Economic Assessments of Best Management Practices and Environmental Policy Options for Attaining the Total Maximum Daily Load (TMDL) Goal in Louisiana Major Milkshed

Krishna P. Paudel, Assistant Professor
Department of Agricultural Economics and Agribusiness
Louisiana State University
Baton Rouge, LA 70803
Phone: 225-578-7363
Fax: 225-578-2716
Email: kpaudel@agcenter.lsu.edu

Wayne M. Gauthier, Associate Professor
Department of Agricultural Economics and Agribusiness
Louisiana State University
Baton Rouge, LA 70803
Phone: 225-578- 2765
Fax: 225-578-2716
Email: wgauthier@agcenter.lsu.edu

Preliminary Report submitted to Louisiana Water Resource Research Institute as a fulfillment for a project funded between March 1, 2003 - Feb 28, 2005

ECONOMIC ASSESSMENTS OF BEST MANAGEMENT PRACTICES AND ENVIRONMENTAL POLICY OPTIONS FOR ATTAINING THE TOTAL MAXIMUM DAILY LOAD (TMDL) GOAL IN LOUISIANA MAJOR MILKSHED

EXECUTIVE SUMMARY

Louisiana Dairy farmers were surveyed to understand dairy manure disposal, perception toward the implementation of dairy termination programs to reduce water pollution, BMP adoption rate and impact of alternative BMP policy on water pollution reduction in the region. Survey information indicated that many farmers are applying manure on nearby pasture and cropland primarily because cost associated with manure hauling and spreading farther would be in excess of the amount when chemical fertilizer is used as a substitute for manure. Many farmers also indicated that the reason for not selling dairy manure is due to a lack of functioning manure market in the region. Very few farmers supported the use of dairy termination program as a tool for reducing manure related problem in the region. Farmers have not adopted best management practices sufficiently primarily because the government support in terms of cost share is not sufficient to adopt these environmentally benign practices. Simulation of alternative best management practices to reduce water quality came out too costly even to reduce a small amount of pollutant load in the watershed. This indicates a need for significant role of the government support to reduce water pollution in the region in terms of dairy best management adoption cost share.

SECTION I. BMP adoption

Best management practices (BMPs) are voluntary environmental practices recommended for nonpoint source pollution control and funded by the Environmental Quality Incentive Program (EQIP) of the United States Department of Agriculture/Natural Resource Conservation Service (NRCS). The federal government enters into cost share and fixed incentive payment arrangements with farmers who qualify and are willing to incorporate selected BMPs into their farming operations. Despite the government's willingness to underwrite the cost of implementation, BMP adoption rates are uniformly and relatively low. The main reasons cited by farmers for their nonadoption decisions are the associated production and profit reductions, too low percentages of cost share by the government, and too small incentive payments.

Over time, dairy farming in Louisiana has trended downward both in the number of dairy farms and total volume of milk produced. Primary reasons for the decline include the technologically driven intensity of competition from other regions and the cost of compliance with environmental regulations. As a consequence, the Louisiana dairy industry is no longer the engine of economic activity that it once was in areas of the state largely in need of such an engine. Maintaining and enhancing that engine will require Louisiana farmers to remain in compliance with environmental regulations while enhancing the profitability of dairy farming in Louisiana. This most likely will require increases in total milk production both at the farm and industry levels. This translates into more milk per cow and more cows in the state.

Milk production has a great potential to create negative externalities associated with the production, storage and handling of dairy manure. Dairy manure can be both a point and nonpoint source of water pollution. Manure can harm the environment through nutrient buildup in the soil and subsequent runoff and leaching to surface and ground water. The volume of

manure can be minimized by reducing cow numbers but that option has negative implications for maintaining and creating a viable dairy industry. An alternative to reducing cow numbers is to implement BMPs for handling and storing dairy manure. Some adoption of dairy manure BMPs has occurred in Louisiana due to the cost share percentages and one-time fixed incentive payments. Encouragement to maintain an established BMP, waste treatment lagoon, through the use of environmental funds for lagoon cleanouts is evidence of a commitment on the local level to maintain both the dairy farms and promote the environment. The perception among dairy farmers in Louisiana is that, as goods, BMPs are publicly desirable but privately too costly. The obvious result is low adoption rates despite the claim from the USDA that all BMPs are profitable (Cooper and Keim 1996).

Objectives

The adoption of BMPs has been studied in Louisiana (Rahelizatovo and Gillespie; Henning and Cardona) and other areas of the country (Valentin, Bernardo, and Kastens; Cooper; Ribaudo and Agapof; Taylor *et al.*). The purposes of this paper are to describe factors bearing on adoption decisions by Louisiana dairy farmers for specific BMPs and to contrast the cost share levels granted to the adopters against the levels identified by nonadopters as being necessary to make them adopt a BMP. To accomplish this, we will:

(1) Relate sets of variables describing Louisiana dairies and dairy farmers to the adoption of BMPs in terms of adoption costs, producer's cost share percentages, and EQIP incentive payments required to entice non-adopters to adopt specific BMPs;

(2) Assess how selected socio-economic characteristics of Louisiana dairy farmers contribute to the likelihood of the adoption of a BMP;

(3) Compare USDA-NRCS benchmark adoption cost estimates with the cost of BMP establishment reported by survey respondents and to identify their cost share percentages and incentive payments by BMP; and

(4) Identify how sources of information might influence the BMP adoption decision.

Data and methods

The tailored design method (Dillman) was followed in the construction and conduct of the survey. A focus group, consisting of dairy farmers and county agents from the three parishes in the principal milk production area of Louisiana, was used to help design and pre-test the survey instrument. The survey was mailed to all 325 Louisiana dairy farmers with an option to complete the survey online. The twelve-page length of the survey was a known negative. Two weeks after the initial mailing, non-respondents were contacted with a postcard reminder request to complete the survey. A second round of surveys was mailed to dairy farmers three weeks after the first round. To further encourage participation, payments of $10 per survey for the first fifty fully completed surveys were promised along with an opportunity for all respondents to qualify for a $250 lottery cash prize drawing. The size and number of payments offered were limited by the availability of funds. A graduate student repeatedly contacted dairy farmers by phone requesting survey completion. The combination of payments, follow-up post card requests and phone calls resulted in only 49 usable surveys for a 15 percent response rate.

The twelve-page survey had four distinct sections including dairy manure disposal, milk reduction programs, dairy best management practices (BMP) adoption, and socio-economic characteristics of the principal operator.

One section of the survey asked questions related to the adoption of best management practices (BMP) in terms of: 1) cost shares and EQIP incentive payments; 2) sources of information most important in making the adopt /non-adopt decision; and 3) the role of USDA-NRCS in the responder's adoption or non-adoption decision. Eighteen BMPs identified by USDA-NRCS as most appropriate for Louisiana dairy farms were identified in terms of cost-share or EQIP incentive payment per practice. A common format used in presenting each of the eighteen BMP practices and in eliciting responses is presented in Appendix A. The BMP was described in the survey and identified with its USDA-NRCS code number and an estimated reference cost. The BMP reference cost was an average cost based on adoption information of the BMP in Louisiana between 1997 and 2001. It was the reference value used to elicit responses about BMP adoption for the farmer if the farmer was required to use that BMP to produce and sell milk. Because the true cost of a BMP is unique to each dairy farm, responders were asked to estimate their cost of implementing each BMP on their farm. Appendix A identifies each of the 18 BMPs with a definition and estimated reference cost.

The BMP adoption section of the survey also asked producers to identify which of the following reasons best described why they did not adopt a specific BMP: 1) producer expected to retire from dairy farming; 2) BMP was not cost effective, regardless of cost share; and 3) decided not to adopt BMP after discussions with USDA-NRCS. Additionally, producers ranked 11 sources of information about BMPs according to how well that source contributed to their understanding of that BMP. Section III also had questions about interactions with USDA-NRCS personnel, the EQIP application experience and the producer's view on environmental laws and programs.

The other section of the survey requested socio-economic information about the principal operator of the dairy farm. Standard information regarding length of tenure as the principal farmer, age, educational level, marital status, employment of either spouse off the farm, outside income and financial condition of the dairy operation. This section also asked about use of a personal computer to gather information about dairy farming.

