, Dean A. Bangsund, and F. Larry Leistritz. All rights reserved. Readers may make verbatim copies of this document for non-commercial purposes by any means, provided that this copyright notice appears on all such copies.

TABLE OF CONTENTS

Item — Page

LIST OF TABLES ii

ABSTRACT iii

HIGHLIGHTS iv

INTRODUCTION 1

PROCEDURES 2
- Bison Production 2
  - Bison Cow-calf Enterprise 3
  - Bison Finishing Enterprise 5
- Bison Processing 5
- Input-Output Analysis 6

ECONOMIC IMPACTS 6
- Direct Impacts 6
  - Bison Production 6
    - Bison Cow-Calf 7
    - Bison Finishing 9
  - Bison Processing 13
- Secondary Impacts 14
  - Bison Production 14
  - Bison Processing 15
- Tax Revenue 16
- Total Economic Impacts 17

CONCLUSIONS 21

REFERENCES 22

APPENDICES

A. COVER LETTER AND QUESTIONNAIRE MAILED TO NORTH DAKOTA BUFFALO ASSOCIATION MEMBERS 24

B. BISON COW-CALF AND BISON FINISHING ECONOMIC CONTRIBUTION AND COST OF PRODUCTION QUESTIONNAIRE 27

C. BISON SURVEY AVERAGE COW-CALF PRODUCTION COEFFICIENTS, 1998 36

D. BISON SURVEY AVERAGE FINISHING PRODUCTION COEFFICIENTS, 1998 38

LIST OF TABLES

Table		Page
1	North Dakota Buffalo Association Survey Responses	3
2	North Dakota Bison Inventory by County, January 1, 1999	8
3	North Dakota Bison Cow-calf Enterprise Budget per Head of Breeding Animals, 1998	10
4	North Dakota Bison Finishing Enterprise Budget per Head of Finishing Animals, 1998	12
5	Annual Expenses From Bison Processing Activities, 1998	14
6	Annual Direct, Secondary and Total Economic Impacts of Bison Production in North Dakota, by Economic Sector, 1998	15
7	Annual Direct, Secondary and Total Economic Impacts of Bison Processing in North Dakota, by Economic Sector, 1998	16
8	Estimated Annual State Tax Collections Generated from Economic Activity Created by the Bison Industry in North Dakota, 1998	17
9	Annual Direct Impacts of the Bison Industry to the North Dakota Economy, by Economic Sector, and Industry Activity, 1998	18
10	Comparison of Annual Direct Impacts and Number of Producers of the Bison Industry to other North Dakota Livestock Production Activities, 1998	18
11	Annual Secondary Impacts of the Bison Industry to the North Dakota Economy, by Economic Sector, and Industry Activity, 1998	19
12	Annual Total (Direct & Secondary) Impacts of the Bison Industry to the North Dakota Economy, by Economic Sector, and Industry Activity, 1998	20

ABSTRACT

The commercial bison industry is relatively new to North Dakota. There were an estimated 23,000 head of bison in North Dakota in 1998, and these animals were found in 47 of 53 counties. The purpose of this study was to estimate the economic contribution of the bison industry to the North Dakota economy. A survey of North Dakota bison producers and processors was conducted to provide estimates of direct impacts of bison activities within the state. Secondary economic impacts were determined using the North Dakota Input-Output Model.

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 generated an additional $47 million in secondary impacts within the state. The North Dakota bison industry supported a total of 757 secondary full-time equivalent (FTE) jobs within the state. Total economic activity generated within the state was estimated at $70 million, including $27 million in personal income and nearly $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). The direct impact of bison production in 1998 ranked fourth in North Dakota's livestock industry; below cattle and calves, dairy products, and hogs, and above turkey and sheep.

The average direct impact generated for every bison in the state was $1,000. Total economic activity generated per bison in 1998 was $3,100 (includes direct and secondary impacts from production and processing). For every 30 head of bison an additional secondary FTE job was supported.

Keywords: bison industry, bison production, bison processing, North Dakota, economic impact

HIGHLIGHTS

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

The bison industry as defined within this study is the production and processing of bison and the related revenues and expenditures generated from those activities which occurred within the state of North Dakota. With the expanded market potential offered because of the construction and operation of a bison processing plant within the state, this industry has undergone rapid expansion within the past 10 years. Currently, all females are retained as breeding stock; only the males are slaughtered for meat and other products. Eventually, as this industry matures, females will begin to be processed for meat products.

A survey was mailed to all 186 members of the North Dakota Buffalo Association. Respondents who indicated they would be interested in completing an economic contribution questionnaire were surveyed again. This survey was used to estimate the in-state economic contribution from bison cow-calf production and bison finishing. Of the 87 respondents who returned the initial questionnaire, 50 respondents (57%) agreed to complete the longer, more detailed questionnaire, and of these, 18 returned a completed questionnaire (which represents approximately 10 percent of the original sample).

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 nearly $18 million in retail sales. In addition, the bison industry generated $4 million in tax revenue (including property, and state collections of personal income, sales and use, and corporate income taxes).

Each 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 FTE job was supported.

Bison production has become a major livestock industry 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 ranked fourth behind beef, dairy, and swine, but ranked ahead of poultry and sheep. Furthermore, the bison industry is continuing to expand production as females are being sold as breeding stock. Currently, most females are more valuable as brood stock rather than for processing.

The bison industry in North Dakota currently plays an important role in North Dakota's livestock sector. North Dakota's economy has benefitted from the expansion of production and processing within the state. While production of bison represents the greatest share of the direct economic impact, the role of processing of bison (28 % of total direct impact) within the state cannot be overlooked. As production and processing expansion continues, it appears likely that bison will remain an important component of North Dakota's livestock sector into the future.

Contribution of the Bison Industry to the North Dakota Economy

Randall S. Sell, Dean A. Bangsund, and F. Larry Leistritz*

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 just a few years.

Oil sunflowers were hardly considered as a cropping alternative by farmers in the early 1970s, but by 1979, 3.3 million acres of oil sunflower were planted in the state and North Dakota had become the leading producer of sunflowers in the U.S. (North Dakota Agricultural Statistics Service, various years). More recently, soybean acreage in North Dakota has expanded significantly (Bangsund and Leistritz 1999). Reasons for these fundamental changes in production activities can be multi-faceted; however, the basic factors are often economic. Price risk, production risk, net returns, U.S. farm policies, world-wide trade relationships, and market opportunities are closely tied to the economics of various production activities. The North Dakota bison industry is now a commercially viable agriculture activity, which was hardly the situation just 10 years ago.

The North American bison[1] 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). The number of bison in North Dakota has expanded by 20 percent annually in the 1990s (Sexhus 1997).

A producer-owned processing facility, which was completed and became operational in 1994, was a major factor in the development of the bison industry in North Dakota (Leistritz 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 (Leistritz and Sell 2000).

---

*Sell and Bangsund are research scientists and Leistritz is a professor at the Department of Agricultural Economics, North Dakota State University, Fargo.

[1] 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.

Information from an economic contribution study can be valuable for educational or public relations efforts. An estimate of the economic contribution of a given industry provides information about that industry's importance to the local economy. The impacts on specific sectors and industries of the economy are identified and measured. This economic information can be valuable to policy makers and industry leaders as they determine how the industry impacts related industries within the state.

In the case of the bison industry in North Dakota, an economic contribution study is important because it can be used to draw attention to, and provide an endorsement of, a fledgling (in terms of commercial production - as bison were present here long before commercial agriculture) industry. An economic study of this type can be used to highlight the importance of allocating resources to promote this new, important, alternative livestock industry.

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.

