
Economic Impact of Washington Dairy Farms: An Input-Output Analysis

Working Paper Draft

October 16, 2007

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Executive Summary and Project Overview

Historically, milk has been Washington's second leading agricultural commodity in terms of value of production following apples. In 2007, milk may become Washington's leading agricultural commodity due to much improved milk prices over 2006. Further when you consider livestock sales from cull cows and calves in addition to milk's value of production, dairy production is a vitally important agriculture commodity in Washington's economy. Cash receipts generated by milk production and livestock sales are important measures of dairy farms' direct economic impact on Washington State. In addition to direct economic impact, dairy farms indirectly impact the local economy through purchases of inputs such as labor, services, equipment and feed. More generally, Washington's economy is affected by income and employment growth within the dairy industry and its supporting businesses. Through this cycling of dollars and industry linkages, economic changes in the dairy sector have an impact on the general economy in Washington that is considerably greater than its direct effects alone.

The purpose of this report is to describe the economic state, conditions and trends for Washington State dairy farm production and to estimate its state level economic impact. Measures of economic impact are estimated using an input-output (I/O) analysis, which explicitly recognizes interrelationships between industries. It measures how an economic sector affects other sectors within an economy in terms of output, income, and employment. The scope of this study is limited to dairy farms. The entire dairy industry which would include farms, milk transportation, milk processing and milk sales, would be substantially larger. It is therefore important to note, that this report estimates the economic impact of Washington dairy farm sector, which should not be inferred to as the entire Washington dairy industry.

Washington's 2006 dairy farms direct economic effect is \$784 million dollars, its indirect effect is \$371.9 million dollars and its induced effect is \$314.0 million dollars. Washington's annual dairy farm's total economic impact is \$1.47 **billion** dollars to the economy based on 2006 costs of production and milk prices. In 2007 milk prices increased substantially and the associated economic impact would be greater as milk prices increase. Washington dairies create substantial employment throughout the State. Washington's direct employment effect is 6,168 jobs, its indirect employment effect is 3,626 jobs and its induced effect is 2,859 jobs. Washington dairy farms total employment 12,653 jobs. Clearly Washington dairy farms create substantial economic impacts to the State's economy.

This project was undertaken with the financial support of the Washington Dairy Commission and the Washington Dairy Federation. Research was conducted through the WSU Extension and the School of Economic Sciences. A survey entitled "Washington Dairy Products Commission Washington Dairy Federation and WSU Extension, 2006 Dairy Economic Impact Survey was conducted from March 2007 to June 2007 to obtain economic data on dairy farm production, revenue, operating costs and employment.

I. An Economic Overview of the Washington Dairy Farm Sector

Washington has long been a national leader in terms of milk yield per cow. Figure 1 shows a comparative state map of average per cow milk yields for 2006. Washington's average annual milk yield per cow is 23,055 lbs per cow. In 2006 Washington ranked eleventh in terms of dairy cow numbers, but Washington's dairy cows ranked second in terms of average milk yield per cow. This identifies Washington's long standing comparative advantage in milk production yield. Washington follows Colorado at 23,155 lbs of annual milk per cow as the United States highest yielding State average herd. Historically Washington has been number one or two in terms of milk yield per cow.

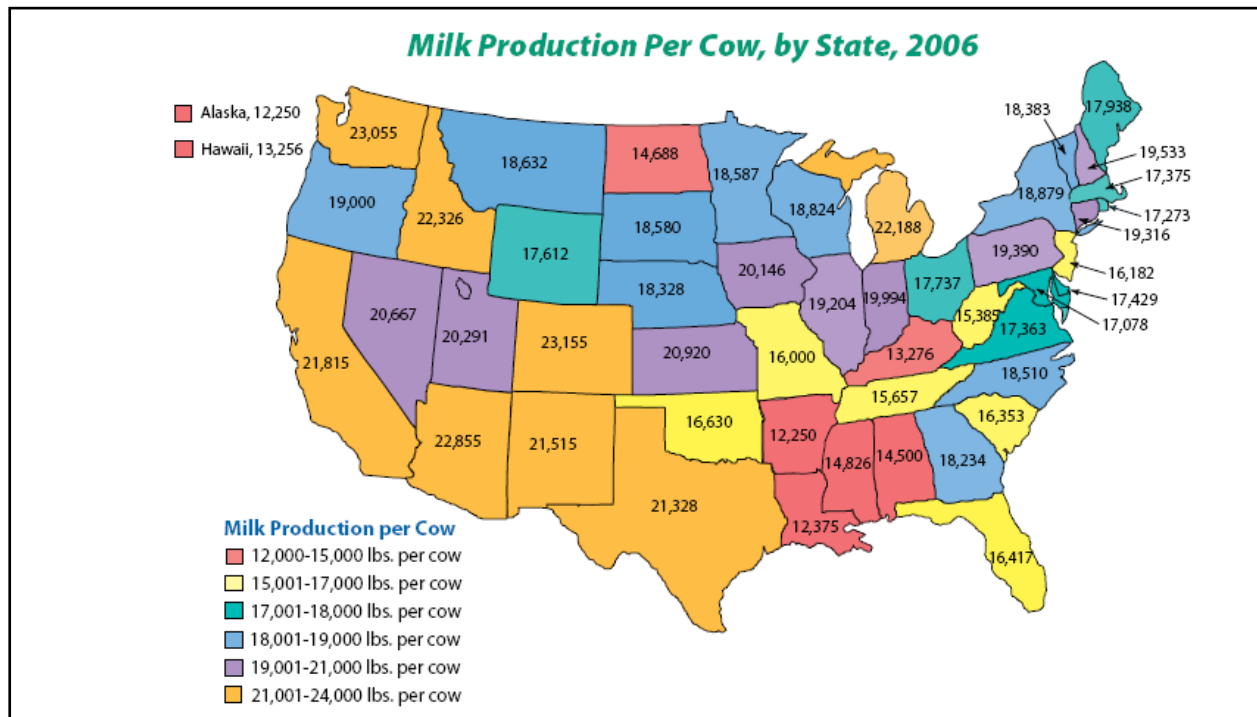


Figure 1. Milk Production Per Cow by State, 2006 USDA Data, Source: http://www.cdffa.ca.gov/dairy/pdf/annual/2006/cost_of_production_annual_2006.pdf

Washington’s total milk production declined 2.6 percent from 2005 to 2006 as shown in Figure 2, due to a decline in the total number of cows in the state. Washington was the only state of the nation’s leading dairy production states to show a decline in total milk production. Although milk production yield per cow continues to grow, the overall dairy herd number has declined from its peak herd size in 1995 and 1996 of 264,000 head, to 237,000 head in 2006. This represents a dairy herd size decline of ten percent. Table 1 provides specific herd demographic, production and cash receipt trend data for Washington’s dairy herd.