Methods

Consider a scenario where a dairy farmer would either adopt (BMP=1) or not adopt (BMP=0) a best management practice. Let's indicate those variables suggested by the literature that influence the adoption decision such as number of years the farmer has been dairying, education, gender, income from the dairy farm and the debt-to-asset ratio as X. The adoption decision can then be modeled as

Prob (BMP=1) = F(X,b)

Prob (BMP=0) = 1- F(X,b)

The logistic distribution can be used which is

$$\Pr ob(BMP = 1) = \frac{e^{\beta' X}}{1 + e^{\beta' X}} = \wedge(\beta' X)$$

The marginal effect can be written as

$$\frac{dE(y \mid X)}{dX} = \wedge(\beta X)[1 - \wedge(\beta X)]\beta$$

In the case of a binary independent variable, the appropriate value of the marginal effect would be Prob [BMP = 1|X^*, d = 1] – Prob [BMP = 1|X^*, d = 0] where X^* denotes the means of all variables in the model except the dummy variable of interest.

Justification of explanatory variables used in the regression

The absence of a guiding theory is a problem in identifying variables that can sufficiently describe the behavior of an agent regarding the adoption of a best management practice. Justification for the inclusion of selected variables in the survey instrument justifies their inclusion in the model to explain their contribution to the BMP adoption decision. The explanatory variables and the rationale for their inclusion in the survey and in the model are as follows.

Number of Years as the Principal Dairy Farm Operator: Traditionally, researchers have used age as a determinant of adoption. The argument is that an older farmer would be more reluctant to adopt new technology than a younger farmer. As an alternative to age, the number of years in the profession can be used to explain the adoption decision. A relatively new entrant would be more likely to adopt new technology because of a stronger desire to be current in the tools of the trade and to address regulations that may otherwise hamper the operation. In addition, a first-time farmer might qualify for a higher cost share on BMP implementation. Therefore, the assumption is that a greater number of years in the business will have a negative effect upon a decision to adopt. This is a continuous variable in the adoption model.

Education: Education is assumed to have a positive impact upon the adoption of a best management practice. A farmer is considered to have implicitly or explicitly recognized the opportunity cost of dairying. Training beyond high school tends to make more opportunities for employment available creating a higher opportunity cost to dairy. The choice to dairy suggests that the dairyman seeks to minimize the opportunity cost to dairy by being as profitable as possible. Thus, the dairyman is likely to be more aggressive in seeking out ways of making his dairy profitable including the adoption of best management practices. Education is considered a

binary explanatory variable where 0 indicates a farmer with high school or less education and 1 otherwise.

Continue: A farmer with an heir apparent to continue the dairy operation is more likely to adopt the BMPs than the farmer without an heir apparent. This is a binary variable with 1 indicating an heir apparent.

Net Farm Income from Dairying: A dairy farmer with a positive net cash flow is more likely to adopt a BMP because of the cost share requirement. Net farm income is treated as a binary explanatory variable where 0 represents the respondent reporting negative incomes from dairying and 1 represent those with positive net returns from dairying.

Debt-to-Asset Ratio: A high debt-to-asset ratio suggests that the farmer is less likely to adopt a best management practice. A binary explanatory variable with 0 indicating a debt-to-asset ratio of 40% or less and a 1 indicating a debt-to-asset ratio of greater than 40 percent denotes this variable in the model.

Presence of a Nearby Subdivision (Worth): A nearby subdivision suggests that the dairy farmer is likely to experience higher cost in maintaining environmental standards. It also suggests that there are alternative uses for the land which drives up its worth thus increasing the opportunity cost to dairy. The combination of potentially greater environmental cost compliance and higher opportunity costs to dairy suggests that the presence of a subdivision would have a negative influence on a BMP adoption decision. The assignment of a 1 to this binary variable reflects the farmer's assessment that the dairy farm is worth more in nonagricultural than agricultural uses.

Respondent's Environmental Attitudes (escale): If a respondent does not care about the environment, he is less likely to choose to adopt a BMP. Therefore, lower values in the

environmental attitude scale are suggestive of a lower likelihood of BMP adoption. Respondents ranked three environmentally related questions using a Likert scale of 1 to 5. The values reported by the respondent were aggregated to create a continuous variable indicating the environmental attitude of a respondent. The three questions used in developing this new variable to discern the respondent's attitude toward the environment were:

1. Laws regulating water pollution are needed,
2. Given the economic realities, soil and water conservation programs are often carried too far, and
3. The government should pay farmers to promote practices that enhance soil and water conservation

Results

BMP Adoption Rates, Costs of Adoption, and Incentive Payments

The BMP is the focal point of analysis and synthesis. In table 1, the BMP listing follows the rank order of BMP adoption. Study of Table 1 suggests that the respondents were only fully responsive to a subset of six of the 18 BMPs as evidenced by the absence of information in the average cost of adoption, the average cost share percentage and the willingness to pay (WTP) columns. The response rate of the 49 survey respondents to the 18 BMP ranged from 78 to 94 percent with the greatest response being associated with the waste treatment lagoon BMP and the lowest response with the waste storage facility BMP. Of the seven BMPs with the highest rates of adoption, six of the seven have average cost of adoption rates and average cost share percentages reported. Such reports suggests that the respondents have had actual experiences with these BMPs.

The BMP adoption rates among the 49 respondents ranged from a low of 2.5% on the roof runoff management BMP to a high of 67% on the waste treatment lagoon BMP. A common interpretative format for each BMP can be illustrated using the waste treatment lagoon BMP. The average cost of adopting a waste treatment lagoon BMP was $12,886 with an average cost share of 39 percent. Of the 33 percent of non-adopters of the waste treatment lagoon BMP, 28 percent indicated that would adopt it if their maximum personal cost share to adopt was under 20 percent. Thus, in the case of the waste treatment lagoon BMP, the non-adopters require a minimum cost share contribution of over 80 % in order to adopt while the adopters only realized a 39% cost share.

With a 67% adoption rate, the waste treatment lagoon BMP had the highest percentage of adoption among the 18 BMPs. The closest ranked adopted BMP with a cost share incentive, the waste storage facility, had a 37% adoption rate and an average cost of $11,800 which had been cost shared at a 33% rate. Of the 63% of non-adopters, thirty percent (30%) indicated a willingness to adopt, but did not provide the information needed to discern the maximum level of cost share they would be willing to bear in order to adopt. Actually, the closest ranked BMP, waste utilization, offered a fixed incentive of $10 per acre with a 100 acre limit or $1000 for two or three years. Forty-one percent (41%) of the responders had adopted this BMP and 55% of the non-adopters indicated a willingness to adopt this BMP. Information to discern an incentive payment level necessary to elicit their participation, however, was not provided.

Among the BMPs with a cost share incentive, the two BMPs with the highest rates of adoption are also the BMPs with the highest average cost of adoption. Experience suggests that these practices were earlier advocated in responding to high levels of *E.coli* in a waterbody within the milkshed which denied its use as a recreational venue. Public outcry led

environmental authorities to impose stricter requirements on dairymen to reduce the *E.coli* levels. Voluntary implementation of these BMPs on farms whose runoffs could enter waterbodies off the farm were accepted by the environmental authorities as a compromise to revoking milk parlor permits. At least one-third of all survey respondents had not adopted these practices. This suggests that they were exempt from any implementation mandate probably because the runoffs from their dairies never crossed their property lines.

The rate of adoption reported in Table 1 identifies the most popular BMPs among the 18 identified for Louisiana dairies. Similarly, the percentage of non-adopters who indicated a willingness to adopt at various cost share percentage levels identifies the least popular BMPs among Louisiana dairymen. The correspondence is not exactly linear, but there appears to be a strong correlation between the relatively high rates of non-adoption and the relatively low rates of non-adopters among the cost share payment group who would adopt if their cost share levels were to be met. For example, the roof runoff management BMP had the highest non-adoption rate of 97.5% and the lowest percentage of nonadopters who would adopt, 19%. As a group, the BMPs with fixed payment incentives had the highest percentages of non-adopters willing to become adopters.

Respondents were asked to identify which sources of information had the greatest influence on their decision to adopt a specific BMP. From among 11 sources of information, the LSU Agricultural Center, USDA-NRCS, and Hoard's Dairyman or other dairy publication were identified as being the most important to the BMP adoption decision regardless of whether the incentive payment was cost-shared or fixed. The majority of nonadopters cited retirement more frequently than cost as the reason for not adopting a BMP.

Likelihood of BMP Adoption

A logit model was estimated to assess the impact of selected explanatory variables upon the BMP adoption decisions of Louisiana dairymen. Matrix singularity resulted in estimation of the model for 11 of the eighteen BMPs. The majority of the regression results suggest that the independent variables were not significant in explaining the BMP adoption decision. Independent variables used in the regression were worth, education, age, debt, net income, environmental scale and continue. A change in the probability of adopting a specific BMP given a one (1) unit increase in the value of an independent variable varies according to the decision maker's reference point as determined by the values of the independent variables belonging to that decision maker at the time of the decision. This is because a logit model assumes a nonlinear relation between the probability of adoption and the relationships between the explanatory variables. Interpretation becomes much simpler, however, if the adoption of a specific BMP is expressed in terms of the odds rather than in terms of probability. For these reasons, identifications and interpretations of the odds ratio that the independent variables contributed to the BMP adoption decisions are presented here. For the binary variables of education, continue, worth, net income and debt, the interpretation of the odds of a BMP adoption is similar. For the quantitative variables of escale and age, the interpretation of the odds ratio of a BMP adoption is different than the interpretation of the odds ratio for a BMP adoption with the qualitative variables.