The following sections present the procedures associated with data collection from producers and processors. The direct impacts for the bison industry are then presented by production and processing activities. Finally, secondary and total impacts for the bison industry are presented, followed by the study conclusions.

PROCEDURES

An economic contribution study, as defined here, represents an estimate of all relevant expenditures and returns associated with an industry (i.e., the economic activity associated with producing, handling, and processing bison within a specific geographic area). The economic contribution approach to estimate economic activity has been used for several similar studies (Bangsund and Leistritz 1999, 1998a, 1998b, 1995a, 1995b 1993; Bangsund et al. 1994).

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) estimation of secondary impacts.

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 (Appendix A) 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 (Table 1). Of the respondents who returned the initial questionnaire, 50 respondents (57 %) agreed to complete a longer, more detailed 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 initial contact questionnaire was mailed May 7, 1999; this was followed by a second survey approximately two weeks later. The economic contribution questionnaire (Appendix B) was mailed approximately August 1, 1999 followed by a personal telephone reminder 10 days later. All non-respondents received a second questionnaire 10 days after the telephone reminder. Non-respondents were again contacted by the president and/or the secretary/treasurer of NDBA in December 1999. In a final attempt to increase survey responses, a personal presentation was made at the NDBA annual meeting in February 2000.

Table 1. North Dakota Buffalo Association Survey Responses

	Initial Contact Survey	Economic Contribution Survey
Total sample	186	50
Completed questionnaire	87 (47 %)	18 (36 %)
Agreed to complete additional questionnaire	50 (57 %)	- -

Based on bison inventory numbers provided by the NDBA and interviews with NDBA representatives, it was determined that most North Dakota bison producers were involved in a cow-calf enterprise and many of these producers finished their own animals. A smaller number of producers were involved in finishing and/or growing bison calves into either finished bulls or breeding stock. Also, because of the similarity between the production schedule of bison and beef animals, primarily due to the reproductive biology of the animals, the enterprise budgets for the bison industry were developed in a manner consistent with the beef industry. Therefore, the economic contribution questionnaire was divided into two main sections, 1) bison cow-calf enterprise and 2) bison finishing enterprise. This questionnaire was mailed to all NDBA members who agreed to participate.

Bison Cow-calf Enterprise

Within the cow-calf enterprise, the respondents were asked to give the total number of cull animal sales and the total sale value of those animals. In addition, the producers were asked to indicate the total number of bull and heifer calf sales and the value at sale. The respondents were also asked to indicate any other income they received from the bison cow-calf enterprise (e.g., sale of hides or skulls).

The expense categories of the cow-calf enterprise were 1) feed, 2) other direct costs, 3) fencing, and 4) other equipment. The final section of the cow-calf questionnaire asked respondents the number of animals in various age and sex groups as well as other production related information (e.g., calves weaned per cow exposed, useful cow life expectancy, death loss, average debt to asset ratio, etc).

Total quantities of feed for the cow-calf herd were asked. Also, for purchased feed, the amount purchased in-state versus out-of-state was asked. A three-year average (1996-1998) price was used to value the various feedstuffs for those feeds for which prices were available (corn, oats, barley, alfalfa hay, and mixed hay) (North Dakota Agricultural Statistics Service, various years). Although bison production coefficients were only used from one year (1998), a three year average price for feedstuffs was used to decrease the yearly fluctuations of feed prices. Those feedstuffs, for which price statistics are not reported, were valued based upon the energy equivalent to comparable feedstuffs (Lardy 2000). For example, a price is not available for sorghum in North Dakota; therefore, since sorghum contains approximately 95 percent of the energy of corn, the sorghum price used was 95 percent of the corn price (on an equal dry matter basis).

The cost of owned pasture was valued at the North Dakota state average pasture rental rate from 1994 to 1997. The respondents were asked to indicate the cost of any pasture they rented for the cow-calf enterprise.

The quantity and total cost for processed feed was indicated by the respondents. Processed feed included protein supplements and range cake, vitamins and minerals, and mixed ration. The quantity purchased in-state and out-of-state was also requested.

Other direct costs can be difficult to obtain on a mail out/mail back survey format because of the vast differences which exist in how individual producers categorize expenses. Also, the thoroughness of accounting for direct expenses can be problematic. A relatively consistent format which the producers must complete is the 1040F Internal Revenue Service tax form. Therefore to minimize the potential for problems and enhance the consistency of categorization of various expenses, all respondents were referred to their 1998 1040F tax form for other direct costs. The categories in this section of the questionnaire closely followed the 1040F tax form. The respondents were asked to indicate their total cost in this category and then to estimate the portion of this expense which was typically allocated to the cow-calf enterprise. Also, the respondents were asked to differentiate between the fuel expense which accrued to the cow-calf enterprise directly versus the fuel expense which accrued to producing grains and forages. This was done to avoid double counting, because the feedstuffs were valued at market prices. In addition, the respondents were asked to indicate the portion of direct expenses purchased in-state and out-of-state. The respondents were asked to indicate the portion of the expense allocated to the bison cow-calf enterprise to differentiate between portions that may have been spent on other enterprises on their farm.

Fencing expenses were generated from estimates of fencing costs per mile and the number of miles for perimeter and cross fencing provided by the respondents. The total fence costs attributed to the cow-calf enterprise were amortized over 20 years. Respondents indicated the amount of the fencing materials purchased in-state.

To determine that portion of facilities and other equipment attributed to the cow-calf enterprise the respondents were asked to estimate the current value (original purchase price or an estimated replacement value) of each piece of equipment (e.g., corrals, chutes, handling facilities, stock trailer, tractor, loader, feed wagon, hay racks, pickup truck, etc.) and the expected years of useful life remaining. Respondents were asked to estimate the portion of that equipment expense which they would allocate to the cow-calf enterprise and the portion purchased in-state. To avoid double-counting, respondents were asked not to include that equipment, or share of equipment, which was used to produce forage and feed grains. In other words, only include the respondent's perception of the share of equipment which is used to actually feed and care for the animals. Annualized equipment costs were calculated based on a 10 percent salvage value.

Respondents were asked to report performance criteria which are often linked to financial performance for beef producers to provide an indication of these relationships for bison producers. The respondents were asked number of months on pasture, crop aftermath, and winter feeding in drylot, calves weaned per cow exposed, weaning weight per calf, useful life expectancy for breeding stock, and debt-to-asset ratio. Although the sample size is small, the average production coefficients may provide some insight into the performance levels that North Dakota bison cow-calf producers are reporting (Appendix C).

Bison Finishing Enterprise

The finishing enterprise includes the activities of finishing bulls for sale to the North American Bison Cooperative (NABC) or producing animals for private sale. Respondents were asked to indicate the total value of animal sales by category (males and females) and the number of animals sold. In addition, they were asked to include any income from other sources (e.g., cooperative dividends) to determine gross sales from the finishing enterprise.

The finishing enterprise expense categories were 1) feed costs, 2) other direct costs, 3) fencing costs, and 4) other equipment costs. The calculation of total costs and in-state costs for the finishing enterprise was similar to costs for the cow-calf enterprise. Average production coefficients (i.e., average daily gain) for bison finishing are shown in Appendix D.

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 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 the 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.

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.

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 are located in 47 of 53 counties in North Dakota (Table 2). The top six counties (Stutsman, Benson, Eddy, Bowman, Sargent, and Towner, listed in order of total number of animals) have about 43 percent of all privately owned bison in North Dakota.[2] 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.

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 (Table 3). 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 within the state was slightly less than $13 million.

[2] Bison which are not privately owned, primarily those within the Theodore Roosevelt National Park, were not included in this analysis.

