Staff Paper

Valuing Losses from Depopulating
Michigan Dairy Herds

By
Christopher Wolf, Steve Harsh
and James Lloyd

Staff Paper #2000-10 May 2000

Department of Agricultural Economics
MICHIGAN STATE UNIVERSITY
East Lansing, Michigan 48824

Valuing Losses from Depopulating Michigan Dairy Herds

Christopher Wolf, Steve Harsh
and James Lloyd

wolfch@msu.edu harsh@msu.edu lloydj@cvm.msu.edu

18 pages

Abstract: Depopulating dairy herds in the effort to eradicate disease would have significant economic effects. This paper evaluates farm-level effects that might occur and puts forth a method for quantifying losses. The reader is directed elsewhere for industry or state-level effects of disease eradication or depopulation.

Valuing Losses from Depopulating Michigan Dairy Herds

Christopher Wolf,* Steve Harsh, and James Lloyd

Department of Agricultural Economics
Michigan State University

Staff Paper 00-10
May 2000

* Contact author: Department of Agricultural Economics, Michigan State University, (517) 353-3974.

Valuing Losses from Depopulating Michigan Dairy Herds

Christopher Wolf, Steve Harsh, and James Lloyd
Michigan State University

Depopulating dairy herds in the effort to eradicate disease would have significant economic effects. This paper evaluates farm-level effects that might occur and puts forth a method for quantifying losses. The reader is directed elsewhere for industry or state-level effects of disease eradication or depopulation.

Dairy farms, even those that also grow other cash crops, usually derive the majority (88% on average, Sumner and Wolf) of farm revenue from milk sales. Dairy farms produce a continuous flow of milk in addition to calves, cull cows, and any other cash crops grown on that farm.

When a herd is depopulated for disease control reasons, animals, feed, labor, and net farm revenues are lost. There is also a period of time—perhaps as much as a year—when animals must be kept off the farm. For our purposes here in the following discussion the time at which the herd is dispersed and period without cattle are referred to as the "depopulation period." In addition, consider the transactions costs to find new cattle and the possibility that the market might change in the interim period before the herd repopulates. The re-building of a herd is referred to here as "repopulation."

Our approach to this issue is to deal with the value of the cow, lost net revenues and other losses to arrive at total losses incurred. Where appropriate, we point out sources of uncertainty.

The farm-level losses from depopulation may be divided into lost cattle, or replacement, value, and foregone revenues. The replacement value of the herd may be grouped into milk cows, heifers, steers, and bulls. Foregone revenues may be subdivided into milk and cattle sales. Some expenses, such as cattle replacement, take place a single time. Others, such as milk revenues have a time dimension.

Assumptions

This analysis is motivated by the on-going bovine tuberculosis outbreak in Michigan. As such the methods are in many ways specific to this concern and several assumptions of the procedures and requirements surrounding this disease are used. These assumptions include:

- Payments are made at the beginning of the first 90-day depopulation period (quarter-year). Further, payments are made quarterly for each farm if depopulation extends beyond the first 90-day period.

- The farm will resume operation after a period of depopulation. If the farm

exits the industry, the losses for milk revenue after repopulation and some other factors considered here are not appropriate.

- The farmer bears no clean-up costs associated with disease control and depopulation.

- While payments are quarterly, cattle replacement takes place one time. Foregone revenues may be for more than one quarter depending on the length of depopulation.

This paper describes economic considerations and a method for valuing dairy farm losses from depopulation and illustrates this method with a simple example. The dairy farm industry is diverse across farms with respect to size, technology, and management practices so that accuracy requires using values specific to a given farm. However, because this level of information required may not be present, we illustrate the concepts and benchmark the values using Michigan State University dairy budgets, Telfarm accounting values, and information gathered in the MSU Dairy Profitability and Production Efficiency Project (DPEP). We point out alternative sources of data when available.

CATTLE VALUE

When a herd is depopulated, all animals are removed. The economic losses from depopulation then start with the replacement values of the milking herd, replacement heifers, and any steers, bulls or other cattle.