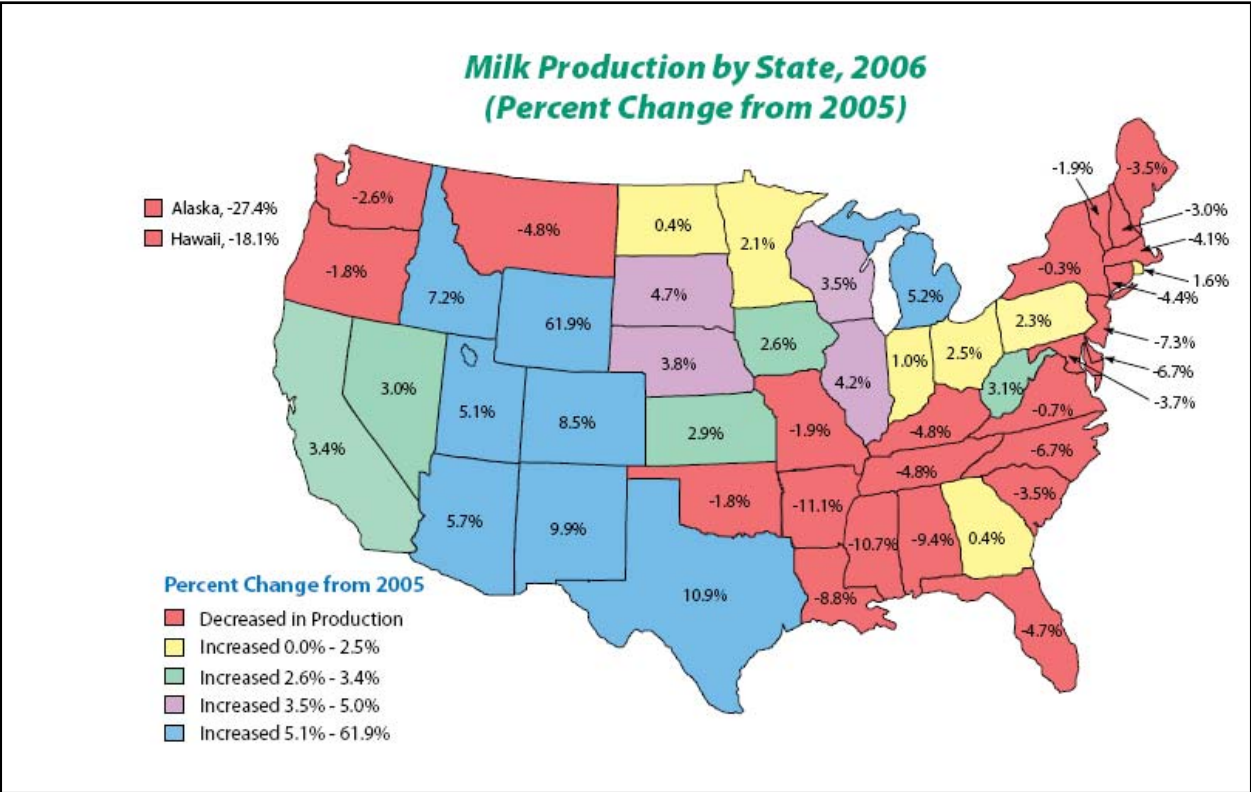


Figure 2. Total Milk Production Percent Change State, 2006 USDA Data, Source: http://www.cdfa.ca.gov/dairy/pdf/annual/2006/cost_of_production_annual_2006.pdf

Table 1. Washington Dairy Herd Demographics and Production Trends

Year	Cows on Farms 1,000 Head	Milk/Cow lbs	Milk Fat/cow lbs	Total Milk Production Million lbs	Total Milk Fat Production Million lbs	Milk Price \$/cwt ¹	Milk Fat Price \$/lb ¹	Milk Cash Receipts 1,000 \$ ^{1,2}
1980	201	14,637	536	2,942	108	13.01	3.55	378,095
1981	205	14,717	537	3,017	110	13.81	3.78	413,822
1982	212	15,198	561	3,222	119	13.66	3.70	436,440
1983	216	16,120	588	3,482	127	13.67	3.75	472,327
1984	214	16,206	593	3,468	127	13.46	3.68	463,211
1985	223	16,816	627	3,750	140	12.76	3.42	476,047
1986	214	17,579	650	3,762	139	12.47	3.37	465,864
1987	216	17,421	643	3,763	139	12.62	3.42	472,340
1988	221	17,946	668	3,966	148	12.50	3.36	492,850
1989	225	18,209	676	4,097	152	13.65	3.68	556,344
1990	237	18,532	680	4,392	161	13.73	3.74	599,294
1991	237	18,814	698	4,459	165	12.57	3.39	557,943
1992	249	19,422	719	4,836	179	13.40	3.62	645,710
1993	257	19,377	711	4,980	183	12.83	3.49	635,005
1994	261	19,935	724	5,203	189	13.09	3.61	677,191
1995	264	20,091	729	5,304	192	12.98	3.57	684,172
1996	264	20,541	728	5,423	192	15.01	4.12	788,075
1997	253	20,968	763	5,305	193	13.81	3.79	728,143
1998	248	21,476	786	5,326	195	15.90	4.34	842,541
1999	247	22,409	818	5,535	202	14.90	4.08	820,245
2000	247	22,644	827	5,593	204	12.80	3.51	711,168
2001	247	22,324	817	5,514	202	15.00	4.10	822,000
2002	247	22,753	835	5,620	206	12.00	3.27	671,040
2003	245	22,780	834	5,581	204	12.10	3.31	671,792
2004	237	22,852	841	5,416	199	15.90	4.32	857,010
2005	241	23,270	854	5,608	206	14.90	4.06	832,165
2006	237	23,055	853	5,464	202	12.60	3.41	686,196

¹ Nominal values

² Cash receipts is production less on farm use, milk utilized, (not in Table 1) multiplied by milk price.

http://www.nass.usda.gov/Statistics_by_State/Washington/Historic_Data/dairy/milkdisp.pdf

Milk production per cow with a few exceptions has been continuously increasing in Table 1 from 1980 to 2006 at 23,055 lbs of milk per cow. Similarly, milk and milk fat production has been increasing in a linear trend. Milk cash receipts or the value of production has substantial variation due to a variable milk price. The average milk price for 2006 was weak at \$12.60 per cwt. Figure 3 shows Washington’s historic value of milk production variability on a nominal and deflated basis. Figure 3 is striking in that on a nominal basis the value of milk production is increasing with variability between years due to variable milk price. However when the value of production is deflated, Washington’s value of production has declined slightly since 1980. This can be simply explained when you look at the nominal milk price in Table 1 for 1980, which is \$13.01 per cwt and twenty six years later in 2006 it is \$12.60. As is common across all

agricultural commodities when you examine agricultural price series, there has been little commodity price growth over this period, and value of production gains were primarily due to yield improving technologies.