Table 2. North Dakota Bison Inventory by County, January 1, 1999

Counties	Females	Breeding Males	Slaughter Males	Total
Adams	16	7	6	29
Barnes	65	4	35	104
Benson	1,361	88	518	1,967
Billings	58	11	16	85
Bottineau	326	20	38	384
Bowman	1,110	60	360	1,530
Burke	11	0	0	11
Burleigh	196	14	12	222
Cass	325	14	156	495
Cavalier	42	4	16	62
Dickey	287	27	116	430
Divide	105	8	0	113
Dunn	146	12	44	202
Eddy	893	80	760	1,733
Emmons	228	13	305	546
Foster	678	76	110	864
Golden Valley	0	0	0	0
Grand Forks	275	16	130	421
Grant	826	45	99	970
Griggs	0	0	0	0
Hettinger	0	0	0	0
Kidder	73	4	0	77
LaMoure	22	3	3	28
Logan	644	33	270	947
McHenry	564	47	200	811
McIntosh	120	10	30	160
McKenzie	24	1	0	25
McLean	179	15	22	216
Mercer	364	25	27	416
Morton	568	36	365	969
Mountrail	260	30	15	305
Nelson	168	13	59	240
Oliver	0	0	0	0
Pembina	42	2	15	59
Pierce	470	25	108	603
Ramsey	45	3	13	61
Ransom	60	2	0	62
Renville	66	5	30	101

--- continued ---

Table 2. Continued

Counties	Females	Breeding Males	Slaughter Males	Total
Richland	344	21	8	373
Rolette	157	10	70	237
Sargent	477	28	550	1,055
Sheridan	226	15	0	241
Sioux	645	56	12	713
Slope	120	2	0	122
Stark	484	28	179	691
Steele	0	0	0	0
Stutsman	1,164	74	1,252	2,490
Towner	645	43	350	1,038
Traill	0	0	0	0
Walsh	54	4	31	89
Ward	117	6	42	165
Wells	203	13	109	325
Williams	84	5	18	107
Total	15,337	1,058	6,499	22,894

Source: North Dakota Buffalo Association (1999b).

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 4). 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 represented the difference between total expenditures, the original value of the animal, and gross revenue, or $272 per head. The in-state direct impact per finishing animal was $543. Total direct impact for bison finishing in the state was $3.5 million.

Table 3. North Dakota Bison Cow-calf Enterprise Budget per Head of Breeding Animals, 1998

Gross Sales/Breeding Animal [1, 2]	$814.47		
Feed	Cost/unit	Total Cost/ breeding animal	In-State Cost/ breeding animal
Corn (bu) [3]	$2.17	$3.84	$3.84
Oats (bu) [3]	1.32	8.55	8.55
Barley (bu) [3]	1.80	3.31	3.31
Screenings (tons) [4]	54.15	13.76	13.76
Alfalfa hay (tons) [3]	59.78	2.47	2.47
Sorghum silage (tons) [4]	18.41	0.35	0.35
Stover (tons) [4]	28.62	0.50	0.50
Grass hay (tons) [3]	40.56	73.76	73.76
Mixed hay (tons) [4]	40.56	29.88	29.88
Oat or grain hay (tons) [4]	41.85	1.06	1.06
Pasture (owned) [5]	10.09	49.67	49.67
Pasture (rented)		13.49	13.49
Protein supplements, range cake (lbs)		13.32	12.01
Vitamins, minerals (lbs)		3.54	1.85
Mixed ration (tons)		18.55	18.55
Total Feed Costs		$236.05	$233.05
Other Direct Costs			
Fuel and oil		11.54	11.54
Veterinarian and medicine		10.30	10.30
Marketing		1.92	1.79
Supplies		32.78	32.34
Repairs		15.98	15.74
Hired labor		16.85	16.85
Machinery work hired		12.88	12.88
Utilities		12.69	12.69
Miscellaneous farm expense (ins., dues, subs.)		18.38	16.40
Operating interest expense		20.38	20.38
Long-term debt interest expense		52.61	34.90
Property taxes		25.23	24.29
Other (expenses not included above)		1.17	1.17
Perimeter fencing		8.68	8.62
Cross fencing		2.06	2.06
Total Other Direct Costs		$243.45	$221.95

- - - continued - - -

Table 3. Continued

Equipment expenses, not associated with forage production &/or harvesting	Total Cost/ breeding animal	In-State Cost/ breeding animal
Corrals, chutes, and handling facilities	$11.44	$11.33
Stock trailer	2.92	2.68
Tractor		19.93
19.93		
Loader	7.00	6.52
Feed wagon	0.91	0.91
Hay racks/feed bunks	1.86	1.82
Pickup truck	16.91	16.08
Utility vehicle/quad runner	5.97	5.97
Semi tractor-trailer	0.63	0.25
Self-feeders	1.41	1.39
Livestock scale	0.11	0.11
Feed storage (hopper bins)	0.06	0.06
Feed grinder/mixer/roller mill	0.67	0.67
Manure spreader	0.33	0.32
Other equipment	5.50	5.50
Total Equipment Costs	$75.65	$73.54
Total Cost	$555.15	$528.54
Contribution to unpaid labor, management, and equity	$259.32	$259.32
Total Direct Impact	$814.47	$787.86

[1] 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

[2] 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.

[3] Cost per unit is ND marketing year average 1996-1998 (North Dakota Agricultural Statistics Service).

[4] Lardy (2000).

[5] Owned pasture cost is ND 1993-1997 non-irrigated pasture rent/acre (North Dakota Agricultural Statistics Service).

Table 4. North Dakota Bison Finishing Enterprise Budget per Head of Finishing Animals, 1998

Gross sales/finishing animal [1, 2]		$1,288.65	
Feed	Cost/unit	Total Cost/ finishing animal	In-State Cost/ finishing animal
Corn (bu) [3]	$2.17	$31.24	$31.24
Oats (bu) [3]	1.32	40.11	40.11
Barley (bu) [3]	1.8	23.59	23.59
Screenings (tons) [4]	54.15	22.46	22.46
Grass hay (tons) [3]	40.56	20.58	20.58
Mixed hay (tons) [4]	40.56	33.87	33.87
Oat or grain hay (tons) [4]	41.85	3.02	3.02
Protein supplements, range cake (lbs)		3.00	3.00
Vitamins, minerals (lbs)		3.86	2.24
Mixed ration (tons)		0.00	0.00
Total Feed Costs		$181.73	$180.11
Other Direct Costs			
Fuel and oil		7.42	7.42
Veterinarian and medicine		4.07	3.67
Marketing		0.00	0.00
Supplies		5.41	4.56
Repairs		13.15	12.82
Hired labor		7.24	7.24
Machinery work hired		4.67	4.67
Utilities		2.72	2.64
Miscellaneous farm expense (ins. dues, subs.)		2.19	1.55
Operating interest expense		10.87	10.87
Long term debt interest expense		6.93	6.93
Property taxes		0.86	0.86
Other (expenses not included above)		0.00	0.00
Perimeter fencing		1.00	1.00
Cross fencing		0.00	0.00
Total Other Direct Costs		$66.53	$64.23
Equipment Expenses			
Corrals, chutes, and handling facilities		4.79	4.71
Stock trailer		1.67	0.92
Tractor			6.08
6.08			
Loader		1.15	1.15

- - - continued - - -

Table 4. Continued

Equipment Expenses	Total Cost/ finishing animal	In-State Cost/ finishing animal
Feed wagon	$0.49	$0.49
Hay racks/feed bunks	0.80	0.78
Pickup truck	2.21	1.78
Utility vehicle/quad runner	1.70	1.70
Semi tractor-trailer	0.37	0.15
Self-feeders	2.12	2.01
Livestock scale	0.42	0.42
Feed storage (hopper bins)	0.39	0.39
Feed grinder/mixer/roller mill	4.26	4.26
Manure spreader	1.06	1.01
Other equipment	0.50	0.50
Total Equipment Costs	$28.01	$26.35
Total Cost	$276.27	$270.69
Average purchase price of bull calves in 1998[6]	$740.00	$740.00
Contribution to unpaid labor, management, and equity	$272.38	$272.38
Total Direct Impact	$548.65	$543.07

[1] Average finishing animals = (beginning finishing bulls inventory + ending finishing bulls inventory)/2
[2] Gross sales formula = (gross sales of finished animals+ cooperative dividends+other income).
[3] Cost per unit is ND marketing year average 1996-1998 (North Dakota Agricultural Statistics Service).
[4] Lardy (2000).
[5] Owned pasture cost is ND 1993-1997 non-irrigated pasture rent/acre (North Dakota Agricultural Statistics Service).
[6] 1998 Fall Consignment Sale Bull calf average price on 100 head (North Dakota Buffalo Association 1999a).