The odds ratios identifying the contributions of independent variables to a specific BMP adoption for 13 of the 18 BMPs are presented in Table 2. Education, as a binary variable, uses a 1 to identify a farmer with more than a high school degree. A consistent finding was that the odds of BMP adoptions by farmers with more than high school degrees were greater than the

odds of adoption by farmers with a high school or less education for 9 of the 13 BMPs under analysis. In the case of the pest management BMP, the odds of its adoption by farmers with a high school or greater educational level was 6.1 times greater than those farmers with less than a high school education. In the cases of the watering facility and prescribed grazing BMPs, the odds of the more highly educated farmers adopting these practices were reduced by 18 and 11 percent, respectively. In the case of the waste utilization BMP, the educational level had little to no effect upon its odds of adoption.

The variable "continue" represents the situation where the responding farmer thinks there is an heir apparent who will likely continue the farming operation following their retirement. The odds that such a situation would enhance a BMP adoption decision was not only low, but it was uniformly low across all but two of the BMPs, watering facility and pest management. This unexpected finding is contrary to expectations and leads to the suggestions that the present generation of Louisiana dairy farmers are not encouraging the future generation to be dairy farmers.

The variable worth identifies a situation where the dairy farmer thinks that the dairy farm has a greater monetary value in nonagricultural uses. Under this situation, the odds that any BMP other than the waste lagoon and prescribed grazing would be adopted are quite low. The odds strongly favoring adoption of the waste lagoon may be a reflection of the environmental and aesthetic sensitivities to which that farmer is subject to by virtue of the activities on the properties surrounding the farm that are reasons for its enhanced worth. Prescribed grazing is a BMP that can be conducted to promote the aesthetics of country life as well as enhance milk production. All of the other BMPs entail capital investments that would enhance the value of the dairy farm in dairying but even that enhanced value is dwarfed by the appreciated value of the

dairy farm in a nonagricultural use. Thus, there is little incentive to enhance its value as a dairy farm through BMP adoptions especially if the farmer intends to liquidate the farm so as to capture its enhanced nonagricultural use value.

The variable "net income" is used as a binary variable in which a 1 indicates a situation in which the annual net income from dairying is greater than $50,000. With the exception of the waste storage facility and prescribed grazing BMPs, a $50,000 net income enhances the odds of adopting the BMP. Such BMPs provide capital investments that can enhance future milk production and profitability while minimizing the tax burden of a $50,000 income. The combination of cost-share and fixed incentive payments in combination with tax relief would encourage BMP adoptions. The waste facility exception is probably not a profitable BMPs even with the incentive payments and tax relief subsidies that its adoption would provide. This BMP controls manure runoff and provides a product that is a substitute for commercial fertilizer. However, the relative costs of the fertilizer overshadows any savings from the fertilizer. Prescribed grazing is both a capital and labor intensive practice. The incentive payment is probably insufficient to cover the labor costs of implementing it on a $50,000 a year profitable dairy farm

The variable "debt" reflects the situation of farmers whose debt-to-asset ratio is less than 20 percent. Farmers in this situation are more likely to adopt a sediment basin, watering facility, nutrient management, pest management and prescribed grazing BMPs than farmers with greater debt loads.

The explanatory variable "environmental scale" quantifies the farmer's affinity for the environment. This variable is measured using a 15 point scale. The coefficient in table 2 expresses the percentage change in the odds of adopting a specific BMP for each one (1) unit

increase in the environmental scale value. In this study, a 1 unit increase in the environmental scale increases the odds of adopting the waste treatment lagoon, the field border and filter strips, the sediment basin, watering facility and residue management BMPs. The highest percentage increase in the odds is for field borders and filter strips. This is the practice where strips of grasses are planted around the boundaries of fields and along drainage ditches and other water bodies to reduce sediment, organic materials and chemicals carried in the runoff. This is the most visible BMP in terms of its effect in pollution reduction. Therefore, the result is consistent with the real world experience.

Quantitative variable indicating the number of years a farmer has been dairying increases the odds of adoption only for the waste treatment lagoon and field borders and filter strips BMPs. The odds for these BMPs are 0.4 and 3.5, respectively. The relatively few BMPs that would be adopted by a long term dairyman are probably not capital intensive with the decision being driven by a desire to maximize rent returns from the existing set of capital assets and to minimize capital expenditures due to the nearness of retirement. For example, we find that 1 year increase in dairy profession increases the odds of not adopting BMP pest management by 11 percent.

Summary and Conclusions

This work identified 18 BMPs and reports survey findings that identify their rates of adoption and the cost share incentive payments associated with those adoptions. It identifies the percentage of non-adopters who would be willing to become adopters for increases in the cost share incentive payments. The likelihood of a specific BMP adoption was related to the socio-economic and financial variables of years as the principal dairy farmer, level of educational attainment, the presence of an heir apparent, net farm income, debt-to-asset ratio, the worth of

the farm in nonagricultural uses and the farmer's affinity for the environment. Data constraints limited the documentation of the average cost of BMP adoption and in ascertaining the survey respondents' willingness to pay to six of the 18 BMPs. Those same constraints limited the statistical significance with which the reported findings could be held. Out of eleven sources of information, survey respondents identified the LSU Agricultural Center, the NRCS and Hoard's Dairyman and similar publications as being the most important.

Chapter II. Dairy Manure Application and Transportation

The objectives of this section of the proposal are:

- To develop a decision making tool to minimize the runoff and leaching of nutrients from dairy manure application through the selection of a suite of the best management practices (BMPs) based on the physical characteristics of soil and nutrient loading constraint in receiving waterbodies, and

- To develop a GIS-based transportation model to find the optimal routes needed for the cost-effective method of dairy manure applications based on the environmental characteristics of a watershed.

Dairy in Louisiana

- LA had over 1,000 dairy farms in the 1980s, but has only 325 farms operating today (Louisiana Department of Health and Hospitality, 2004).
- Small family farms are replaced by large confinement facilities.
- Dairy cow numbers have declined but milk production per cow has increased by over 10% over recent years
- LA's farmers keep their cows on pasture rather than in confined lots making manure collection difficult.
- Responsible dairy manure use consistent with nutrient needs of crop and soil characteristics can make it a cheap substitute of chemical fertilizer.

Economic Benefits *vs*. Environmental Problems

- Dairy provides economic incentives, but brings several environmental problems due to the deteriorating water qualities and environment from dairy wastes.
- Many rivers and waterbodies in the area face environmental threats due to the discharge of nutrients and fecal coliform from dairy manure.

Study Area: Three Parishes

- The area of St. Helena, Tangipahoa, and Washington (commonly known as Florida Parishes), has concentration of majority of Louisiana's current dairy farms with only a few other farms scattered in northwest Louisiana.

Dairy Farm Concentration

- Tangipahoa Parish has the highest dairy concentration in Louisiana

- Louisiana Department of Environmental Quality and State and Federal Agricultural Agencies are working for corrective measures (dairy waste lagoons) to reduce the level of fecal coliform bacteria entering the river systems from dairy wastes.

- Over 20 years data analysis indicates the increasing incidence of fecal coliform counts (5000-25,000) cells per 100 mL in Tangipahoa River.

Location specific problems

- Low relative relief and vulnerability to rain-induced coastal backwater flooding in LA compounds dairy related pollution.

- Rising insurance costs due to repeated losses faced by insurance agencies resulting from natural and/or manmade environmental disasters.

- Dairy manure still remains as the major sources of crop nutrients; however, P runoff and N leaching raises environmental concerns.

Methodology and Data

Software for spatial data analyses: Erdas Imagine 8.7, ArcGIS 9.0.

Raster: Thematic Mapper Images 30 x 30 m (1991 & 2001)
DOQQ 1m x 1m (2004), DEM (5m x 5m), and Soil.

Vector: Counties shapefiles (polygons, roads, rivers, dairy location--points, animal density, and septic systems.)

Socioeconomic: Milk productions, manure productions, animal population, manure transportation cost, manure chemistry, loading and unloading costs.
Hypotheses

- Dairy farms located in single watershed are easier to mange than multi-watersheds.

- Use of dairy manure could be economic and environmentally benign, if manures are efficiently gathered in lagoons and transported to farm sites.
- Land use changes (1990-2000) and locations of dairy farms in Florida Parishes

How Manure Pollutes Water?