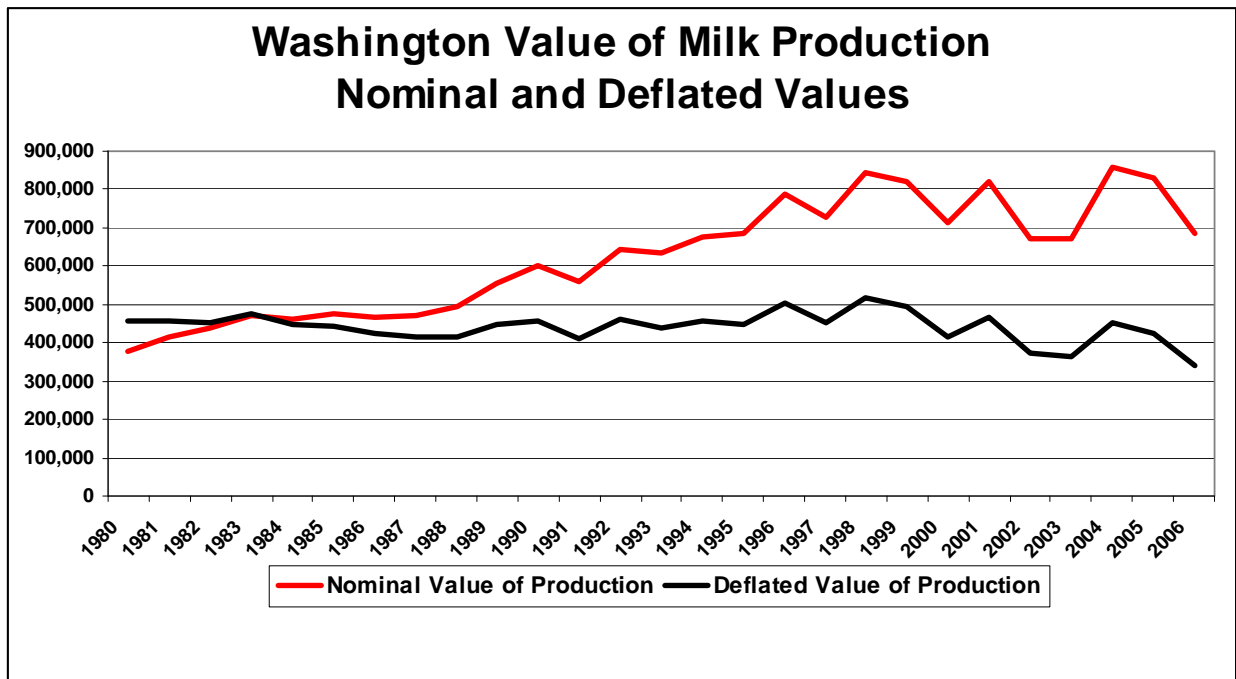


Figure 3. Nominal and Deflated Washington Value of Milk Production.

Figure 4 further illustrates Washington’s milk price dynamics. Nominal milk price exhibits increasing price variation from about 1998 through the end of the series. Importantly when deflating the milk price using the consumer price index, (1982-84 = 100), the price milk producers receive has shown a negative trend. Both milk per cow and milk fat per cow continues to increase. The trend variation in cash receipts is directly attributable to the variation in milk price.

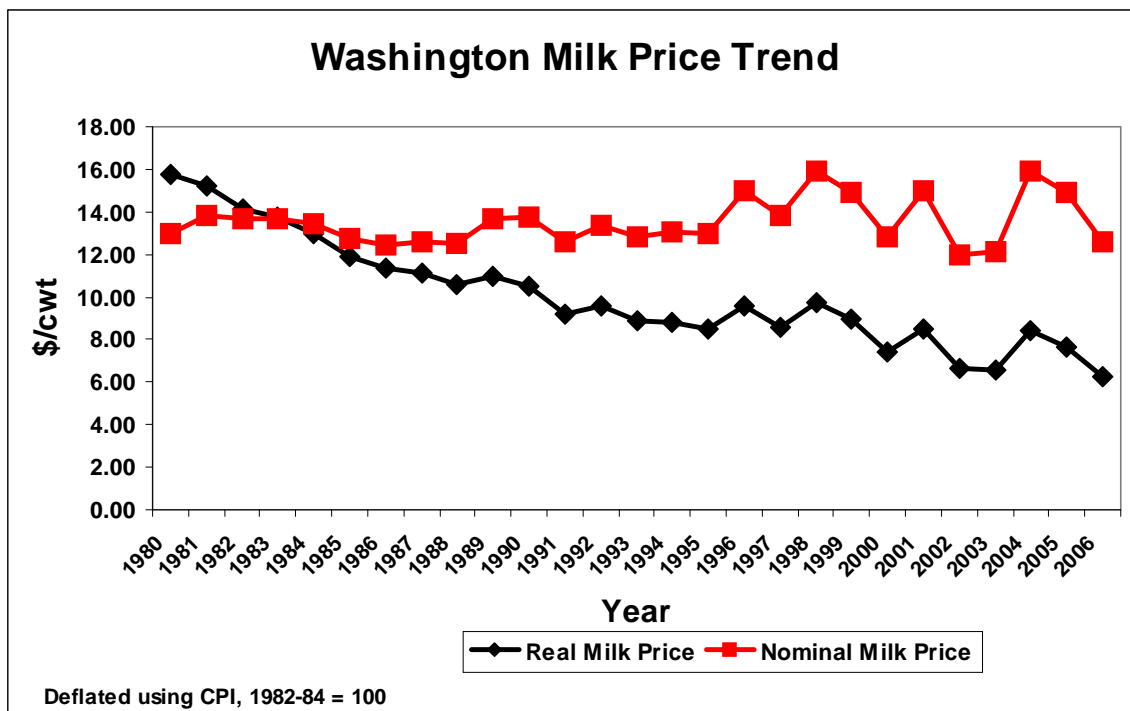


Figure 4. Nominal and Deflated Washington Milk Price.