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 5. Annual Expenses From Bison Processing Activities, 1998

Operational Expenditures	In-State	Out-State	Total
Labor	$1,000,000	$0	$1,000,000
Employee benefits	200,000	0	200,000
Utility and communication costs	100,000	0	100,000
Capital equipment purchases	0	0	0
Plant maintenance and repair	100,000	0	100,000
Animals purchased	4,345,000	3,555,000	7,900,000
Other inputs/supplies	200,000	0	200,000
License and fees	0	0	0
Contract services	0	0	0
Insurance	0	0	0
Transportation	200,000	0	200,000
Property taxes	0	0	0
Debt Service (interest)	300,000	0	300,000
Net Returns [1]	0	0	0
Total	$6,445,000	$3,555,000	$10,000,000

[1] No dividends were paid to cooperative members from the 1998 processing plant returns.

Secondary Impacts

The secondary impacts from bison production in North Dakota were estimated using the North Dakota I-O Model. The North Dakota I-O Model traces linkages among the sectors of the North Dakota economy and estimates the resultant total business activity resulting from a direct impact to a basic sector (Coon et al. 1985). 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 (Hamm et al. 1993).

Secondary impacts were estimated separately for bison production and processing. The following sections discuss the allocation of direct impacts into various economic sectors of the North Dakota I-O Model and the amount of secondary impacts which were generated in those sectors.

Bison Production

Bison production expenditures and returns were allocated into the various economic sectors of the North Dakota I-O Model. Protein supplements, vitamins and minerals, fuel and oil, supplies, repairs, other expenses, fencing, machinery and equipment depreciation were allocated

to the **Retail Trade** sector. Interest and 90 percent of the miscellaneous farm expense were allocated to the **Finance, Insurance, and Real Estate** (FIRE) sector. The remaining 10 percent of miscellaneous farm expense was categorized as **Professional and Social Services**. All feed and owned and rented pasture expenses were allocated to the **Agricultural-Crops** sector. Machine work hired, hired labor, and contribution to unpaid labor, management and equity were allocated to the **Households** sector. The **Government** sector contained property taxes expenses. The **Transportation** sector had marketing expenses, **Business and Professional Services** sector had veterinarian and medicine expenses, and the **Communications and Public Utilities** sector had utility expenses.

Total direct impacts of $16.4 million generated about $34 million in secondary impacts to the state (Table 6). 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.

Table 6. Annual Direct, Secondary and Total Economic Impacts of Bison Production in North Dakota, by Economic Sector, 1998

	Economic Impacts from Bison Production		
Economic Sectors	Direct	Secondary	Total
	---------- 000's $ ----------		
Ag-livestock	0	1,172	1,172
Ag-crops	4,730	760	5,490
Nonmetal mining	0	85	85
Construction	0	1,196	1,196
Transportation	29	167	196
Comm and public utilities	225	1,466	1,691
Ag proc and misc mnfg	0	1,273	1,273
Retail trade	2,978	10,645	13,623
FIRE	1,273	2,307	3,580
Bus & Pers Serv	193	898	1,091
Prof and Soc Serv	28	1,163	1,191
Households	6,587	11,300	17,887
Government	404	1,465	1,869
Totals	16,447	33,897	50,344
Secondary Employment (full-time equivalent jobs)			546

Bison Processing

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 (Table 7). 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 **FIRE** sector. Secondary FTE jobs resulting from bison processing activities were 211.

Table 7. Annual Direct, Secondary and Total Economic Impacts of Bison Processing in North Dakota, by Economic Sector, 1998

	Economic Impacts from Bison Processing		
Economic Sectors	Direct	Secondary	Total
	---------- 000's $ ----------		
Ag-livestock	0	425	425
Ag-crops	0	173	173
Nonmetal mining	0	39	39
Construction	100	548	648
Transportation	200	62	262
Comm and public utilities	100	673	773
Ag proc and misc mnfg	0	277	277
Retail trade	200	4,567	4,767
FIRE	500	1,025	1,525
Bus & Pers Serv	0	381	381
Prof and Soc Serv	0	591	591
Households	5,345	3,932	9,277
Government	0	706	706
Totals	6,445	13,399	19,844
Secondary Employment (full-time equivalent jobs)			211

Tax Revenue

Tax collections are another important measure of the economic impact of an industry on the economy. Tax implications are becoming an increasingly important measure of local and state-level impacts. Some of the interest in estimating tax revenue generated by an industry originates from public awareness of the importance of tax revenue to local and state governments. As the public places ever increasing demands on government for a plethora of services, while at the same time demanding decreasing tax burdens, tax collections are becoming an ever more important factor in assessing economic impacts.

While business activity alone does not directly support local government functions, taxes on personal income, retail trade, real estate property, and corporate income are important revenue sources for local and state governments. The total economic impacts in the **Retail Trade** sector were used to estimate revenue from sales and use taxes. Economic activity in the **Households** sector was used to estimate personal income tax collections. Corporate income tax revenue was estimated from the economic activity in all business sectors excluding **Households**, **Government**, and **Agricultural** sectors.

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 (Table 8). 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 8. Estimated Annual State Tax Collections Generated from Economic Activity Created by the Bison Industry in North Dakota, 1998

Tax	Estimated Tax Collections
Sales and use tax	851,000
Individual income tax	353,000
Corporate income tax	431,000
Total	$1,635,000

Total Economic Impacts

The objective of this study was to estimate the economic contribution that the bison industry makes to the North Dakota economy. The following section compares the bison industry to other North Dakota livestock industries and presents the cumulative impacts by industry activity.

The total annual direct impacts from bison production in North Dakota were estimated to be $16.4 million in 1998. Bison processing added an additional direct impact of $6.4 million for a total direct impact to the state of nearly $23 million. The greatest amount of business activity was generated in the **Households** ($11.9 million), **Agricultural-crops** ($4.7 million), and **Retail Trade** ($3.2 million) sectors (Table 9).

Bison production has become an important industry to North Dakota. A comparison of direct livestock receipts for bison production versus other North Dakota livestock production activities reveals that bison ranks fourth behind cattle and calves ($353 million), dairy products ($99 million), and hogs ($30 million) (Table 10). The top two livestock production activities in the state are many times larger than the bison production. The hog production industry is about 80 percent larger than the bison production industry. If the bison industry were to maintain its present growth rate (estimated between 15 to 20% per year), it will be larger than the North Dakota hog industry within 3 years (this assumes the hog industry would remain relatively stable, when in fact the hog industry has actually declined by nearly 30 percent since 1995.) The bison production industry was just slightly bigger than honey production in the state, is about 10 percent larger than turkey production in the state, and was nearly three times as large as sheep production in North Dakota in 1998. However, there are far more producers involved in sheep production than in bison production in the state (1,150 sheep operations versus 178 bison operations).