Milk Cows

What is the value of a dairy cow? The simple answer is that the value of a cow is reflected in the current cattle prices. Springing heifers and milk cows are sold everyday. This market is large. In this respect, if $1,500 is the going market, then this reflects the stream of milk revenues, calves, and the cull value of the cow. If this price is too low, then there should be large amounts of cows demanded which will ultimately short the supply driving up price. Conversely, if that price is too high, supply will exceed demand which drives price down.

The market price of a cow is a function of that cow's traits. The main traits that affect dairy cow value include:

- *Milk production level*: Milk production is the primary value of dairy cattle and the primary indicator of dairy cattle quality. Milk production records might be derived from milk check quantities divided by the number of lactating cows results in an average milk production level or Dairy Herd Improvement (DHI) records.

- *Age*: At some age the value declines as they near the end of their life and, therefore, income generating potential.

- *Breed*: Cow price varies with breed. This is directly related to milk butterfat and protein production levels which are correlated with desirable genetics. Breed also influences animal size and subsequent cull value.

- *Reproductive state*: Cows that are pregnant are worth more than open cattle.

The Michigan Agricultural Statistics Service (MASS) collects cow values. These values are averages, though, and may not reflect the traits of a cow discussed above. Auctions and private sales are also sources of current cow replacement value.

The farmer will also incur transportation costs to repopulate the herd. We assume that these costs are included in the replacement value of the cows in our calculations. If this is not the case, transportation costs should be added to reflect the actual replacement costs the farmer incurs.

The rest of the herd--Heifers, Steers and Calves

Other animals in a dairy herd, whether heifers, steers, bulls or calves are also valued at replacement market rate. Bred heifer value is affected by many of the same variables discussed for the milk cows above. The difference is that rather than actual production records, dam (and sire) records are used to estimate production potential and, therefore, quality.

Steers and bull calves not meant for reproduction are valued by the pound at current market rates which are readily available through public auctions (which may require adjustment by appropriate basis if the market is outside the state).

While the cross-section of herd ages and genetics will not likely be identically replaced during repopulation, it is arguable in most cases whether the replacement animals will be an improvement or decline relative to the original herd.

Geneticists largely agree that environment is more important than genetics in determining milk production level.

Herd replacement takes place only one time. Below, we consider foregone revenues that occur over the depopulation period.

FOREGONE REVENUE

Foregone revenues are a primary concern for a depopulated dairy farm. Revenues that will be foregone during the depopulation period includes milk and unborn calves. In this section we focus on gross revenues which are later adjusted by costs.

Unborn Calf Revenue

Since we considered the pregnancy state of the cow in the milk cow replacement value above, unborn calves were somewhat reflected in cow value. However, to be as accurate as possible, we must account for revenues from calves that would be born during depopulation period without cattle on-farm.

Because the probability of a bull or heifer are roughly equal, the calculation of annual foregone calf value is:

(1) $$\textit{Calf Value} = (1 - \textit{calf mortality rate}) \times \{[0.50 \times \textit{bull calf price}] + [0.50 \times \textit{heifer calf price}]\}.$$

Calf mortality rate is the percent that die either during birth or shortly thereafter. The calf prices are market price and we assume that these calves are sold as new-borns.

Milk Revenue

Milk is the bulk of the total farm revenues on most dairy farms and is straightforward to value. However, the implications of depopulating a dairy herd include the revenues lost while milk production is ceased during depopulation as well as lost milk production after repopulation. Both considerations are dealt with here.

The general amount of milk revenue can be expressed as:

(2) $$\textit{Milk Revenue} = \textit{Milk quantity} \times \textit{Milk price}.$$

Both the price and quantity have herd-specific concerns in their calculation which we discuss here.

Milk Quantity

Quantity of milk can be projected using herd, or better yet individual cow, records. Milk production is affected by weather and general market conditions at the state or region level as well as farm and herd-specific conditions. Two factors complicate the milk quantity calculation: the general nation-wide trend of increasing milk production per cow and seasonal patterns of milk production.