The lack of growth in milk prices has depressed dairy farm profitability and as a result the number of dairy farms in the state has declined. The dairy herd size peaked in 1995 and 1996 at 264,000 head. The most recent available data for 2006 shows head size at 237,000 head, a decrease of 10 percent, see Table 1. Although state herd size has shown only 10 percent decrease from its peak, the number of dairy operations has declined at a much greater pace. From 1996 to 2006 the number of dairy farms has decreased from 1,700 to 790, a decline of about 54 percent. Figure 5 illustrates the decline in the number of Washington’s dairy operations since 1990.

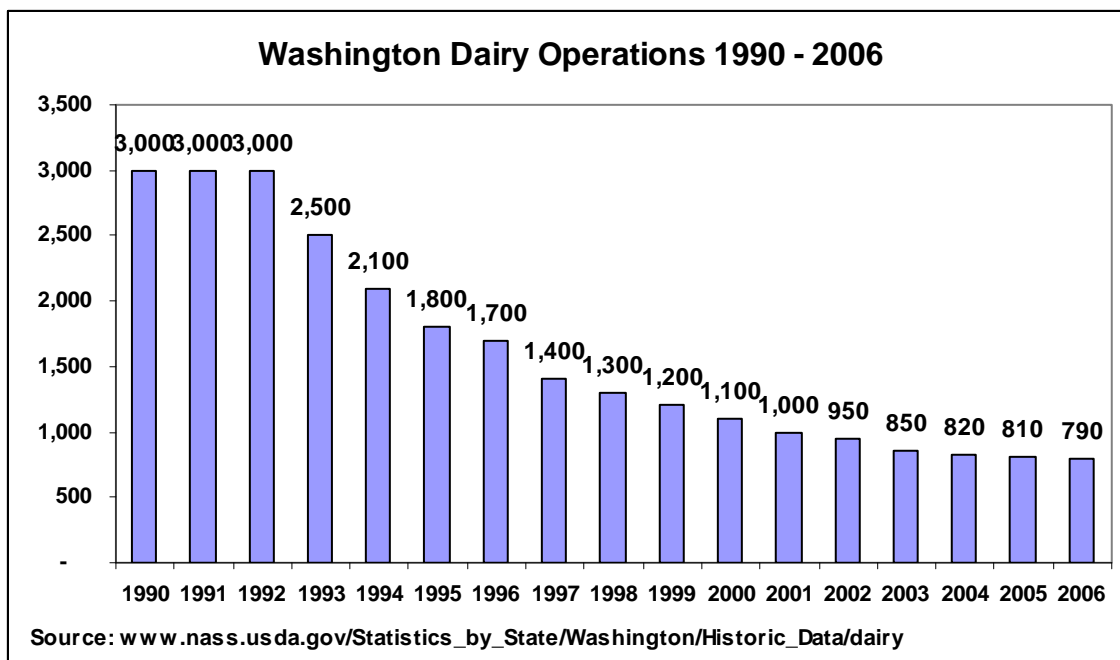


Figure 5. Trend in Washington Dairy Operation Numbers 1990 to 2006.

The decline from 3,000 dairy operations in 1990 to 790 in 2006 represents almost a 74 percent decline in the number of operations. Specifically determining the cause of the decline in operations or identifying the converted use of the terminated dairy operation capital assets is beyond the scope of this study. The decline in dairy operation numbers does have economic effects as the concentration of dairy cows per farm increases. This can be shown using data on production per size group shown in Table 2.

Table 2. Number of Washington Dairies by Herd Size

	1-29 head	30-49 head	50-99 head	100-199 head	200-499 head	500+ head	Total number
2006 data							
Number of operations	250	20	90	140	160	130	790
% inventory	0.3	0.3	2.4	8	22	67	100
% production	0.2	0.2	2	6.6	21	70	100
% change '98-'06	-44	-55	-38	-50	-37	4	-39

Source: <http://www.nass.usda.gov/StatisticsbyState/Washington/HistoricData/dairy/mlcopsz.pdf>

Every herd size category except for the largest size of over 500 head, has had a sizable drop in the number of operations from 1998 to 2006, ranging from a 37 percent decrease in the 200 to 499 herd size to a 55 percent decrease in the number of operations in the 30-49 head herd size. The largest number of operations is small operations with under 30 head, but this group accounts for only, 0.3 percent of the number of cows and 0.2 percent of the production. The largest reported herd size group represents slightly over 16 percent of the total number of operations, but has 67 percent of the number of cows and accounts for 70 percent of Washington's milk production. Clearly the majority of the milk production and cow inventory and thus economic output is generated from the largest farms, but the decline in the number of small operations has negative economic effects due to decreases in a larger number of repeated capital investments needed to operate small operations.

The changing trend in dairy production toward fewer farms with larger number of cows per farm is shown in Table 3. The average number of cows per farm has grown from 191 to 300, an increase of 57 percent from 1998 to 2006.

Table 3. Washington Dairy Farm Size and Average Cows per Dairy.

Year				Total	Total	Average	Milk
	0-99	100-499	> 500	Number of Dairies	Number of Cows 1,000 head	Cows per Dairy	Production million lbs
1998	640	535	125	1,300	248	191	5,326
1999	580	490	130	1,200	247	206	5,535
2000	520	440	140	1,100	247	225	5,593
2001	490	390	140	1,020	247	242	5,514
2002	450	360	140	950	247	260	5,620
2003	360	370	140	870	245	282	5,581
2004	350	335	135	820	237	289	5,416
2005	355	320	135	810	241	298	5,608
2006	360	300	130	790	237	300	5,464

Source:

<http://www.nass.usda.gov/StatisticsbyState/Washington/HistoricData/dairy/mlcopsz.pdf>

Washington Leading Dairy Counties

Using an east-west boundary line of the Cascade Mountain range, approximately 55 percent of Washington dairy herd is West of the Cascades leaving 45 percent east of the Cascades Mountain range. The east side's dairy production is primarily located in Yakima and Grant Counties. As shown in Table 4 Yakima is the county with the largest number of dairy cows, 70,500 cows and about 30 percent of the State's dairy cow population and Grant county has seven percent of the State's dairy cows. Whatcom is the leading West side dairy county and has twenty-two percent of the State's dairy cows. The top 10 counties account for 90 percent of the State's dairy production.

Table 4. Washington's Top Ten Dairy Counties.