Table 9. 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	404	0	404
Total Direct Impacts	16,447	6,445	22,892

Table 10. Comparison of Annual Direct Impacts and Number of Producers of the Bison Industry to other North Dakota Livestock Production Activities, 1998

Livestock Type	Total Direct Impacts	Number of Operations
	----- 000's $ —	
Cattle and Calves	352,887	14,300
Dairy Products	98,670	1,200
Hogs	29,528	850
Bison	16,447	189
Turkeys	14,553	NA
Sheep and Lambs	6,290	1,150
Eggs	2,250	NA

NA means 'not available'
Sources: North Dakota Agricultural Statistics Service (1999) and North Dakota Buffalo Association (1999b).

Annual secondary impacts from bison production totaled $34 million in 1998 (Table 11). Bison processing generated an additional $13 million, for a total annual secondary impact for the bison industry of $47 million. Two sectors of the economy captured about 65 percent of the secondary impacts, **Retail trade** and **Households** sectors ($15.2 million each). Every dollar of direct impacts from the bison industry generated $2.07 in secondary impacts.

The annual total (direct and secondary) economic contribution from bison production expenditures and returns were $50.3 million (Table 12). 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 12).

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.

Every head of bison in North Dakota in 1998 contributed $1,000 in direct impacts which in turn produced $3,066 in total economic activity (direct and secondary economic impacts) within the state. In addition, for every 30 bison in North Dakota, one secondary FTE job was supported within the state. On average, each head of bison generated about $184 in tax revenue ($112 in property tax, and $72 in combined sales and use tax, personal income tax, and corporate income taxes).

Table 11. Annual Secondary Impacts of the Bison Industry to the North Dakota Economy, by Economic Sector, and Industry Activity, 1998

	Total Secondary Impacts by Industry Activity		
Economic Sectors	Production	Processing	Total
	---------- 000's $ ----------		
Ag-livestock	1,172	425	1,597
Ag-crops	760	173	933
Nonmetal mining	85	39	124
Construction	1,196	548	1,744
Transportation	167	62	229
Comm and public utilities	1,466	673	2,139
Ag proc and misc mnfg	1,273	277	1,550
Retail trade	10,645	4,567	15,212
FIRE	2,307	1,025	3,332
Bus & Pers Serv	898	381	1,279
Prof and Soc Serv	1,163	591	1,754
Households	11,300	3,932	15,232
Government	1,465	706	2,171
Total Secondary Impacts	33,897	13,399	47,296

Table 12. Annual Total (Direct & Secondary) Impacts of the Bison Industry to the North Dakota Economy, by Economic Sector, and Industry Activity, 1998

	Total Economic Impacts by Industry Activity		
Economic Sectors	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	1,869	706	2,575
Total Economic Impacts	50,344	19,844	70,188
Secondary Employment	546	211	757
Share of Total Economic Activity	72 %	28%	

CONCLUSIONS

The bison industry as defined within this study is the production and processing of bison and the related revenues and expenditures generated from those activities which occurred within the state of North Dakota. With the expanded market potential offered because of the construction and operation of a bison processing plant within the state, this industry has undergone rapid expansion within the past 10 years. Currently all females are retained as breeding stock; only the males are slaughtered for meat and other products. Eventually, as this industry matures, females will begin to be processed for meat products.

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 North Dakota bison industry has become a major livestock industry 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.

REFERENCES

Alberta Agriculture, Food and Rural Development. 1999. Bison Profits. . . 50 Cow Start-up Enterprise. FS492/821-1.

Bangsund, Dean A. and F. Larry Leistritz. 1993. Economic Contribution of the Sugarbeet Industry to the Economy of North Dakota and Minnesota. Agricultural Economics Report No. 305, Department of Agricultural Economics, North Dakota State University, Fargo, ND.

Bangsund, Dean A. and F. Larry Leistritz. 1995a. Economic Contribution of the Wheat Industry to the North Dakota Economy. Agricultural Economics Report No. 332, Department of Agricultural Economics, North Dakota State University, Fargo, ND.

Bangsund, Dean A. and F. Larry Leistritz. 1995b. Economic Contribution of the United States Sunflower Industry. Agricultural Economics Report No. 327, Department of Agricultural Economics, North Dakota State University, Fargo, ND.

Bangsund, Dean A. and F. Larry Leistritz. 1998a. Economic Contribution of the Barley Industry in North Dakota, South Dakota, and Minnesota. Agricultural Economics Report No. 391, Department of Agricultural Economics, North Dakota State University, Fargo, ND.

Bangsund, Dean A. and F. Larry Leistritz. 1998b. Economic Contribution of the Sugarbeet Industry to North Dakota and Minnesota. Agricultural Economics Report No. 395, Department of Agricultural Economics, North Dakota State University, Fargo, ND.

Bangsund, Dean A., Randall S. Sell, and F. Larry Leistritz. 1994. Economic Contribution of the Wheat Industry to the Minnesota Economy. Agricultural Economics Report No. 312, Department of Agricultural Economics, North Dakota State University, Fargo, ND.

Bangsund, Dean A. and F. Larry Leistritz. 1999. Economic Contribution of the Soybean Industry to North Dakota. Agricultural Economics Report No. 416, Department of Agricultural Economics, North Dakota State University, Fargo, ND.

Coon, Randal C., F. Larry Leistritz, Thor A. Hertsgaard, and Arlen G. Leholm. 1985. The North Dakota Input-Output Model: A Tool for Analyzing Economic Linkages. Agricultural Economics Report No. 187, Department of Agricultural Economics, North Dakota State University, Fargo, ND.

Coon, Randal C., and F. Larry Leistritz. 1998. The State of North Dakota: Economic, Demographic, Public Service, and Fiscal Conditions. Department of Agricultural Economics, North Dakota State University, Fargo, ND.

Hamm, Rita R., JoAnn M. Thompson, Randal C. Coon, and F. Larry Leistritz. 1993. The Economic Impact of North Dakota's Health Care Industry on the State's Economy in 1991. Agricultural Economics Report No. 296, Institute for Business and Industry Development and North Dakota Agricultural Experiment Station, North Dakota State University, Fargo, ND.

Lardy, Greg. 2000. Personal Communication. Associate Professor Extension Animal & Range Science, North Dakota State University, Fargo, ND.

Leistritz, F. Larry and Steve H. Murdock. 1981. Socioeconomic Impact of Resource Development: Methods for Assessment. Westview Press, Boulder, CO.

Leistritz, F. Larry and Randall S. Sell. 2000. Agricultural Processing Plants in North Dakota: Socioeconomic Impacts. Agricultural Economics Report No. 437, Department of Agricultural Economics, North Dakota State University, Fargo, ND.

Metzger, Steve and Vern L. Anderson. 1998. Commercial Bison Production: Economic Analysis and Budget Projections. Beef and Bison Field Day Proceedings, Carrington Research Extension Center, North Dakota State University. Vol 21:46-52.

National Bison Association. 2000. http://www.nbabison.org/. Denver, CO.

North Dakota Agricultural Statistics Service. *Various Years*. North Dakota Agricultural Statistics. North Dakota Agricultural Statistics Service, North Dakota State University, and U.S. Department of Agriculture, Fargo, ND.

North Dakota Buffalo Association. 1999a. http://www.ndbuffalo.org/. North Dakota Buffalo Association, Bismarck, ND.

North Dakota Buffalo Association. 1999b. Personal Communication. North Dakota Buffalo Association, Bismarck, ND.