As we mentioned above, weather, crop, and farm conditions influence cow productivity. However, the general trend has been increasing productivity. From 1988 through 1998, Michigan dairy cows increased production by an average of 2% per year (USDA). To accurately account for increased productivity on the farm in question, the past three to five years of milk production on the farm can be used to create a “trend” milk production. The trend is calculated as:

(3) $$\textit{Trend} = [(\textit{Milk production/cow})_t - (\textit{Milk production/cow})_{t-y}]/y \ ,$$

where the milk production values are averages for the herd, *t* represents the most recent year the milk production is available, and *y* is three or five years prior. Then *t-y* is the year three to five previous to the most recent year for milk production. If the base year, *y*, is three (five) years prior, the divisor is three (five). If this trend is an increase of 2% per year, then the milk production level from last year plus 2% is foregone during the depopulation period.

The other consideration for calculating milk quantity is seasonality. Seasonality is the pattern of higher milk production in the spring and lower milk production in the fall and winter. This production pattern reflects the general feed and weather conditions as well as the norm of spring calving (although some herds calve in the fall to take advantage of "fall-incentive" pay). To more accurately predict milk production foregone during the depopulation period, milk production from the same period a year earlier is used.

The milk quantity lost during depopulation is calculated as the milk production from that herd during the most recent year for the season of depopulation plus the trend increase in milk production. The result is a milk quantity calculated as:

(4) $$(Milk\ quantity)^{depop} = (Milk\ quantity)^{s} \times (1+Trend),$$

where "$(Milk\ quantity)^{s}$" is the amount of milk produced during the season, *s*, (or months) of depopulation from the most recent year and "*Trend*" is calculated as in equation (3) above.

Milk Price

Milk price is a combination of the price of butterfat and protein multiplied by the relative amounts of each, plus any other volume and quality bonuses less hauling costs and any deductions for quality.

USDA calculates a milk price for every state that reflects the relevant characteristics, bonuses, and deductions discussed above called the "mailbox price." This price may be used as a proxy for Michigan milk price.

However, it is possible to arrive at an individual milk price for any given farm. By using current butterfat and protein prices, the current producer price differential, and current volume and quality bonuses and deductions, the milk price may be expressed as:

(5)
$$\begin{aligned} Milk\ Price = \quad & (Fat\ Price \times Quantity\ of\ Fat) \\ + \quad & (Protein\ Price \times Quantity\ of\ Protein) \\ + \quad & Quality\ bonuses \\ - \quad & Quality\ deductions \\ - \quad & Hauling\ cost \\ - \quad & Marketing\ assessments. \end{aligned}$$

The protein and butterfat prices should be the blend or uniform prices to reflect the utilization of milk in the order. That is, these prices are weighted by the percent of fluid and manufacturing use milk.

Other sources of milk prices

The need to make predicted payments at least 3 months at a time requires forecasting. There are several sources that might be used to forecast milk prices. These include futures markets (Chicago Mercantile Exchange or New York Board of Trade), academic forecasters (e.g., Larry Hamm), or past prices (e.g., average of last five years for that month).

Each of these sources has the potential for error. Dairy futures contracts in the past three years have been quite accurate one month out (around 97% accurate), reasonably accurate two months out (80%), and virtually worthless three months and beyond (11% accuracy defined by the correlation of nearby futures price to actual milk price; Wolf and Berwald). Academic forecasters synthesize supply, demand, weather, and outlook but are subject to errors. Given the new federal milk marketing order pricing reforms, incorporated January 2000, past prices are not necessarily a reasonable forecast of future prices.

Regardless of the source of the milk price used, a forecast price could be paid (or perhaps 80% of the forecasted revenues) and later corrected after the fact when all prices are known with certainty.

Lost Milk Production after Repopulation

After the depopulation period ends and the dairy herd is repopulated, bringing in new cattle may result in a period of time where the production of those cows is lower than previous levels because of stress of adjusting to new surroundings, herd-mates, and diet. There seems to be support among industry and dairy scientists to support this lost milk production, although the magnitude and persistency of this drop in milk production is not known. However, some experts are of the opinion that this drop was severe but short-term while others thought it less severe and longer-term.