Rank	County	Milk Cow Number	Percent of State Total
1	Yakima	70,500	30
2	Whatcom	52,000	22
3	Grant	16,500	7
4	Snohomish	16,500	7
5	San Juan	16,000	7
6	King	10,500	4
7	Lewis	9,500	4
8	Adams	8,400	4
9	Thurston	6,500	3
10	Franklin	6,400	3
Top Ten Total		212,800	90

Source:

<http://www.nass.usda.gov/StatisticsbyState/Washington/HistoricData/dairy/mlcopsz.pdf>

Pacific Northwest Regional Trends

Washington is seeing increased regional competition in dairy production primarily from Idaho's growing dairy industry, and a continued strong California dairy industry. Idaho is one of the fastest growing dairy states in the nation. Figure 5 illustrates Pacific Northwest dairy cow numbers. Since 1990, Idaho's cow numbers have grown from 179,000 cows to 478,000 in 2006. This represents an average annual growth rate of 6.4 percent in cow numbers for Idaho. Idaho surpassed Washington's cow population in 1997. Washington has exactly the same reported number of cows in 2006 as in 1990 with 237,000 cows. Idaho's growth in dairy herd size has introduced increased regional competition in dairy feedstuff markets notably high quality alfalfa hay and has injected tremendous milk production into the regional milk market.

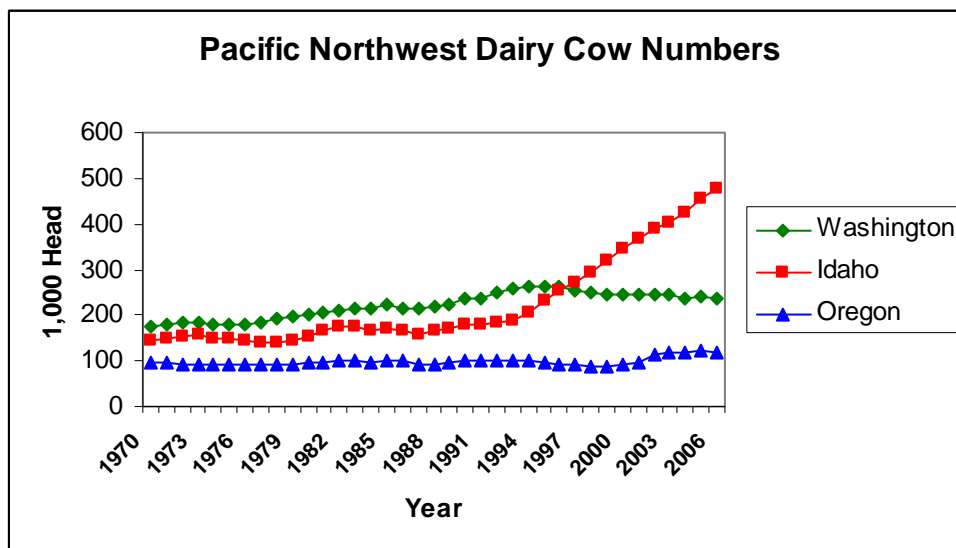


Figure 5. Growth in Pacific Northwest Dairy Cow Numbers.

The Pacific Northwest’s comparative national ranking by total milk production is given in Table 5. Washington has fallen in the rankings as New Mexico and Idaho dairy production has been expanding. Washington’s national ranking is currently the tenth for total milk production. Table 5 further identifies Idaho’s dramatic growth in dairy production as it has increased in state rankings from tenth to fourth over the 1994 to 2006 time periods provided in the table. Oregon has remained the 16th ranked dairy production state, since 2000.

Table 5. Pacific Northwest States Comparative Rank in National Milk Production by Volume of Milk Produced.

	1994	2000	2006
Washington	8	9	10
Idaho	10	6	4
Oregon	15	16	16

Summary of the Economic State of Washington Dairy Farms

Washington’s dairy strength is concentrated in its herd of highly productive milking cows and remains a national leader in terms of milk cow yields. This section presented declining trends in terms of dairy cow numbers, the number of dairy operations, Washington’s comparative national dairy production ranking, and declining deflated milk prices. Dairy farmers are facing economic challenges concerning stagnant to declining milk sales prices and increasing production costs from feed, labor and employee benefit expenses.

II. 2006 Dairy Economic Impact Survey Results

A survey entitled “2006 Dairy Economic Impact Survey” was conducted from March 2007 to May 2007 to obtain data needed to estimate the economic impact of Washington’s Dairy industry using 2006 costs and returns (see appendix 1). The study’s basic framework is built around an economic model to identify dairy farming annual revenues and costs of production. Estimating an industry’s economic impact requires data on income, expenses, sources of inputs purchased, capital improvements, and taxes paid. This research utilizes primary data acquired through a survey instrument in an attempt to improve and calibrate IMPLAN’s internal production functions to improve the economic modeling data inputs representing Washington’s economic conditions. The survey included questions on revenues received by producers for commodities other than milk, such as the sales of heifers, calves, cull cows, and other revenues received. The expense categories included questions on the actual expenses incurred (operating and capital) and on the percentage purchased locally, regionally and out of state. For capital expenses, producers were asked to provide typical annual expenditures.

Surveys were sent to all 480 Washington Dairy Federation member dairy farm owners. Eighty-eight surveys were returned and yielded 82 usable surveys representing a usable response rate of 17 percent. Using the 2006 USDA reported herd size and production as reported in Section I, the survey response represents approximately 20.7 percent of the total state’s inventory of dairy cows, and 23.4 percent of the state’s total milk production.

Table 6 presents a demographic summary of the survey respondents’ dairy operations. The average number of years the dairy operated at its location was 45 years. On average the farm milked 598 cows and had an average annual milk yield per cow of 25,072 pounds of milk per cow. The average dairy owned 333 acres and 62 or 80 percent of the respondents leased additional acreage, 213 acres. Eight-nine percent of the respondents raised crops for their dairy with the majority of raised crop acreage used for corn silage. Only 16 percent of the dairies raised crops for cash sale.

Table 6. Survey Results – Dairy Farm Demographics

Description	n	Average	Standard Deviation
How long had dairy operated at this location (years)	82	45	29
Number of cows milked	82	598	925
Annual milk production per cow (lbs)	82	25,072	5,345
Number of acres owned	82	333	407
Number of acres leased	65	213	277
Do you raise crops for feed	82	0.89	0.31
Do you raise crops not used for feed (yes = 1)	82	0.16	0.37

Table 7 provides summary statistics on the revenue generating activities of the dairy. Clearly milk sales dominate the dairies revenue stream. The average dairy generates over \$1.9 million dollars in milk sales. Additional revenues from cull cows, calves and replacement heifers contribute to total dairy revenue.

Table 7. Survey Results - Dairy Farm Sales and Receipts

Description	n	Average \$	Standard Deviation \$
Milk sales	82	1,959,533	3,142,261
Cull cows	81	81,333	130,948
Calves	72	31,880	58,003
Replacement heifers	20	68,381	153,561
Other dairy income	46	62,861	78,350

The survey results average dairy farm expenses are provided in Table 8. The labor and benefit expenses are separated out from operating and capital expenses. The average farm expense for labor was \$260,525 and on average paid \$44,293 in benefit expense. The survey asked for average over the past five year average annual capital expense cost. The average annual capital expense cost was \$167,437. The average annual property tax paid per farm was \$15,725.