Sexhus, Dennis O. March 26, 1997. Gate to Plate: Producers Take Control of an Industry, a case study of the North American Bison Cooperative. Third Annual Aldrich C. Bloomquist Lectureship; Sponsored by Quentin N. Burdick Center for Cooperatives, North Dakota State University, Fargo, ND.

APPENDIX A.
COVER LETTER AND QUESTIONNAIRE MAILED TO NORTH DAKOTA BUFFALO ASSOCIATION MEMBERS

May 7, 1999

Name
Address
address
address

Dear ??:

The Department of Agricultural Economics at North Dakota State University has been asked by the North Dakota Buffalo Association to determine the economic impact of buffalo production, transportation, and processing to North Dakota's economy. The study is designed to measure the size of the Bison Industry in terms of overall economic activity, employment, and tax revenues generated in the state. The results of this study will be used by the North Dakota Buffalo Association for educational, promotional, and legislative efforts for the industry. The North Dakota Buffalo Association feels an economic study of the industry will be helpful in providing recognition and credibility for this growing industry. The results of this study will be available to the public.

As part of this process, we would like to ask members of the North Dakota Buffalo Association a few questions about their buffalo enterprise. We also are soliciting individuals to participate later this spring in a longer, more detailed survey about specifics of their buffalo enterprise. The attached questions and our future survey are both absolutely confidential and will only be used by us to develop the economic impact statement for the North Dakota buffalo industry. If you have any questions about the study or the detailed survey please contact me at (701)231-7455. Thank you for your time and assistance with this matter.

Sincerely,

Larry Leistritz
Professor

Questions about your bison enterprise:

1) What is the total number of buffalo you have in your herd?

_____ mature cows
_____ mature bulls
_____ yearlings
_____ calves
_____ **Total**

2) Please circle one of the following which best describes your buffalo enterprise:

a. cow-calf - sell calves at weaning
b. cow-calf - sell calves at breeding age (2 years old)
c. cow-calf-sell females for breeding and males delivered to processing plant
d. buffalo feedlot (buy calves and fatten &/or custom feed)
e. Other: (please describe)_____

_____

3) What year did you begin raising buffalo on your farm/ranch? _____

4) What percentage of your 1998 gross farm income came from your bison enterprise? _____%

5) Are you a member of the North American Bison Cooperative? Yes/ No

5a) If Yes, how many shares do you own? _____

6) Would you like to participate in a more detailed mail out/mail back survey to help develop an economic impact statement for the North Dakota buffalo industry? Yes/ No

APPENDIX B.
BISON COW-CALF AND BISON FINISHING ECONOMIC CONTRIBUTION AND COST OF PRODUCTION QUESTIONNAIRE

Bison Cow-calf Enterprise Budget Instructions

Sales

Sales for the cow-calf enterprise consist of selling calves at weaning and cull animals. Please indicate the total number of animals sold and the total value for all of the animals sold in each category. If there is any other income associated with or derived from the bison cow-calf enterprise, please enter that amount in the total for the herd.

Direct Costs

Feed

This section of the questionnaire determines those quantities of various feedstuffs used to maintain the cow-calf herd. Please indicate the quantities of feed and pasture used for the entire breeding herd, including replacement heifers, breeding bulls, and the calves until they are weaned. Feed quantities for those animals to be sold for slaughter or replacement animals will be included in the bison finishing questionnaire.

Crops produced on the farm will be valued at their market price. As such, you do not need to indicate the cost associated with producing the crop or the cost if those feeds were purchased. However, for those feeds which the value can vary dramatically, please indicate what the cost is (for example, protein supplements, range cake, vitamins, and minerals). The mixed ration would include any processed feed which is, or could be, commercially blended; such as a pelleted blend of screenings, corn, and vitamins. Also, please note that the quantities of feed are for the entire cow-calf herd.

If you rent pasture, please indicate the number of acres grazed and the pasture rental rate per acre. Please include any additional fencing costs on rental pasture in the fence expense section.

In order to estimate the economic impact of the bison industry on North Dakota's economy the amount of each input that is purchased in-state versus out-of-state must be known. For purchased feed, please indicate the amount purchased in-state versus out-of-state.

Other Direct Costs

Probably the easiest method to obtain the other direct costs is to use the 1998 1040F tax statement. Please transfer the amount from each category on the 1040F tax form to the questionnaire in the appropriate expense category, under the 'Total Cost' column in the questionnaire. Then indicate the percentage of the total cost that should be attributed to the bison cow-calf enterprise. Any expenses which are not requested in the direct costs section may be included in the 'other' expense category. Subsequently, please estimate the amount of each expense purchased in-state and out-of-state.

To avoid double counting when estimating the percentage of fuel and oil expense attributed to the cow-calf enterprise, please do not include the percentage of fuel expense that is used to produce forage and feed grains. This expense will be captured in the market value of the forage. Operating interest expense is that interest which accrues on annually borrowed operating capital. Long term interest expense is that interest which accrues on long-term purchases (more than 1 year) such as breeding stock, machinery, fencing, etc.

Overhead Costs

Fencing

To estimate fencing costs, please estimate the per mile cost of your perimeter and cross fences. Please estimate the miles of both types of fencing. Fencing costs were separated because we (from interviews with your fellow North Dakota bison producers) found that producers would be most likely to remember the cost per mile of their perimeter and cross fencing. Then simply estimating the number of miles of fencing should be straight forward. Again, please indicate if any fencing materials were purchased out-of-state.

As part of the overhead expenses, please indicate the current value (original purchase price or an estimated replacement value) of your bison handling facilities (corrals, chutes, headgates, and handling facilities) and the expected years of useful life. Also, please enter the percentage of these expenses that you would allocate to the bison cow-calf enterprise.

To determine the cost of equipment a typical North Dakota producer uses for his bison cow-calf enterprise please indicate the current value and years of remaining useful life of each piece of equipment you use for your cow-calf enterprise. Then please estimate the relative share of that equipment used in the cow-calf enterprise. If you have equipment which is not listed, please include it in the other category. Again, to avoid double-counting, do not include that equipment, or share of equipment, which is used to produce the forage and feed grains. In other words, only include your perception of the share of equipment which is used to actually feed and care for the animals. Please indicate the amount of equipment that was purchased out-of-state.

Production coefficients

To better understand how the typical bison cow-calf enterprise is managed in North Dakota, please estimate the average number of months that the cow herd grazes pasture and crop aftermath and is fed previously harvested forage. Finally, in order to develop a meaningful enterprise budget, we need some production coefficients. These coefficients are self explanatory (the number of head in each category in the beginning of the year and end of the year).