- A cow weighing 1400 lbs produces 115 lbs of manure daily supplying 0.57, 0.23, and 0.46 lbs of N, P2O5 and K2O. Storage loss of nutrient ranges from 15 to 60% depending on storage method used.

- A metric ton of dairy manure contains N-nitrogen (2.6 kg), P-phosphorus (2.5 kg), and K-potassium (4.1kg) at 50% moisture content (Adhikari *et al*. 2005)

- Nitrogen and Phosphorus dissolve in surface water and run-off to nearby waterbodies.

- When P content is high, it goes along with the eroded soil particles. As phosphorus leaches to water, algae grow vigorously along with other microbes causing eutrophication problem in waterbodies.

How dairies are contributing to pollution in Tangipahoa?

- Of the 63 dairy farms in Tangipahoa, many are located near the water *sources—Tangipahoa, Copper Creek, Skulls Creeks, Big Branch, Spring Creek, & Chappeela Creek.*

- Out of 11 surveyed, nine farms are in violation of their limits for fecal coliform levels.

- Dairies locating in the watershed areas discharge manure directly into ditches and to rivers.

Aspects and Possible Drainage

Flow Directions
Sink Holes
Stream Network and Flow Accumulation Raster
Watershed
Locating Dairies as Point Source Pollution

Finding cost effective way to apply cow manure on farmlands considering environmental constraints

- Examining slope, landuse, soils, and watershed
- Dairy Farms, Farmlands, and Soils
- Modeling to Compare Cost Effectiveness

Assumptions

Transportation cost:
–10Ć/mile on blacktopped (metalled) road
–15Ć/mile on graveled road
–20Ć/mile on dirt road and while passing through bareland, bushland, and tilled farmland,
Loading $0.60 /ton
Spreading ($8.65 /hectare)

Modeling

- Cost Surface (A) & Transportation Cost (B)

- BMPs Applicable to Dairy Farms

- Dairy farmers have adopted Best Management Practices on a cost share basis from the USDA to reduce environmental damages from a dairy operation.

- A survey indicates that approximately 50 lagoon systems have been installed in Tangipahoa parish from the federal cost-share funds.

Conclusions

Two important contributions:

–manure transportation based on environmental characteristics

–Optimal BMP design based on water flow characteristics

- Watershed analysis indicates that dairy farms affecting water sources within 700 meters perimeters require to install no-discharge lagoon systems to avoid water pollution.

- Average cost shares by the USDA for Waste treatment lagoon and waste storage facility are 61 and 67 percents, respectively.

- Survey results from Louisiana dairy farmers indicate low desire (only 33% current nonadopters) for water quality improving BMPs adoption. One of the main reasons given for the low desire to adopt BMPs was low cost share by the government.

- A GIS model justifies the adoption of dairy manure transportation from production facility to crop field application based on soil characteristics and nutrient constraints to overcome the environmental concerns in the region.

References

Adhikari, M., K. P. Paudel, N. R. Martin, and W. M. Gauthier (2005) Economics of Dairy Waste Use as Fertilizer in Central Texas. Forthcoming *Waste Management* Journal

2000 Louisiana Summary of Agriculture and Natural Resources published by the LSU AgCenter.

Jim Beatty (2000) Resident director of the LSU AgCenter's Southeast Research Station in Franklinton, La.

Gauthier, Wayne (2000) LSU AgCenter's Department of Agricultural Economics.
Louisiana State Department of Health and health Resources. Office of Health Services and Environmental quality. Report Prepared by Milk and Dairy Division (1981 through 2000)

Louisiana Agricultural Statistics. Louisiana state University Agricultural Center. Department of Agricultural Economics and Agribusiness. A. E. A. Information Series, 1999, 2001.

Tangipahoa River Watershed, http://nonpoint.deq.state.la.us/ws_tangipahoa.html
State of Louisiana nonpoint source pollution assessment report November 1993
http://nonpoint.deq.state.la.us/assess9.html

Zapata, H. O. and David Frank. *Agricultural Statistics and Prices for Louisiana*. Louisiana state University Agricultural Center. Department of Agricultural Economics and Agribusiness. A. E. A. Information Series. 1991, 1996, 1997.

Chapter III. Modeling the effects of BMPs to reduce water pollution in Louisiana Watershed

Layers need to run AVGWLF model

1. Weather: it's a point layer that includes all the weather stations in the area. Also there is a table associated with each weather station. It contains daily weather information (TMax, TMin. and Precipitation) for each station. You can find data at: http://lwf.ncdc.noaa.gov/oa/climate/stationlocator.html

2. Point Source: It's a point layer that contains ***monthly load*** of nitrogen and phosphorus data. We have only one point for this layer with Nitrogen loads.
3. Basin: We have it
4. Watershed (Sub watershed Layer)
   There are big watersheds which you can find them in EPA web site or extract from BASIN System. But in AVGWLF software, it has a small watershed layer which is divided from big watershed based on streams. I use DEM to generate this layer. You can download DEM data from Louisianan Statewide GIS Web site at: http://www.atlas.lsu.edu

5. Streams: From Louisiana GIS CD
6. Unpaved Roads: Digitized this layer
7. Road: From Louisiana GIS CD
8. Counties: From Louisiana GIS CD
9. Septic System: it's census pop by census tract level data.
10. Animal-Density: We have zip code polygon layer from ESRI. We found the farm number by zip code from AG. NASS web site at: http://www.nass.usda.gov/census/index1997.htm

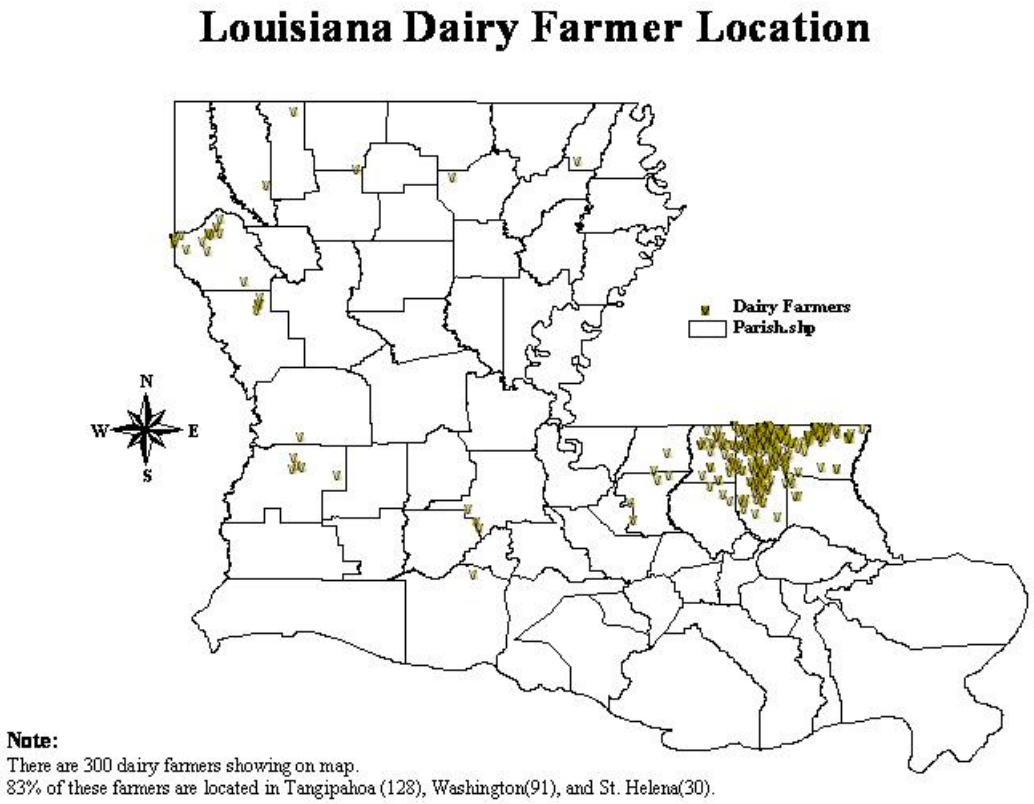
    But it didn't have animal numbers by zip code area. We will use parish level data (number of animals in each farm) to estimate how many animals in each zip code area.

11. Soils: From Louisiana GIS CD
12. Physiographic Provinces: It's a polygon layer. Somebody recommend me an image map of physiographic of Nation. http://tapestry.usgs.gov/physiogr/physio.html

    Digitized this layer in ArcMap.
13. Land use: From Louisiana GIS CD
14: Elevation: You can download DEM data from Louisianan Statewide GIS Web site at: http://www.atlas.lsu.edu
15. Groundwater-N: It's a grid (image) layer. We found the groundwater sample data at DEQ web site: http://www.deq.state.la.us/surveillance/wqdata/wqdata.aspx
    I created this grid layer based on the sample data collected from above web site.
16. Soil-P: It's a grid (image) layer. We found soil sample data in Soil Testing Lab of

Department of Agronomy at LSU Campus.