Table 8. Survey Results - Dairy Farm Expenses

Description	n	Average \$	Standard Deviation \$
Annual labor expense	77	260,525	371,446
Annual labor benefit expense	71	44,293	55,418
Annual operating expense (excluding labor and capital)	72	1,477,718	2,231,317
Average annual capital expense	68	167,437	302,394
Annual property tax expense	74	15,725	19,237

The number of farm employees is reported in Table 9. The survey asked for the number of people hired in both full time and part time positions. The part time positions were converted in full time equivalences. On average the farm hired 10.2 employees per farm. The full time equivalency on a per cow basis was 0.01975 employees per cow. Or in other words, each 100 cows required 1.975 employees.

Table 9. Survey Results – Number of Employees

Description	n	Average	Standard Deviation
Total FTE hired employees per farm	76	10.2	13.71
Employees per cow	76	0.01975	0.0154

Total employees is full time employees plus part time and seasonal employees converted to FTE

The survey asked questions to determine regional purchase coefficients for their dairy farm expenses. The dairies predominantly purchase inputs within Washington and locally. The survey estimates that 64 percent of dairy operating purchases are local within 30 miles of their operation. Thirty percent of the inputs are purchased regionally in Washington. For example, it is common for dairies to purchase hay from the Columbia Basin, which in many cases would be a regional purchase as opposed to a local purchase. Out-of-State purchases were estimated to be six percent.

Table 10. Survey Results – Regional Purchase Coefficients

	Percent
Locally (within 30 miles)	64
Regionally (over 30 miles but in Washington)	30
Out-of-State (mail order for example)	6

Survey Respondents Issues of Importance

The survey asked respondents to rank a set of provided dairy issues on a 1 to 5 scale. The number 1 was defined as “**not** important” and 5 was defined “**highly** important”. Table 11 provides the issues and their rankings in the order from highest to lowest importance. Profitability in terms of revenues and costs are the leading issues of concern. Revenue as dictated by milk price has the highest issue ranking at 4.45 ranking, and has the second lowest standard deviation, indicating that its importance is consistent across the survey respondents. Throughout this report milk price consistently emerges as the critical factor effecting dairy farms. As reported in the economic overview section, milk price is in a declining trend, and the 2006 nominal price is the third lowest on record over the twenty-six year history of available data.

Milk price is the primary factor effecting dairy revenue, and feed costs are the primary variable cost and is the second ranked issue of importance. Price and cost were the only two issues that received issue importance scores above 4.

Table 11. Dairy Issues of Importance

Rank	Description	n	Average	Standard Deviation
1	Milk price	83	4.45	1.21
2	Feed costs	83	4.32	1.25
3	Environment	83	3.99	1.23
4	Herd health	83	3.94	1.31
5	Property rights	83	3.93	1.32
6	Regulatory issues	83	3.91	1.25
7	Animal well being	83	3.90	1.34
8	Nutrient management	83	3.82	1.11
9	Labor	83	3.68	1.30
10	Urban encroachment	83	3.22	1.41
11	Estate planning	83	3.11	1.34

Likert question scale, 1= not important, 5 = highly important

III. Input – Output Model: How Dairy Farms’ Economic Impact Multiplies

The agricultural sector in general and the dairy industry specifically, represents basic industries to Washington. Basic industries provide income to a locality by producing an output, purchasing production inputs, services and labor. Dairy product sales and the local jobs and incomes directly responsible for the production of dairy products represent the direct impact of the industry on the locality.

The dairy industry also generates indirect impacts as the revenues from the sales of dairy products are re-spent in the local economy. The indirect impact of the dairy industry on local economies includes purchases of a variety of agricultural inputs and professional services in the process of producing milk. Indirect effects represent additional economic activity in the local economy driven by dairy product sales. These effects appear as jobs and income in local industries serving the dairy industry (e.g., veterinarians, feed suppliers, implement suppliers, trucking and transport).

In addition to the direct and indirect impacts of the production and sales of dairy products outside of the region, the dairy industry is responsible for induced economic impacts in the form of the local goods and service purchased by people using the salaries and wages earned contributing to the productivity of the dairy industry. These induced expenditures translate into jobs and income for retailers, bank tellers, grocery store clerks, restaurant employees, and gas station attendants and so on.

The income generated directly by dairy farms adds to this interdependency; dairy farm employees spend their wages and salaries on groceries, housing, entertainment, and a range of other consumer goods and services. Typically in the dairy farm’s local rural area generating rural economic development. In turn employees in these industries spend their income on consumer goods and services. These additional linkages, beyond dairy and indirectly related sectors of the economy, create induced effects, which help to form a complex intertwining of industries within Washington. So the relevant question to ask is not only what dairy adds to the Washington economy directly, but also how much do dairy farms contribute to Washington’s economy through this complex networking of industries.

To measure the economic impact, we used a social accounting matrix — basically a “snapshot” of the economy that looks at the sales and purchases of goods and services between all sectors of the economy for a given period of time. A social accounting matrix tracks monetary flows between industries and institutions, both market and non-market. The market flows are those between producers of goods and services and consumers, both industrial, and non-industrial (i.e. households, government, investment, and trade). The non-market flows are those between households and government, government and households, and so on. These flows are often called inter-institutional transfers. By looking at dairy farms’ spending and revenues, we can assess the contribution of the dairy industry to Washington’s economy. By tracing the flow of dairy-related dollars throughout the economy we can capture and measure the “multiplier effect.” We used a software package, IMPLAN (IMPact PLANning), to create the social accounting matrix for Washington.

This study uses primary data collected through the survey, Washington 2006 Dairy Economic Impact Survey to improve and calibrate IMPLAN's production functions so they might better conform to local conditions. For example, the survey included questions on revenues received by producers for commodities other than milk, such as the sales of heifers and cattle, and other dairy income received. The expense categories included questions on the actual expenses incurred (operating and capital) and on the percentage purchased locally, regionally within Washington, and out-of-state. These survey results are summarized in the previous section of the report. IMPLAN uses a set of Bureau economic data for labor and economic conditions, and USDA NASS Washington dairy data was used to measure aggregate production.

I-O Model Development

The Input-Output model in this paper is based on the IMPLAN (Impact analysis for PLANning) ProfessionalTM (MPLANproTM) data and Version 2.0 software. The model represents Washington's economic structure for 1997, the latest available from IMPLAN for Washington. The input-output analysis is presented for a type SAM model treating household income and consumption as endogenous.