Bison Cow-calf Enterprise Budget

Total for cow-calf herd in 1998

Sales	Total Quantity	Total Value (at sale or transfer)
Cull sales-bulls (hd)	_____hd	_____$
Cull sales-cows (hd)	_____hd	_____$
Bull calf sales (sell or transfer at weaning))	_____hd	_____$
Heifer calf sales (sell or transfer at weaning)	_____hd	_____$
Other income (skulls, horns, hides, hunting)		_____$

Direct Costs		If Purchased	
Feed	Quantity	in-N.Dak.	out-of-State
Corn (bu)	_____bu	_____%	_____% = 100%
Oats (bu)	_____bu	_____%	_____% = 100%
Barley (bu)	_____bu	_____%	_____% = 100%
Sorghum (bu)	_____bu	_____%	_____% = 100%
Screenings (tons)	_____tons	_____%	_____% = 100%
Other Grain (specify _____tons)	_____tons	_____%	_____% = 100%
Alfalfa hay (tons)	_____tons	_____%	_____% = 100%
Corn silage (tons)	_____tons	_____%	_____% = 100%
Sorghum silage (tons)	_____tons	_____%	_____% = 100%
Stover (tons)	_____tons	_____%	_____% = 100%
Grass hay (tons)	_____tons	_____%	_____% = 100%
Mixed hay (tons)	_____tons	_____%	_____% = 100%
Oat or grain hay (tons)	_____tons	_____%	_____% = 100%
Pasture (owned)	_____acres	_____%	_____% = 100%
Pasture (rented)	_____acres	_____%	_____% = 100%
If rented, cost per acre	_____$/acre	_____%	_____% = 100%

			Purchased	
	Quantity	Cost	in-N.Dak.	out-of-State
Protein supplements, range cake (lbs)	_____lbs	$_____	_____%	_____% = 100%
Vitamins, minerals (lbs)	_____lbs	$_____	_____%	_____% = 100%
Mixed ration (tons)	_____tons	$_____	_____%	_____% = 100%

	Total Cost	% attributed to cow/	Purchased	
Other Direct Costs	(from 1040F)	calf enterprise	in-N.Dak.	out-of-state
Fuel and oil	$_____	_____%	_____%	_____% = 100%
Veterinarian and medicine	$_____	_____%	_____%	_____% = 100%
Marketing	$_____	_____%	_____%	_____% = 100%
Supplies	$_____	_____%	_____%	_____% = 100%
Repairs	$_____	_____%	_____%	_____% = 100%
Hired labor	$_____	_____%	_____%	_____% = 100%
Machinery work hired	$_____	_____%	_____%	_____% = 100%
Utilities	$_____	_____%	_____%	_____% = 100%
Miscellaneous farm expense (Insurance, dues, subscriptions)	$_____	_____%	_____%	_____% = 100%
Operating interest expense	$_____	_____%	_____%	_____% = 100%
Long term debt interest expense	$_____	_____%	_____%	_____% = 100%
Property taxes	$_____	_____%	_____%	_____% = 100%
Other (expenses not included above)	$_____	_____%	_____%	_____% = 100%

Fencing Mile	Cost per to cow-calf enterprise	Number of miles attributed in-N.Dak.	Purchased in-N.Dak.	Purchased out-of-state	
Perimeter fencing	$_____	_____miles	_____%	_____%	= 100%
Cross fencing	$_____	_____miles	_____%	_____%	= 100%

Other equipment not associated with forage production &/or harvesting	Current Value	Useful life remaining	% attributed to cow-calf enterprise	Purchased in-N.Dak.	Purchased Out-of-state	
corrals, chutes, and handling facilities	$_____	_____yrs	_____%	_____%	_____%	= 100%
stock trailer	$_____	_____yrs	_____%	_____%	_____%	= 100%
tractor	$_____	_____yrs	_____%	_____%	_____%	= 100%
loader	$_____	_____yrs	_____%	_____%	_____%	= 100%
feed wagon	$_____	_____yrs	_____%	_____%	_____%	= 100%
hay racks/feed bunks	$_____	_____yrs	_____%	_____%	_____%	= 100%
pickup truck	$_____	_____yrs	_____%	_____%	_____%	= 100%
utility vehicle/quad runner	$_____	_____yrs	_____%	_____%	_____%	= 100%
semi tractor-trailer	$_____	_____yrs	_____%	_____%	_____%	= 100%
self-feeders	$_____	_____yrs	_____%	_____%	_____%	= 100%
livestock scale	$_____	_____yrs	_____%	_____%	_____%	= 100%
feed storage (hopper bins)	$_____	_____yrs	_____%	_____%	_____%	= 100%
feed grinder/mixer/roller mill	$_____	_____yrs	_____%	_____%	_____%	= 100%
manure spreader	$_____	_____yrs	_____%	_____%	_____%	= 100%
other equipment	$_____	_____yrs	_____%	_____%	_____%	= 100%

Typical Feeding Year

Graze pasture	_____	months
Graze crop aftermath	_____	months
Winter feeding	_____	months
	12	Total

Production Coefficients	Beginning of 1998	End of 1998
Number of cows	_____hd	_____hd
Number of breeding bulls	_____hd	_____hd
Bull calves	_____hd	_____hd
Heifer calves (includes replacements less than 3 yrs of age)	_____hd	_____hd
Calves weaned per cow exposed)	_____%	
Wt. of calves at transfer into backgrounding/finishing	_____lbs	
Value of bred brood cows	_____$/head	
Salvage (cull) value brood cows	_____$/head sold	
Useful life expectancy of cows	_____years	
Value of breeding bulls	_____$/head	
Salvage (cull) value breeding bulls	_____$/head	
Useful life of breeding bulls	_____yrs	
Breeding stock death loss	_____%	
Average debt-to-asset ratio	_____%	
Shares of Bison Coop Stock	_____number	

Bison Finishing Enterprise Budget Instructions

Sales

Sales for the finishing enterprise consist of selling finished bulls to the North American Bison Cooperative, or selling the animals through private sale. Please indicate the number of animal sales by category and the total value of the animals sold in each category. Please include the value of any animals which are used for home consumption. If there is any other income associated with or derived from the bison finishing enterprise, please enter that amount in the total for the enterprise.

Direct Costs

Feed

This section of the questionnaire determines those quantities of various feedstuffs used for the finishing enterprise. Please indicate the quantities of feed and pasture used for the finishing enterprise on an annual basis even though the average finishing period (from weaning to slaughter) is likely longer than 12 months.

Crops produced on the farm will be valued at their market price. As such, you do not need to indicate the cost associated with producing the crop or the cost if those feeds were purchased. However, for those feeds which the value can vary dramatically, please indicate what the cost is (for example, protein supplements, range cake, vitamins, and minerals). The mixed ration would include any processed feed which is, or could be, commercially blended; such as a pelleted blend of screenings, corn, and vitamins. Also, please remember that the quantities of feed are for the entire finishing enterprise.

If you rent pasture, please indicate the number of acres grazed and the pasture rental rate per acre. Please include any additional fencing costs on rental pasture in the fence expense section.

In order to estimate the economic impact of the bison industry on North Dakota's economy, the amount of each input that is purchased in-state versus out-of-state must be known. For purchased feed, please indicate the amount purchased in-state versus out-of-state.

Other Direct Costs

Probably the easiest method to obtain the other direct costs is to use the 1998 1040F tax statement. Please transfer the amount from each category on the 1040F tax form to the questionnaire in the appropriate expense category, under the 'Total Cost' column in the questionnaire. Then indicate the percentage of the total cost that should be attributed to the bison finishing enterprise. Any expenses which are not requested in the direct costs section may be included in the 'other' expense category. Subsequently, please estimate the amount of each expense purchased in-state and out-of-state.

To avoid double counting when estimating the percentage of fuel and oil expense attributed to the finishing enterprise, please do not include the percentage of fuel expense that is used to produce forage and feed grains. This expense will be captured in the market value of the forage and grains. Operating interest expense is that interest which accrues on annually borrowed operating capital. Long term interest expense is that interest which accrues on long-term purchases (more than 1 year) such as finishing bulls, machinery, fencing, etc.

Overhead Costs

Fencing

To estimate fencing costs, please estimate the per mile cost of your perimeter and cross fences. Please estimate the miles of both types of fencing. Fencing costs were separated because we (from interviews with your fellow North Dakota bison producers) found that producers would be most likely to remember the cost per mile of their perimeter and cross fencing. Then simply estimating the number of miles of fencing should be straight forward. Again, please indicate if any fencing materials were purchased out-of-state.