An attached CD along with the AVGWLF, GWLF and PRedICT manuals should be sufficient to find the impact on pollutant load by adopting a suite of best management practices.



References

Cooper, J. C. "A Joint Framework for Analysis of Agri-environmental Payment Programs." *American Journal of Agricultural Economics* 85(2003): 976-87

Cooper, J.C. and R.W. Keim. "Incentive payments to encourage farmer adoption of water quality protection practices." *American Journal of Agricultural Economics* 78(1996):54-64.

Henning, S.A. and H. Cardona "An analysis of factors influencing adoption of BMPs among Louisiana Sugarcane Producers." Selected paper presented at the AAEA meeting, Tampa, Florida, 2000.

Ribaudo, M. and J. Agapoff. "Importance of Cost Offsets for Dairy Farms Meeting a Nutrient Application Standard." Selected paper presented at the AAEA annual meeting, Denver, Colorado, 2004.

Rahelizatovo, N. C. and J.M. Gillespie "The Adoption of Best-Management Practices by Louisiana Dairy Producers*" Journal of Agricultural and Applied Economics* 36(2004):229-40.

Taylor, M. L., R. M. Adams and S. F. Miller. "Farm-level response to agricultural effluent control strategies." *Journal of Agricultural and Resource Economics*. 17 (1992): 173-185.

Valentin, L.,D.J. Bernardo, and T.L. Kastens. "Testing the Empirical Relationship between Best Management Practice Adoption and Farm Profitability." *Review of Agricultural Economics* 26(2004):489-504.

APPENDIX

DAIRY SURVEY

DAIRY MANURE DISPOSAL, DAIRY PROGRAM, AND BMP ADOPTION SURVEY

MILKING PARLOR LOCATION Physical Address: _____
City or Town / Zip: _____ / _____
If Known: Longitude _____ Latitude ____

SECTION I. SOCIO-ECONOMIC CHARACTERISTICS OF THE PRINCIPAL OPERATOR

1. **How many years since age 18 has the principal operator worked on a dairy farm?** _____ years

2. **What is the age of the principal operator of this dairy farm?** _____ years

3. **How many years has this dairy farm been in the family?** _____ years

4. **What is the principal farm operator's educational level?**
   [ ] Less Than High School [ ] High School [ ] Some College
   [ ] Bachelor's Degree [ ] Graduate Degree [ ] Vocational Training

5. **Do you use a personal computer to get information on dairy related matters?** [ ] YES [ ] NO

6. **Gender of Principal Operator** [ ] Male [ ] Female

7. **What is the ownership arrangement of your dairy farm operation?**
   [ ] Individual owner [ ] Other partnership [ ] Other _____ (specify)
   [ ] Father-son partnership [ ] Family Corporation

8. **Does the principal operator have off-farm employment?** [ ] YES [ ] NO.
   If YES, approximately how many hours per week? _____

9. **Does your spouse have off-farm employment?** [ ] YES [ ] NO.
   If YES, approximately how many hours per week? _____

10. **When you retire, will someone in your family continue your dairy operation?** [ ] YES [ ] NO

11. **Are any residential subdivisions adjacent to or near the dairy farm?** [ ] YES [ ] NO
    If YES, please estimate the distance: _____ miles

12. **Do you think your dairy farm would be worth more if developed for nonagricultural uses, like a subdivision?** [ ] YES [ ] NO

13. **Are you a member of a dairy marketing cooperative?** [ ] YES [ ] NO.

14. **Do you have other sources of income (stocks, bonds, pensions, etc.) besides your dairy?** [ ] YES [ ] NO

15. **What percentage of total family income comes from off-farm and other income sources?** _____ %

16. **What was the estimated net income from the dairy in 2003?**
    [ ] $100,000 or more
    [ ] $50,000- 99,999
    [ ] 0- $49,999
    [ ] Lost up to $25,000
    [ ] Lost between $25,000-50,000

[ ] Lost more than $50,000

17. What percentage of your annual household net income comes from the dairy operation?

[ ] 0 - 20% [ ] 21- 40% [ ] 41- 60% [ ] 61- 80% [ ] 81- 100%

18. Liability is an obligation or debt owed to someone else. Assets include the monetary values of all the properties and tangible assets you have in the farm. Which of the following best describes your liability and asset situation?

[ ] I do not have any liability or debt.
[ ] My liability is anywhere between 1- 20% of my total assets.
[ ] My liability is anywhere between 21- 40% of my total assets.
[ ] My liability is anywhere between 41- 60% of my total assets.
[ ] My liability is more than 60% of my total assets

SECTION II. DAIRY MANURE DISPOSAL

1. How many cows are in your dairy herd?

_____ Number of milking cows
_____ Number of dry cows
_____ Number of heifers over one year old not freshened
_____ Number of heifers and calves under one year old

2. What was your herd's annual average milk production per cow last year (Jan 1, 2003- Dec 31, 2003)?

_____ Lbs of milk per cow last year

3. For your dairy operation, please complete this table:

	ACRES OWNED	ACRES RENTED	MAJOR CROPS GROWN
Permanent pasture for hay, grazing & winter ryegrass	_____	_____	
Permanent pasture only	_____	_____	
Hay crop only	_____	_____	
Row cropland	_____	_____	_____
Woodlands used for shade & loafing	_____	_____	
Acres tied up by milking parlor and farmstead	_____	_____	

4. How many additional acres do you own and rent such as woodland or pasture for beef? _____ acres
Of these acres, how many could manure be spread on? _____ acres
How many of these are rented acres? _____ acres

5. How do you currently dispose of the dairy manure produced in and around your milking parlor, barns, and other dairy facilities? Please mark [X] all that apply.

[ ] Scrape manure and load into a spreader for dispersal.
[ ] Pile it up and spread it every _____ months.
[ ] Flush manure into the lagoon and pump it out later.
[ ] Apply to crops and pasture that I own or rent.
Number of years I've been applying manure to my land: _____ years
[ ] Sell it to other farmers.
[ ] Give manure to others and
[ ] They haul it away.
[ ] I haul it away.
[ ] Pay someone to pump it out of the lagoon and apply it to my land.
[ ] Apply it to neighbor's land at:
[ ] No Charge.
[ ] Neighbor pays $_____ per ton.
[ ] I pay $_____ per ton to spread.
[ ] Wash it off the slab.
[ ] No need for formal manure management. Manure remains on land.

[ ] Other; please specify _____

6. What is the main reason for not selling your dairy manure?

[ ] No good method for moving it off my farm.
[ ] Market is not available to sell manure in my area (no one will buy it).
[ ] I use all the manure on my own crops.
[ ] I use all the manure on my pastures.
[ ] Absence of custom removal services.

7. Do you store manure? [ ] YES [ ] NO

If YES, which of the following describes your storage facility and its storage capacity?

Type of Storage Facility	**Approximate Capacity**
[ ] Pile	_____ *(tons)*
[ ] Lagoon	_____ *(designed for how many cows)*
[ ] Other (Specify) _____	_____ *(_____)*

8. Do you have a waste lagoon? [ ] YES [ ] NO

If YES, what year was it built? _____. How many cows were you milking at that time? _____ cows

9. Do you have a sand trap in your milking or feeding sheds? [ ] YES [ ] NO

If YES, is it functional? [ ] YES [ ] NO

10. How often do you pump out (remove waste water only) your manure lagoon?

[ ] Weekly [ ] Every _____ weeks [ ] Never [ ] Other (Specify) _____

11. How often do you clean out (remove waste water, dig out & remove solids) your lagoon?

[ ] Annually [ ] Every _____ years [ ] Never [ ] Other (Specify) _____

12. When you clean out your lagoon, what is the estimated total cost of cleaning? $_____

13. If you apply manure on your land (owned, rented or leased), what determines the time of application?

[ ] Manure lagoon is full.
[ ] Application optimum for planting or plant growth.
[ ] My turn on the "clean out" circuit.

14. What form of manure do you primarily apply on crop and pasture?

A. Cropland	[ ] Solid	[ ] Liquid/slurry	[ ] Combinations
B. Pastureland	[ ] Solid	[ ] Liquid/slurry	[ ] Combinations

15. If you apply as *slurry*, indicate how many acres and how many inches of manure slurry you applied to pasture and cropland when you last emptied your lagoon.

	Numbers of acres	**Inches of manure slurry applied**
A. Apply on pasture	_____	_____
B. Apply on cropland	_____	_____

16. If you apply as *solid*, indicate how many acres and how many tons of manure solids you applied to pasture and cropland when you last emptied your lagoon.

	Numbers of acres	**Tons of manure solids applied**
A. Apply on pasture	_____	_____
B. Apply on cropland	_____	_____

17. What are the minimum and maximum distances your dairy manure needs to be transported from the manure lagoon or assembly pile for application to crop or pasture lands?

Minimum: _____ Miles Maximum: _____ Miles

18. Have you bought any specialized equipment to handle manure in the last five years? [ ] YES [ ] NO

19. What kind of specialized equipment is used for manure handling and application on your farm?

	Size	**Purchase Price**
[ ] Honey Wagon	_____	_____
[ ] Spreader	_____	_____
[ ] Reel Applicator	_____	_____
[ ] Others (Specify) _____	_____	_____

20. Have you ever cost-shared dairy waste disposal with the Lake Pontchatrain Basin Foundation?
[ ] YES [ ] NO

21. As you know, disposing of manure is a regular and necessary activity in any dairy operation. Do you find it profitable or at least cost-effective to apply dairy manure (slurry and solid) to your land, given the cost of commercial fertilizer and given the fact that manure handling and disposal are necessary milk production activities? [ ] YES [ ] NO

If NO... At present, USDA/NRCS (with funds from the Lake Pontchatrain Basin Foundation) offers a 75% cost share up to a maximum of $3,750 to clean out a lagoon every four years. This assumes it takes $5,000 to clean out an average-sized lagoon. Suppose the price of cleaning out the lagoon increases, but the cost-share and NRCS support does not increase beyond $3,750. At what cost would it be too expensive for you to clean out the lagoon? Mark [X] one that applies for you.

[ ] I would not clean out the lagoon if the total cost for cleaning increases to $5,500 (or 10%).
[ ] I would not clean out the lagoon if the total cost for cleaning increases to $6,000 (or 20%).
[ ] I would not clean out the lagoon if the total cost for cleaning increases to $6,500 (or 30%).
[ ] I would not clean out the lagoon if the total cost for cleaning increases to $7,000 (or 40%).
[ ] I would not clean out the lagoon if the total cost for cleaning increases to $7,500 (or 50%).

22. Have you heard of a Comprehensive Nutrient Management Plan? [ ] YES [ ] NO
If YES, has not been developed one for your dairy farm? [ ] YES [ ] NO

SECTION III. MILK REDUCTION PROGRAMS

Please read the following paragraphs before you answer the questions in this section.

Some consider dairy farms in Louisiana's Florida Parishes to be both point and nonpoint sources of pollution. This means there are two possible alternatives for minimizing pollution problems attributable to dairy farms. The first alternative is to reduce the number of dairy cows in the area. The second alternative is for dairy farmers to adopt the maximum number of applicable best management practices (BMPs) to minimize the negative environmental problems attributable to dairy farms.

The dairy termination program (DTP) of 1986 and the milk diversion program (MDP) of 1984-1985 were implemented to reduce the amount of milk produced by reducing the number of dairy cows. The purpose of these programs was to reduce milk production so as to raise milk prices and reduce the costs of the dairy price support program to the government. Similarly, the amount of manure being produced can be reduced by decreasing the number of cows. In the DTP, the producer submitted a bid price per hundredweight of milk for which the producer agreed to slaughter or export all female dairy animals and to exit milk production for at least five years. All bids of $22.50 or less per hundredweight of milk were accepted. In the MDP, the producer entered into a contract with the government to reduce milk production 5 - 30% from some base period level of production in exchange for a payment of $10.00 per hundredweight for an 18-month period. Since the rational producer would cull the lowest producing cows first, a participating producer would cull a percentage of cows that was higher than the contracted percentage of production. Both programs had the effect of reducing cow numbers, which reduced the total milk supply, put upward pressures on milk prices and reduced surplus stock levels. It follows that any reductions in cow

numbers will reduce the volume of cow manure and its contributions to water pollution and phosphorous buildup in the soil.

The second alternative is to promote best management practices (BMPs) that minimize water quality deterioration and soil phosphorous buildups from dairy production. Since 1996, USDA has used the Environmental Quality Incentive Program (EQIP) to assist farmers in adopting BMPs. Adopting BMPs allows dairy producers to simultaneously produce milk and be more environmentally responsible because BMPs reduce both point and nonpoint sources of pollution in water bodies. Dairy farmers have many BMPs available under EQIP, and the BMPs vary in their suitability by farm. Generally, the USDA helps share the cost of implementing various BMPs with the dairy producer. The cost share from the USDA under EQIP could be up to 75%, depending upon land quality, proximity to water bodies, and other unique attributes of the dairy farm. Limited resource farmers or first-time farmers potentially qualify for up to a 90% cost share. The contracts for BMPs under EQIP last for 1-10 years.

When requesting hypothetical values for participating in a milk reduction program or cost sharing in a BMP, previous research indicates that respondents over-estimate the amount they are willing to accept to participate in a supply control program and underestimate the amounts they are willing to pay to cost share in a BMP. If your responses are not well thought out, policy makers would most likely ignore the responses and look at industry cost levels or benefit data in establishing cost share values for the various BMPs. Therefore, it is imperative that you respond with values you believe to be true for you today, not historical values from other programs.

Now, we would like to ask you a series of questions regarding supply control programs and BMP initiatives.

1. Did you participate in the Milk Diversion Program or the Dairy Termination Program in the past?

Milk Diversion Program (MDP) (1984-85) [ ] YES [ ] NO

Dairy Termination Program (DTP) (1986) [ ] YES [ ] NO

If YES, what was the minimum amount you bid to participate in the DTP (to stop producing milk for at least five years, and to slaughter or export all of your female dairy animals)? $_____ per cwt milk.
What was the maximum contraction in milk production you agreed to under the MDP for the $10 per hundredweight payment? _____ %.

2. Would you consider participating in a Milk Diversion Program if it were offered today? [ ] YES [ ] NO

If YES, what is the minimum payment you would be willing to accept to reduce your milk production? $ _____ per cwt milk.
For that payment, what is the maximum percent you would be willing to reduce your milk production? _____ %.
What percentage of your cow herd would be culled to achieve this rate of reduction? _____ %.
What would you bid to participate in a Dairy Termination Program today? $_____ per cwt milk.

3. Why would you be willing to participate in a DTP or MDP today? Check all that apply.

[ ] Dairy operation is not profitable.
[ ] Dairy operation is reasonably profitable, but the future for dairying in Louisiana does not appear bright.
[ ] I am of retirement age.
[ ] Other (Specify) _____

4. Did you submit a bid to participate in the August 2003 CWT program? [ ] YES [ ] NO

If YES, how much did you bid? $ _____ per cwt milk. **Was your bid accepted?** [ ] YES [ ] NO

5. If your CWT bid had been accepted and you had exited the dairy industry, what would you be doing ?

[ ] Retire from full-time farming
[ ] Continue to farm full-time, but not dairy
[ ] Continue to farm part-time, but not dairy

[ ] Seek nonfarm employment
[ ] Other (specify) _____

SECTION IV. DAIRY BEST MANAGEMENT PRACTICES (BMP) ADOPTION

Regardless of your responses to both MDP and DTP questions, suppose that to continue producing milk you were required to incorporate BMPs into your dairy herd and dairy manure management programs. For the following BMPs, please indicate if a given dairy BMP is suitable for your particular dairy farm. The average cost cited following the BMP description is an estimated benchmark average cost value based on one or more earlier adoptions in Louisiana during 1997-2001. It is used here for purposes of providing a common reference value critical to intended analyses of questionnaire responses. Because the true cost of a BMP is unique to every dairy farm, use your best estimate for implementation of this BMP on your farm.

1. Waste Treatment Lagoon (NRCS code 359): *An impoundment made by excavation or earth fill for the temporary storage and biological treatment of animal or other agricultural waste. Estimated Reference cost=$11,750 each*

Has this BMP been adopted on your farm?
[ ] YES → **If YES, in which year? _____ If stopped, in what year? _____ Total cost from all sources to install BMP** $ **_____** ***Your*** **cost-share ____**%
[ ] NO → **If NO, would you adopt this BMP on your farm?**

[ ] YES
[ ] NO
[ ] Not s

If YES, what is the maximum percentage of total cost you would pay to adopt this BMP?
[ ] 0 - 9.9% [ ] 10 - 19.9% [ ] 20 - 29.9% [ ] 30 - 40% [ ] more than 40%

2. Cover and Green Manure Crop (NRCS code 340): *A crop of close growing grasses, legumes or small grains primarily for seasonal protection and soil improvement. Estimated Reference Cost = $12 per acre*

Have you adopted this BMP on your farm?
[ ] YES → **If YES, in which year? _____ If stopped, in what year_____? Total cost from all sources to install BMP** $ **_____** ***Your*** **cost-share ____**%
[ ] NO → **If NO, would you adopt this BMP on your farm?**

[ ] YES
[ ] NO
[ ] Not s

If YES, what is the maximum percentage of total cost you would pay to adopt this BMP?
[ ] 0 - 9.9% [ ] 10 - 19.9% [ ] 20 - 29.9% [ ] 30 - 40% [ ] more than 40%

3. Critical Area Planting (NRCS code 342): *A planting of vegetation such as trees, shrubs, vines, grasses or legumes on highly erodible areas. Estimated Reference Cost = $415 per acre*

Have you adopted this BMP on your farm?
[ ] YES → **If YES, in which year? _____ If stopped, in what year_____? Total cost from all sources to install BMP** $ **_____** ***Your*** **cost-share ____**%
[ ] NO → **If NO, would you adopt this BMP on your farm?**

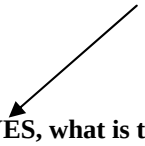
[ ] YES
[ ] NO
[ ] Not s

If YES, what is the maximum percentage of total cost you would pay to adopt this BMP?
[ ] 0 - 9.9% [ ] 10 - 19.9% [ ] 20 - 29.9% [ ] 30 - 40% [ ] more than 40%

4. **Fence (NRCS code 382):** *A constructed barrier to livestock, wildlife or people to facilitate the application of conservation practices. Estimated Reference Cost = $1 per foot*

Have you adopted this BMP on your farm?
[ ] YES → **If YES, in which year? _____ If stopped, in what year_____? Total cost from all sources to install BMP** $ **_____** ***Your*** **cost-share ____**%
[ ] NO → **If NO, would you adopt this BMP on your farm?**

[ ] YES
[ ] NO
[ ] Not s

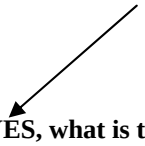


If YES, what is the maximum percentage of total cost you would pay to adopt this BMP?
[ ] 0 - 9.9% [ ] 10 - 19.9% [ ] 20 - 29.9% [ ] 30 - 40% [ ] more than 40%

5. **Field Borders and Filter Strips (NRCS code 386 and 393):** *Strips of grasses planted around fields and along drainage ways and other water bodies to reduce sediment, organic materials and chemicals carried in runoff. Estimated Reference Cost = $0.10 per foot for Field Borders and $210 per acre for Filter Strips.*

Have you adopted this BMP on your farm?
[ ] YES → **If YES, in which year? _____ If stopped, in what year_____? Total cost from all sources to install BMP** $ **_____** **Y*our*** **cost-share ____**%
[ ] NO → **If NO, would you adopt this BMP on your farm?**

[ ] YES
[ ] NO
[ ] Not s

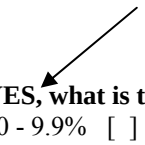


If YES, what is the maximum percentage of total cost you would pay to adopt this BMP?
[ ] 0 - 9.9% [ ] 10 - 19.9% [ ] 20 - 29.9% [ ] 30 - 40% [ ] more than 40%

6. **Grassed Waterways (NRCS code 422):** *A channel, shaped or graded to required dimensions and established in suitable vegetation to convey runoff from terraces, diversion or other water concentration. Estimated Reference Cost = $1 per foot*

Have you adopted this BMP on your farm?
[ ] YES → **If YES, in which year? _____ If stopped, in what year_____? Total cost from all sources to install BMP** $ **_____** ***Your*** **cost-share ____**%
[ ] NO → **If NO, would you adopt this BMP on your farm?**

[ ] YES
[ ] NO
[ ] Not s

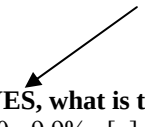


If YES, what is the maximum percentage of total cost you would pay to adopt this BMP?
[ ] 0 - 9.9% [ ] 10 - 19.9% [ ] 20 - 29.9% [ ] 30 - 40% [ ] more than 40%

7. **Heavy Use Area Protection (NRCS code 561):** *Protecting areas by establishing vegetative cover. Estimated Reference Cost =$1 per acre*

Have you adopted this BMP on your farm?
[ ] YES → **If YES, in which year? _____If stopped, in what year_____? Total cost from all sources to install BMP** $ **_____** ***Your*** **cost-share ____**%
[ ] NO → **If NO, would you adopt this BMP on your farm?**

[ ] YES
[ ] NO
[ ] Not s

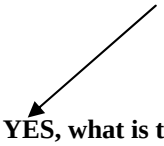


If YES, what is the maximum percentage of total cost you would pay to adopt this BMP?
[ ] 0 - 9.9% [ ] 10 - 19.9% [ ] 20 - 29.9% [ ] 30 - 40% [ ] more than 40%

8. Riparian Forest Buffer (NRCS code 391): *An area of trees, shrubs and other vegetation located adjacent to watercourses or water bodies. Estimated Reference Cost = $1 per acre*

Have you adopted this BMP on your farm?
[ ] YES → **If YES, in which year? _____ If stopped, in what year_____? Total cost from all sources to install BMP** $ **_____** ***Your*** **cost-share ____**%
[ ] NO → **If NO, would you adopt this BMP on your farm?**

[ ] YES
[ ] NO
[ ] Not s

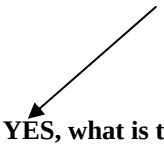


If YES, what is the maximum percentage of total cost you would pay to adopt this BMP?
[ ] 0 - 9.9% [ ] 10 - 19.9% [ ] 20 - 29.9% [ ] 30 - 40% [ ] more than 40%

9. Roof Runoff Management (NRCS code 558): *A facility for collecting, controlling and disposing of roof runoff water. Estimated Reference Cost =$75 each*

Have you adopted this BMP on your farm?
[ ] YES → **If YES, in which year? _____ If stopped, in what year_____? Total cost from all sources to install BMP** $ **_____** ***Your*** **cost-share ____**%
[ ] NO → **If NO, would you adopt this BMP on your farm?**

[ ] YES
[ ] NO
[ ] Not s

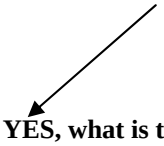


If YES, what is the maximum percentage of total cost you would pay to adopt this BMP?
[ ] 0 - 9.9% [ ] 10 - 19.9% [ ] 20 - 29.9% [ ] 30 - 40% [ ] more than 40%

10. Sediment Basin (NRCS code 350): *A basin to collect and store debris or sediment (sand trap). Estimated Reference Cost = $4,100 for each basin*

Have you adopted this BMP on your farm?
[ ] YES → **If YES, in which year? _____ If stopped, in what year_____? Total cost from all sources to install BMP** $ **_____** ***Your*** **cost-share ____**%
[ ] NO → **If NO, would you adopt this BMP on your farm?**

[ ] YES
[ ] NO
[ ] Not s

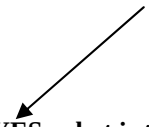


If YES, what is the maximum percentage of total cost you would pay to adopt this BMP?
[ ] 0 - 9.9% [ ] 10 - 19.9% [ ] 20 - 29.9% [ ] 30 - 40% [ ] more than 40%

11. Streambank and Shoreline Protection (NRCS code 580): *Use of vegetation or structures to stabilize and protect banks or streams and lakes against scouring and erosion. Estimated Reference Cost =$4,100 per acre*

Have you adopted this BMP on your farm?
[ ] YES → **If YES, in which year? _____ If stopped, in what year_____? Total cost from all sources to install BMP** $ **_____** ***Your*** **cost-share ____**%
[ ] NO → **If NO, would you adopt this BMP on your farm?**

[ ] YES
[ ] NO
[ ] Not s

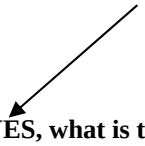


If YES, what is the maximum percentage of total cost you would pay to adopt this BMP?
[ ] 0 - 9.9% [ ] 10 - 19.9% [ ] 20 - 29.9% [ ] 30 - 40% [ ] more than 40%

12. Watering Facility (NRCS code 614): *A trough or tank with needed devices for water control and waste disposal installed to provide drinking water for livestock. Estimated Reference Cost = $780 for each*

Have you adopted this BMP on your farm?
[ ] YES → **If YES, in which year? _____ If stopped, in what year_____? Total cost from all sources to install BMP** $ **_____ *Your* cost-share ____**%
[ ] NO → **If NO, would you adopt this BMP on your farm?**

[ ] YES
[ ] NO
[ ] Not s

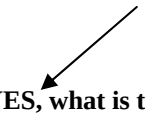


If YES, what is the maximum percentage of total cost you would pay to adopt this BMP?
[ ] 0 - 9.9% [ ] 10 - 19.9% [ ] 20 - 29.9% [ ] 30 - 40% [ ] more than 40%

13. Waste Storage Facility (NRCS code 313): *An impoundment to temporarily store manure, wastewater and contaminated runoff. Estimated Reference Cost = $90,000 for each facility*

Have you adopted this BMP on your farm?
[ ] YES → **If YES, in which year? _____ If stopped, in what year_____? Total cost from all sources to install BMP** $ **_____ *Your* cost-share ____**%
[ ] NO → **If NO, would you adopt this BMP on your farm?**

[ ] YES
[ ] NO
[ ] Not s



If YES, what is the maximum percentage of total cost you would pay to adopt this BMP?
[ ] 0 - 9.9% [ ] 10 - 19.9% [ ] 20 - 29.9% [ ] 30 - 40% [ ] more than 40%

The following BMPs qualify for incentive payments under EQIP. Practices with Incentive Payments, that are part of an EQIP contract that involves structural BMPs like those above, receive a one-time set fee per acre for a limited period (1-3 years). There is no cost share associated with these practices.

14. Residue Management or Conservation Tillage Practices (NRCS code 329A,B,C) : *A system designed to manage the amount, orientation and distribution of crop and other plant residues on the soil surface year round (such as No-till, Strip-till, Ridge-till and Mulch-till systems). Incentive payment =$10 -15 per acre, 100 acre limit, 2-3 years.*

Have you adopted this BMP on your farm?
[ ] YES → **If YES, in which year? _____ If stopped, in what year_____?**
Total Incentive Payment received for this BMP $_____ per acre
[ ] NO → **If NO, would you adopt this BMP on your farm?**

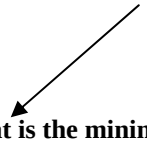
[ ] YES
[ ] NO
[ ] Not s

If YES, what is the minimum additional incentive payment you need to receive to adopt this BMP? [ ] 20% [ ] 40% [ ] 60% [ ] 80% [ ] 100%

15. **Nutrient Management:** *Management of the amount, form, placement and timing of application of plant nutrients (fertilizers) for optimum forage and crop yields. Also includes soil samples and comprehensive nutrient management plans. Incentive payment =$5 per acre, 50-100 acre limit, 1-2 years.*

Have you adopted this BMP on your farm?
[ ] YES → **If YES, in which year? _____ If stopped, in what year_____?**
Total Incentive Payment received for this BMP $_____ per acre
[ ] NO → **If NO, would you adopt this BMP on your farm?**

[ ] YES
[ ] NO
[ ] Not s

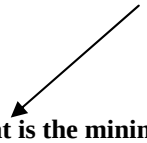


If YES, what is the minimum additional incentive payment do you need to receive to adopt this BMP? [ ] 20% [ ] 40% [ ] 60% [ ] 80% [ ] 100%

16. **Pest Management (NRCS code 595):** *A pest control program consistent with crop production goals and environmental standards. Incentive payment = $5 per acre, 50 -100 acre limit, 1- 2 years.*

Have you adopted this BMP on your farm?
[ ] YES → **If YES, in which year? _____ If stopped, in what year_____?**
Total Incentive Payment received for this BMP $_____ per acre
[ ] NO → **If NO, would you adopt this BMP on your farm?**

[ ] YES
[ ] NO
[ ] Not s

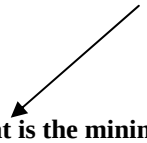


If YES, what is the minimum additional incentive payment do you need to receive to adopt this BMP? [ ] 20% [ ] 40% [ ] 60% [ ] 80% [ ] 100%

17. **Prescribed Grazing (NRCS code 528A):** *Controlled harvest of vegetation with grazing animals. Incentive payment =$5 per acre, 50-100 acre limit, 1-2 years.*

Have you adopted this BMP on your farm?
[ ] YES → **If YES, in which year? _____ If stopped, in what year_____?**
Total Incentive Payment received for this BMP $_____ per acre
[ ] NO → **If NO, would you adopt this BMP on your farm?**

[ ] YES
[ ] NO
[ ] Not s

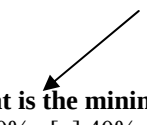


If YES, what is the minimum additional incentive payment do you need to receive to adopt this BMP? [ ] 20% [ ] 40% [ ] 60% [ ] 80% [ ] 100%

18. **Waste Utilization:** *Use of agricultural wastes on land in an environmentally acceptable manner to fertilize crops and to improve/ maintain soils. Incentive payment =$10 per acre, 100 acre limit, 2-3 years.*

Have you adopted this BMP on your farm?
[ ] YES → **If YES, in which year? _____ If stopped, in what year_____?**
Total Incentive Payment received for this BMP $_____ per acre
[ ] NO → **If NO, would you adopt this BMP on your farm?**

[ ] YES
[ ] NO
[ ] Not s



If YES, what is the minimum additional incentive payment do you need to receive to adopt this BMP? [ ] 20% [ ] 40% [ ] 60% [ ] 80% [ ] 100%

19. If you answered NO to any of the BMP adoption questions, please check [x] all that apply and identify the BMP by *question number*.

[ ] I am planning to retire from farming in a few years.
[ ] It is not cost-effective on my farm, regardless of the cost-share. #____, # ____, # ____, # ___, #___
[ ] I talked to USDA /NRCS about this BMP and decided not to use it on my farm. #____, # ____, # ____, # ___

20. Please rate the following sources in *1* to *5* scale (*1* is not at all important, *2* is not very important, *3* is important, *4* is very important, *5* is most important) to indicate how important these sources of information were for you in learning about BMPs or EQIP.

BMPs	EQIP	Sources
_____	_____	Hoard's Dairyman or other dairy publication
_____	_____	Delta Farm Press or other farm publication
_____	_____	Article in newspaper
_____	_____	TV or radio
_____	_____	USDA-NRCS
_____	_____	LSU Ag Center
_____	_____	Southern University Ag Center
_____	_____	Master Farmer Program
_____	_____	DHIA or other dairy association
_____	_____	Dairy producers
_____	_____	Non-dairy producers

21. Have you ever visited or talked with USDA-NRCS District Conservationists about any BMPs or EQIP?

[ ] NO, I have never visited or talked with USDA-NRCS about BMPs or EQIP.
[ ] YES, I visited the USDA Service Center and/or talked with NRCS staff about BMPs or EQIP.

22. Have you ever submitted an application for EQIP to USDA-NRCS?

[ ] NO, I have never submitted an application for EQIP.
[ ] YES, I submitted an application for EQIP.
[ ] YES, I submitted an application for EQIP, BUT I withdrew it before it was ranked for environmental (practice) benefits.

23. Have you ever had an EQIP application ranked for environmental (practice) benefits by USDA-NRCS?

[ ] NO, my EQIP application was never ranked. I withdrew the application before this step was completed.
[ ] YES, my EQIP application was ranked for environmental (practice) benefits by USDA-NRCS.
[ ] YES, my EQIP application was ranked for environmental (practice) benefits, BUT I withdrew it before it was sorted with all the other applications.

24. Have you ever had an EQIP application accepted by USDA-NRCS?

[ ] NO, my EQIP application was not accepted USDA-NRCS.
[ ] YES, my EQIP application was accepted by USDA-NRCS.
[ ] YES, my EQIP application was accepted by USDA-NRCS, BUT I withdrew it before USDA-NRCS visited my farm.
[ ] YES, my EQIP application was accepted by USDA-NRCS, BUT it was declared ineligible by USDA-NRCS after they visited my farm.

25. After an EQIP application was accepted by USDA-NRCS, did you draw up a plan?

[ ] NO, USDA-NRCS staff visited my farm but we never drew up a plan.
[ ] YES, USDA-NRCS staff helped me develop plans to implement the BMPs in the EQIP application.

26. After a plan was developed for your EQIP application, did you sign a contract for the plan?

[ ] NO, I decided not to sign the EQIP contract because of the costs required to implement it.
[ ] NO, I decided not to sign the EQIP contract for one or more reason other than the costs of required to implementation .
[ ] YES, I signed the EQIP contract with USDA-NRCS.

27. For each statement, please place an [X] in the column that most nearly represents your views.

Statements	Strongly agree	Somewhat agree	Undecided	Somewhat disagree	Strongly disagree
Laws regulating water pollution are needed.					
Given the economic realities, soil and water conservation programs are often carried too far.					
The government should pay farmers to promote practices that enhance soil and water conservation.					
The government should not be involved in agriculture at all.					
Government involvement in dairy has helped farmers.					

Thank you! Only with your help can we do an effective study for the dairy industry.