In order to be consistent with standard I/O accounting, all expenditures in the dairy production enterprise budget must be converted to producer prices rather than purchaser prices. Margin tables were used to convert the enterprise budgets purchaser prices to producer prices. The final products that producers bought in purchaser price were separated into transportation, wholesale, retail margin, and producer price as is standard practice for Input-Output analysis. This was done by using information from the IMPLAN margin tables.

The procedure of Willis and Holland was used to convert dairy enterprise budget into a framework consistent with the standard Input-Output accounting structure. Willis and Holland used six sequential procedures to translate producer enterprise budgets into Input-Output accounts. Similar procedures using two steps were used in this study. The first step was mapping the enterprise budgets into an I/O account framework. This was done by mapping the annual dairy enterprise budget given in Appendix Table 1 into the Input-Output accounting structure. The second step was converting the enterprise budget fixed costs into the IO format presented in Appendix Table 2. To do so, three accounts were created 1) proprietary income; 2) total value added; and 3) total industry outlay (TIO). Finally, it was necessary to calculate the production function technical coefficients. This coefficient was calculated by dividing the individual inter-industries purchase in producer price value by the TIO. Appendix Table 3 illustrates the state's dairy direct economic aggregation mapping to IMPLAN sectors.

Family owned farms have a different economic expenditure flow than corporate owned farms primarily due to farm financial differences in labor expenditures and returns to capital. Proprietary income is the proportion of dairy farm income to family or individually owned dairy farms. Corporate farm income is the proportion of dairy farm income produced by corporately owned dairy farm structures. A study of dairy farm ownership structure using the 1992 Agricultural Census revealed that 80 percent of the dairies were family owned, 15 percent were partnership owned, and about 5 percent were family owned corporations (Outlaw et al. 1996). The 2002 Agricultural Censuses for Washington does not separate Dairy farms from all farms. All

farm ownership structure for Washington has a distribution of about 85 percent family owned, 5 percent partnership and 8 percent corporate ownership (USDA 2002 Ag. Census). For this study it is estimated that 60 percent of the dairy farms have family ownership, and 40 percent impact the economy in a corporate ownership structure. The National Agricultural Statistical Service (NASS) publishes state-level average monthly and annual estimates of milk prices paid to producers (USDA NASS, 2006). This study uses the NASS average annual prices for Washington.

Results and Economic impacts

When final demand for a particular commodity changes, three types of economy wide impacts are measured in a SAM input output model: direct, indirect, and induced effects. Direct effects are the immediate effects within the economy as result of the change in final demand of a particular industry. Table 12 provides the IMPLAN modeling results estimating the economic impact of the dairy farm sector on Washington’s economy. The direct effect Washington dairy production is \$784 million dollars. The indirect and induced effects are \$371.9 and \$314.9 million dollars respectively. The total economic effect is \$1.47 billion dollars. The associated economic output multiplier is 1.876.

Table 12. Results of Washington Dairy Farm Economic Impact

Output (in thousands US\$)	\$
Direct effect	784,000,000
Indirect effect	371,876,133
Induced effect	314,915,297
Total effect	1,470,791,430
Employment (jobs)	jobs
Direct effect	6,168
Indirect effect	3,626
Induced effect	2,859
Total effect	12,653
	multiplier
Output Multiplier	1.876
Employment Multiplier	2.051

Table 13 presents economic impact multipliers for comparable dairy farm studies. This study's findings for Washington output multiplier of 1.876 and employment multiplier of 2.051 are toward the higher end of these comparable studies. This is not surprising given Washington's high yielding dairy cows and mix of large and small dairy farm sizes.

Table 13. Literature Review Dairy Farm Economic Impact Multipliers

Study Description	Location	Year	Output	
			Expenditure Multiplier	Employment Multiplier
Nielsen, et al	Erath County, TX	1998	1.440	2.030
Seidl and Weiler	Colorado	2000	1.948	5.943
Jafri and Buland	Erath County, TX	2000	1.320	1.480
Deller	Wisconsin	2002	1.564	1.424
Flanders, et al	Georgia	2006	1.975	1.680

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Nielsen, Tommie G., Keith O. Keplinger, and Robert H. Neal, Economic Impacts of the Erath County Dairy Industry: An Input-Output Analysis, Livestock and the Environment A National Pilot Project, Texas Institute for Applied Environmental Research Tarleton State University, September 1998.

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USDA, Washington State and County Data, Volume 1 Geographical Area Series, 2002 Census of Agriculture, <http://www.nass.usda.gov/census/census02/volume1/wa/WAVolume104.pdf>

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Appendix Table 1. Annual Revenues and Costs per Cow

Income¹	\$ per cow
Milk sales (\$12.98 cwt * 230.55 cwt)	2,992.54
Cull cow (per cow)	136.45
Calf sales (per cow)	81.77
Other	95.84
Gross Income	\$3,306.60
Variable Costs	
Grain Protein Mix	516.38
Corn silage	195.00
Hay - alfalfa	425.60
Salts and minerals	14.60
Calf starter	50.00
Total Feed Costs	\$1,201.58
Veterinary health, hormones	250.00
Utilities, water, etc	154.00
Fuel	62.00
DHIA and accounting	28.00
Breeding Fees	40.00
Supplies, repairs, misc	130.00
Bedding	30.00
Milk hauling and check-off	297.41
Interest on variable costs	38.38
Labor ¹	397.66
Labor benefits ¹	68.35
Total Variable Costs	\$2,697.38
Fixed Costs¹	
Annual capital cost	289.00
Property taxes	44.00
Insurance	13.64
Total Fixed Costs	\$346.64
Total Cost	\$3,044.02
Income over all costs	\$262.58

¹ Source 2006 Dairy Economic Impact Survey
Milk yield adjusted from survey responses 250.72 cwt. to
USDA reported average milk yield 230.55 cwt.

Appendix Table 2. Washington Dairy Farm Production Function in Input Output Accounting Framework Before Margining.