As part of the overhead expenses, please indicate the current value (original purchase price or an estimated replacement value) of your bison handling facilities (corrals, chutes, headgates, and handling facilities) and the expected years of useful life. Also, please enter the percentage of these expenses that you would allocate to the bison finishing enterprise. [**HINT**: The percentage of fixed expenses allocated to the bison finishing enterprise and the cow-calf enterprise should total 100 percent for those types of equipment which are used exclusively for bison production.]

To determine the cost of equipment a typical North Dakota producer uses for his bison finishing enterprise please indicate the current value and years of remaining useful life of each piece of equipment you use for the enterprise. Then please estimate the relative share of that equipment which is allocated to the enterprise. If you have equipment which is not listed, please include it in the other category. Again, to avoid double-counting, do not include that equipment, or share of equipment, which is used to produce the forage and feed grains. In other words, only include your perception of the share of equipment which is used to actually feed and care for the finishing animals. Please indicate the amount of equipment that was purchased out-of-state.

Production coefficients

To better understand how the typical bison finishing enterprise is managed in North Dakota, please estimate the average number of months that the finishing herd grazes pasture and crop aftermath (if any) and is fed previously harvested forage. Finally, in order to develop a meaningful enterprise budget, we need some production coefficients. These coefficients are self explanatory (the number of head in each category in the beginning of the year and end of the year).

Bison Backgrounding/Finishing Enterprise Budget-1998

Total for enterprise

Sales	Total Quantity	Total Value (at sale or transfer)
Heifer sales	_____hd	_____$
Bull sales	_____hd	_____$
Stock dividend		_____$
Other Income (skulls, hides, horns, hunting)		_____$

Direct Costs		If Purchased		
Feed	Quantity	in-N.Dak.	out-of-State	
Corn (bu)	_____bu	_____%	_____%	= 100%
Oats (bu)	_____bu	_____%	_____%	= 100%
Barley (bu)	_____bu	_____%	_____%	= 100%
Sorghum (bu)	_____bu	_____%	_____%	= 100%
Screenings (tons)	_____tons	_____%	_____%	= 100%
Other Grain (specify _____tons)	_____tons	_____%	_____%	= 100%
Alfalfa hay (tons)	_____tons	_____%	_____%	= 100%
Corn silage (tons)	_____tons	_____%	_____%	= 100%
Sorghum silage (tons)	_____tons	_____%	_____%	= 100%
Stover (tons)	_____tons	_____%	_____%	= 100%
Grass hay (tons)	_____tons	_____%	_____%	= 100%
Mixed hay (tons)	_____tons	_____%	_____%	= 100%
Oat or grain hay (tons)	_____tons	_____%	_____%	= 100%
Pasture (owned)	_____acres	_____%	_____%	= 100%
Pasture (rented)	_____acres	_____%	_____%	= 100%
If rented, cost per acre	_____$/acre	_____%	_____%	= 100%

	Quantity	Cost	Purchased in-N.Dak.	out-of-State	
Protein supplements, range cake (lbs)	_____lbs	$_____	_____%	_____%	= 100%
Vitamins, minerals (lbs)	_____lbs	$_____	_____%	_____%	= 100%
Mixed ration (tons)	_____tons	$_____	_____%	_____%	= 100%

Other Direct Costs	Total Cost (from 1040F)	% attributed to finishing enterprise	Purchased in-N.Dak.	out-of-state	
Fuel and oil	$_____	_____%	_____%	_____%	= 100%
Veterinarian and medicine	$_____	_____%	_____%	_____%	= 100%
Marketing	$_____	_____%	_____%	_____%	= 100%
Supplies	$_____	_____%	_____%	_____%	= 100%
Repairs	$_____	_____%	_____%	_____%	= 100%
Hired labor	$_____	_____%	_____%	_____%	= 100%
Machinery work hired	$_____	_____%	_____%	_____%	= 100%
Utilities	$_____	_____%	_____%	_____%	= 100%
Miscellaneous farm expense (Insurance, dues, subscriptions)	$_____	_____%	_____%	_____%	= 100%
Operating interest expense	$_____	_____%	_____%	_____%	= 100%
Long term debt interest expense	$_____	_____%	_____%	_____%	= 100%
Property taxes	$_____	_____%	_____%	_____%	= 100%

Fencing (finishing enterprise)	Cost per Mile	Number of miles attributed to finishing enterprise	Purchased in-N.Dak.	Purchased out-of-state	
Perimeter fencing	$_____	_____miles	_____%	_____%	= 100%
Cross fencing	$_____	_____miles	_____%	_____%	= 100%

Other equipment not associated with forage production &/or harvesting	Current Value	Useful life remaining	% attributed to finishing enterprise	Purchased in-N.Dak.	Purchased out-of-state	
corrals, chutes, and handling facilities	$_____	_____yrs	_____%	_____%	_____%	= 100%
stock trailer	$_____	_____yrs	_____%	_____%	_____%	= 100%
tractor	$_____	_____yrs	_____%	_____%	_____%	= 100%
loader	$_____	_____yrs	_____%	_____%	_____%	= 100%
feed wagon	$_____	_____yrs	_____%	_____%	_____%	= 100%
hay racks/feed bunks	$_____	_____yrs	_____%	_____%	_____%	= 100%
pickup truck	$_____	_____yrs	_____%	_____%	_____%	= 100%
utility vehicle/quad runner	$_____	_____yrs	_____%	_____%	_____%	= 100%
semi tractor-trailer	$_____	_____yrs	_____%	_____%	_____%	= 100%
self-feeders	$_____	_____yrs	_____%	_____%	_____%	= 100%
livestock scale	$_____	_____yrs	_____%	_____%	_____%	= 100%
feed storage (hopper bins)	$_____	_____yrs	_____%	_____%	_____%	= 100%
feed grinder/mixer/roller mill	$_____	_____yrs	_____%	_____%	_____%	= 100%
manure spreader	$_____	_____yrs	_____%	_____%	_____%	= 100%
other equipment	$_____	_____yrs	_____%	_____%	_____%	= 100%

Typical Feeding Year

Graze pasture	_____	months
Graze crop aftermath	_____	months
Feedlot	_____	months
	12	Total

Production Coefficients	Beginning of 1998	End of 1998
Number of bulls on feed	_____hd	_____hd
Number of heifers on feed	_____hd	_____hd
Weight of bull calves	_____lbs/hd	_____lbs/hd
Weight of heifer calves	_____lbs/hd	_____lbs/hd
Average replacement (cull) rate of brood cows	_____%	
Average debt-to-asset ratio	_____%	
Rate of gain from weaning to slaughter or sale	_____lbs/day	
Sale or slaughter wt	_____lbs/hd	
Death loss	_____%	
Shares of Bison Coop Stock	_____number	
Bulls purchased to finish in 1998	_____number	

APPENDIX C.
BISON SURVEY AVERAGE COW-CALF PRODUCTION COEFFICIENTS, 1998

Typical Feeding Year	
Graze Pasture	7 months
Graze Crop Aftermath	1 months
Winter Feeding	4 months
Total	12 months

Calves weaned per cow exposed	85 %
Calculated calves weaned per beginning inventory of cows	88 %
Weaning weight of calves (lbs)	416
Useful life expectancy of cows (yrs)	20
Useful life expectancy of breeding bulls (yrs)	8
Average replacement rate of brood cows	3.3 %
Average debt-to-asset ratio	10 %
Breeding stock death loss	1.3 %
Shares of NABC stock owned (number per respondent)	52
Number of observations	16

APPENDIX D.
BISON SURVEY AVERAGE FINISHING PRODUCTION COEFFICIENTS, 1998

Rate of gain from weaning to slaughter (lb/day)	1.3
Average slaughter weight (lbs)	1,064
Death loss	1.0 %
Shares of NABC stock owned (number per respondent)	135
Number of observations	6