There are several potential scenarios including: a drop in milk production of 25 to 40% for 7 to 10 days; a 10% decline in milk production for 4 months; or both a large production drop for a short period followed by a smaller deficit over a longer period.

There is also some evidence that cows might actually increase milk production in the period following a move. This usually occurs when the cows are moved to a preferable situation (Hadley). For example, if the cows are moved from stanchions to a free-stall barn, less crowded conditions, better ventilated facilities, or the diet is greatly improved on the new farm, then milk production might increase. However, it is reasonable to believe that stress of transport and new surroundings will stress the cattle resulting in milk production levels below potential.

Below we value the losses in milk revenue. As will later be evident, the milk revenue lost during depopulation is actually net of variable milk production costs. However, the milk loss after repopulation is valued at the gross milk price, variable costs are not subtracted, because the farmer is now largely realizing these costs.

Other Losses

In a disease-positive herd, inspectors also determine whether feed and any other substances that cattle have been in contact with must be destroyed. These are valued at current market value. The current market value is less clear for feed not usually traded, like silage. However, prices for products not announced through formal markets are available through informal channels or as a function of related products (e.g., price of corn silage as a function of the price of corn grain).

COST OF PRODUCING MILK

The cost of producing milk enters the calculation of losses from depopulating a dairy herd because lost milk revenues are appropriately reimbursed as *net* of variable costs of milk production. That is, if a farm is not currently producing milk, the losses are not gross milk revenues but the net beyond variable costs which would have been incurred if milk was produced.

During the depopulation period, a dairy farm will not be producing milk and, therefore, will not have variable costs associated with milk production. However, during this period there are fixed costs, such as taxes, insurance, and interest that must be paid to remain in business until such time as repopulation can occur. These fixed costs cannot be avoided during depopulation and therefore are not subtracted from gross milk revenues. There are also reasons to treat labor as a "fixed cost" for these loss calculations which are discussed further below. For this reason, gross milk revenues are reduced by the amount of variable costs forgone during the depopulation period to arrive at the appropriate level of lost net revenue.

Variable Costs

Variable costs for our purposes are those associated with milk production and raising replacements. That is, we need to consider any costs that will not occur when the farm is without cattle and we are only interested in those costs that occur with milk production and raising replacements. These costs include feed, herd health, marketing, supplies, and repairs, custom hire, fuel, replacement, and interest on cattle or operating capital. The values we use are derived from 1998 MSU Telfarm summaries (Nott), MSU Livestock Budgets (Nott *et al.*) and the 1998 MSU Dairy Profitability and Enterprise Efficiency Project (Harsh *et al.*).

Table 1 shows the variable costs by average production for 19,000 and 22,000 pound average herd production levels (state average was 18,000 pounds in 1998, MASS—DHIA is higher).

Table 1. Variable Cost of Milk Production (Cow and Replacement)

	Herd Average Milk Production	
	19,000 lbs	**22,000 lbs**
	$/cwt	$/cwt
1. Feed		
a. Purchased	3.32	3.14
b. Raised*	4.45	4.52
2. Herd Health		
a. Breeding	0.18	0.20
b. Veterinary and medicine	0.47	0.50
3. Supplies	0.58	0.64
4. Repairs	0.48	0.47
5. Fuel and oil	0.04	0.04
Total variable cost	**$9.52**	**$9.51**

* Assumes corn at $2/bushel, corn silage at $16/ton, and hay at $80/ton which reflect conditions at time of writing.

The majority of variable cost of milk production is feed cost. The feed cost above reflects both purchased and home-grown feeds. Other than feed destroyed for disease eradication purposes, feed in inventory will be available after repopulation.

Milk hauling is a variable cost. However, it was accounted for above in calculating the "mailbox" milk price which is net of hauling.

Hired labor would normally be a variable cost. It was not included in this section and is a special case considered after fixed costs below.

The total variable cost, on per hundredweight of milk produced in Table 1 above, will later be multiplied by the amount of milk that would have been produced during depopulation and subtracted from lost milk revenue to arrive at lost "net" milk revenues. We illustrate this in further detail below.

Fixed Costs

Fixed costs cannot be avoided or varied. These include overhead expenses and other costs that accompany an operational farm. The standard table of fixed costs includes interest on investment, depreciation, property taxes and insurance. Because the depopulated farms are assumed to resume operation, the fixed costs must be covered during the interim period. For this reason, we do not subtract fixed costs from the milk

revenues which should allow the farm to stay current on these expenses. Given this handling of fixed costs, it is not necessary to go any further into their calculation.

Labor

Labor is one of the scarce resources on dairy farms. Michigan State University work found that hired labor (both hourly and wage) was used primarily (80%) for the dairy enterprise, including the milking herd and replacements, on Michigan dairy farms (Harsh *et al*.). During the depopulation period, labor used for these enterprises is not needed. However, it is often infeasible to "lay-off" labor and expect it to be available when the farm is repopulated. For this reason, we allow for payment of workers during the depopulation period by not deducting this cost from gross milk revenues.

Since we do not subtract labor costs out of milk revenues, we are allowing for the reimbursement of labor specific to the dairy enterprise and it need not be explicitly accounted for separately.

TOTALING LOSSES

The most accurate method for these calculations incorporates farm-specific records. An alternative to specific farm values is to use values provided by summaries from Michigan State University Telfarm averages (Nott), or Michigan State University Livestock Budgets (Nott *et al*.) and scale those values using size and production values from the farm in question as we have done throughout this paper.

The total losses are the sum from Table 2 below where the milk revenues during depopulation are net of variable costs of production (Table 1). Other prices and quantities are determined as discussed above.

Table 2. Cattle Value and Foregone Revenues

	Unit	Price or cost/unit	Quantity	Value or cost
I. Cattle Replacement Value				
A. Milk cows	head	market price	number on farm	price x quantity
B. Heifers	head	market price	number on farm	price x quantity
C. Bulls/steers	head	market price	number on farm	price x quantity
II. Foregone Revenues				
A. Net Milk Revenue				
1. During depopulation	cwt	(milk price) – variable cost[1]	(herd average + trend) x time[2]	price x quantity
2. After repopulation	cwt	milk price	herd average x (% loss) x time	price x quantity
B. Lost Cow Revenues				
1. Bull calves	head	market price	projected[3]	price x projected quantity
2. Cull cows	head	market price	projected[3]	
III. Feed	tons, bushels, or pounds	market price	amount destroyed	price x quantity
Total				**Sum**

[1] See equation (5) and Table 1 with related discussions.
[2] See equation (4) and discussion for milk quantity.
[3] See equation (1) and discussion for number of bull calves and heifer calves.
[5] Hours required to retain employees—see labor discussion.

EXAMPLE

In order to verify the validity of the methods employed to estimate depopulation loss calculations, we illustrate an example. This example spans the depopulation period and the start-up (repopulation) period that follows. The values are not necessarily indicators of any Michigan operation.

Consider a farm with 100 milk cows that produced an average of 18,630 pounds of milk during the third quarter (July through September) in 1999. This farm showed a trend per cow increase of 2% per year over the 1995 to 1999 period. Using this trend increase, the milk production during the depopulated period of the year 2000 would have been 19,000 pounds of milk per year (15.83 cwt/cow/month). The farm also had 100 replacement heifers of various ages but no steers or bulls. This farm receives an average mailbox price of $13/cwt. The depopulation is for 90 days; the third quarter of 2000. During this depopulation the milk is reimbursed at ($13/cwt - $9.52/cwt) = $3.48/cwt net of variable costs. The total foregone milk production is (100 cows x 15.83 cwt/cow/month x 3 months) = 4,749 cwt total.

Assume that an allowance is made for a 25% decline in milk production for one month (100 cows x 15.83 cwt/cow/month x 0.25 decline x 1 month) = 396 cwt. This milk is reimbursed at $13/cwt as the farmer is paying the bulk of variable costs.

During this three-month period the farm expected 20 calves born. The calf mortality rate is 12%. With the expectation that the calves are 50/50 bull/heifer and heifer calves, the result is:

$$[(1 - 0.12) \times (0.5 \times \text{heifer or bull})] = 11 \text{ of each sold at market price.}$$

There are round bales, 20 at 1,000 pounds each, that must be destroyed as well.

These losses and replacement costs for this farm are totaled in Table 3.

Table 3. Example Depopulation Cattle and Feed Losses-Base, 3 month period

	Unit	Price or cost/unit	Quantity	Value or cost
1. Net Milk Revenue				
a. During depopulation	cwt	$3.48	4,749	$16,527
b. After repopulation	cwt	$13.00	396	$5,148
2. Depopulated Herd				
a. Milk cows	head	$1,800	100	$180,000
b. Heifers	head	$700	100	$70,000
c. Bulls/steers	head		0	0
3. Lost Cow Revenues				
a. Bull calves	head	$100	11	$1,100
b. Heifer calves	head	$200	11	$2,200
4. Feed	tons	$80 (hay)	10 (20 X ½ ton)	$800
Total (for 3 months)				**$275,775**

* Average heifer value across all ages.

The total losses to this farm from the depopulation and following repopulation are $275,775. Of this the majority of the payments reflect replacement value of the cows and heifers. The milk revenue is $21,675 total which represents 7.86 percent of the farm losses.

Sensitivity Analysis—Farm-specific effects

The lack of generality or application of the value from Table 3 to specific Michigan farms cannot be over-stressed. That is to say, the losses in Table 3 will NOT be the value incurred by ANY Michigan farm. Each farm will have different, milk production, herd size, mailbox milk price, and calf mortality just to mention a few farm-specific factors. To illustrate how these factors affect the losses on a farm, we change a couple of the farm values and see how this changes losses from depopulation. Specifically, consider the effect of the milk production level and the price of cattle.

First, consider the milk production level and consequent effect on foregone milk revenues. In the base example (Table 3), the production level had been 18,630 which was trend adjusted to 19,000 pounds. Instead of this production level, consider if this farm had a 25,000 pound herd production average in 1999. With a 2% five year trend increase, the projected milk production in the year 2000 is 25,500 pounds per cow per year (21.25 cwt/cow/month) (Table 4).

Sensitivity analysis is most effective when a single change is made. For this reason, other factors remain as in the base example: the mailbox price is $13/cwt; the depopulation period is 90 days (the third quarter of 2000). During this depopulation the milk is reimbursed at ($13/cwt - $9.52/cwt) = $3.48/cwt net of variable costs. The total foregone milk production is (100 cows x 21.25 cwt/cow/month x 3 months) = 6,375 cwt total.

Assume that an allowance is made for a 25% decline in milk production for one month (100 cows x 21.25 cwt/cow/month x 0.25 decline x 1 month) = 531 cwt. This milk is reimbursed at $13/cwt as the farmer is paying the bulk of variable costs.

Table 4. Example Cattle and Feed Losses—25,000 pound/cow milk production

	Unit	**Price or cost/unit**	**Quantity**	**Value or cost**
1. Net Milk Revenue				
a. During depopulation	cwt	$3.48	6,375	$22,185
b. After repopulation	cwt	$13.00	531	$6,903
2. Depopulated Herd				
a. Milk cows	head	$1,800	100	$180,000
b. Heifers	head	$700	100	$70,000
c. Bulls/steers	head		0	0
3. Lost Cow Revenues				
a. Bull calves	head	$100	11	$1,100
b. Heifer calves	head	$200	11	$2,200
4. Feed	tons	$80 (hay)	10 (20 X ½ ton)	$800
Total (for 3 months)				**$283,188**

The result of a 25,000 pound herd milk production level relative to a 18,630 1999 herd production level is $7,413 more in losses from foregone milk revenue.

As another example of the herd or farm-specific effect on the economic losses of depopulation, consider the value of cattle. Actually, the previous example might have more accurately reflected reality if replacement value of cattle had increased with the milk production level. As was discussed earlier in valuing cattle, the major attribute in determining milk cow value is milk production.

Rather than a difference in milk production, consider a herd with cows worth $1,400 each (Table 5). We leave all other factors the same so that we can consider the change from base case.

Table 5. Example Cattle and Feed Losses—$1,400 cow price

	Unit	**Price or cost/unit**	**Quantity**	**Value or cost**
1. Net Milk Revenue				
a. During depopulation	cwt	$3.48	4,749	$16,527
b. After repopulation	cwt	$13.00	396	$5,148
2. Depopulated Herd				
a. Milk cows	head	$1,400	100	$140,000
b. Heifers	head	$700	100	$70,000
c. Bulls/steers	head		0	0
3. Lost Cow Revenues				
a. Bull calves	head	$100	11	$1,100
b. Heifer calves	head	$200	11	$2,200
4. Feed	tons	$80 (hay)	10 (20 X ½ ton)	$800
Total (for 3 months)				**$235,775**

The result of this $400 per cow decrease in value is a $60,000 increase in losses or replacement costs. The total losses are then $235,775.

Alternatively, the cow replacement value or milk production, or any number of other factors, could be different (higher or lower) for a given farm.

SUMMARY AND CONCLUSIONS

Depopulation has serious economic implications for a dairy farm. We identified losses from depopulation in replacement of animals, net milk revenues, milk production after repopulation, bull calves and heifer calves, and feed. The herd replacement is a single calculation while the foregone revenues might be over a period up to a year.

One method of payments is to make pre-payments of perhaps 80% of projected net milk revenues during depopulation and follow that with an amendment check. This allows actual current milk price to be used. It is very important that the losses be calculated for the individual situation of the farm in question. To this end this paper might serve as a model to illustrate the sources and calculation of losses.

This paper considers total losses. The percent of these losses that should be indemnified and compensated to producers is up to policy-makers and beyond the scope of this work.

References

Fiez, E.A. and N.R. Rimbey. "Enterprise budgets for dairy operations." *Western Regional Extension Publication 124*. 1993.

Frank, G.G. "Calculating you milk production costs and using the results to manage your expenses." University of Wisconsin, Center for Dairy Profitability. August 1996.

Hadley, G. "Dairy Expansion in the Upper Midwest." Unpublished M.S. Thesis. 2000.

Harsh, S.B., C.A. Wolf, and E. Wittenberg. "Summary of Michigan Dairy Profitability and Enterprise Efficiency Project, 1998." Draft Michigan Agricultural Experiment Station Research Report. January 2000.

Nott, S.B. "1998 Business Analysis Summary for Dairy Farms." *Staff Paper 99-37*. Department of Agricultural Economics, Michigan State University, July 1999.

Nott, S.B., G.D. Schwab, J.D. Jones, J.H. Hilker, and L.O. Copeland. "1995 Crops and Livestock Budgets Estimates for Michigan." *Agricultural Economics Report No. 581*. Michigan State University, May 1995.

United States Department of Agriculture – National Agricultural Statistics Service. *Agricultural Statistics*, Annual Issues 1989-1999.

Wolf,C.A. and D.K. Berwald. "The Performance of an Emerging Futures Market: The BFP Contract at the New York Board of Trade." MSU Ag. Econ. Staff Paper 99-47. October 1999.

Sumner, D.A. and C.A. Wolf. "Diversification, Vertical Integration and Dairy Farm Size." Draft paper, June 1999.

APPENDIX—BLANK TABLE

Dairy Farm Losses from Depopulation

	Unit	Price or cost/unit	Quantity	Value or cost
I. Cattle Replacement Value				
A. Milk cows	head			
B. Heifers	head			
C. Bulls/steers	head			
II. Foregone Revenues				
A. Net Milk Revenue				
1. During depopulation	cwt			
2. After repopulation	cwt			
B. Lost Cow Revenues				
1. Bull calves	head			
2. Cull cows	head			
III. Feed	tons, bushels, or pounds			
Total				