Sector Names	Dairy Farm Output per Milking Cow	Dairy Farm State Aggregation
	\$	\$
Inputs		
Grain Protein Mix	516.38	122,382,060
Corn silage	195.00	46,215,000
Hay - alfalfa	425.60	100,867,200
Salts and minerals	14.60	3,460,200
Calf starter	50.00	11,850,000
Veterinary inputs medicines, hormones supplies	210.00	49,770,000
Veterinary Services	40.00	9,480,000
DHIA and accounting	28.00	6,636,000
Utilities, water, etc	154.00	36,498,000
Fuel	62.00	14,694,000
Breeding Fees	40.00	9,480,000
Supplies, misc	130.00	30,810,000
Bedding	30.00	7,110,000
Milk hauling	66.86	15,845,820
Check-off (separated)	230.55	54,640,350
Insurance	13.64	3,232,680
 Total Inputs	 2,206.63	 522,971,310
Value Added		
Employee compensation	466.01	110,444,370
Proprietary income	471.97	111,856,890
Other property income	117.99	27,963,630
Indirect business taxes	44.00	10,428,000
 Total Value Added	 1,099.97	 260,692,890
 Total Industry Outlay	 3,306.60	 783,664,200

Appendix Table 3. Dairy Farm Production Function Input and Their Associated IMPLAN Sector.

Sector Names	IMPLAN Sector Number	IMPLAN Sector Description	State Aggregation \$
Inputs			
Grain Protein Mix	47	Animal Food Manufacturing	122,382,060
Corn silage	2	Grain Farming	46,215,000
Hay - alfalfa	10	All other crop farming	100,867,200
Salts and minerals	47	Animal Food Manufacturing	3,460,200
Calf starter	47	Animal Food Manufacturing	11,850,000
Veterinary inputs medicines, hormones supplies	160	Pharmaceutical and medicine manufacturing	49,770,000
Veterinary Services	449	Veterinary Services	9,480,000
DHIA and accounting	455	Business Support Services	6,636,000
Utilities, water, etc	30	Power generation and Supply	36,498,000
Fuel	142	Petroleum Refineries	14,694,000
Breeding Fees	18	Agriculture support activities	9,480,000
Bedding	112	Saw mills	7,110,000
Supplies, misc		\$30,810,000	
70%	257	Farm Equip and Mach. Mnfc.	21,567,000
10%	42	Maint. of Farm and non farm	3,081,000
10%	483	Automotive Truck Repair	3,081,000
10%	410	General Merchandise	3,081,000
Milk hauling	394	Truck Transportation	15,845,820
Check-off (separated)	447	Advertising and Related Services	54,640,350
Insurance	428	Insurance agencies and brokerages	3,232,680
Value Added			
Employee compensation			110,444,370
Proprietary income			111,856,890
Other property income			27,963,630
Indirect business taxes			10,428,000

**Washington Dairy Federation and WSU Extension
2006 Dairy Economic Impact Survey**

The purpose of this survey is to collect the basic information necessary to conduct an economic impact study of Washington's Dairy Industry. Your participation is needed to produce study results that can be used to promote Washington's dairy industry. The information provided will be maintained in a confidential manner. If you have any questions on the survey please contact Stephen Matzen, Washington Dairy Products Commission 425-672-0118 or Shannon Neibergs, WSU Extension, 509-335-6360, sneibergs@wsu.edu.

Demographic and Operation Description

1. Zip code your dairy is located in _____ 2. How long has the dairy operated at this location? _____ (years)
3. How many cows do you milk _____ (head) 4. What is your average daily milked shipped _____ (cwt)
5. How many acres is your dairy _____ (owned) _____ (leased) (acres)
6. Do you raise crops (for example hay, grain or silage) that are used as feed in your dairy (check) ___ yes or ___ no
7. Approximately how many acres are: pasture _____ silage or hay ground _____ grass for dairy feed _____
alfalfa for dairy feed _____ corn silage for dairy feed _____ corn grain for dairy feed _____
acres used for double crop _____ Buildings/parlor _____ other dairy crop _____
nutrient management (manure) not included above _____

8. What are your annual receipts for each of the following dairy categories:

Milk / Farm Receipts		Livestock Sales	
Milk sales	\$ _____	Cull Cows	\$ _____
Other dairy income	\$ _____	Calves	\$ _____
Crop Sales	\$ _____	Replacement Heifers	\$ _____

Labor and Benefit Information and Expenses

9. What is your estimated total annual hired labor expense for the dairy? (do not include benefits) \$ _____
10. What is your estimated annual labor benefit expense (eg. workers comp., social security, insurance)? \$ _____

11. Please complete the table of employment information for your dairy operation:

	Number Employed as	Estimated average percent of full time employment	Estimated average annual amount paid**
Full time year round – category 1*		100%	
Full time year round – category 2*		100%	
Part time year round			
Seasonal labor			
Family labor not included above			

* Categories 1 and 2 are to separate full time higher paid eg. a foreman versus full time lower skilled/paid labor
 ** Annual salary for full time for part time just what you pay them in a year. Do not adjust part time to a full time wage.

12. What benefits do you provide?

	Benefit Provided (check)	If yes, number of employees provided	Estimated annual cost per employee
Workers Compensation	Yes ____ No ____		
Health Insurance	Yes ____ No ____		
Housing	Yes ____ No ____		
Transportation	Yes ____ No ____		
Other _____	Yes ____ No ____		

Dairy Operating Expenses

13. What is your estimated total annual cost of operating your dairy (excluding labor and benefits given above and excluding capital depreciation expense).

\$ _____

14. What is your estimated annual operating costs for your nutrient management plan? \$ _____ (This cost should be included as part of the total in question 13.)

How many acres are listed in your nutrient management plan? _____ acres.

15. How many heifer replacements do you raise _____ and/or purchase _____ (head) for your dairy.

If you purchase heifer replacements what is the typical total annual expense \$ _____.

16. For your annual total dairy expenses in a typical year please estimate the percent of the total that is spent:

Locally (25-30 miles) _____%

Regionally (over 30 but in Washington) _____%

Out of state (mail order for example) _____%

Total adds to 100% 100%

Dairy Capital Expenses (Capital refers to facilities and equipment - machinery)

17. Considering the past five years, what has been your average annual capital investment? \$ _____

18. Are you planning a major capital expansion to expand or invest in your dairy in the next five years? ____ yes ____ no.

If yes, please identify the expansion focus and capital cost, or if no please identify if any expansion constraints exist.

_____ Estimated expansion capital cost \$ _____

19. Estimated annual property tax expense \$ _____

20. For your dairy, please rank the following issues from **1 = not important** to **5 = highly important** by circling number.

Environment	1 2 3 4 5	Real estate development	1 2 3 4 5	GMO feeds	1 2 3 4 5
Urban encroachment	1 2 3 4 5	Animal well being	1 2 3 4 5	Labor	1 2 3 4 5
Gov. milk price order	1 2 3 4 5	Nutrient management	1 2 3 4 5	Herd health	1 2 3 4 5
Feed costs	1 2 3 4 5	Estate planning	1 2 3 4 5		1 2 3 4 5

Thank you for taking the time to complete this survey. Your participation is critical to the success of this project, and your effort is appreciated. Please return the completed survey using the enclosed return envelop, or to: